Introduction to Medical Assisting

Lessons 15-27
Pharmacology and Patient Examinations, Specimens, Tests and Therapeutic Modalities

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Table of Contents

Lesson 15—Electronic Health Records

Lesson 16—The Patient Exam

Lesson 17—Medical Ethics and Legal Responsibilities

Lesson 18—Blood Testing

Lesson 19—Introduction to Bookkeeping Procedures

Lesson 20—Technology and Health Care

Lesson 21—Bacterial Smears and Cultures

Lesson 22—Body Fluid Specimens

Lesson 23—Patient Therapies

Lesson 24—Pharmacology

Lesson 25—Assisting with Special Examinations

Lesson 26—Minor Surgical Procedures

Lesson 27—Preparing and Administering Medications

Lesson 15
Electronic Health Records

Step 1 Learning Objectives for Lesson 15

- When you complete the instruction in this lesson, you will be trained to do the following:
  - Describe the Electronic Health Record (EHR), including its history and goals.
  - Explain what Practice Fusion is, and determine its capabilities.
  - Use Practice Fusion to:
    - create a new patient account;
    - schedule, cancel and reschedule appointments; and
    - change patient status.

Step 2 Lesson Preview

- Think of the last time you visited your doctor. Did he bring your personal information in a large manila folder when he entered the examination room? Was it a laptop that accompanied your physician? Or did a personal computer await the doctor in the examination room?

For some time, computers have played a large role in the world of health care.

Computers have played a large role in the world of health care for some time. Now, electronic health records (EHRs) are commonplace in the medical industry, as well. It's important that you be familiar with the basics of how these records work and what they offer since there is a good chance you'll encounter EHRs in your career.

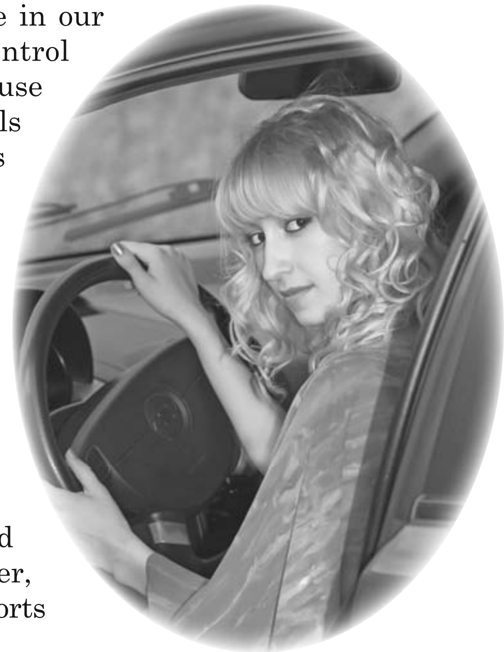
We will describe the electronic health record, its history and its goals in this lesson. We will also introduce you to a Web-based electronic health record and provide hands-on practice as you create records and schedule patients.

Keep in mind throughout this lesson that we're exposing you to one type of EHR software called Practice Fusion. The general experience you gain from this software will prepare you to work with other types of EHR software, even though you may not work with Practice Fusion in your career. Think of it like this: If you know how to use one word-processing program, such as Microsoft Word, there's a good chance your experience with that program will help you catch on quickly to other word-processing programs, such as WordPerfect.

Now, are you ready to learn a bit about the EHR? Let's begin!

Step 3 Electronic Health Records

- Think of all the ways in which computers play a role in our lives. They are in our cars and cell phones; they control cash registers and library card catalogs. You probably use computers at home to manage your finances, send e-mails and help your children with their homework. Computers are cheaper and easier to use than ever before, and their power and abilities continue to increase. It's safe to say that there aren't many industries that *don't* use computers today, and health care is no exception!



Computers are in our cars and cell phones; they control cash registers and library card catalogs.

The world of medicine has used computers for many years. For example, laboratory systems in most hospitals have electronic recording and reporting systems. Hospitals and doctors' offices use computer programs to schedule patient appointments. And medical transcriptionists have used computer-based word-processing systems since the early 1980s. However, until recently, these computer-generated transcribed reports were printed and placed in a patient's paper chart.

In the past, healthcare records were primarily in that form—paper charts—and it's true that many maintain this format today. Such records are difficult to organize and use efficiently, especially as an individual's care becomes more complex. In addition, the various departments and services involved in patient care encounter problems in coordinating care and sharing patient information—even within one clinic or hospital.

The computer has changed all of this. It's now clear that computers can effectively store and maintain medical records in the form of electronic health records. But what, exactly, is an EHR?

Definition of Electronic Health Records

"The **Electronic Health Record** (**EHR**) is a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. Included in this information are patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports."[1]

The electronic health record provides a completely electronic system to create, store and access medical records. In other words, the patient's entire medical record is in a computerized database. Ideally, there are no paper records to generate, store and retrieve. Patient information goes directly into an electronic database, and healthcare professionals make any necessary changes to the electronic version of the medical record. Additionally, the EHR incorporates special data-management functions to assist healthcare providers with decision-making, prevent medical errors and enhance medical research.

EHR Terminology

You now know what an EHR is, but what about EMRs (electronic medical records)? Or CBPRs (computer-based patient records)? You'll find that different resources, practices and people use all of these terms in different ways as you continue your studies and begin your career. In fact, the EHR software you'll use in this lesson seems to use the terms EHR and EMR interchangeably. For the purposes of this lesson, we'll use the term electronic health record (EHR) to refer to a computerized patient record. However, be aware you'll encounter the terms EMR and CBPR from time to time, and the meanings of these terms might vary depending on the user.

The hope is that, eventually, EHRs will make all medical records universally portable, provide continuity of care for patients and support administrative functions.

So, how did EHRs come about and evolve in to what they are today?

History of the Electronic Health Record

Believe it or not, the first EHRs appeared in the mid-1960s. The use of electronic data management became a necessity—at least for accounting purposes—when the government instituted Medicare in 1965.

Believe it or not, the first EHRs appeared in the mid-1960s.

For the next two decades, computerized healthcare data systems were used in areas of health care where the captured information was mostly numerical and inherently structured. This kind of information is discrete data. **Discrete data** refers to information that consists of separate and limited values, such as distinct points on a numeric scale, with distinct intervals between any two values. It's also referred to as *quantifiable* information. **Quantifiable** information can be determined, indicated or expressed. Laboratory data fits this description, as does all information that has numeric value. A patient's age, height and weight are examples of discrete data. Discrete data is "structured" because it can be sorted into categories and hierarchies.

Information was sorted into consistent categories because early computerized healthcare data systems could really only capture discrete data. Categories included areas, such as billing and related administrative functions (like keeping track of equipment inventories), laboratory results, pharmacy records and, a bit later, radiology records.

One drawback to these original EHRs was that they were specific to single institutions. This meant that healthcare providers couldn't easily share the data the EHRs contained. As you might guess, this limited the use of such databases for patient care.

The earliest computerized healthcare data systems were specific to single institutions.

As the 90s approached, it became clear that the purpose of the EHR shouldn't just benefit healthcare professionals and their facilities. The patient's needs should play a role, too!

In addition, much of what goes in to a patient's medical record is *not* discrete data. Most of what a surgeon dictates in an operative report, for example, is unstructured narrative—clinical information. And, while an unexpected arterial bleed may be quantifiable in terms of amount of blood lost before the bleed is controlled, the fact that the bleed occurs, where it occurs, why it might have occurred, what happened when it occurred and what the surgeon did to control it is not. These are facts that are difficult, perhaps impossible, to transform into discrete, quantifiable information. Yet this information can be crucial for further diagnosis and treatment of this patient.

As the 90s approached, it became clear that the purpose of the EHR shouldn't just benefit healthcare professionals and their facilities. The patient's needs should play a role, too! In 1991, the American Institute of Medicine (IOM) issued a report: *The Computer-based Patient Record: An Essential Technology for Health Care*. This report focused on the patient as the primary beneficiary of the EHR. The report also made some specific recommendations for building a nationally coordinated system of electronic health records.

The U.S. Department of Defense followed this lead and created a clinical care patient record system, the **Composite Health Care System** (**CHCS**), which it implemented worldwide. In addition, the Veterans Administration developed its **Decentralized Hospital Computer Program** (**DHCP**), which it used for medical care of veterans nationwide. This was an important step in the EHR evolution. The DHCP linked a broad network of healthcare providers in different facilities. The ability to share medical information in such networks is one of the important goals of the EHR, and the VA demonstrated one way to accomplish this.

In 2003, the IOM released another report that outlined what the EHR should be and what capacities it should have. And, in 2010, the U.S. government renewed a national commitment to the EHR, making it a priority. It's now a national goal for healthcare providers in the United States to replace all paper records with computer-based systems by 2014. The government provides financial incentives for healthcare entities that transition to the EHR in a timely manner.

Hospitals, clinics, healthcare professionals and information technologists currently build on all of these experiences, recommendations and incentives as they continue to work toward a fully functional EHR.

In 2010, the U.S. government renewed a national commitment to the EHR.

Future Goals for the Electronic Health Record

Today, the main goal of the EHR is to improve the accuracy, organization, management and accessibility of patient records. You now know EHRs allow interactive functions, such as the ability to generate alerts to healthcare providers. One example of this is warnings about dangerous medication interactions. (Remember that paper records can't provide these types of alerts.) The alert functions can help prevent errors and improve delivery of care at appropriate times. Doing so benefits healthcare providers, facilities and patients.

Another hope for the future is that the EHR will make it possible for all agencies and providers involved in patient care to communicate quickly and accurately. From an EHR, an administrator will be able to obtain information for billing, a physician can track whether a treatment is effective, a nurse can report a change in patient condition and a researcher can evaluate the value of medications in patients with multiple medical problems. The patient's information (both clinical documentation and discrete data) is collected once, then shared—so it's used multiple times. This ability to share the same information will reduce the possibility of errors that can occur when information is repeatedly copied and transferred from document to document, from department to department and from facility to facility. It's also expected to substantially reduce costs.

Today, the main goal of the EHR is to improve the accuracy, organization, management and accessibility of patient records.

A key element in the EHR of the future is interoperability. **Interoperability** refers to the ability for different EHR software to communicate among multiple machines. Ideally, the whole EHR system will be able to share information: for example, among offices, departments, clinics and hospitals, nationwide and even worldwide. To achieve interoperability, the EHR creators need to develop standards.

Standards for EHRs refer to consistent information that EHR software and vendors will include. Standards are necessary in vocabularies, in the technology of information exchange and in the structure of data. The EHR must be private and secure. Several national and international organizations are working to develop these system-wide standards for healthcare data. Facilities will be able to use different EHR software and share and edit information as needed once EHR standards and interoperability are established.

Interactive features of the EHR will assist healthcare providers in making decisions about patient care.

Let's take a look at an example of how the EHR allows providers to share information. Judy, a nurse at a local doctor's office, sees Jim one morning. Jim's hip hurts during his daily run. He stopped running for a few weeks in hopes that his hip would feel better. But it hasn't improved at all. As Judy talks with Jim, she types his information into her office's EHR system. Jim's doctor writes orders for a hip x-ray, so Jim heads to the hospital for the procedure. The hospital pulls up Jim's EHR to see the information that Judy typed. The hospital staff can also type information into Jim's EHR. As you can see, both Jim and his healthcare providers benefit from the shared information.

Interactive features of the EHR assist healthcare providers in making decisions about patient care. And EHR systems can contain a large amount of information about individual patients and state-of-the-art practices in medical devices, diagnosis and treatment. This information will provide an array of diagnostic and treatment options for providers. Finally, the EHR allows 24/7 availability of legible and well-organized medical data about any patient's diagnoses, condition, treatment and outcomes.

In summary, the goals of the electronic health record include:

- Improve accuracy, organization and management of medical information
- Improve accessibility to medical information
- Reduce medical errors
- Improve patient care
- Reduce costs

There's no doubt it will take time (and probably lots of it) for EHRs to do all of this and more. In the meantime, many healthcare organizations—especially large providers, such as acute-care hospitals and large clinics—have implemented a **hybrid medical records system** (also known as an **Electronic Data Management System**, or **EDMS**). Such systems use standard word-processed documents in conjunction with the EHR.

In the EDMS, an individual patient's free-form clinical narrative is available electronically but in the familiar document form. Healthcare professionals can electronically access those documents in the same way that they can access a patient's laboratory and radiology results. Information included in the word-processed document is not "visible" to the facilities that share the EHR. For example, Josh's doctor sent him to get some blood work at the hospital. The hospital staff can see the data associated with Josh's medical records. However, the hospital staff cannot access the word-processed documents in Josh's records. Only the doctor's office has access to that information. As a result, the information is visible to doctors, nurses and others who take care of the patient.

As you can see, patients, practices and healthcare professionals benefit from the little advances that technology makes in the medical world each day. You'll see these benefits firsthand in the remainder of this lesson as you get the opportunity to work with an EHR software.

Step 4 Practice Fusion

- [ ] Now that you have some background on what EHRs are, what they can do now and what we all hope they will do in the future, let's take an in-depth look at one type of Web-based EHR software.

A variety of EHR vendors exist. If you'd like to explore what the EHR looks like from different vendors, head to the Internet, and check out these sites.

VersaForm EMR—www.versaform.com/products/online-demos

eMDfix—www.emdfix.com/onlinedemo.htm

EMR Experts—www.emrexperts.com

Practice Fusion—www.practicefusion.com

For this lesson, you will use a Web-based electronic health record software from Practice Fusion. This program provides "award-winning EHR technology at no cost to universities, students and medical residents. Participants gain a competitive edge by training on superior tools. The result is an ability to learn about technology and medical informatics during the educational process and be more efficient and profitable when entering the workforce."[2] Not only will this Web-based program offer you hands-on experience, you can also continue to use this product after you complete the lesson.

Now that you have some background on what EHRs are, what they can do now and what we all hope they will do in the future, let's take an in-depth look at one type of EHR.

Please note that while Practice Fusion is provided to you at no cost, the company does need to make money to support the Web-based electronic health record software. This is done through advertising. You will note ads on the bottom of the software screens. These ads range from computer sells to consultant help. (You may also receive e-mails advertising these services.) If you choose to click on the ads or e-mails and use the services, a charge may be applied. Contact your instructor for assistance with the Practice Fusion account while you complete this lesson; do not contact a consultant. If you choose to use the Web-based program in an active practice once you complete this lesson, your instructor will no longer be available for support. You may need to contact a consultant for assistance at that time.

Practice Fusion System Requirements

To maximize your learning experience in this lesson, please ensure you have access to a computer with the following requirements.

Broadband Requirements

Practice Fusion is a robust Internet application and requires a broadband connection. A minimum speed of 256k upload and download is highly recommended. To test your connection speed and for a more technical description, please visit the Practice Fusion System Requirements page at http://www.practicefusion.com/pages/system_requirements.html.

Hardware Requirements

The following minimum hardware systems support Practice Fusion:

Windows®	**Macintosh**	**Linux®**
Intel® Celeron® 2GHz or faster processor (or equivalent)	Intel® Celeron® 2GHz or faster processor (or equivalent)	Intel® Celeron® 2GHz or faster processor (or equivalent)
1024x768 minimum screen resolution	1024x768 minimum screen resolution	1024x768 minimum screen resolution
1GB of RAM	1GB of RAM	1GB of RM, 128MB of graphics memory

Operating Systems and Browsers

The following minimum operating systems and browsers support Practice Fusion:

Windows

Platform	**Browser**
Microsoft® Windows Vista®	Microsoft Internet Explorer 7 or later, Firefox 2.0 or later, Safari 3.x or later, Google Chrome
Microsoft Windows XP	Microsoft Internet Explorer 7 or later, Firefox 1.x or later, Mozilla 1.x or later, Netscape 7.x or later, Opera 7.11 or later, Safari 3.x or later, Google Chrome
Microsoft Windows Server® 2003	Microsoft Internet Explorer 7 or later, Firefox 1.x or later
Microsoft Windows 2000	Microsoft Internet Explorer 7, Firefox 1.x or later, Mozilla 1.x, Netscape 7.x or later, Opera 7.11 or later
Microsoft Windows Millennium Edition	Microsoft Internet Explorer 7 or later, Firefox 1.x or later, Mozilla 1.x, Netscape 7.x or later, Opera 7.11 or later
Microsoft Windows 98	Microsoft Internet Explorer 7 or later, Firefox 1.x or later, Mozilla 1.x, Netscape 7.x or later, Opera 7.11 or later

Macintosh

Platform	Browser
Mac OS X v10.1 or later (PowerPC)	Firefox 1.x, Mozilla 1.x, Netscape 7.x or later, Opera 6, Safari 1.x or later
Mac OS X v10.4.x or later (Intel)	Firefox 1.5.0.3 or later, Opera 6, Safari 2.x or later

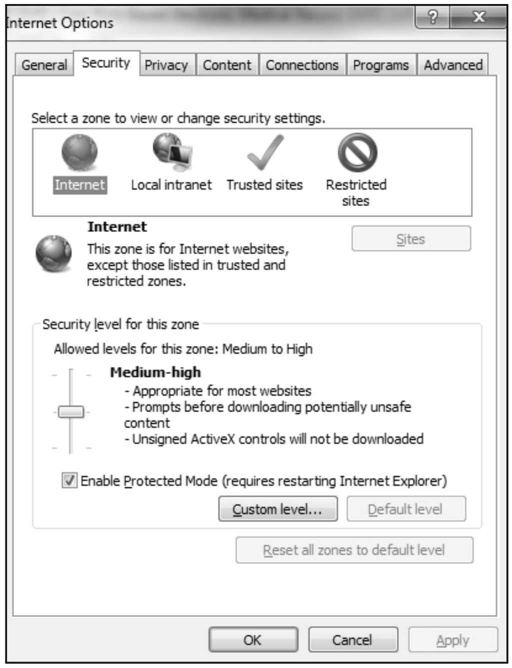
Linux

Platform	Browser
Red Hat® Enterprise Linux (RHEL) 3 update 8, RHEL 4 update 4 (AS/ES/WS)	Firefox 1.5.0.7 or later, Mozilla 1.7.x or later, SeaMonkey 1.0.5 or later
Novell SUSE™ 9.x or 10.1	Firefox 1.5.0.7 or later, Mozilla 1.7.x or later, SeaMonkey 1.0.5 or later[3]

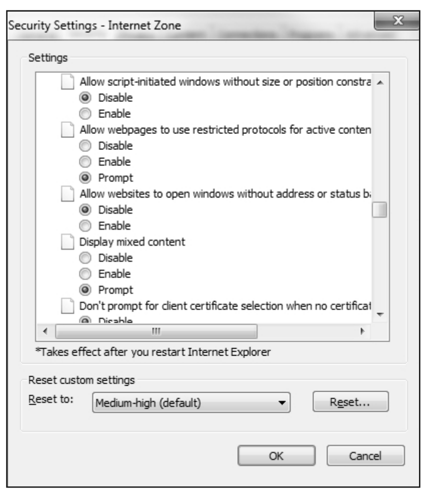
Some windows may not appear in the Practice Fusion platform due to Internet Explorer settings. To avoid this issue, we recommend that you use a Web browser *other* than Internet Explorer, such as Firefox or Google Chrome. Another option is to ask Internet Explorer to let you see all items, not just secure items, on a page when prompted. (If you use Internet Explorer while in Practice Fusion, boxes may appear that ask if you want to view only secure items on a page. Select *No* so that you can see all items. Internet Explorer does not recognize certain items, which is why it does not load some pages.)

If you use Internet Explorer while in Practice Fusion, boxes may appear that ask if you want to view only secure items on a page. Select No so that you can see all items.

Internet Explorer may not ask if you want to view only secure items. If so, you will need to adjust your Internet Explorer settings. Click the *Tools* menu at the top of your Internet Explorer browser, and select *Internet Options*. In the popup box that appears, click on the *Security* tab, and choose *Internet*.



In the popup box that appears, click on the *Security* tab, and choose *Internet.*



Next, click the *Custom Level* button, and locate the bullet point *Display Mixed Content* under the *Miscellaneous* section.

Next, click the *Custom Level* button, and locate the bullet point *Display Mixed Content* under the *Miscellaneous* section. Set this to *Enable*, click *OK* and then click *Apply*.

Finally, you will need to have the most recent version of Adobe Flash Player installed on your computer.For installation instructions on Internet Explorer, Non-Internet Explorer, Macintosh and Linux based systems, please log onto http://www.adobe.com/products/flashplayer/productinfo/instructions/.

Step 5 Get Started

Now, let's set up and access your Practice Fusion account.

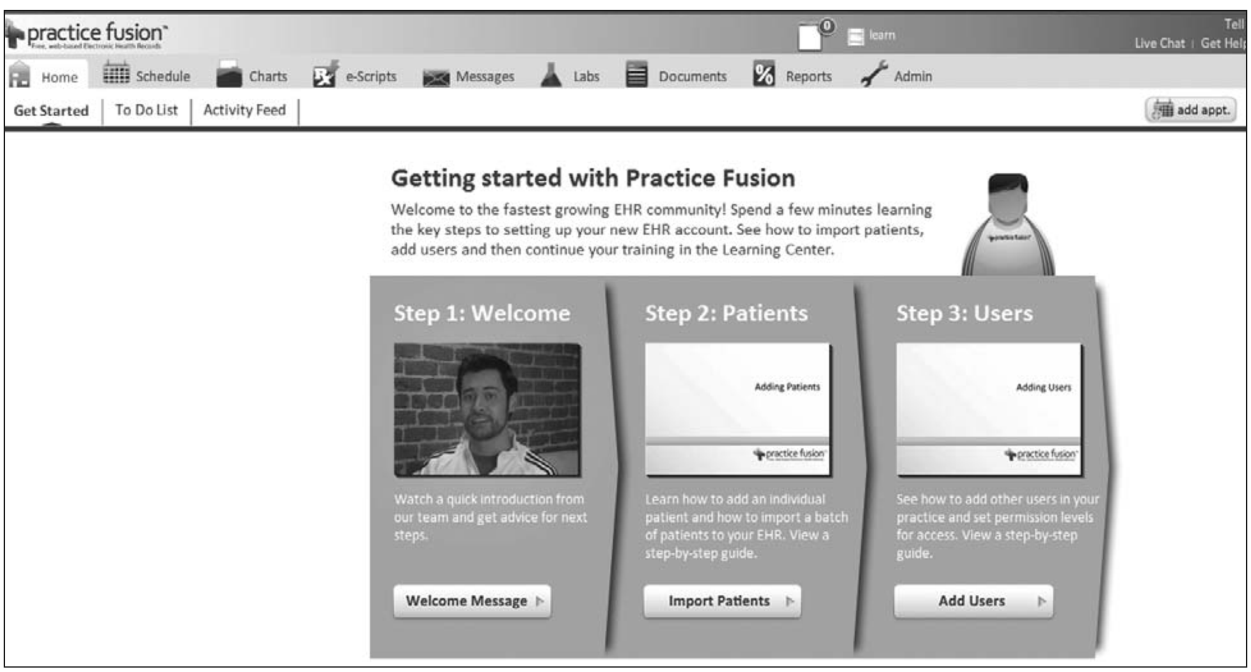
First, open your Web browser, and access the Practice Fusion Web site at www.practicefusion.com. Then, click on *Sign-Up*. A window will appear, and you will enter your *First Name*, *Last Name*, *Phone* and *Email*. Scroll through the *Specialty* list until you locate *Academic (I am a student),* and click that option. Check the box to acknowledge that you have read and agree to the terms of the *License Agreement* and *Privacy Policy*. Finally, click *Sign up*.

Enter your *First Name*, *Last Name*, *Phone* and *Email*. Scroll through the Specialty list until you have located *Academic (I am a student)*, and click that option.

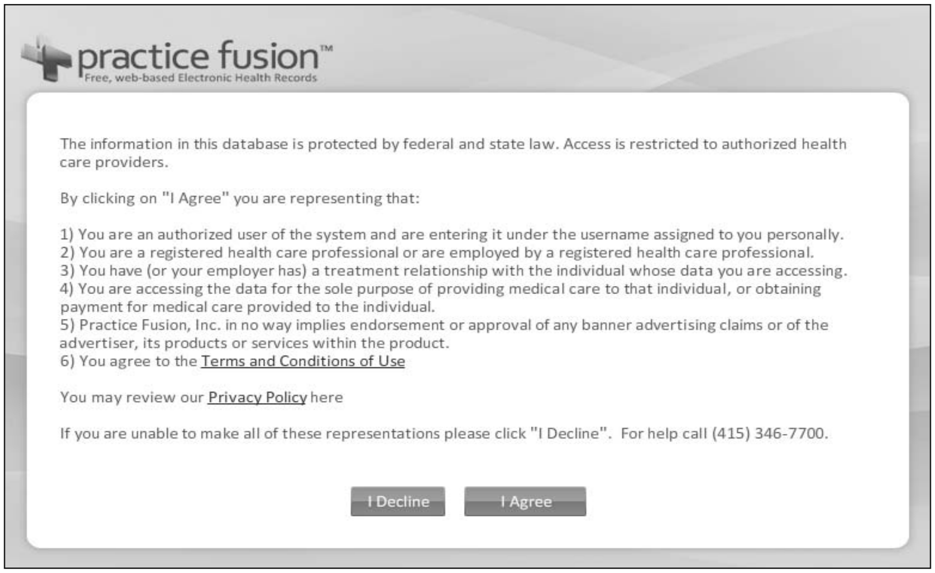
A window appears with your *Practice ID* and *Username*. Although the software also sends this information to the e-mail adress you provide, it's a good idea to note this information for future reference. You'll choose a *Password,* and re-enter that *Password* as confirmation. (Review the creation guidelines to select a more secure password, if prompted.) Once you complete this step, click *Next*.

A window appears with your *Practice ID* and *Username.*

The Practice Fusion homepage appears. You will see that Practice Fusion has a welcome message and instructional videos on how to import patients and add users. We will go through this process step by step in the material, so let's move on now.

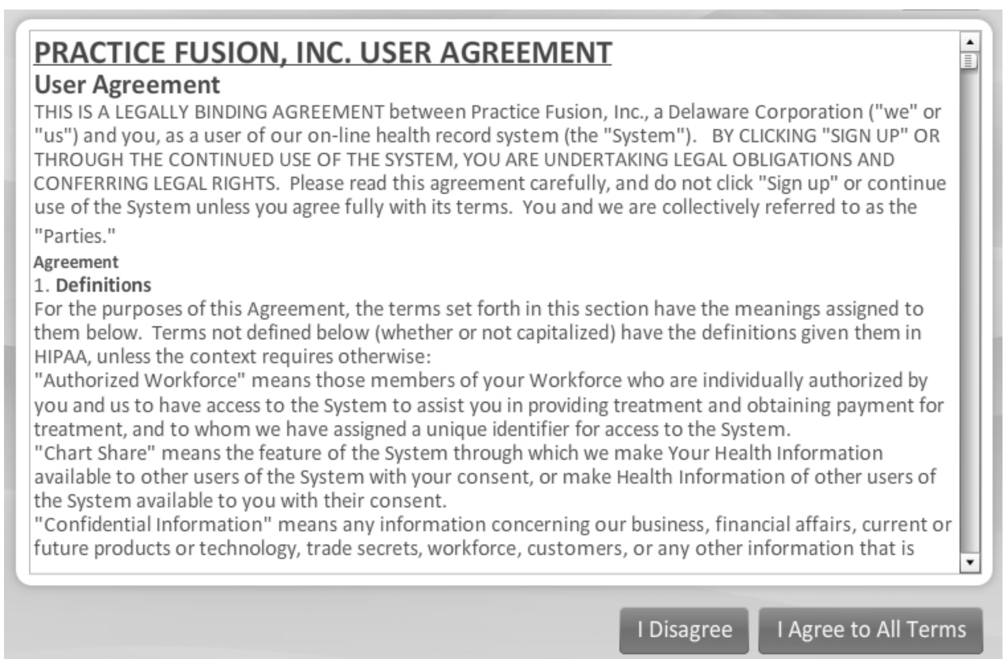


At this point, log off the Practice Fusion site. (Click *Log Off* in the upper-right corner and *Yes, proceed* when prompted.) Now, log back in. Each time you log on to Practice Fusion, you will need to agree to the confidentiality information provided. ,



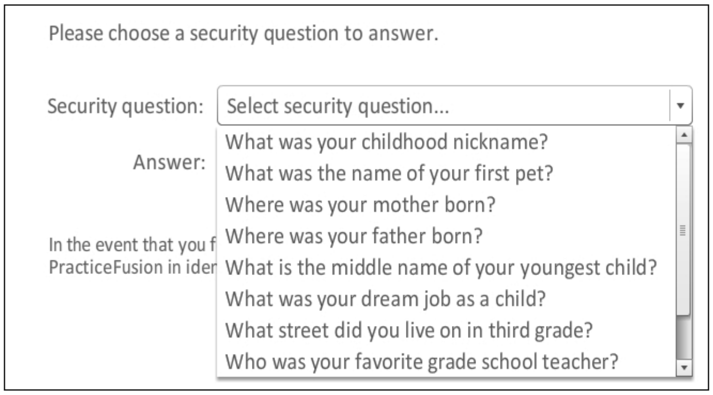
Each time you log on to Practice Fusion, you will need to agree to the confidentiality information provided.

In most cases, you will go straight to the Practice Fusion homepage after you agree to the confidentiality information. But the first time you log in, you will encounter a User Agreement.



Next, you will select a security question. Click the triangle on the right side of the screen to display the different questions the software can ask. Select a question, and type the appropriate answer. (Be sure to spell your answer correctly. Should you need to answer this question to get your password in the future, you will need to type your answer exactly as you input here.) It's a good idea to note your security question and answer and keep them in a safe place for future reference.

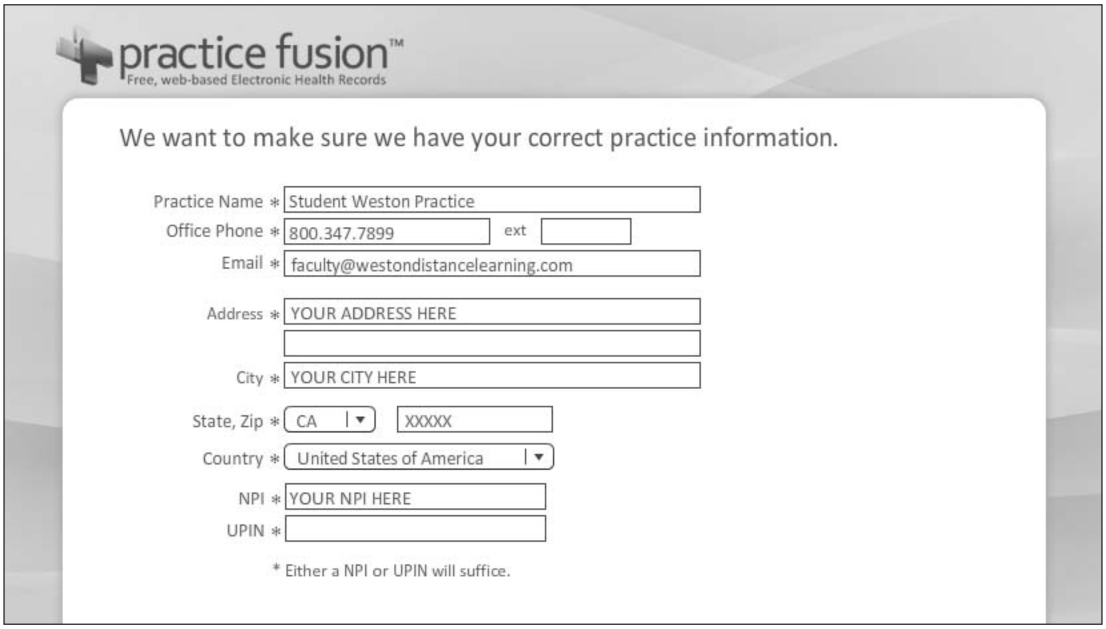
Once you provide the answer to your security question, click *Next*.



Once you provide the answer to your security question, click *Next.*

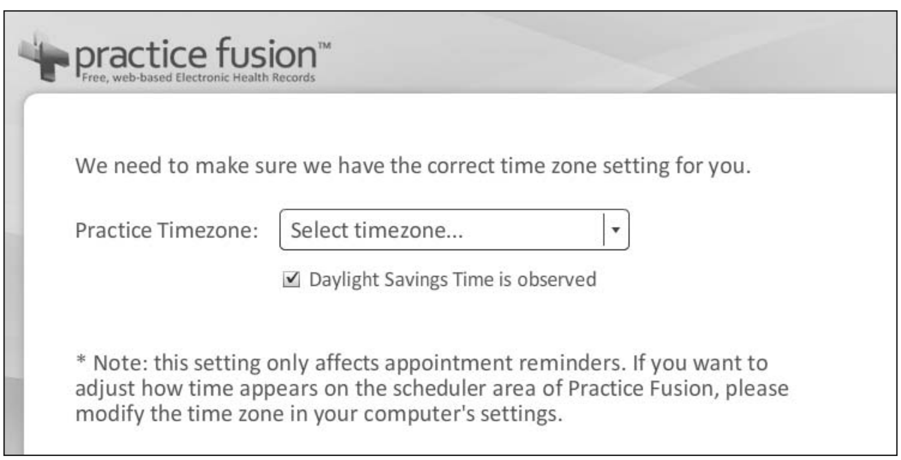
> Unable to remember your password when you log on to Practice Fusion? Click Get it!, which appears next to Forgot your password? on the Log in page. Select Reset my password, and your security question will appear. If you answer the question correctly, the software resets your password and notifies you through the e-mail address that you provided.

In the next step of the setup process, Practice Fusion will ask you to verify your practice information and add your address. You will enter your personal information so that Practice Fusion understands that this is your account. For the NPI number, you can enter 10 zeros or simply leave the words in it; however, you cannot leave the field blank.



Practice Fusion will ask you to verify your practice information and add your address.

Practice Fusion can send appointment reminders to patients. Select the time zone that you want to appear in the schedule area of Practice Fusion. Usually the time zone is the same as the practice facility; however, you can select the time zone of your home address. (Click the arrow to the right of the dropdown box, and click on the appropriate time zone. Click *Next*.)



Select the time zone that you want to appear in the schedule area of Practice Fusion.

Sometimes, Practice Fusion will display alerts that you must acknowledge before you can proceed to the homepage of your practice. If the software provides other alerts, you can review the information, and click *I acknowledge* to continue to the homepage.

Please be aware that Practice Fusion is a live Web-based system. Examples provided in this lesson show current dates as of the creation of the screenshots (print screens); however, the dates will vary based on when you complete the steps. The dates provided in this lesson are listed as 20XX. You will use the current year to function in the live Web-based system.

> **Please note:** Practice Fusion is a live Web-based system. When this lesson instructs you to set up an appointment, you may want to consider selecting a date a few weeks into the future. As you work through this lesson, the information you enter at one point may be used later in the lesson. If you schedule an appointment for today and don't complete other steps in the lesson until a later date, your appointment will be gone because "today" has passed, and you'll have to recreate it.

Step 6 New Patients

Patty is the office manager for an allergy clinic. The practice currently uses paper records, but it is considering a switch to electronic health records. Patty has asked to shadow Ann, an office manager for Hudson Medical Clinic, to get a clear picture of how to use electronic health records. Let's follow along as Patty learns the ins and outs of the electronic health record using Practice Fusion. (Keep in mind that while healthcare professionals are not able to share patient information, this scenario is set up with Patty shadowing other healthcare professionals simply to provide examples as to how paper and electronic health records differ, as well as the capabilities of EHRs.)

Use EHR software to enter new patient information.

Ann begins her day by entering new patients into the EHR. Ann locates New Patient Information forms for patients that she needs to enter into Practice Fusion. Entering basic and insurance information for each patient will create an EHR for each person. Patty's allergy clinic uses paper records. She is accustomed to locating a thick manila folder for each patient! It's easy to see why the idea of having access to all of the office's health records at the touch of a button intrigues Patty.

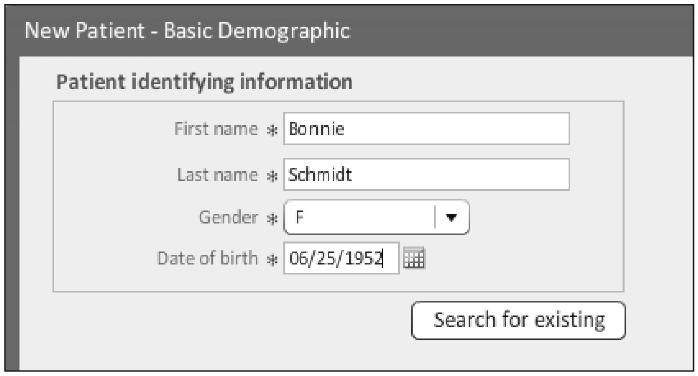
Ann begins with the New Patient Information form for Bonnie Schmidt.

Hudson Medical Clinic				
PATIENT INFORMATION				
Last Name: Schmidt		Home Phone: 970-555-9041		Work Phone: 970-555-6001
First Name: Bonnie	MI:	Address: 1810 Bluegrass Drive		
DOB: 06/25/1952	Sex: F	City: Springtown	State: CO	ZIP: 80002
E-mail Address: bschmidt@kaingraphics.net		Marital Status: Married		
Insurance Information: Insurance Company Name: McKinley Medical Group (HMO)				
Insurance holder name: Bonnie Schmidt		Effective date of insurance: 1/1/20XX-12/31/20XX		
Insurance holder DOB: 06/25/1952		Home phone: 970-555-9041		Work Phone: 970-555-6001
Copay Amount: $20		Address: 1810 Bluegrass Drive	State: CO	ZIP: 80002
Employer's Name: Kain Graphics		Policy #: 560001113	Group #: 208	
Secondary Insurance Company: Name of Company: None				
Insurance holder name:		Effective date of insurance:		
Insurance holder DOB:		Home phone:		Work Phone:
Copay Amount:		Address:	State:	ZIP:
Employer's Name:		Policy #:	Group #:	

Ann is ready to enter Bonnie's information into the software, so she logs in to Practice Fusion. Once she reaches the practice's homepage, she clicks *Charts*. The list of *Recently accessed patients* appears. To create Bonnie's chart, Ann clicks *New Patient* on the far-right side of the page.

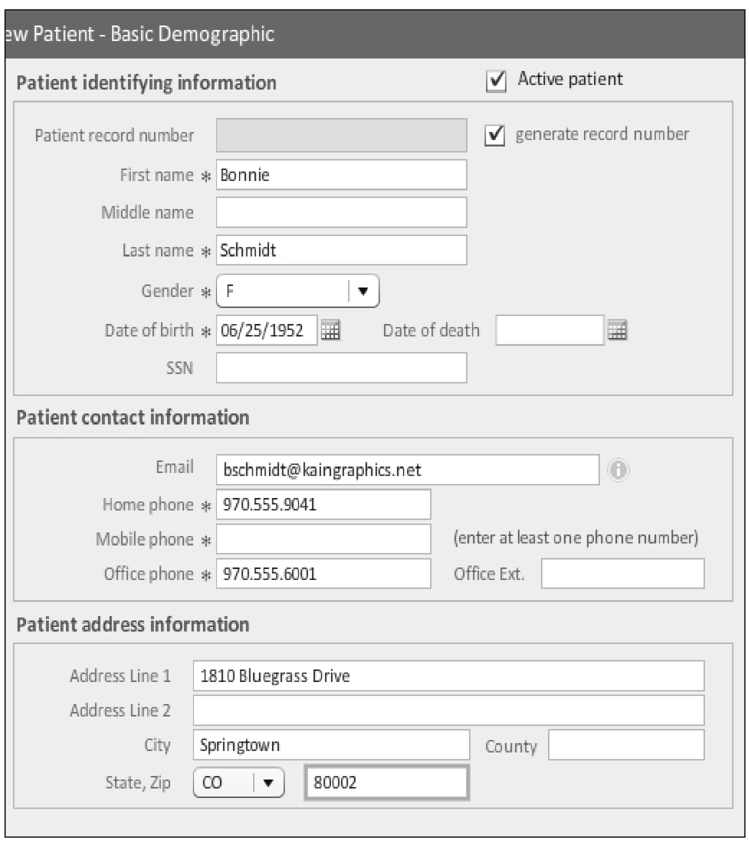
Click *New Patient* on the far-right side of the page.

The *New Patient – Basic Demographic* box appears, and Ann enters the patient indentifying information: Bonnie's first and last name, gender and date of birth. Ann cautions Patty to be sure to format the date of birth as: MM/DD/YYYY. Otherwise, the software will not accept the information.



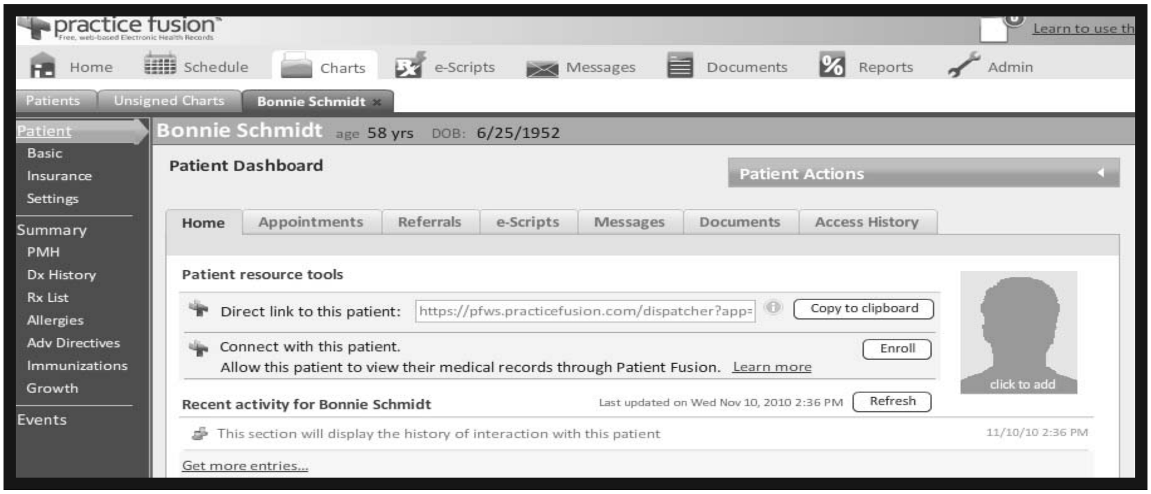
The *New Patient – Basic Demographic* box appears. Enter the patient indentifying information: first and last name, gender and date of birth.

Ann clicks *Search for existing* once she's input the patient identifying information. Because Bonnie is a new patient, Ann will click *Create as new*. Ann adds the necessary information from the New Patient Information form; the red asterisk indicates the fields that she must complete, while the other fields are optional, and she can complete them if the patient provides the information. Ann then clicks *Save*.



The software prompts you to supply additional identifying information for new patients.

Once the page refreshes, Ann explains to Patty that the *Patient Dashboard* appears.



The *Patient Dashboard* is the homepage for the patient's electronic health record.

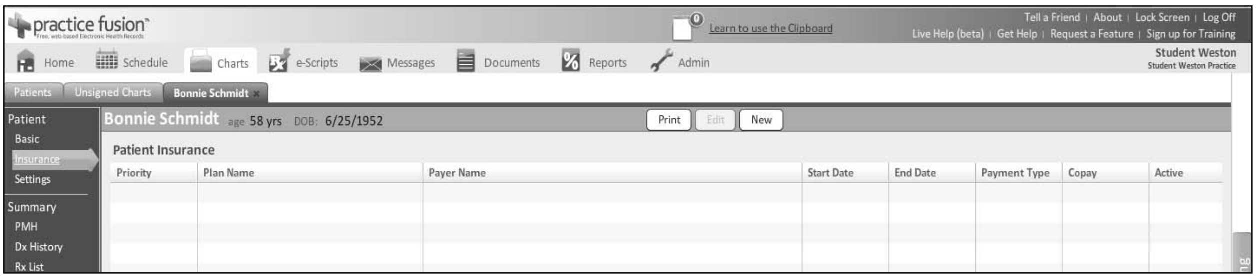
Patty is unfamiliar with the *Patient Dashboard* and asks for more details. Ann explains that the *Patient Dashboard* is the homepage for the patient's electronic health record. From the *Patient Dashboard*, Ann can select options from the left side of the page to update insurance information, review the summary of the patient's health record or view record events. Various staff members in the practice can use the options in the *Patient Dashboard* to enter the chief complaint, vitals and dictation. Ann assures Patty her that using the dashboard will be second nature soon enough. For now, Ann focuses on entering Bonnie Schmidt's insurance information in to the EHR.

Ann shows Patty the functions of the links on the left side of the *Patient Dashboard*. Under the *Patient* heading, she clicks *Basic*. This shows Ann the patient identifying information that she just entered. (The patient record number will vary.)

The *Basic* tab shows the patient identifying information.

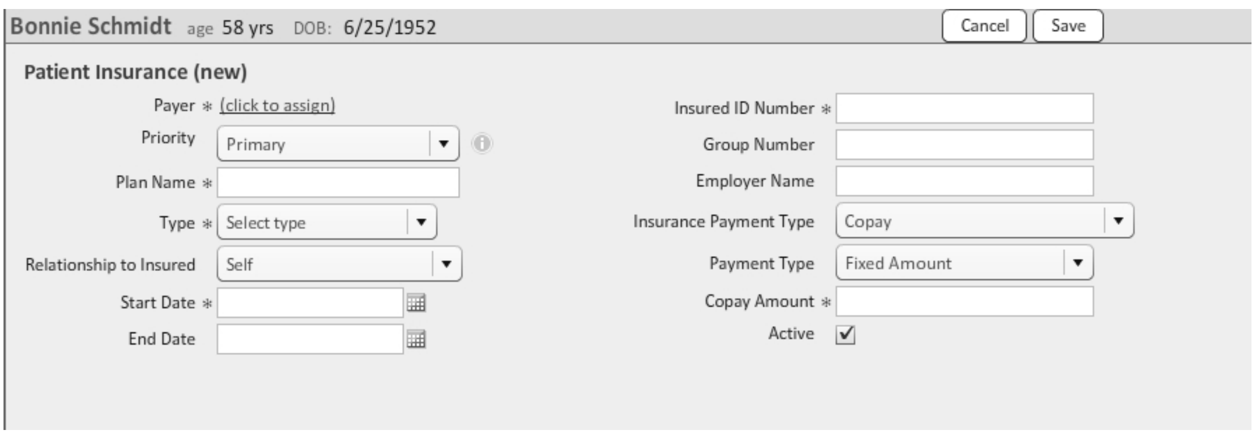
At this screen, Ann can edit the patient information. She may notice a typo or information has been updated, such as a new address due to a move. To edit the patient information, click *Edit* in the right hand corner. The editing screen appears and Ann is able to type the correct information. She will click *Save* and the newly edited information will appear in all the basic patient information window.

Now, Ann clicks *Insurance* under the *Patient* heading, and the patient's insurance information appears. Ann has not entered Bonnie's insurance information yet, so she does that now. From the *Patient Insurance* screen, Ann clicks *New*.

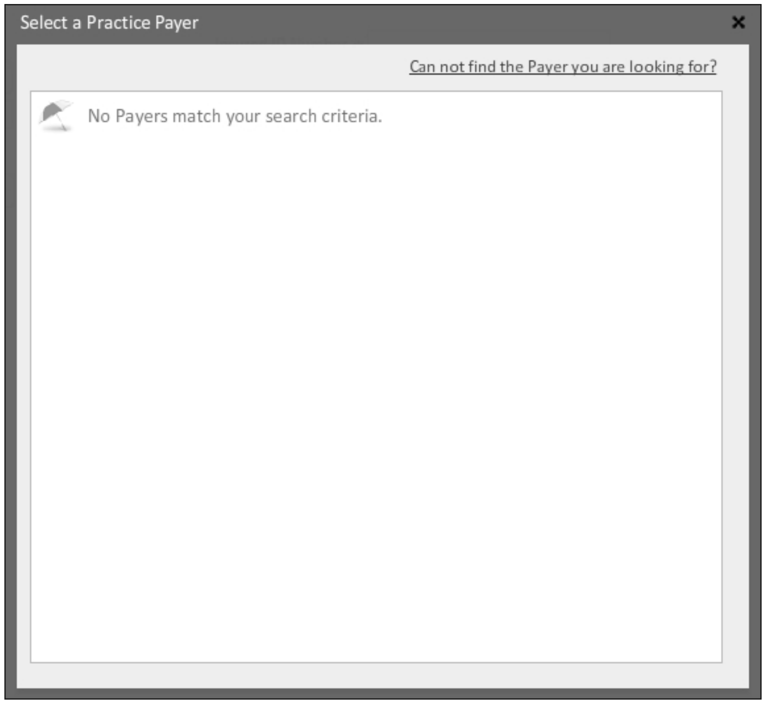


From the *Patient Insurance* screen, click *New.*

To add payors to your practice, follow along as Ann adds Bonnie's insurance. Click *(click to assign)* next to *Payer*.

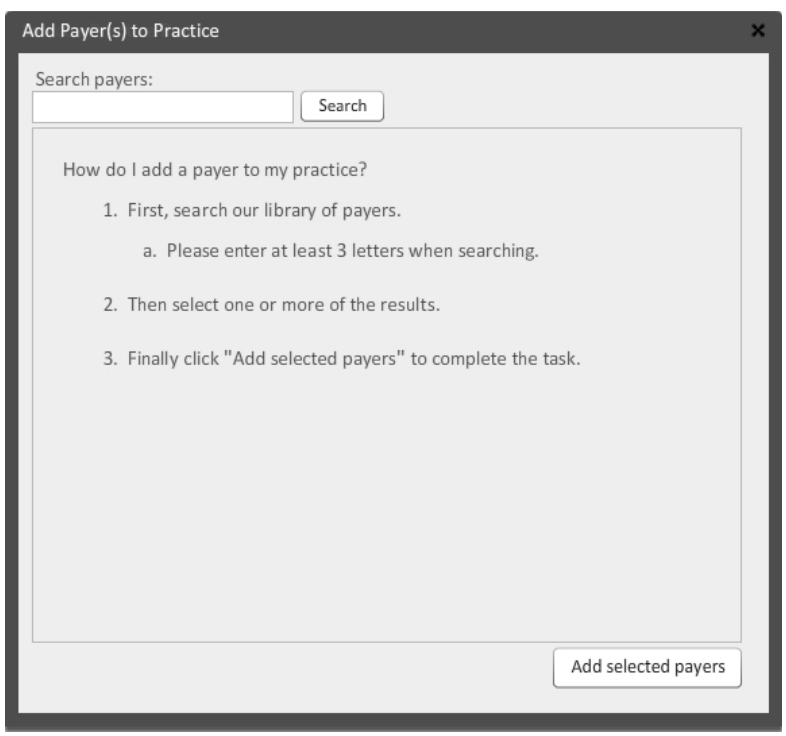


Select a practice payer in the window that opens. At this point, your practice doesn't have payers preloaded into the Practice Fusion system. You will need to add each insurance company. Click the link _Can not find the Payer you are looking for?_ You will then click *Add Practice Payer*.

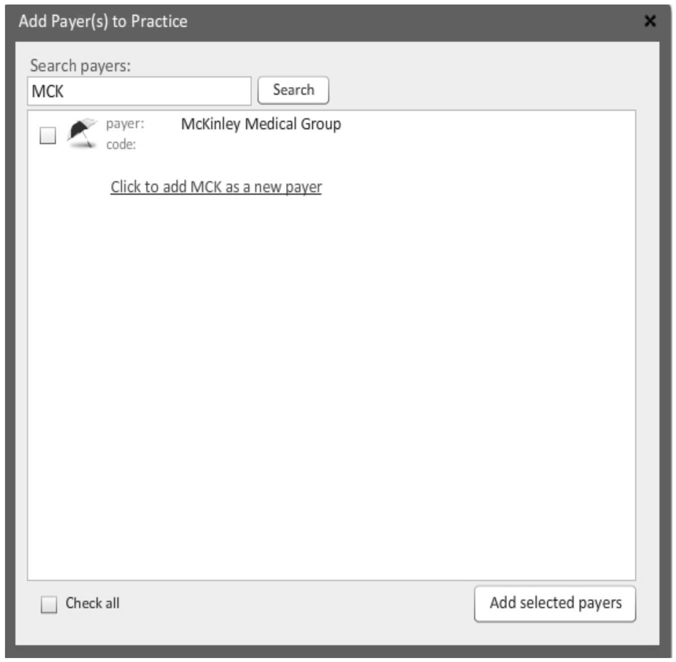


Click the link _Can not find the Payer you are looking for?_

You can search the library of payers in the Practice Fusion system.



Type the first three letters in the insurance company name, and click *Search*. (In this case, the letters would be *mck* since from the New Patient Information form you know Bonnie's insurance is through McKinley Medical Group.) *McKinley Medical Group* appears because it is in the library of payers for Practice Fusion; mark the box to the left, and click *Add selected payers*. Then, close the box with the *x* in the top-right corner. Now McKinley Medical Group is part of your practice's payers, and you will not need to go through this process with this specific group again!

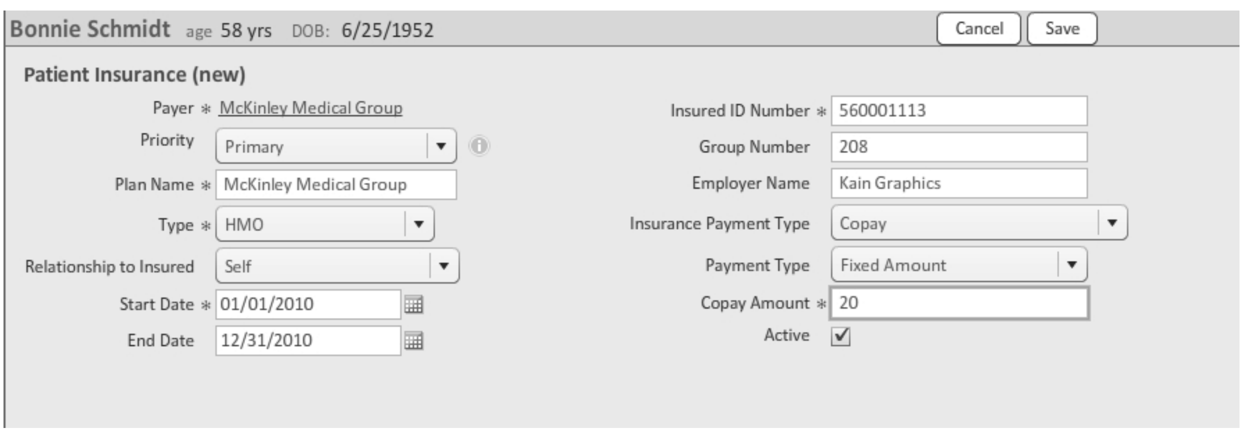


McKinley Medical Group appears; mark the box to the left, and click *Add selected payers.*

Ann clicks *(click to assign)* next to *Payer*. A window appears with *McKinley Medical Group* listed, and Ann double-clicks that insurance provider. The page returns to the *Patient Insurance* screen, and Ann continues to enter the following information from the New Patient Information form:

> *Priority:* Primary
>
> *Plan Name:* McKinley Medical Group (The system completes this.)
>
> *Type:* HMO
>
> *Relationship to Insured:* Self
>
> *Start Date:* 01/01/20XX (current year)
>
> *End Date:* 12/31/20XX (current year)
>
> *Insured ID Number:* 560001113
>
> *Group Number:* 208
>
> *Employer Name:* Kain Graphics
>
> *Insurance Payment Type:* Copay
>
> *Payment Type:* Fixed Amount
>
> *Copay Amount:* 20

As Ann completes the information, please enter the information into your Practice Fusion account, as well. You will leave the *Active* box checked. Then, ensure that your information matches the following.



Compare your *Patient Insurance* screen to the example.

Ann clicks *Save* once she has accurately entered the information into the EHR. The plan name now appears in the *Patient Insurance* list.

Now, if it's necessary to edit the insurance information, you will begin on the *Patient Insurance* window. Put the cursor on the insurance you'd like to change to highlight it, and then double click on it. This will bring up the insurance information allowing you to edit mistakes, update policy numbers or make other necessary changes to the patient's insurance. Once you have edited the insurance, click *Save*.

Patty is impressed with how easy it is to add new patients to the system. Ann is ready to enter the next new patient, Brenton Niles, who is the child of Theresa and Gary Niles. Practice Fusion requires that the *guarantor* be listed as a patient in the practice. A **guarantor** is someone who is responsible for an account because the patient is a minor. The guarantor is liable for any amounts not paid to the provider, whether the insurance company makes partial payment or declines to pay. This means that Ann will create EHRs for Gary, Theresa and Brenton next. As Ann completes the process, you will use your Practice Fusion account to create EHRs in the next Practice Exercise. Be sure to enter the data just as it's found on the New Patient Information form. You will use the EHRs that you create here to complete the next step in this lesson. Accuracy is the key to success!

Please pause to complete online Practice Exercise 15-1.

Step 7 Schedule, Cancel and Reschedule Appointments

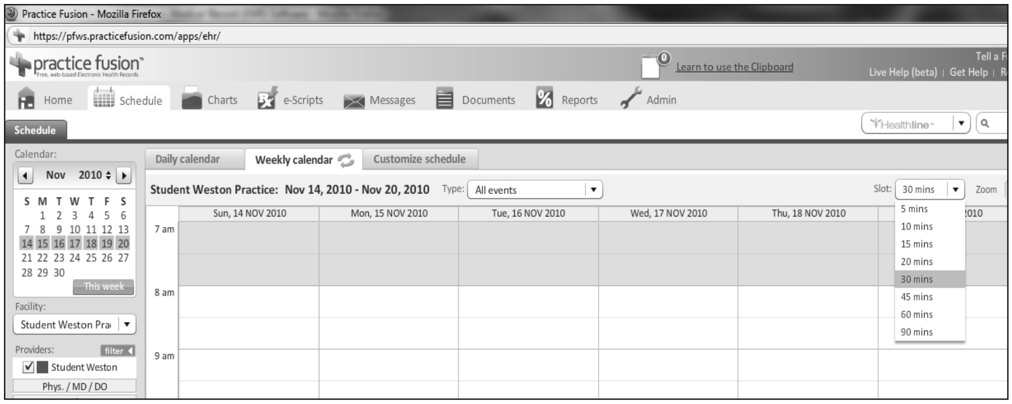
- ❑ Before we move on, it's important to note that Practice Fusion is an EHR software that also has the capability to send messages and appointment reminders, schedule appointments and perform a number of other tasks. While you will view actual patient EHRs in this lesson, keep in mind that the EHR software does contain these other features and tools.

Now let's move on to one of the capabilities of Practice Fusion: scheduling appointments. There are different systems that healthcare professionals use to make appointments. **Open office hours** allow clients to walk into an office without an appointment. Although this type of system might work in an emergency department, it is not well-suited for the medical office. Most clinics use a scheduled appointment system, which is the focus of this part of your material. The **wave-scheduling system** bases appointments on the average length of a routine visit. For example, consider a medical clinic that sees an average of four people an hour for about 15 minutes each. With the wave system, four patients are told to come to the clinic each hour, usually on the hour, and they are seen in the order of their arrival.

In a **time-specific system**, each patient gets an assigned appointment time. The time units can be as little as 10 minutes or as much as an hour, depending on the need. For example, in a dentist's office that uses 20 minute units, a dentist might request that the medical office manager put a patient down for two units, or 40 minutes, for an appointment that week.

Practice Fusion is based on the time-specific system. Let's set the standard practice appointment for 30 minutes before you learn to schedule appointments.

At the Practice Fusion homepage, you will click *Schedule*, and then select *Weekly calendar*. Look at the top of the calendar, and locate *Slot:* Click the down arrow at the right, and select *30 mins* to indicate each appointment will be 30 minutes in length. You are able to adjust this standard when you enter an appointment, and we will discuss how to make these adjustments later. Now, you're ready to schedule an appointment.



Patty returns to Hudson Medical Clinic the next day to explore EHRs and what they have to offer in more detail. You know that the allergy clinic where Patty works uses paper medical records. In addition, Patty makes appointments with a pencil and appointment book. Ann is excited to show Patty how easy it is to schedule, cancel and reschedule appointments electronically.

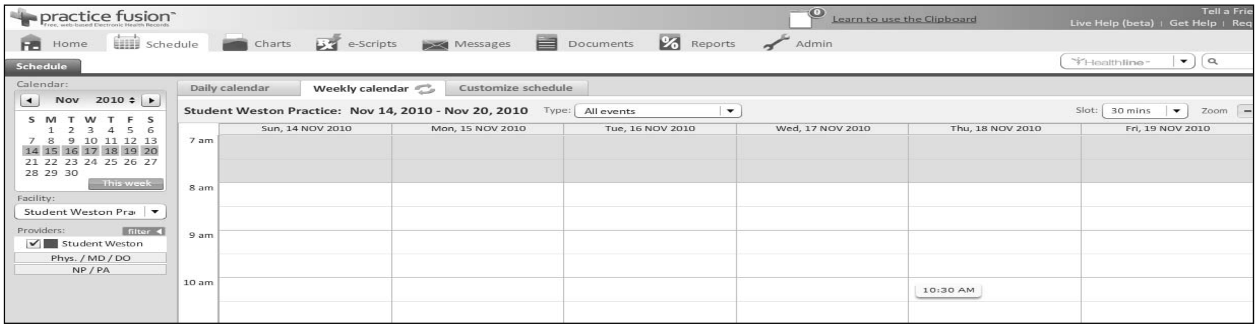
TUESDAY **MARCH 28, 20XX**

7:00		1:00	
7:15		1:15	Bruce J. Bell (924-2378)
7:30		1:30	
7:45		1:45	
8:00		2:00	Jolene Ramsey (752-2222)
8:15		2:15	
8:30		2:30	Jimmy Ramsey (")
8:45		2:45	
9:00	Ronald J. Simpson (727-3480)	3:00	BREAK/BUFFER
9:15		3:15	
9:30	Jane L. Owens (752-2626)	3:30	Ramon Garcia (368-5252)
9:45		3:45	
10:00	Linda Martinez (368-4555)	4:00	
10:15		4:15	
10:30		4:30	(BUFFER)
10:45		4:45	
11:00	James Watts (727-3211)	5:00	
11:15		5:15	
11:30		5:30	
11:45		5:45	
12:00	LUNCH	6:00	
12:15		6:15	
12:30		6:30	
12:45		6:45	
EVENING		NOTES	
7:00			
8:00			
9:00			

Some clinics use an appointment book for scheduling.

Schedule Appointments

Bonnie Schmidt calls to request an appointment with her doctor as Ann and Patty begin their second day together. Ann logs onto Practice Fusion. Once she is at the Practice Fusion home screen, she simply clicks *Schedule*. This opens the *Daily calendar*. Ann shows Patty that to begin the process of scheduling appointments, she must click *Weekly calendar*. Ann then uses the calendar provided on the left-hand side of the screen to navigate to various days and weeks. Ann explains to Patty that this is a quick way to move about the schedule and find a date that works for both patient and provider.



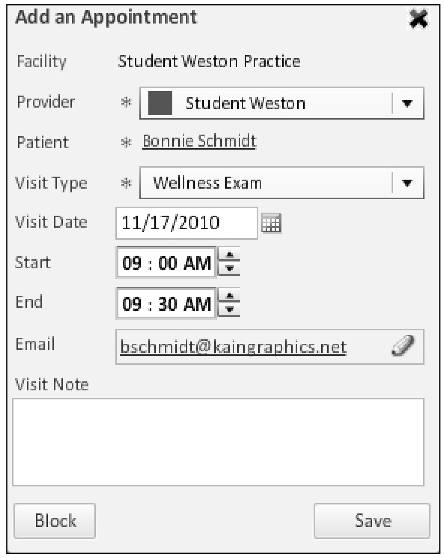
Once the *Daily calendar* opens, click *Weekly calendar.*

Now, Ann is ready to make an appointment for Bonnie. Bonnie would like an appointment for Monday, preferably in the morning, about 9 a.m. She needs to see the doctor for her annual checkup. (Remember that because Practice Fusion is a live Web-based system, you may want to schedule this appointment for some time in the future so that it remains visible as you work through the lesson. If you schedule it for this Monday but do not complete the lesson for several weeks, the appointment will be gone as you try to work through other exercises, and you will have to recreate it.)

Ann quickly locates the date on her Practice Fusion calendar and clicks on that date. The *Weekly calendar* will update with the week that Ann clicked. The *Add an Appointment* window appears when Ann clicks on the block for 9 a.m. Let's walk through the process to schedule Bonnie's appointment step-by-step in Practice Fusion.

Your name will appear in the *Provider* field. Click the hyperlink *(click to select a Patient)* in the *Patient* field to select a patient. The *Find Patient* box will appear, listing *Recently assessed patients*. The patients appear in alphabetical order. Simply locate *Bonnie Schmidt* from the list, and double-click her name to select her. In the *Visit Type* field, click the dropdown box to set the type of appointment. In this case, you'll select *Wellness Exam*. The software completes the fields for *Visit Date* and *Start* for you. The *End* field will show *9:30 a.m.* Because you are not dealing with real patients at this time, you will always skip over the *Email* field that sends reminders. Finally, leave the *Visit Note* field blank as there is no note to add at this time.

Your *Add an Appointment* box should look similar to the one Ann created. Please note that the provider and date will vary. (Be sure to note the visit date so that you are able to locate this appointment in the next step of your lesson.)



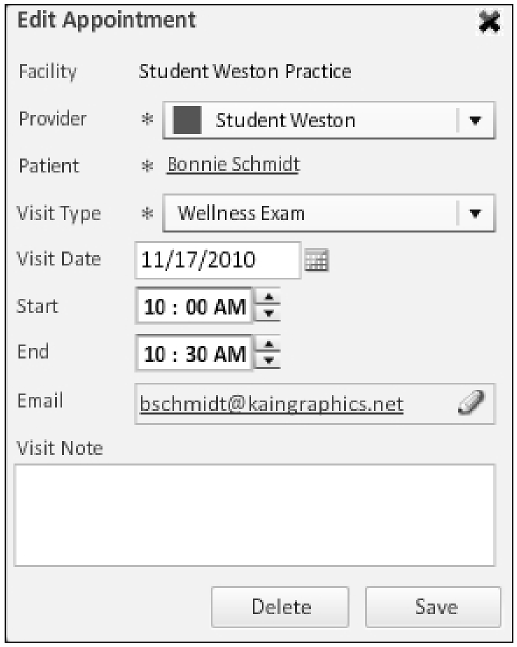
Your *Add an Appointment* box should look similar to our example.

Click *Save* if your *Add an Appointment* box looks like the one Ann created. The appointment will appear on the schedule. If your box doesn't look like Ann's, complete the process again to correct any errors you made.

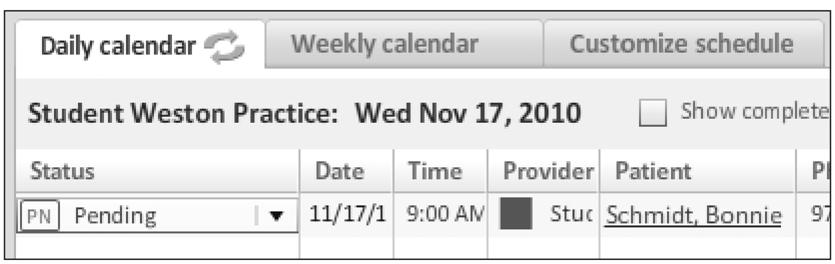
Patty is impressed with the simplicity of the system and is excited to try what she's learned. However, before she gets a chance, Bonnie calls the office for a second time in five minutes. She's forgotten that she has an early work meeting the same day as the appointment she just scheduled. She'd like to reschedule for 10 a.m. Ann assures Bonnie that this won't be a problem and returns to the *Schedule* tab, prepared to cancel Bonnie's appointment and reschedule it for the later date and time.

Cancel and Reschedule Appointments

Let's walk through the process with Ann as she reschedules Bonnie's appointment. From the Practice Fusion homepage (click *Home* in the upper-left corner of the screen), Ann clicks on *Schedule* and then *Weekly calendar* to begin the process. To change the appointment, Ann must first locate the appointment she set. Once Ann has located the appointment on the *Weekly calendar*, she'll double-click the box, and an *Edit Appointment* box appears. Simply change the date or time of the appointment, whichever applies, and the appointment will move to the rescheduled time or date.



If a patient needs to cancel the appointment completely, you'll locate the appointment in the *Daily calendar* to begin the process. The patient's current *Status* will show *Pending*; Ann would click the dropdown box beneath *Status* and select *Cancelled*.



Click the dropdown box beneath *Status* to change the status of an appointment.

The software requests the reason for the cancellation. Ann simply types "*change time*" and clicks *Submit*.

To schedule multiple appointments for the same time, or to schedule an appointment for the time of a cancelled appointment, you will click on the white area of the time block. This will expand the appointment block to adjust for multiple patients.

The next call Ann receives is from Theresa Niles who needs to schedule an appointment for her son, Brenton. Try your hand at scheduling the appointment as Ann enters it. Be sure to enter the appointment accurately because you will use it to complete other tasks.

> Brenton's mother calls to set up an appointment for her son, who has stitches that must be removed. Afternoons work best for them, so Ann schedules a 15-minute follow-up visit at 4:30 p.m. today for Brenton. Ann notes the reason for the appointment in the *Visit Notes* section.

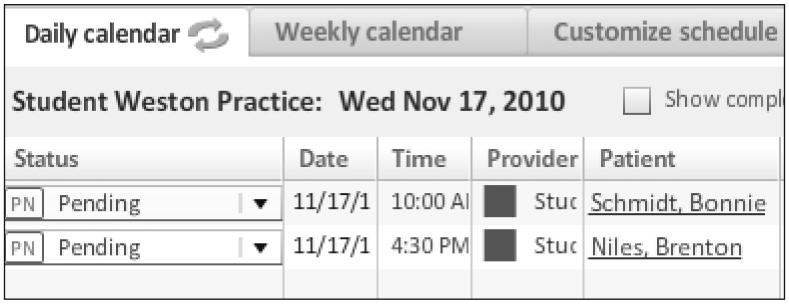
Your *Add an Appointment* box should look similar to the following, though the provider and date will vary.

Step 8 Patient Status

- ❑ As Patty and Ann discuss the process of checking in patients, Patty notes that at the allergy clinic, it's a challenge to recall where each patient is in the appointment process. For example, sometimes, the nurse takes a patient into an examination room while Patty is working with another patient. Patty is so busy that she doesn't realize the nurse took the patient to a room. Other times, a patient might be in the restroom when the nurse arrives to take the patient to an examination room. In these cases, Patty can't even confirm that the patient is in the building!

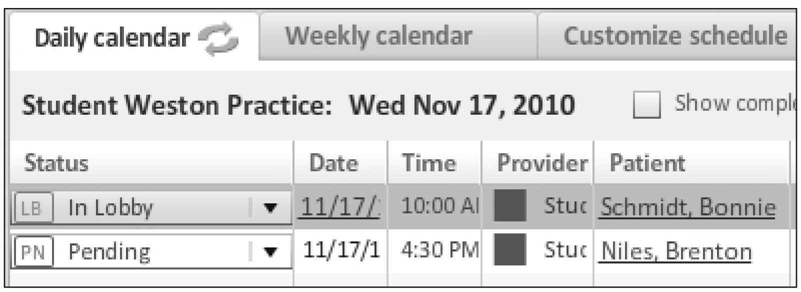
  Ann explains how the EHR software assists the office staff at Hudson Medical Clinic with the appointment process. The staff can see if a patient arrives, cancels or doesn't show with a quick check of the patient's status in the EHR. Patty saw how Ann cancelled Bonnie's appointment. Now, follow along as Ann teaches her to change a patient's status in Practice Fusion.

Remember that you scheduled Bonnie for her wellness exam at 10 a.m. She arrives at 9:50 a.m., and Ann changes the patient's status in Practice Fusion to indicate Bonnie arrived for her appointment.



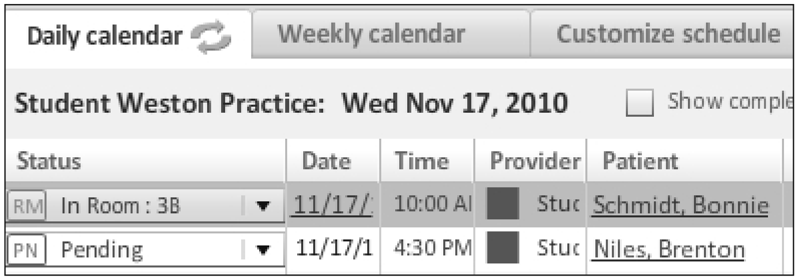
Click the *Schedule* tab and then *Daily calendar* to locate Bonnie in the schedule.

From the practice homepage (click *Home* in the upper-left corner of the screen), Ann clicks the *Schedule* tab and then *Daily calendar* to locate Bonnie Schmidt in the schedule. Bonnie's current status shows her appointment as *Pending*. Ann clicks the dropdown box to show all of the options: *Arrived*, *No Show* or *Cancelled*. Ann clicks *Arrived,* and *Status Changed* flashes on the screen just before the status for Bonnie changes to *In Lobby*.



Click *Arrived*, and *Status Changed* flashes on the screen just before the status for Bonnie changes to *In Lobby.*

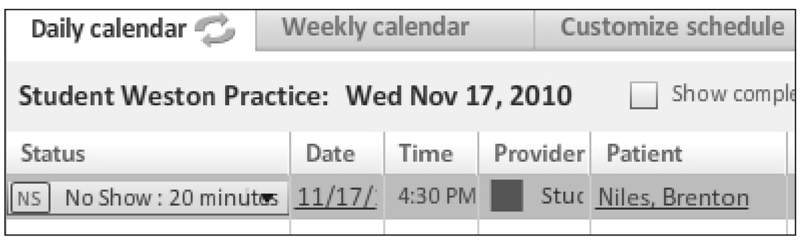
Pam, the nurse at Hudson Medical Clinic, enters the lobby and calls Bonnie for her appointment. Pam checks Bonnie's weight and height before she takes Bonnie to an examination room. She takes Bonnie's vital signs (temperature, blood pressure, pulse and respiratory rate) and uses a computer in the examination room to change Bonnie's status to *In Room*. Additional information is needed, so a box that asks "*Which Room*?" pops up. Pam completes the necessary information; she indicates that Bonnie is in room 3B and clicks submit. The status on the *Daily calendar* is now updated to show that Bonnie is *In Room: 3B*. Pam then uses the computer to access Bonnie's EHR and enter the vitals that she took.



The status on the *Daily calendar* is now updated to show that the patient is *In Room: 3B.*

Now that Bonnie has been assigned a room, the doctor will see her. Then, she may change rooms, or she could be discharged to the lobby. In this case, Dr. Bailey examines Bonnie in room 3B. He then changes Bonnie's status to *Seen,* and Bonnie disappears from the *Daily schedule* as the process is complete.

As the end of the day draws near, Ann notes that Brenton and his mother haven't arrived for Brenton's appointment. According to Hudson Medical Clinic's practice policy, any patient who is 20 minutes late for a scheduled appointment is considered a no-show. It's 5 p.m., and Brenton still hasn't arrived, so Ann will change his status from pending to *No Show*. When the software prompts her for a *No Show Reason,* she indicates *20-minute policy* and clicks *Submit*.



According to Hudson Medical Clinic's practice policy, any patient who is 20 minutes late for a scheduled appointment is considered a no-show.

You covered a lot of ground in this lesson! You now know how to schedule, cancel and reschedule appointments, and you are able to change a patient's status to track his progress in the medical office. As you can see, the electronic health record allows you to manage a healthcare facility's schedule with ease.

If you find that you have questions about what we've done so far, go back and work through the scenarios using different dates. You can schedule, cancel and change the status of patients and appointments as often as necessary so that you can master these new skills.

Please pause to complete online Practice Exercise 15-2.

Step 9 Lesson Summary

- In this lesson, you explored the history and goals of the EHR—a completely electronic system to create, store and access medical records. You used your Practice Fusion account to schedule, cancel and reschedule appointments as a member of the clinic staff, and you discovered how to change the patient status in the electronic health record. You are also able to create a new EHR within the Practice Fusion platform.

  In the next section, we will examine the *Patient Dashboard* in more detail. You'll examine how other healthcare providers utilize EHRs. Doing so will give you insight into the big picture of EHRs and how they impact everyone involved—from the patient and office staff to the nurse and physician.

Please pause to complete an online Quiz.

Endnotes

[1] "EHR Electronic Health Record." *Health Information Management Systems Society.* Health Information Management Systems Society, 2010. Web. 8 December 2009.

[2] "Academic License FAQ." *Practice Fusion.* Practice Fusion, 2010. Web. July 2010.

[3] "Practice Fusion System Requirements." *Practice Fusion.* Practice Fusion, 2010. 27 September 2010.

Lesson 16
The Patient Exam

Step 1 Learning Objectives for Lesson 16

❑ When you have completed the instruction in this lesson, you will be trained to do the following:

- Discuss changes in the concept of the physical examination.
- Discuss the purpose of the patient interview and outline the process.
- Describe various interviewing skills and identify communication barriers.
- Identify the guidelines to follow for patient education.
- Explain the origin of triage and discuss the purpose of triage in today's medical office.
- Explain the role of the medical assistant in the examination process.
- Explain the function of the instruments, equipment and supplies used in the CPE.
- Explain how to accurately measure and weigh patients (infants, children and adults) and properly record the information.
- Outline the medical assistant's duties in preparing for a patient's complete physical examination (CPE).
- Identify each section of the CPE and describe how the physician conducts each part of the examination.
- Discuss the warning signs of cancer in adults and children.
- Describe the physical examination schedules for adults and children.
- Explain pediatric examinations and growth patterns.
- Describe how to accurately measure an infant's head circumference and chest and plot on a growth chart.
- Explain obstetric and gynecologic examinations.
- Identify the purpose of each of the examination positions.
- Determine how to assist patients to each position and drape accordingly.
- Discuss safety precautions regarding both the medical assistant and patient in positioning for examinations.

Step 2 Lesson Preview

- An estimated one in three American adults has high blood pressure or hypertension. Having high blood pressure increases your chances of developing heart disease, a stroke and other serious conditions. High blood pressure is sometimes called the "silent killer" because it usually has no noticeable warning signs or symptoms until other serious problems arise, so many people don't know that they have it. Anyone, including children, can develop high blood pressure. However, high blood pressure is easily detectable and can usually be controlled. Maintaining a healthy blood pressure is an important health strategy, so it is important for you to know your blood pressure level and to check it regularly.[1]

No one is immune from the possibility of heart disease.

Another 17 percent of adult Americans have high blood cholesterol, a major risk factor for heart disease, the leading cause of death in the United States. Cholesterol is a waxy, fat-like substance that your body produces to function normally. When there is too much cholesterol in your body due to a high-fat diet or genetics, it is deposited in arteries, including those of the heart, which can lead to narrowing of the arteries and to heart disease. Many people do not know that their blood cholesterol is too high even though it can be easily checked and can be controlled.[2]

These are just two of the many health indicators that are generally assessed only during a physical examination or other medical visit. Yet, over one-third of the American population ages 18-64 never saw a doctor in 2004.[3] Whether the reasons for not seeking medical care are financial, emotional or geographical; the long-term benefits of a physical examination far outweigh any perceived drawbacks.

So what can you, as a medical assistant, do to educate and persuade the general population to seek regular medical attention? Well, you can make the procedure a more pleasant experience for the patient, you can educate patients, friends and family of the benefits of health care and you can display the warmth and compassion that all patients should receive when seeing a medical professional. You will learn all of these skills in this lesson.

First, you will learn the patient examination process, beginning with a warm greeting and continuing with the interview process, performing physical assessments and educating the patient during an exam. You will also learn your role in preparing for the physical exam and assisting the physician in the examination. An important aspect of your contact with the public will be medical triage, both in person and on the telephone, which we'll cover in this lesson. All of these interactions with the public contribute to breaking down the barriers that prevent some people from seeking medical treatment. Let's begin by discussing some changes in the concept of the physical examination.

Step 3 The Physical Examination: A Change in Concept

- ☐ In the early 1970s Dr. Barbara Bates turned the medical field upside down by challenging the current methods of physical examination and diagnosis. She envisioned an expanded role for the nurse; to share with doctors some of the responsibilities of patient care. She also became particularly interested in how physicians are trained to diagnose patients.

As she taught the skills of physical examination and clinical thinking, she realized the standard teaching text used by students was inadequate and began meeting with a group of nurses and physicians to completely re-think the teaching guides. The result of their efforts was a hand-drawn, informative and easy-to-use text for nurse-practitioner students. Introductory chapters addressed interview techniques, taking notes on health history, common and important symptoms and assessment of mental health. Techniques for physical exams were described in detail. The first edition of Dr. Bates' "Guide to Physical Examinations and History Taking" was published in 1974. Since then it has become a standard textbook for nursing and medical training programs.[4]

The physical examination is much more pleasant in modern times than in the early days of medicine.

We can thank Dr. Bates for her insight into the ability of the nurse, nurse's assistant and medical assistant to be a part of the patient's healthcare team. Let's explore the roles that you will fill as an active facilitator of the physical examination process. Our first step is to greet the patient and conduct the patient interview.

A patient is sitting in the waiting room as another patient leaves. The patient in the waiting room asks you, "Was that Jenny Smith? I lost track of her and would like to catch up. Could you give me her phone number?" Be careful to avoid mentioning the patient's name and, of course, keep her phone number confidential. You can reply, "I'm sorry, I can't give out anyone's phone number," or "I know you wouldn't want me to give your phone number to anyone without your permission."

Let's look at another awkward scene that could have been prevented.

Two coworkers use the same physician. By chance, they both had appointments at different times on the same day. Patient A's morning appointment was to discuss the findings of a recent biopsy. She was devastated to learn that she has breast cancer. Patient B came in at lunchtime, and saw Patient A's name on the sign-in sheet. Later that day at work, Patient B mentioned to Patient A, "Hey, I saw you went to see Dr. Z this morning. What were you there for?" This blunder could easily have been avoided if patients were told to enter only a first name and last name initial on the sign-in sheet.

Still another danger lies in two medical professionals discussing a case outside of the office. The grocery store aisle is not an appropriate place for a sharing session. Anyone could be around the corner or on the next aisle—including the patient.

con·fi·den·tial (adjective):
carried out or revealed in the expectation that anything done or revealed will be kept private[9]

A different situation where you'll need to protect patient information is in the release of records. Patient records are never released without signed consent forms from the patient or the patient's representative. The consent form is usually placed in the patient's medical record.

Refer to your HIPAA supplement if you have any questions about the appropriate release of patient information.

Now that we've covered the initial activity of the patient examination—obtaining medical record information—let's move on to patient education.

Step 4 The Patient Interview

❑ Think about your last visit to the doctor—did the medical assistant or nurse ask you a lot of questions that had nothing to do with your visit? Did you wonder if she knew why you were there? Believe it or not, those questions had a purpose. The purpose of the **patient interview** is to gather subjective information from the patient to clarify and verify the patient's health. The interview is most effective when it is performed verbally, as an interaction between you and the interviewer. Verbal communication in the medical office has several benefits:

- The patient's information is accurate, reliable and up to date.
- The patient recognizes that the physician and medical assistant are interested in her and her care.[5]
- The physician and patient can come to an agreement on the diagnosis and treatment.
- The patient is more likely to play an active role in her medical care.[6]

It may seem like you're wasting time answering needless questions, but you're actually providing valuable information to the doctor. You're participating in a patient interview. Now that you know why the interview is important, let's trade places and examine how you, as the medical assistant, can make the interview effective. We'll start by describing the interview phases.

Interview Phases

Interviews move through phases. You wouldn't start an interview with an extremely personal question. Instead, you'd begin by greeting the patient warmly. Then, start with some introductory questions and slowly move into more personal areas of discussion. Let's examine each interview phase and what you want to accomplish in each.

Phase 1

The first phase is an introductory stage where you want to set the stage for an effective interview. In this stage, you will do the following:

1. Welcome the patient.
2. Know and use the patient's name.
3. Introduce and identify yourself.
4. Ensure comfort and privacy.

Phase 2

The next phase of the interview is to discuss the chief complaint. In this stage, you will do the following:

1. Briefly have the patient explain his issues, including his chief complaint, other symptoms and any specific requests, such as prescription refills.
2. Determine why the patient came to the doctor.

Phase 3

The third phase of the interview is to obtain the patient's story so that you can gather information. In this stage, you will do the following:

1. Ask open-ended questions in the beginning.
2. Encourage further explanation with silence and verbal and nonverbal cues.
3. Paraphrase and summarize what the patient is saying.

Phase 4

This phase of the interview is the transition, where you begin to shift the interview to the physician. In order to do this, you will do the following:

1. Summarize the interview up to that point.
2. Thank the patient for his information and explain that the physician will be in to examine him soon.

Occasionally, the medical assistant will gather the following information for the physician. Otherwise, the physician or another staff member will gather this information.

- Patient's highest-priority problems
  - Ask about the most urgent problem, or the history of present illness.
  - Move from general to specific questions.
  - Begin with open-ended questions and move to closed-ended questions.

- Pursue other problems as time permits
  - Review of systems
  - Past medical history
    - Allergies/Adverse Reactions
    - Medications/Immunization
    - Major Medical or Psychiatric Problems/Major Surgeries
    - Last Menstrual Period/Pregnancies/Contraception (if female)
    - Smoking/Alcohol/Caffeine/Other Drugs

- Other History (as appropriate)
  - Family/social history
  - Occupational history
  - Sexual history

At the end of the interview, explain the physical examination procedures and help the patient prepare for the examination.

Patient Interviewing Skills

Attitude is everything, isn't it? Even the simple word "No" can mean "Yes," "Maybe" or "No way!" It can be a menacing "No!" a gentle "No, no," or an indifferent "Nah." It's all in the way you say it. As you learned in Lesson 13, communication involves so much more than the words you say. Effective communication is essential in the therapeutic environment. You'll converse with the public, other medical staff and most importantly, patients. One of your first interactions with a new patient is the interview. You may have all the right forms, ask all the right questions and say all the right things, but come away with no more information than when you started. Effective interviewing skills not only involve gathering information efficiently, but also forging a mutually beneficial relationship with your patient. You don't have to be Oprah Winfrey to get people to trust you enough to open up—anyone can learn these skills. By following these steps and practicing the skills, you can too. Let's see how.

Discussion Facilitation

To **facilitate** means to make something easy. Rather than a nervous interchange of questions and answers, a facilitated interview is relaxed, open-ended and friendly. The first step in facilitating a discussion is to make sure your patient feels comfortable talking with you. Create a welcoming, warm environment when you first meet your patient. Look directly at him, smile and use his name. Keep your body language open and relaxed. Ask him how he is and listen and respond to his answer.

Sometimes a family member or interpreter will accompany the patient. It's easy to start speaking to the person assisting your patient, but avoid that tendency. He is not the patient. Speak directly to the patient, even if he's not the one answering your questions directly.

The Warm-up

Warm up with some general questions in the beginning of the discussion. You can chit chat for a little while instead of diving in with questions. Mention something about yourself in relation to the conversation. This will help your patient feel more comfortable discussing his information with you. Smile while you are conversing.

Use a Common Language

Interview the patient by asking open-ended questions that allow him to explain his answers rather than replying yes or no. Speak in clear, concise language so the patient can absorb what you're saying. Avoid medical jargon. When you do have to use a medical term, explain it in terms that the average person would understand. Above all, if the patient doesn't understand something, assure him that most other people don't understand it at first either. Then find a different way to explain the term.

Laughter is the best medicine.

Use Those Listening Skills!

In addition, make sure you listen well. Apply the active listening skills that you learned previously. Respond to your patient in a way that indicates that you hear and understand his question or comment. If you need to clarify what the patient is saying, summarize what you think he said and ask the patient if that's correct.

Take Your Time

Also, allow your patient time to reflect and respond to your questions. Don't interrupt when he's talking, even if he seems to be rambling. His apprehension might cause him to take a little longer to get to the point. When your patient responds, acknowledge his feelings and validate his concerns. If the patient gets off track while he's answering a question, try to get him back on the subject by asking a question.

If you see that the patient is having difficulty answering a question, acknowledge the delicate nature of the subject. Make sure the patient knows how dedicated the practice is to the protection of his privacy. It might ease your patient's concerns and allow him to speak more freely.

Document, Document, Document

Write down the smallest details. Information that the patient deems unimportant may help the physician understand the patient's condition. It's important to keep accurate records, even if the patient or you feel that something that was said was unimportant.

The Closing

When ending the interview, thank the patient. He has opened himself up to you and may feel awkward and vulnerable, so it's important that you end the interview on a high note. Find something positive to say to close the interview. It can be a compliment, a reassurance about something he's concerned with or an expression of appreciation.

Explain the next step so the patient is aware of what is coming. For example, if the physician is currently with another patient but will be with your patient soon, let him know that it'll be a few minutes. An automatic "The doctor will be right with you," followed by a five minute wait does not show respect for the patient's time. If the wait will be even longer, check back in with him and offer to bring him a magazine or some water. Explain the reason for the wait.


Maintain a consistent level of familiarity during and after the patient interview.

Communication Barriers

The barriers to communication that you learned in Lesson 13 can sabotage all of your efforts to effectively facilitate the interview. Let's review the pitfalls to avoid.

Don't . . .

Stereotype—To judge or label a person based on an oversimplified, standardized image based on bias, fear and the inability to separate the person from the disability. Get to know the individual patient and always avoid stereotypes and labels.

Give personal opinions—To inject your own personal opinion into discussions with the patient. Give only the medically accurate information that the patient has requested. Let him make his own decisions. If he asks your opinion about a simple issue, you can relate your personal experiences. If the issue is medically complex or outside of your scope of expertise, ask his doctor to discuss the matter with him.

Express disapproval—To convey disagreement with a patient's decision or lifestyle. The patient will do what is right for him. Maintain the trusting relationship you have with your patient and remember that you don't know everything. To express disapproval could cause the patient to shut down communication.

Belittle patients' feelings—To deny the importance or relevance of a patient's fears or concerns. Most likely you've heard the expression "Put yourself in his shoes." When you find yourself denying or minimizing the patient's statements, excuse yourself from the conversation and take a moment for a reality check. Literally imagine what your life would be like if you had his ailment or disability. You'll probably realize that you don't know enough about the patient's situation to make a judgment. At that point, it should be easy for you to modify your attitude to one of acceptance of your patient's feelings and sympathy for his situation.

Change the subject or interrupt—To stop the flow of the patient's communication by bringing up another topic or a question. These are both obvious communication barriers—the patient realizes that you're not listening or are in a hurry to wrap up the conversation. The patient should feel that he can talk to you about anything and that you have the time to listen.

Do you know someone who can make friends everywhere she goes? Or maybe you're one of those rare individuals. Well, good communicators use these techniques—possibly without even realizing it. Are you imagining how some of these tips might help in your personal life as well? Great! There's even more you can do to communicate effectively with the people in your life. Let's review the aspects of nonverbal communication to keep in mind when interviewing a patient.

Nonverbal Communication

The first scientific study of nonverbal communication was Charles Darwin's book *The Expression of the Emotions in Man and Animals* published in 1872. He theorized that all mammals show emotion in their faces. Studies now range across a number of fields, including kinesics, linguistics and social psychology. A large proportion of nonverbal communication is iconic and may be universally understood. Paul Ekman's influential 1960's studies of facial expression determined that expressions of anger, disgust, fear, joy, sadness and surprise are universal.[7] That means that a person halfway around the world will make the same facial expression when scared by a spider as you would!

Oculesics is the study of the role of eyes—both eye gaze and pupil dilation—in nonverbal communication. People use eye contact to indicate interest in something. For example, when a patient is discussing the increase in pain in his wrist after a change of medication, a medical assistant may communicate disinterest by reading the patient's chart instead of looking at the patient.[8]

Eye contact is an important aspect of nonverbal communication, and it's essential between medical assistants and patients. Make eye contact with your patient and have a positive facial expression. Don't underestimate the power of nonverbal communication. Your patients will read into negative nonverbal communication.

Although some cultures in Italy still believe in the "Evil Eye," modern society no longer frowns upon direct eye contact.

Similarly, your seating position also affects communication with your patients. For example, if your patient is sitting in a chair in the exam room and you're standing up while talking to him, he may feel that you don't have time to sit down and talk, or he may feel like you're talking down to him. Make sure you're at eye level with the person you are talking to.

And don't forget the nonverbal cues that you learned about in Lesson 13. Practice these communication techniques and you'll be an expert interviewer in no time!

Active and Passive Communication

In order for you to effectively assess a patient, you'll need to use active communication. You've probably heard the terms active and passive communication before, but you may not be aware of how these terms apply to assessing a patient. **Active communication** is a two-way communication and is an affirmation that the information is understood. For example, you are actively communicating with a patient when you verbally confirm that she understands the instructions you gave her. **Passive communication** occurs when there is no response to your questions or the communication is one-sided. Ideally, you want active communication when you're using your triage techniques. Ask different types of questions to get the caller or patient involved in communicating.

Another aspect of assisting patients in the medical office is to provide information. Let's examine your role in educating patients.

Step 5 Educating Your Patients

- [ ] As a medical assistant, you play a vital role in educating patients. Patients may ask you simple questions regarding billing or an appointment. They may also want information on complex matters such as pain control or medical procedures. The purpose of patient education is to empower the patient in a vulnerable situation. She does not control the invasiveness or the discomfort caused by the procedures or treatment that will be performed on her. But if she knows the purpose and the process of each event, she has the knowledge to weigh the costs versus the benefits. She is no longer the recipient of her medical care; she is the administrator.

The medical assistant has the opportunity to build a foundation of trust with the patient by providing accurate information in a caring manner. As a result, the patient feels well treated and the physician has a cooperative and knowledgeable partner who is invested in the management of her health care.

Education Preparation

Typically, the medical assistant will get a lot of logistical questions such as the office's hours, billing, insurance services, appointment schedules, phone number, hospital affiliation and after-hours contact information. Ask more experienced medical staff for this information if you don't have it and memorize it so you won't have to look it up. In addition, ask staff members what other logistical questions you should be prepared to answer.

Questions about terminology, tests, procedures, diagnoses and medications are more complex, and need more preparation to answer accurately. You'll know much of this information from the training you've received, but when you don't know, don't try to make a "best guess." Tell the patient that you don't know and that you'll do some research and get back to him. One option if you don't feel qualified to discuss the topic is to ask the physician to discuss the patient's question with him. Remember, a professional medical assistant recognizes the boundaries of her role. The medical assistant can't—and shouldn't—answer the more complex medical questions. Leave those to the nurse or physician to answer.

Don't ever be afraid to say, "I don't know." Giving an incorrect answer to a patient not only breaks down the trust the patient has in you, but it can have serious consequences. For example, a patient may ask you about a medication's side effects and when he should call the doctor. If the medicine sounds familiar to you, you may be tempted to list some good guesses. However, if the patient is allergic to the medication or experiences different side effects, he may not recognize the problem and wait several days before alerting his physician.

The policy and procedures manual that you studied in Lesson 2 is a good source for many of your questions about providing information to patients. Read your office's manual and any patient information that the practice provides before you start answering patients' questions.

Don't be afraid to say "I don't know." You can always find the answer and then call the patient back.

Let's look at an example. Carolyn has a mole on her calf but has been reluctant to visit the doctor. Her husband convinces her to make the appointment to have the mole examined and removed. Carolyn calls your office to schedule the procedure. She asks you several questions about the office, physician, insurance, billing and medication. You carefully answer each question. Carolyn then asks a specific question about the procedure that you can't answer. It would be tempting at this point to provide a vague answer so you can get off the phone and continue what you were doing. This would be a mistake. The level of trust that you have inspired in Carolyn so far would disappear.

Instead, you tell Carolyn that you don't know, but you'll do some research and call her back. After you hang up, you check a reputable Web site and talk to the doctor to get Carolyn's answer. You then call Carolyn back with the information. This simple task has reduced Carolyn's anxiety about the procedure by demonstrating that she can trust you, and in turn the practice, with her medical care.

Methods of Teaching

The holidays are less than a month away, and you've purchased a computer desk for your daughter—assembly required. Which do you do,

a) read the instructions front to back, or

b) just start putting the pieces together in the most logical way?

If you said a, you are most likely a reading/writing learner. If your choice was b, you like to learn by doing, or kinesthetically.

Just as you have a particular *learning style*, your patients learn in different ways as well. To make your education effective, you must present it in a way that each patient can understand. It's your job as the educator to adapt to meet the patient's needs. If you can identify her learning style, you have a much better chance of meeting her needs. Let's discuss the many types of learning styles.

Learning Styles

Learning styles are the most effective way that someone processes and absorbs information. **Multi-modal learners** are people who have more than one strong learning style. Learning styles are divided into the following categories:

Learning Styles		
Style	**Learns By**	**Best Teaching Methods**
Visual	Seeing	Poster, magazine, diagram, DVD, visual demonstration, Web site with illustrations
Verbal/auditory	Hearing	Spoken instruction, lecture, CD, audiotape, Web site with emphasis on audio presentation
Reading/writing	Processing text	Written directions, signage, posted notice, brochure, pamphlet, Web site with emphasis on text
Kinesthetic or **practical**	Doing	Hands-on demonstration, keyboard, practice, interactive Web site

Most patients don't know what type of learner they are, so try different methods to see what works best for each patient. In addition, ask patients if they have questions before, during and after your discussion.

Let's go over a few tips to help you educate your patients.

- Address your patient with her full name. If she prefers you use her first name, she'll let you know.
- Don't assume that a patient already knows anything regarding the subject at hand.
- Don't judge your patient. She should feel comfortable asking you questions.
- Treat all of your patients respectfully, regardless of race, financial status, religion or age.
- Don't **patronize** your patients, which means to treat them in a condescending manner.
- Don't rush when you're talking with a patient. Speak slowly and clearly.

Lastly, you can keep your knowledge current with continuing education. Some employers will pay for continuing education, so look into it once you start your medical assistant career. By being knowledgeable, you can be a resource to your patients.

Please pause to complete online Practice Exercise 16-1.

🕮 Step 6 Assisting with the Examination

- ❑ Your role as a medical assistant is important as you prepare patients for their exams. You will make sure the examination room is stocked with supplies and ready for every patient. You may measure and document patients' height, weight and other information. Most importantly, you will assist the physician and patient through the examination.

Room Preparation

An important responsibility of the medical assistant is to keep the examination rooms clean and stocked with supplies. Prepare examination rooms at the beginning of the day, between patients and at closing time.

You should focus on the following tasks:

- **Clean up**—Pick up any supplies that were used by an earlier patient. Make sure disposable supplies are thrown away in the trash or in a hazardous waste receptacle. Wipe the counter and sink with a paper towel.
- **Wipe down surfaces**—Make sure you wear gloves when you clean any surface that may have had blood or bodily fluids on it. Either use a disinfectant or a solution of 1 part bleach to 10 parts water, or a **1:10 solution**.
- **Change paper**—Throw away used paper on the examination table and replace with new, clean paper. Fold or tuck the ends under the table.
- **Wash hands**—Use proper hand washing to thoroughly wash your hands.

By properly preparing examination rooms, you're protecting the safety of your patients. Thoroughly cleaned examination tables, clean gowns and new sanitation paper are essential to discourage transmission of germs.

After your last patient leaves, make sure that the rooms are well-stocked for the following day. Double check items such as patient gowns, tongue depressors, cotton balls, medical gloves, bandages and blood pressure cuffs.

Some equipment, such as the otoscope, will need to be recharged. Plug in the equipment so it can charge overnight and be ready to use the next day. When the office closes, turn off computers and lights in each room.

Now that you know how to prepare a room, let's learn about some more equipment that you'll become familiar with as a medical assistant.

Instruments Used in the Physical Examination

In addition to the medical equipment you learned about in Lesson 8, you'll use some other medical equipment for patient examinations. Let's introduce you to some of the instruments that you'll become familiar with as a medical assistant.

- **Penlight**—As the name implies, a penlight is a tiny flashlight that is about the size of a pen. You can use this to examine a patient's ears, nose and mouth and check a patient's pupils.
- **Guaiac kit**—A test that is used to detect blood leaking into the intestine, usually from the stomach, intestine or rectum. Stool samples are applied to a special cardboard and after a few drops of developer are added, a color change indicates whether microscopic amounts of blood are present.
- **Tape measure**—Small, retractable tape measure that medical assistants use to take patients' physical measurements.
- **Urine specimen container**—A clean, sterile cup that is used to collect urine for tests.
- **Speculum (ear and nasal)**—Used to investigate body cavities such as the ear and nose. Ear specula look like a funnel and come in a variety of sizes. Nasal specula have two fairly flat blades with a handle. The nasal speculum is hinged so that when the handles are squeezed together, the blades spread, which allow you to examine the nose.
- **Tuning fork**—A two-pronged, metal instrument that is used to assess a patient's hearing. A tuning fork resonates at a specific, constant pitch when it's struck against something, which makes it vibrate and creates a sound.
- **Percussion hammer**—Used to test reflexes and find bone fractures in joints. It has a triangular rubber head and a short, flattened metal handle.
- **Tongue depressor**—A thin blade that is used to press down the tongue during an examination of the mouth and throat.

Patient Preparation

In addition to preparing the examination room and equipment, you will also prepare the patient. In some cases, you'll contact the patient before the appointment to give her special instructions. For example, some exams require fasting, such as a cholesterol test or an enema for a sigmoidoscopy.

Patient Rooming

When the patient checks in at the front desk, she may have some forms to complete, then she'll wait in the reception area until her examination room is ready. You or another medical staff member will call the patient's name in the waiting area. If you're unclear on how to pronounce the patient's name, ask the receptionist. Once you are away from other patients, you can address the patient as Mr., Mrs., Miss, Ms., Dr. or any other appropriate title followed by her last name. If the patient would like to be addressed another way, she'll let you know.

As you know, you should greet the patient with a smile, establish eye contact and make her feel comfortable. In addition, speak slowly, confidently and clearly.

Escort the patient to the examination room. In some cases, you'll take the patient to a central area for weight and height measurements. In other cases, you'll sit down with the patient and review her medical history or confirm the information on forms that she filled out while in the waiting area. You can save the physician time by clarifying information and documenting the chief complaint.

Once you've reviewed this information, you may ask the patient to change into a gown if it's necessary. Otherwise, tell the patient when she can expect to see the physician.

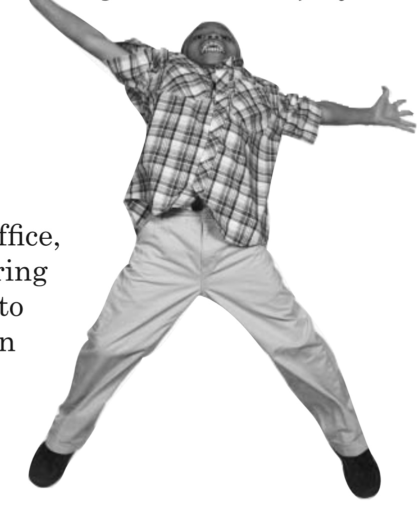
Let's discuss the details of taking a patient's physical measurements.

Physical Measurements

Even though height and weight may not seem as important as a patient's blood pressure or temperature, they're usually measured during a physical examination and do have importance. Physicians usually measure an adult's height and weight during a yearly exam. Children and adolescents grow much faster than adults, so their height and weight are taken at every examination to monitor their growth. Elderly patients also may have their height taken at every exam to monitor changes. Older patients tend to become shorter because the cushion between their vertebrae shrinks as part of the aging process.

The patient's height and weight are recorded under the chart notes in the patient's medical record. As you know, when you take the patient's height and weight, the measurements are considered objective information. You may also record this information elsewhere in the chart depending on the medical office's policies.

The average six- to 12-year-old grows two inches per year.



Patient Height

Most likely, you've had your height measured at a doctor's office, so you've seen a traditional balance beam scale with a measuring bar. The **measuring bar** is part of the scale that extends up to measure height. Ask the patient to remove her shoes so you can get an accurate measurement. Next, place a paper towel on the scale so that the patient isn't barefoot on the scale. The patient should have her back against the scale. This will avoid injuries as the measuring bar is lifted as well as keep her head level for an accurate measurement.

Once the patient is on the scale, the measuring bar is placed directly on the crown of the patient's head, the **vertex**, and you read the line between where the solid bar and the sliding bar meet. Most scales' bars are measured in quarter inches, so you'll record your patient's height in feet and inches. Children's heights may be recorded in feet and inches, or only inches.

Conversions to Know

1 foot = 12 inches

To convert inches to feet, divide the amount of inches by 12.

1 kilogram = 2.2 pounds

To convert pounds to kilograms, take the number of pounds and divide by 2.2.

To convert from kilograms to pounds, take the number of kilograms and multiply by 2.2.

1 inch = 2.54 cm

To convert inches to centimeters, take the number of inches and multiply by 2.54.

To convert centimeters to inches, take the number of centimeters and divide by 2.54.

Assist patients onto and off the scale as needed. Elderly patients in particular will need assistance. The movable platform and the step up may throw your older patients off balance. In addition, like other medical equipment, scales should be sanitized after each use.

There are a few ways to make sure you take accurate height measurements of your patients. As we mentioned before, have your patient remove her shoes. Make sure the top of the measuring bar rests on the highest point of the patient's head. Some patients may have hair that adds height, so make sure you're not measuring your patient's hairstyle! In addition, ask your patient to stand up straight to take an accurate height measurement.

Although traditional beam balance scales are the most common way to measure height, alternative methods are used. Some medical offices use wall charts to measure patients' height. Wall charts are attached to the wall and are marked with inches and feet. Patients stand with their back to the wall. In addition, patients should have their feet together, a level head and good posture.

Refer to Virtual Lab 8-7 in Procedure Guide 1 to review the proper procedure for measuring height.

Patient Weight

The patient's health and the physician's preferences determine whether a patient's weight is measured at each visit. Some physicians will measure adults' weight at each visit due to health conditions such as obesity, eating disorders, diabetes, hypertension, pregnancy and cancer. A patient's weight can tell a physician about her nutritional status, fluid status and response to treatment. For example, pregnant women are supposed to gain weight, and their amniotic fluid should increase during pregnancy. If the pregnant woman's weight has not changed in several months, it could mean that her baby is not developing properly. The physician will examine the amniotic fluid levels and the patient's dietary needs.

Other physicians may measure all patients' weight at each visit. As with height, children's weight is measured at every doctor's visit.

When you're measuring a patient's weight, make sure you have privacy. Many patients are sensitive about their weight and may not want others to see or hear their weight. In addition, if a patient has an eating disorder, she may be extremely anxious about being weighed. Regardless of the situation, don't comment on the patient's weight and protect the patient's privacy as always.

Before you can weigh a patient, you will **calibrate**, or standardize the scale so it will give an accurate measurement. To calibrate the scale, make sure the point of the balance beam is floating in the center when there is no weight on the scale. Once the scale is centered, it is calibrated and ready for use.

Ask patients to remove their shoes and any heavy outerwear. Also, ask patients with bags or purses to set them on a chair or on the counter so you can get an accurate weight measurement. Remember, some patients require assistance on and off the scale.

Another type of scale is the *eye-level digital scale* that takes weight measurements quickly and easily. The **eye-level digital scale** usually has a stationary platform, which makes it safer for patients, and the digital reading is displayed within a few seconds.

Other types of scales are available for special situations, such as *chair scales*, *bed scales* and *infant scales*. If a patient is unable to stand to be weighed, a chair scale is used to measure weight. Like the name implies, a **chair scale** looks like a chair, and has either a digital scale or a balance beam to weigh the patient. A **bed scale** allows bed-ridden or severely injured patients to be weighed by placing the patient on a stretcher and hydraulically lifting the stretcher a few inches off the bed. An **infant scale** is shaped like a wide bowl that rests on a scale. The baby is placed in the bowl to measure her weight.

An infant doubles her birth weight during the first six months.

Refer to Virtual Lab 8-7 in Procedure Guide 1 to review the proper procedure for measuring weight.

Adult measurements are recorded and sometimes used to calculate **BMI**, or **Body Mass Index**, which is a measurement of the patient's body fat level calculated using her height and weight measurements.

BMI	Weight Status[9]
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.9	Overweight
30.0 and Above	Obese

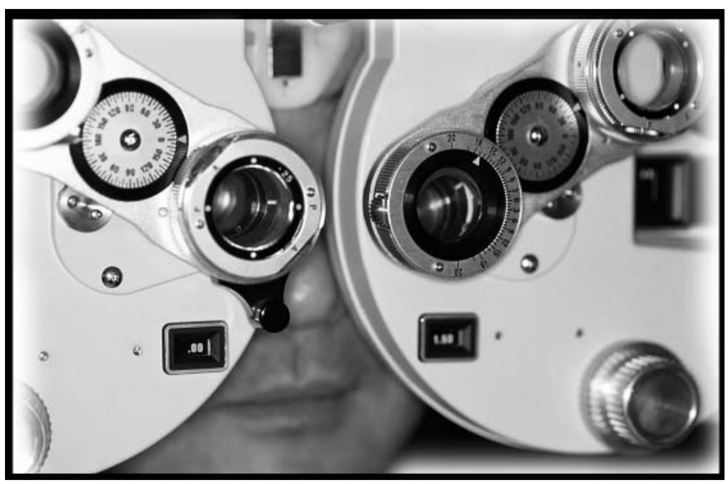
Eye and Ear Acuity

Part of a general physical examination is to test a patient's hearing and vision. As a medical assistant, you will prepare patients for exams and may assist with the tests. You'll make sure sterilized equipment is in the exam room so the physician can examine and test the patient's eyes and ears. When preparing for an eye exam, make sure the room has an occluder, an ophthalmoscope, a *Snellen* test and Ishihara plates. Prepare a tuning fork and possibly an audiometer for an ear exam. Note: See Lesson 8 if you need to review these devices.

Now that you've reviewed the equipment used for these examinations, let's discuss the actual vision and hearing tests.

Visual Acuity

Medical professionals use a few different methods to test patients' **visual acuity**, or sharpness of vision.



Eyesight should be tested at least every two years.

You may not have heard the term *Snellen chart* but most likely you've seen one. The **Snellen chart** is a large white poster printed with eleven lines of block letters in black and is used to test patients' vision. The first line has a large letter E and the rows below the E have increasing numbers of letters that decrease in size. A patient who takes this test stands 20 or more feet away. She covers one eye and reads the letters of each row out loud, beginning at the top.

The smallest row that can be read accurately indicates the patient's visual acuity in that eye. Each row has a fraction associated with it, such as 20/200. For example, the large E at the top of the chart is 20/200, or a normal eye can see the E from 200 feet. If the bottom number is greater than the top number, the patient needs assistance from glasses or contacts to see what a normal eye could see from 20 feet. For example, the last row on the chart is 20/100. A normal eye can read that row from 100 feet. If the patient misses more than two letters in a line, record the fraction from that line in the medical record.

Steps to Take 16-1—Perform the Snellen Chart Test

1. Turn to Steps to Take 16-1 in your Procedure Guide Supplement.
2. Read the Steps to Take to measure a patient's distance vision.
3. Review this information several times until you can describe it without reading the steps.

In addition to the Snellen test, medical professionals use the Ishihara test to assess patients' color vision. Refer to Steps to Take 8-5 in Procedure Guide for a review of the Ishihara test.

Auditory Acuity

Medical professionals also need to test patients' hearing, or their **auditory acuity**. Decreased hearing is common, especially as we age. As a result, elderly patients' hearing is often tested. If the physician finds hearing-loss problems, she can refer the patient to a hearing specialist. Let's look at two hearing tests that complement each other, the *Weber* and *Rinne* tests.

In the **Weber test**, a *tuning fork* is struck and placed on the patient's forehead. A **tuning fork** is a small metal instrument with one handle and two prongs that vibrate when struck. You then ask the patient in which ear the sound is louder. The Weber test can't confirm normal hearing because if a patient has a similar defect in each ear, the test results will appear to be normal. So, the Rinne test is used with the Weber test to determine in which ear bone conduction is loudest.

The **Rinne test** compares perception of sounds, as transmitted by air or by sound conduction through the **mastoid**, the large, bony prominence on the base of the skull behind the ear. The test begins by placing a vibrating tuning fork on the mastoid first and then next to the ear. You then ask the patient at which location the sound was the loudest.

A patient with normal hearing as measured by the Rinne test hears the sound from the tuning fork equally in both ears. On the other hand, she may not hear it at all if the room noise masks the subtle sound of the tuning fork.

So how do you know if your patient's hearing is normal? Using the Weber test, the patient is considered to have normal hearing if the tone produced when the tuning fork is placed along the patient's forehead or face is the same volume in each ear. The volume of sound vibrations conducted through parts of the skull and face during the Weber test can indicate which ear may have hearing loss, if the patient hears louder sound vibrations in one ear compared to sounds picked up by the opposite ear.

With the Rinne test, a patient with normal hearing will hear the tone of the vibration longer and louder when the tuning fork is held next to the ear, as opposed to when it is held against the mastoid bone. If the patient hears a louder and longer tone when the vibrating tuning fork is held against the mastoid bone she might have a hearing problem.

Steps to Take 16-2—Perform the Weber and Rinne Hearing Tests

1. Turn to Steps to Take 16-2 in your Procedure Guide Supplement.
2. Read the Steps to Take to measure hearing with the tuning fork.
3. Review this information several times until you can describe it without reading the steps.

Vital Signs

In Lesson 11, you learned how to take a patient's vital signs—pulse, blood pressure, respiration and temperature. Taking vital signs is part of the patient's medical exam. Refer to Lesson 11 if you need to review these procedures.

As you are measuring the patient's height, weight, auditory and visual acuity and vital signs, you will be entering the information on the patient's chart. This is the documentation of the exam.

Documentation of the Exam

By now you're familiar with the importance of medical records. What you may not be familiar with is **charting**, or written documentation of any medication, treatment, procedure or action done to a patient. If it's not recorded in the medical record, then in the medical world, it didn't happen. So it's important to document everything. In addition, the information must be accurate, clear, complete, timely and properly written. Keep the following tips in mind when you're charting.

- Write in blue or black ink.
- Sign with your first initial, last name and title.
- Never leave empty space between the chart entry and your signature. Otherwise someone might chart in the empty space. Draw a line through any empty lines.
- You cannot erase any entry. If you make a mistake, draw a single line through it and write the correct information above it.
- Only use standard abbreviations.
- If you're unsure of the spelling of a word—especially a medical term—look it up in a dictionary.
- Make sure the patient's name is included on every page.
- Only chart what you know, not what someone has told you.
- Be specific.

Now that you know how to chart information, let's look at how chart notes are documented.

Typically, there are three types of chart notes—source-oriented medical records, problem-oriented medical records and computer-generated records.

Source-oriented medical records (SOMR) include a chronological set of notes for each patient. The information is either handwritten in the patient's chart, or the doctor dictates the information and a medical transcriptionist types the information for the chart.

Problem-oriented medical records (POMR) list the patient's problems along with a date and a number that is assigned to each problem. The POMR includes four parts:

- Database—the patient's medical history, laboratory and diagnostic test results and results of a physical examination.
- Problem list—a list of problems that are each given a number and date.
- Diagnostic and treatment plan—information on the laboratory and diagnostic tests and the physician's plan for the patient.
- Progress notes—The patient's complaints, problems, treatment and responses to treatment for every problem listed.

Computer-generated records—A chronological order of problems. Records can be pulled up, updated, reviewed and saved from the physician's home computer.

Please pause to complete online Practice Exercise 16-2.

Step 7 Complete Physical Examination (CPE)

- The **complete physical examination (CPE)** is an examination of the body from head to toe. After the patient's vital signs, height and weight are taken and the medical history has been reviewed, a physical examination is performed.

The patient should be in a gown so that the physician can examine all areas of the body. Let's look at six methods that are used to evaluate the patient.

Evaluation Techniques

The six methods that a physician uses to evaluate a patient are: *observation/inspection*, *palpation*, *percussion*, *auscultation*, *mensuration* and *manipulation*.

Observation/inspection is the visual inspection of the body for color, shape, rashes, swelling or visible injuries. The physician will look at posture, body movements, mannerisms and grooming as well.

Palpation uses touch to examine the body and verify any observations. The physician will feel body parts and organs. In addition, the physician may note the skin texture, moisture and temperature.

Percussion is tapping on the body using fingers or an instrument. Different organs produce different sounds depending on their hollowness. For example, the lungs should produce a hollow sound because they hold air. Physicians will use a percussion hammer to test the arms, legs and feet reflexes.

A complete physical examination includes checking the patient from head to toe.

Auscultation is when the physician listens to the patient's heart, lungs and abdomen with a stethoscope. She listens for abnormal sounds such as murmurs or rales.

Mensuration is the measurement of the patient's height, weight, blood pressure, temperature, head circumference, chest circumference and leg or ankle diameter. A tape measure is used to measure head and chest circumference. We'll discuss these measurements in detail when we discuss pediatric exams.

Manipulation is the technique of moving joints to check the range of motion.

Now let's look at the different parts of the physical examination.

Physical Assessment

The first part of the physical exam is a general overview, and then the exam begins with the head and ends with the patient's toes. The physical assessment has nine parts:

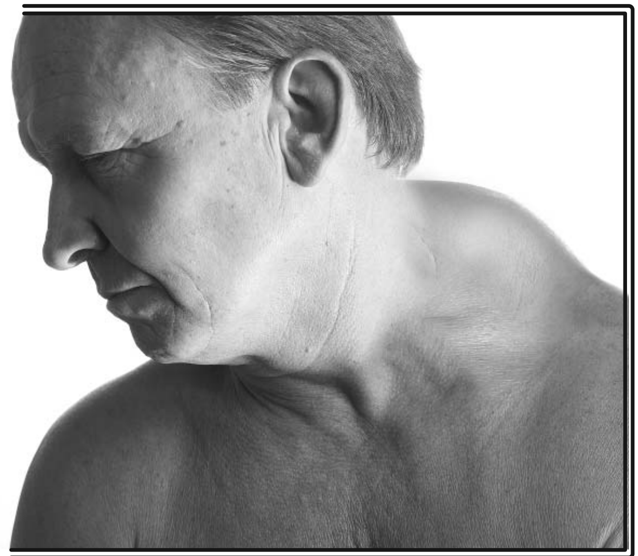
- General appearance
- HEENT (head, eyes, ears, nose and throat)
- Neck
- Chest
- Breast exam
- Abdomen
- Genitalia
- Rectum
- Extremities

The medical assistant usually documents the height, weight and vital signs. In addition, the medical assistant can document vision and hearing tests. The rest of the physical exam is done by a doctor, nurse practitioner or physician assistant.

Let's take a closer look at the nine parts of the physical exam.

General Appearance

The physician will look at the patient's general appearance including the patient's walk, posture, speech, breath, nutritional status, skin and hair distribution.



One sign of Cushing's disease is a humped back.

First, let's discuss a patient's walk, or **gait**. If a patient limps, walks with feet wide apart or cannot stay balanced, it's noted in this part of the examination. Abnormal gait can signal a health problem or disease.

A person's posture can also display health problems. For example, if a patient is in pain, he might have limited mobility. The physician will look at the spine and its alignment. **Scoliosis**, or curvature of the spine and **kyphosis**, or a humped back, are abnormal health conditions that could be found during this part of the examination.

If a patient has lost his voice, cannot get his words out or mixes up words, his speech problem could indicate another more serious problem. Brain diseases, lesions and disorders could affect a patient's speech patterns.

A patient's breath can also signify a health problem. A sweet, fruity odor could mean the patient has **acidosis**, or a problem with the acidity of the body's fluids. A musty breath odor could indicate a problem with the patient's liver.

Physicians use the height and weight guidelines mentioned earlier to monitor her patients' nutrition.

An assortment of health issues can be revealed by an examination of the skin. For example, **jaundice**, or yellowing of the skin, can indicate a problem with the liver.

HEENT

HEENT stands for head, eyes, ears, nose and throat. The physician will begin by looking for blemishes on the head and face. Next, the physician will use an ophthalmoscope to examine the retina and optic disk. The patient's pupils should be equal in size, round and react to light and accommodation (**PERRLA**). The physician will examine the ear with an otoscope and ear speculum and the nasal cavity with the nasal speculum. She'll look for discharge, obstruction or abnormalities. Lastly, the physician will use a tongue depressor and a penlight to look at the gums, teeth, palate and throat.

Neck

The physician will examine the neck for any lumps or swelling. The patient will be asked to swallow and the physician will feel the thyroid gland. In addition, the physician may use a stethoscope to listen to the carotid artery.

Chest

The physician will visually check for abnormalities and any swelling or masses. She will place a stethoscope on the patient's back to listen to the lungs. The patient is asked to take several deep breaths so the doctor can listen for any abnormal sounds. The physician will also listen to the heart for any abnormal sounds. In addition to the stethoscope, the physician often examines the lungs using percussion.

In female patients, the doctor will examine the breasts for **symmetry**, or similar size and shape. In addition, she will check for any masses in the breast and armpit. Any discharge from the nipple is also noted. We'll discuss the breast exam in detail later in the lesson.

Abdomen

First, the physician will look at the abdomen for any visual abnormalities. Then the physician will use palpation, percussion and auscultation to examine the abdomen. The physician will palpate the organs in each of the abdomen's quadrants. The physician is looking for tenderness, masses or increased size of internal organs. Next, the physician will percuss the abdomen to listen for sounds from abdominal organs. In addition, the stethoscope is used to listen to abdominal sounds.

Genitalia

Both female and males have genitalia examinations. We'll discuss the female examination later in the chapter. Let's learn about the male exam now.

Male Testicular Exam

The male exam includes an examination of the penis and testes for any discharge, redness, tenderness and masses. In addition, the physician will check for **hernias**, or protrusions of an organ through the cavity wall that holds it.

Rectum

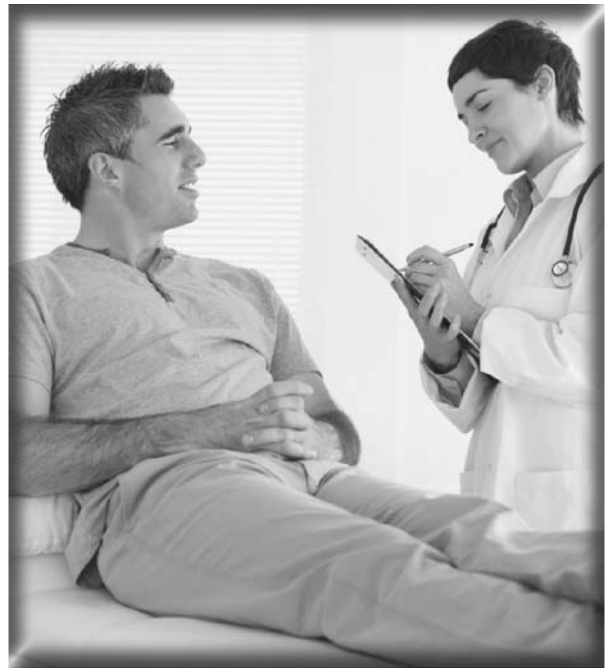
To conduct a rectal exam, a gloved finger is placed into the rectum to check for masses and hemorrhoids. In males, the doctor will palpate the prostate gland to check for masses or enlargement. In females, the doctor will check for herniation of the rectum.

Extremities

The focus of the extremities portion of the examination is poor circulation. Feet and ankle temperature, color and swelling will indicate any circulation problems. The physician may also check the limbs' **range of motion** (**ROM**), or ability to move in normal ways. Finally, she will check reflexes with a percussion hammer.

Cancer

During the CPE, the physician will be alert to symptoms that may indicate the presence of cancer. Early detection of cancer is a key factor in survival rates. It's helpful for patients and you to be aware of early signs of cancer. The acronym *CAUTION* can help you remember the signs of cancer in adults:



A combination of symptoms may be a sign of cancer in adults.

Change in bowel or bladder habits

A sore that does not heal

Unusual bleeding or discharge

Thickening or lump in breast or elsewhere

Indigestion or difficulty swallowing

Obvious change in wart or mole

Nagging cough or hoarseness

Use the acronym *CHILDREN* to remember the signs of cancer in your pediatric patients:

Continued, unexplained weight loss

Headaches with vomiting in the morning

Increased swelling or persistent pain in bones or joints

Lump or mass in abdomen, neck or elsewhere

Development of a whitish appearance in the pupil of the eye

Recurrent fevers not due to infections

Excessive bruising or bleeding

Noticeable paleness or prolonged tiredness

Cancer is generally categorized into four stages. Some cancers may use different categories, but most kinds of cancer use these four stages.

- **Stage 1—**The cancer is relatively small and contained within the organ where it originated.
- **Stage 2**—The cancer is localized, but the tumor has grown larger than in Stage 1. Stage 2 can also indicate that nearby lymph nodes are vulnerable.
- **Stage 3—**The neoplasm is larger and cancer cells are now in the nearby lymph nodes.
- **Stage 4—**The cancer has **metastasized**, or spread from the tumor's original site to other lymph nodes and organs.

The CPE is one of the physician's most important tools to monitor her patients' health and detect illness in its early stages, while it can still be treated.

Please pause to complete online Practice Exercise 16-3.

Step 8 The Pediatric Examination

- A yearly checkup is considered adequate to monitor an adult's health because her body has stopped growing; however, a child's development should be assessed more often, and by a pediatrician. As you may recall from previous lessons, **pediatrics** is the branch of medicine that specializes in the care of newborns, infants, children and adolescents. Pediatricians recommend a strict schedule of assessments, or **well-baby checkups**, for their young patients. A newborn will have checkups at one month, two months, four, six and nine months. Assessments continue at 12, 15, 18 and 24 months. After two years, a yearly checkup is sufficient.

A child's development should be assessed often.

Pediatric Vital Signs

As a medical assistant at these exams, you will take a history of the child, assess the child, measure vital signs, height, weight, vision and hearing. The table below describes normal ranges for pulse, respiration rate and blood pressure.

Normal Vital Sign Measurements throughout Childhood

Stage	Age	Pulse	Respiration Rate	Blood Pressure
Newborn	Birth to 1 month	100-150 beats/ min.	30-60 breaths/ min.	N/A
Infant	1 month to 1 year	100-160 beats/ min.	20-40 breaths/ min.	74/50 to 100/70 mm Hg
Toddler	1 year to 3 years	70-110 beats/ min.	25-30 breaths/ min.	90/50 mm Hg
Preschoolers	3 to 6 years	70-120 beats/ min.	20-30 at 3, 16-22 by 6	80/50 to 112/80 mm Hg
School-aged	6 to 12 years	90/ beats/min.	20 breaths/min.	82/50 to 119/80 mm Hg
Adolescents	12 to 21 years	60-70 beats/ min.	16-20 breaths/ min.	100/50 to 120/70 mm Hg

Pediatric Measurements

In addition to measuring the child's vital signs, you will take his measurements. Let's begin with a discussion of the infant's measurements.

Infant Measurements

In order to examine an infant's growth patterns, you'll need to take a few measurements. Some can be trickier than others, but we'll give you instructions that will have you measuring infants' length, weight and head and chest circumference in no time.

An infant is fragile and wiggly, so you must be careful when you lift and hold him. In particular, be very careful of the infant's neck if he's younger than four months. Make sure it's always supported by your arm or hand. When the infant is on the examination table, keep one hand on him at all times. He can easily roll off while you're trying to measure and examine him.

If you're measuring an older infant or a toddler who doesn't want to sit still, the child's parent can give you a hand.

Infant Weight

To measure the baby's weight, you will use the **infant platform scale** that displays the weight in either pounds and ounces or kilograms and grams. The infant is completely undressed and either sits or lies on the platform, which has curved edges. Place a paper towel or cloth on the platform for sanitary purposes before you set the baby on the scale.

If you're measuring an older infant or a toddler who doesn't want to sit still long enough to be weighed, the child's parent can give you a hand. Ask the parent to hold the child and step on the scale. Write down this weight. Then hold the child while the parent steps on the scale by herself. Subtract the adult's weight from the first measurement, and you'll have the child's weight.

Infant Recumbent Length

There are two methods to measure an infant's length. The first uses an **infant measuring board**, which is a stationary headboard and a moveable footboard attached to a rigid board imprinted with a height scale. Lay the measuring board on the examination table, then lay the infant on the measuring board so that his head touches the headboard. Adjust the footboard so it touches the infant's feet. The measurement on the scale that lines up with the footboard is the child's length.

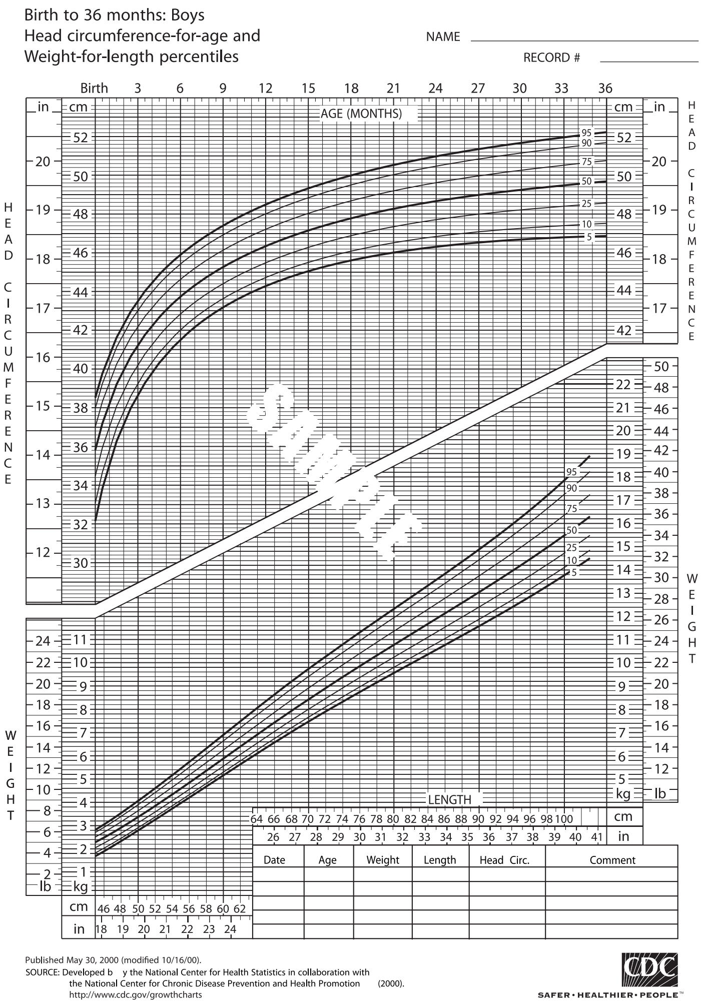
The second way to measure infant length is to lay the infant on top of the exam table paper or a pad on the examination table. Use a straight pin or a pen to mark the paper or pad at the infant's head and at his heel. After removing the baby, measure the distance between the two pins or pen marks.

Once a child is able to stand up without support, a *stature-measuring device* can be used. This is similar to the adult measuring bar that we discussed earlier. The **stature-measuring device** has a moveable headpiece that is attached to a measuring bar and platform.

Head Circumference

The infant's head circumference is measured during the physical exam to monitor brain development. Usually an infant's head is measured at every visit until he is 36 months old. After that, the head circumference is measured once a year.

In order to measure head circumference, you'll need a paper or metal measuring tape. Don't use a cloth measuring tape because it can stretch and isn't as accurate. Place the tape around the widest part of the child's head. Make sure the tape is snug, and read the measurement to the nearest inch or centimeter. Record the circumference in the child's chart. Most likely, you'll plot the circumference on a chart as you do with weight and length.



Birth to 36 months: Boys head circumference-for-age and weight-for-length percentiles[10]

If the head and chest circumference are not about equal when the child is one or two years old, it could indicate a health problem. **Hydrocephalus**—a condition where the head size is increased because of fluid around the brain—is one possible condition. Another possible condition is **microencephaly**, a condition in which the skull's **fontanels**, or bones, fuse too soon in the infant's development so the brain cannot grow and develop.

Usually, a girl or boy newborn's head circumference is between 12.5 and 14.5 inches. Look at the chart on the following page to see the circumference growth for a boy up to 36 months. An infant girl's chart is similar, but tracks growth to a three-year-old average head size 1/2 inch smaller than a boy's.

Chest Circumference

The chest circumference is not as common a measurement as the head circumference measurement. If the physician believes the infant's heart or lungs are over- or underdeveloped, you may be asked to measure the infant's chest. To do this, wrap the metal or paper measuring tape tightly around the infant's upper chest. If possible, read the measuring tape in between the infant's breaths.

Turn now to your Procedure Guide to learn the Steps to Take to properly measure an infant.

Steps to Take 16-3—Measure an Infant

1. Turn to Steps to Take 16-3 in your Procedure Guide.
2. Read the Steps to Take to properly measure an infant's weight, length, head circumference and chest circumference.
3. Review this information several times until you can describe it without reading the steps.

Child Measurements

Once the child is able to stand unsupported, his weight and height are measured using the same methods as an adult's. However, whether an infant or a child, it's important to document the pattern of growth from birth to adulthood.

Growth Patterns

Growth patterns are tracked in children to monitor their development in relation to the "average" child. If an abnormal pattern is detected at a young age, it can often be corrected, or educational needs can be addressed much sooner. To track these growth patterns, the physician uses various types of *growth charts*. **Growth charts** display the patient's age, weight, length, head circumference or chest circumference that you have plotted at each well-baby visit. You can then see how the patient compares with average growth rates that are preprinted on the chart. This information is also used to calculate pediatric medication dosages.

For example, Izzy and her parents have arrived at the doctor's office for Izzy's 18-month well-baby checkup. Izzy weighs 29 pounds and is 33 inches long. Let's figure out her growth rate Go to http://www.cdc.gov/nchs/about/major/nhanes/growthcharts/clinical_charts.htm. First, we need to plot Izzy's weight to find her percentile. Find the point where her age and weight intersect, then follow the line to the percentile. Izzy is in the 95th percentile for weight. Now let's look at Izzy's height. Again, find the spot where Izzy's age and height intersect. Then follow that line to the percentile. Izzy is in the 90th percentile for height. Looks like Izzy is growing very well!

After your measurements have been completed, you may be asked to make an initial assessment of the child's developmental level. To accurately describe growth and development, you must know how it compares to normal—let's learn more!

Children's Growth and Development

Children develop and grow at different rates, but you should know some general guidelines for growth. Let's take a look at the growth of *infants*, *toddlers*, *preschoolers*, *school-aged children* and *adolescents*.

Infants

An infant's first year of life is full of growth and development. **Infants**, or the stage between one month and one year, begin their *gross* and *fine motor skills* development at the head and then progress down the body to the feet. For example, at one month of age, the infant may be able to imitate facial expressions, and then by one year be able to walk. **Gross motor skills** are bigger muscle movements, such as crawling, pulling up and walking. **Fine motor skills** are smaller movements, such as picking up a cracker and putting it into the mouth or using a crayon to scribble.

In the first six months, a baby usually doubles her birth weight. By one year, she has tripled her birth weight. Usually the infant will grow in length at the rate of about an inch a month for the first year, and then height development slows. Of course, the infant's head is growing quickly to accommodate the equally rapid growth of the brain. By the end of the year, the infant's head is about 66 percent of the size of an adult's.

Once an infant is one year old, she's considered a toddler.

At one month of age, the infant may be able to imitate facial expressions.

Toddlers

Toddlers—the stage between one to three years of age—experience a lot of change. They become more independent, improve their gross motor skills and begin to communicate verbally. Toddlers are curious and their independence is important, but it's essential to educate the parents that some guidelines should be set to protect children from harm during their explorations.

Toddlers continue to grow, but not as rapidly as infants. The rate of height growth in a toddler is about three inches a year. The rate of weight gain is approximately five pounds per year. In addition, toddlers are usually walking at around 12 to 15 months and can climb stairs by 18 months old.

Some toddlers also gain bladder and bowel control between the ages of one and three. Parents or caregivers may need information on potty-training strategies.

An area that some parents may talk to you about is their toddler's nutrition. Toddlers will eat when they're hungry, but they are less interested in food at this stage. This is because growth has slowed, so they don't need as many calories. Parents or caregivers may need reassurance that their toddlers are getting the food they need.

If proper diet and exercise are ingrained in the child at this age, most likely they will continue into adulthood. The future benefits of disease prevention and a longer life can be goals even at this young age.

Preschoolers

Once children are between the ages of three and six, they're considered **preschoolers**. Preschoolers typically grow at the rate of two pounds in weight and three inches in height per year.

Most preschoolers can control their bowel and bladder, dress and feed themselves and interact with others. Preschoolers use a great deal of creativity and imagination to play with others. In addition, preschoolers learn through play and imitation.


Children's sense of independence increases in the preschool stage.

Preschoolers should have examinations every year to monitor growth, vision, nutrition, hearing and blood pressure. As with toddlerhood, parents may have questions about their children's nutrition. Some preschoolers will refuse to eat for the day or will only eat one kind of food. Educate yourself and discuss these issues with children's parents or caregivers.

School-aged Children

School-aged children—between the ages of six and twelve years—gain about five pounds of weight and two inches in height a year. In addition, children's motor skills continue to improve and their muscle size increases.

School-aged children should visit the doctor at five, six, eight, ten, eleven and twelve years of age. At these appointments, children's height, weight, vital signs, vision and hearing are tested. They also receive a physical exam and the doctor will counsel them about nutrition. A scoliosis screening and tuberculosis test are conducted at these visits as well. Children should be educated on good nutrition, exercise and the dangers of recreational drugs, tobacco and alcohol.

The last stage of the school-aged years is **prepuberty**, in which axillary and pubic hair appear and sexual characteristics begin developing. Hormonal changes cause an increase in body odor as well. During prepuberty, some children may be concerned about not looking the same as their friends because children develop differently. Educate parents or caregivers about this concern as well as other potential concerns such as stress, bullying and peer pressure.

Adolescents

Adolescents—children between 11 and 21 years old—experience tremendous physiological changes. Girls gain about 10 pounds and can grow up to five inches yearly. Boys annually gain up to 14 pounds and can grow up to six inches.

Because of the rapid physiological and psychological changes in adolescence, children in this stage should visit the doctor once a year to discuss physical activity, injury prevention, nutrition, birth control, depression and suicide. The physical examination will check vital signs, height, weight, vision and hearing. It may also include laboratory tests, urinalyses and complete blood counts (CBCs).

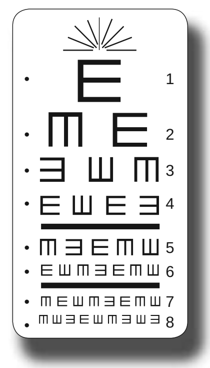
In this stage, adolescents focus more on relationships with friends than their relationships with their families. They become more independent from their parents as they think ahead to their own adulthood. Oftentimes, this is a period of conflict. You can assist parents with problems with adolescents through education. Provide parents and caregivers with handouts, demonstrations, videos and discussions that address their concerns.

Adolescents focus more on their peers than on family.

Pediatric Vision and Hearing Tests

Vision and hearing are not normally tested on young children unless a problem is suspected. When a test is necessary, use the following methods.

Pediatric Vision Tests



Infants are naturally difficult to test, but the doctor has a few resources when a problem is suspected. Newborns react to light by tightly closing their eyes until the light is removed. Infants will focus on an object that is directly in front of their eyes, and then will follow the object as it moves. Your role in these examinations is to keep the exam room quiet and still so the baby is not distracted.

Young children are tested using a chart similar to the Snellen chart; however, rather than using letters, the **kindergarten chart** or **Allen cards** are labeled with pictures.

Older children will read the **E chart** to test their vision. The format is the same as the Snellen chart, but the capital letter E is the only letter used. The E is printed facing in four different directions, and children indicate which way the E is pointing with their hand.

Pediatric Hearing Tests

Conventional methods of hearing testing can be performed on children as well as adults. Newborns are tested soon after delivery using an automated system. Sensors are placed on the newborn, who will move in response to sounds produced by the system. Your role is to maintain a quiet environment while these tests are performed.

Immunizations

After the patient's physical exam, you may be the staff member given the painful, yetnecessary task of administering immunizations. Immunizations protect against hepatitis A and B, polio, measles, mumps, rubella, pertussis, diphtheria, tetanus, haemophilus influenza type b, pneumococcal, chicken pox and influenza. All of these immunizations are given to children before the age of two to protect them from diseases when they're most vulnerable.

Take a look at the following two tables of recommended vaccines.

Recommended Immunization Schedule for Persons Aged 0 Through 6 Years—United States • 2009
For those who fall behind or start late, see the catch-up schedule

Vaccine ▼ Age ▶	Birth	1 month	2 months	4 months	6 months	12 months	15 months	18 months	19–23 months	2–3 years	4–6 years
Hepatitis B[1]	HepB	HepB		see footnote 1		HepB					
Rotavirus[2]			RV	RV	RV[2]						
Diphtheria, Tetanus, Pertussis[3]			DTaP	DTaP	DTaP	see footnote 3	DTaP				DTaP
Haemophilus influenzae type b[4]			Hib	Hib	Hib[4]	Hib					
Pneumococcal[5]			PCV	PCV	PCV	PCV				PPSV	
Inactivated Poliovirus			IPV	IPV		IPV					IPV
Influenza[6]								Influenza (Yearly)			
Measles, Mumps, Rubella[7]						MMR			see footnote 7		MMR
Varicella[8]						Varicella			see footnote 8		Varicella
Hepatitis A[9]							HepA (2 doses)			HepA Series	
Meningococcal[10]										MCV	

Range of recommended ages

Certain high-risk groups

Recommended childhood immunization schedule[11]

Recommended Immunization Schedule for Persons Aged 7 Through 18 Years—United States • 2009
For those who fall behind or start late, see the schedule below and the catch-up schedule

Vaccine ▼ Age ▶	7–10 years	11–12 years	13–18 years
Tetanus, Diphtheria, Pertussis[1]	see footnote 1	Tdap	Tdap
Human Papillomavirus[2]	see footnote 2	HPV (3 doses)	HPV Series
Meningococcal[3]	MCV	MCV	MCV
Influenza[4]		Influenza (Yearly)	
Pneumococcal[5]		PPSV	
Hepatitis A[6]		HepA Series	
Hepatitis B[7]		HepB Series	
Inactivated Poliovirus[8]		IPV Series	
Measles, Mumps, Rubella[9]		MMR Series	
Varicella[10]		Varicella Series	

Range of recommended ages

Catch-up immunization

Certain high-risk groups

Recommended adolescent immunization schedule[12]

Childhood Immunization Schedule and Diseases Prevented			
Vaccine	**Disease Name**	**Disease Information[13]**	**Vaccine Schedule**
Inactivated poliovirus (IPV)	Poliomyelitis	Prevents breathing by paralyzing the skeletal muscles and diaphragm	2 months, 4 months, 16-18 months, 4-6 years (booster)
Haemophilus influenza type B (Hib)	Meningitis, pneumonia, epiglottitis, pericarditis	Causes bacterial meningitis, pneumonia, epiglottis, septicemia, death	2 months, 4 months, 16-18 months, 4-6 years (booster)
DTaP, DT, Td	Diphtheria, tetanus, pertussis	**Diphtheria** causes breathing problems, paralysis, heart failure and death **Tetanus** (Lockjaw) causes painful locking of muscles, especially in the jaw **Pertussis** (whooping cough) causes severe coughing spells, vomiting and disturbed sleep	2 months, 4 months, 6 months, 15-18 months, 4-6 years
Hep B Series	Hepatitis B	Anorexia, fatigue, diarrhea, vomiting, liver damage, cancer, death	Within 12 hours of birth, 1-2 months, 6 months
Pediatrix, DTaP, HepV, IPV	Diphtheria, tetanus, pertussis, haemophilus influenzae, hepatitis B, poliovirus		2 months, 4 months and 6 months
Td	Tetanus, diphtheria		7 years or older, then every 10 years for life
MMR	Measles, mumps, rubella	**Measles** causes pneumonia, seizures, brain damage, death **Mumps** causes fever, swollen glands, deafness, meningitis, swelling of testicles or ovaries, death **Rubella** causes miscarriages or babies with anomalies later in life	12-15 months and at 4-6 years

Childhood Immunization Schedule and Diseases Prevented			
Vaccine	**Disease Name**	**Disease Information[13]**	**Vaccine Schedule**
Varicella	Chicken pox	Skin infection, pneumonia, brain damage, death	Between 12 and 18 months or any age if the patient has not had chicken pox
Hep A Series	Hepatitis A	Liver disease with flu-like symptoms, jaundice, nausea, vomiting	1 month before traveling or if the patient is at risk of infection
Influenza	Influenza	Fever, cough, chills, aches, death	Children ages 6-23 months–annually
Pneumococcal conjugate	Pneumonia, bacterial meningitis	Meningitis, septicemia, otitis media, pneumonia, deafness, brain damage	2 months, 4 months, 6 months, 12-15 months
Meningococcal	Meningitis	Infection of the brain and spinal cord coverings, mental retardation, seizures, stroke, death	Not for children younger than 2
Rotavirus (RV)	Rotavirus	Leading cause of severe, acute gastrointeritis (vomiting and diarrhea) among children worldwide	6-14 weeks, and by age 8 months

If you think this is a lot of information to keep track of, you're right! Luckily, each child's medical record includes an immunization record. For each immunization, the following information is recorded:

- Month, day and year that the vaccine is given
- Name of vaccine given
- Manufacturer name
- Lot number and the expiration date
- Site and route of where the vaccine was given
- Name and address of the medical office or clinic
- Title of person giving the vaccine

Childhood Diseases and Illnesses

A child's immune system develops and strengthens over a period of years. Therefore, he is more susceptible to illness than an adult might be, despite immunizations. Some illnesses and diseases are more severe than others. Let's discuss some common childhood illnesses and diseases.

- **Otitis media**—Inflammation of the middle ear causing fluid to collect and resulting in hearing loss. Pain and hearing loss are common symptoms. If you look into a patient's ear with your otoscope, the child most likely has otitis media if the tympanic membrane looks red, inflamed and bulging. Otitis media is treated with antibiotics.

- **Common cold**—A viral infection that affects the respiratory system. This is the most frequent and common illness that young children can—and most often will—experience. Symptoms include coughing, nasal discharge, sneezing and fever. Treatment is rest, fluids and eating a healthy diet.

- **Tonsillitis**—Tonsils—in the back of the nose and throat—become infected and inflamed as a result of a streptococcus or virus. Symptoms include fever, cough, sore throat and red, swollen tonsils. Children are prescribed antibiotics to clear the infection. Older children with recurring tonsillitis often have a **tonsillectomy—**the tonsils are removed.

- **Asthma**—A serious chronic respiratory disease that appears to be stimulated by environmental pollutants. Symptoms include wheezing, coughing and shortness of breath. In addition, the child may feel like her chest is tight. The physician will treat the child with respiratory therapy and possibly suggest an allergist to try to determine the source of the irritant.

- **Child abuse or neglect**—Symptoms of child abuse or neglect are poor hygiene, bruises, welts, malnutrition, burns, fractures, head injuries and dislocated joints. By law, healthcare professionals must report suspected child abuse. If abuse is suspected, you or another medical staff member should do the following:

    - Treat the injuries.
    - Have the child hospitalized if the injuries are severe.
    - Notify the parents of the diagnosis.
    - Notify the parents that child abuse is being reported.
    - Report the incident to a child protective agency or social service agency.
    - Document everything.
    - Testify in court if asked.

Pediatric Communication Skills

Children have special needs and should feel comfortable in the medical office. As a medical assistant who works with children, you'll need to gain the child's trust and confidence. Always address children by their first name, even if they're newborns. This will help establish a relationship and a rapport with your patient. In addition, you'll need to alleviate any fear that they have. Children will cooperate better for an exam if they feel comfortable.

Children will cooperate if they feel comfortable.

Supporting New Parents

New parents depend on the medical staff for information and may have questions about growth, development, nutrition, hygiene, safety and vaccines. You can help new parents by educating them with brochures and explanations. Listen to new parents' concerns and provide them with helpful information because they view you as an expert.

Seasoned parents may also need your help sifting through information. As a medical assistant, you'll relay information between the physician and the parents. Also, you may be asked to repeat or explain what the physician said so that the parents can understand it. Some parents are anxious during their child's exams and may have trouble listening—so be patient.

Now that we've looked at pediatrics, let's learn about another type of exam.

Step 9 Obstetrics and Gynecological Exams

- [ ] As with infant examinations, *obstetrics* and *gynecological* exams have some unique procedures. In this section, we'll briefly discuss obstetrics and gynecological exams. **Obstetrics** is a branch of medicine that provides medical care for a mother and fetus during pregnancy, labor, delivery and after the baby is born. **Gynecology** is the branch of medicine that studies the female reproductive tract and the breasts.

First, let's discuss obstetrics examinations. Pregnancy usually lasts about 40 weeks. It's recommended that a pregnant woman visit the doctor for an initial visit, every month until the 28th week and then every week. During an initial visit, a history and physical examination are done, which includes breast, abdominal, pelvic and vaginal examinations. At every other visit, the woman is weighed, her blood pressure is checked, and her urine and blood are tested. Physicians answer questions and provide information about nutrition, childbirth and pregnancy health.

Gynecologic examinations—including a Pap smear and pelvic exam—are recommended every year after the age of 20 or once a woman is sexually active. Pap tests are done to detect any cervical cancer. In addition, patients with a history of breast, uterine or cervical cancer should be educated on the importance of yearly mammograms—x-rays of the breast tissue—and Pap tests.

The gynecologic examination includes the inspection of external genitalia for swelling, lesions or ulcerations. Next, the pelvic examination is done to check the cervix, uterus, tubes and ovaries. Then the physician will perform a rectal examination.

Also included in the examination is a breast examination. The physician will look for any redness, dimpling or puckering and palpates to look for lumps or thickening. Then, the patient is instructed on how to perform a breast self-examination or BSE. You may provide patients with brochures on how to perform a BSE.

What is your role with the gynecologic examination? As a medical assistant, you may need to assist with many aspects of the examination. First, you may collect a urine sample from the patient. Then, you'll collect the following information from your patient:

- Date of last menstrual period
- Hormonal therapies, such as oral contraceptives, which we'll discuss in a moment, or hormone replacement therapy
- Surgical history
- Sexual history and habits
- Any unusual symptoms

It's important to monitor a woman's health when she is pregnant.

After collecting information from the patient, ask the patient to undress and put on a patient gown. The opening of the gown should be in the front. Have the patient sit on the examination table and place a drape on her lap. Then let the patient know when she can expect the physician.

Once the physician is ready to see the patient, you'll assist by making sure supplies are ready for use. For example, the physician will need the vaginal speculum, lubricant, cotton applicators, tissues, cytology brush or broom and containers and swabs for the Pap test.

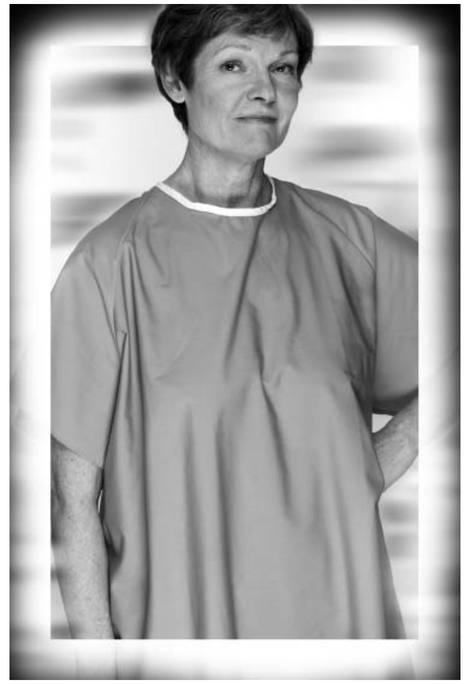
After the examination is complete, you'll assist the patient off the table and have her get dressed. Sometimes a private discussion is held after the examination or the patient is escorted back to the waiting area so she can leave.

One discussion the physician might have with a patient is about *contraception*. A variety of **contraception devices**—voluntary pregnancy prevention methods—are available and you may have to help the physician educate patients about them. Both nonprescription and prescription contraception methods are available. Latex condoms, male and female contraceptive foam, spermicide with a condom, vaginal sponges with spermicide and abstinence are nonprescription forms of contraception. Prescription contraception methods include oral birth control pills, birth control patches, surgical implants in the arm that release hormones, diaphragms with spermicide, cervical caps that cover the cervix, intrauterine devices and vaginal rings.

Along with a discussion about contraception comes the discussion of STDs, or sexually transmitted diseases. Patients may be examined or tested for STDs during an examination. Some tests are outside the realms of a normal exam and need to be requested by the patient. Some common STDs include the following:

- AIDS—HIV test
- Chlamydia—tested by a Pap test or a vaginal culture
- Condylomata—tested by a Pap test
- Gonorrhea—can be tested with a Pap test or another test
- Herpes Simplex—tested with a visual exam
- Syphilis—laboratory test

You've learned about several types of examinations; now let's look at how you can position patients for effective exams.



Have the patient change into a gown while she is waiting for the physician.

Step 10 Patient Positioning and Draping

❑ As you now know, the CPE has many components. Some examinations may require the patient to be placed in different positions in order to make the examination easier and more efficient. As a medical assistant, you may need to help your patients get undressed if they're older, children or have difficulty moving around. In addition, you'll give the patient her gown and provide a drape. **Draping**, placing a sheet over your patient, is done to protect her privacy and keep her warm while she's undressed or in a gown.

In addition to protecting your patient's privacy, you'll also want to ensure her safety. If your patient is extremely ill or disoriented, don't leave her alone in the room. Also, don't turn your back on extremely ill, disoriented or young patients.

In addition, some patients will need assistance for some examination positions. Be gentle with your patients, as some will be fragile. If you need more safety information, you can review Lesson 12.

It's important for you to know different patient positions, because you'll instruct and assist the patients on each position. So let's learn about patient positioning!

Positions

The following are common patient positions you'll need to know.

Anatomical or standing erect position—The patient's head, eyes and toes point forward. Her feet are together with arms by her sides. This type of position could be used when you're taking height and weight measurements.

Supine or horizontal recumbent position—The patient lies on her back. Instruct patient to lie flat on her back, facing up. A physician would use this position during a breast examination. Again, the patient wears the gown with the opening in front and a drape is placed on her lap.

Dorsal recumbent position—The patient lies on her back with her legs separated, the knees flexed and feet flat on the table. Physicians could use this position for genital, head, neck and chest examinations. The drape should be placed on the patient's lap with one corner pointing toward the face. This will allow the physician to examine different areas of the body without exposing other areas.

Prone position—The patient lies face down. A physician would use this position if she wanted to examine a patient's back or spine. The drape should be placed over the patient's legs and mid back.

Sims' position—The patient lies on her left side with the right knee and thigh flexed and the left arm placed along the back. This position is used for rectal examinations, enemas and some vaginal examinations.

Knee-chest position—The patient is supported by knees and chest resting on the table. A physician would use this position for rectal examinations. You'll need a large drape to cover the patient's entire body. Although this position looks awkward, it's comfortable for the patient. You may need to help the patient get into this position. In addition, don't get the patient into this position until the physician is ready to begin the examination or procedure.

Fowler's position—The patient is in the supine position and the head of the examination table is raised. The semi-Fowler's position requires the head of the table to be raised to 45 degrees. The high-Fowler's position requires the head of the table to be at 90 degrees. A Fowler's position is used if patients are having cardiovascular or respiratory problems because it helps them breathe. This position is also used for examinations of the upper body and head. The patient's drape should cover her chest and legs.

Trendelenburg or shock position—The patient is in the supine position on a table or bed and the bed's head is tilted downward 30 to 40 degrees. In addition, the table or bed is angulated beneath the knees. This position is used if the healthcare team needs to raise a patient's blood pressure because of shock or hypotension. A drape should cover the patient's legs and chest.

Lithotomy position—The patient is in the dorsal recumbent position with her buttocks near the bottom edge of the table. This position is often used for vaginal examinations. A drape should be placed on the patient's lap and legs. Keep in mind that some patients may not be able to get into this position even with assistance. If this is the case, see if the patient can get into the Sims' position.

Let's turn now to your Procedure Guide to learn the steps to take to properly position patients.

Steps to Take 16-4—Patient Positioning: Supine or Horizontal Recumbent Position

1. Turn to Steps to Take 16-4 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the supine or horizontal recumbent position.
3. Enlist a friend or relative to help you practice this procedure. Practice this until you can perform the procedure without reading the steps.

Steps to Take 16-5—Patient Positioning: Dorsal Recumbent Position

1. Turn to Steps to Take 16-5 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the dorsal recumbent position.
3. Practice this procedure until you can perform it without reading the steps.

Steps to Take 16-6—Patient Positioning: Lithotomy Position

1. Turn to Steps to Take 16-6 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the lithotomy position.
3. Practice this procedure several times until you can perform it without reading the steps.

Steps to Take 16-7—Patient Positioning: Fowler's Position

1. Turn to Steps to Take 16-7 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the Fowler's position.
3. Practice this procedure several times until you can perform it without reading the steps.

Steps to Take 16-8—Patient Positioning: Knee-Chest Position

1. Turn to Steps to Take 16-8 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the Knee-Chest position.
3. Review this information several times until you can describe it without reading the steps.

Steps to Take 16-9—Patient Positioning: Prone Position

1. Turn to Steps to Take 16-9 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the Prone position.
3. Practice this procedure several times until you can perform it without reading the steps.

Steps to Take 16-10—Patient Positioning: Sims' Position

1. Turn to Steps to Take 16-10 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the Sims' position.
3. Practice this procedure several times until you can perform it without reading the steps.

Steps to Take 16-11—Patient Positioning: Trendelenburg or Shock Position

1. Turn to Steps to Take 16-11 in your Procedure Guide.
2. Read the Steps to Take to properly position a patient in the Trendelenburg or shock position.
3. Practice this procedure several times until you can perform it without reading the steps.

Let's review what you've learned in this lesson.

Please pause to complete online Practice Exercise 16-4.

Step 11 Lesson Summary

- You've learned a lot of useful skills in this lesson. Now you can demonstrate how to prepare patients for examinations. As you now know, patient preparation is more than giving the patient a gown and putting her in a room! You have to prepare the examination room by making sure that it is clean, restocking supplies and making sure that the necessary equipment is charged and ready when the physician begins the exam.

  In addition to assisting the physician, you will also assist patients. All patients will require your help in one form or another. You'll assist patients with their medical history and other documentation required for the medical record. You'll also take height and weight measurements and vital signs. You can also put your patients at ease and help the physician to educate them about particular concerns.

  In this lesson, you also learned about special branches of medicine—pediatrics, gynecology and obstetrics. Each of these branches has patients with unique needs. You learned about immunizations, well-baby checkups, details about the gynecologic exam and how often a pregnant woman should visit the doctor.

  You're doing a great job keeping up with your studies! Next we will discuss medical ethics as it relates to the medical assistant.

Endnotes

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Lesson 17
Medical Ethics and Legal Responsibilities

Step 1 Learning Objectives for Lesson 17

- When you have completed the instruction in this lesson, you will be trained to do the following:
  - Define law, including six different types of law.
  - Define ethics, and summarize the AAMA Code of Ethics.
  - Compare and contrast law and ethics.
  - Identify illegal and unethical medical activities.
  - Analyze and protect a patient's rights.
  - Explain the various legislation that affects health care.
  - Author and correct flawless medical records.
  - Explain consent, implied consent and informed consent.
  - Explain and describe accounts of liability and negligence.
  - Summarize the protections provided by the Good Samaritan law.

Step 2 Lesson Preview

- In Lesson 6, you took a close look at medical records and their role in patient care. You also learned how medical records impact the workflow in a healthcare facility and you learned how important it is to keep good medical records well organized. More recently, in Lessons 13, 14, 15 and 16 you learned some of the best ways to interact with patients, professional colleagues, other healthcare facilities and the insurance industry. All that knowledge has given you a great perspective on knowing what kinds of decisions to make as well as what sorts of actions to take when you deal with other people at your job.

In this lesson, you'll learn to become your patients' healthcare advocate.

In this lesson, you're going to look more closely at the reasons behind some of the decisions you'll soon be making as a medical assistant. For instance, how do our laws influence the medical practices in your state? Did you know that medical professionals have unique and specific codes of ethics to follow? And what does it mean to behave "ethically" anyway?

This lesson is also exciting because you'll be learning how to work with your patients while you become their healthcare advocate. With a comprehensive look at patients' rights and responsibilities and with great tips for keeping good medical records, you'll grasp how to protect a patient's right to privacy and confidential medical care while you discover how easy it is. You'll also learn about the power and grace of different kinds of consent, so you can take care of your patients according to their individual needs and preferences. In this lesson, you'll get comfortable with the concepts of negligence and liability. Finally, you'll also have the chance to practice the learning objectives, making legal and ethical judgments while you remember this lesson's key concepts.

By the end of this lesson, you'll have a strong foundation for moving into the rest of the course's practical learning activities. You're about to cross a threshold into the next level of knowledge, skill and accomplishment—Congratulations! Are you ready? Let's make it happen.

Step 3 Introduction to Law and Ethics

- [ ] A **law** is a formal rule or custom practiced and enforced by a social or geographical community. A law is designed to protect the community's people or resources. So, when you follow the law, you are engaged in legal activities. When you disregard or break the law, you actually commit a crime. Because crimes are illegal activities, they are punishable by law and often carry severe consequences.

Our complete set of laws is influenced by several different kinds of law.

Many Kinds of Laws

Our complete set of laws is influenced by several different kinds of law including *Constitutional law, statutory law, common law, criminal law, civil law* and *administrative law.*

> Because we live in an ever-changing world, all of our laws are subject to cultural influence. So while we may not expect them to change, they can and do.

Constitutional law describes our national or federal governing process. It identifies the way the United States government is organized into three law-making branches: the executive (related to the office of the President), legislative (related to Congress) and judicial (related to the U.S. Supreme Court and other courts). It also refers to the United States Constitution, the legal document that names our rights and protections as U.S. citizens or visiting, international guests.

Statutory law is a fancy way of saying, "state law." Every state in our country has the legal right to make and enforce laws, as long as they do not contradict any of the Federal laws written in the United States Constitution. Also, because every state has the power to make many of its own laws, not every state has the same statutory laws. For example, the speed limit on some highways in Colorado is 75 mph, but the speed limit on a similar highway in Ohio may only be 65 mph.

Common law is a law based on the opinions and experience of local, regional, state and federal judges. Common law is defined by many judges according to the past legal precedents or prior court decisions, that responded to similar cases. Unlike statutory law, common law is not authored and approved by political leaders. Instead, it is collected over time and passed down through the criminal justice system until it is accepted as law.


Criminal law addresses activities that endanger our safety and well-being.

Criminal law refers to the illegal and harmful wrongs individuals and governments commit against community members and society as a whole. Criminal law specifically addresses activities that endanger our welfare and safety.[1] Criminal law also charges, prosecutes and convicts people who commit two kinds of wrongs: a *felony* and a *misdemeanor*. **Felonies** refer to the most serious crimes like murder, rape and large-scale theft. **Misdemeanors** are generally lesser crimes, but they vary from state to state. Some common misdemeanors include prostitution, public drunkenness, trespassing and vandalism.

Civil law is related to the activities that transpire between people, corporations, government agencies/offices and other kinds of organizations. Civil law, or **tort law**, allows citizens to sue someone (usually for money, never for jail time), if that person or group behaves "improperly or unlawfully." Also, if a person or group fails to perform an action, an official responsibility or a legal obligation, they can be prosecuted under civil law.[2]

In your work as a medical assistant, you will learn to follow specific sets of laws and ethics—beyond the laws and ethics already familiar to you as a citizen living in your community. Constitutional, statutory, common, criminal and civil laws all influence agencies that create **administrative laws**. These special laws are for specific industries and professions. For example, the Internal Revenue Service (IRS) is an administrative agency that enforces tax laws. Similarly, healthcare professionals are bound to specific laws and rules regulated by the Social Security Administration (SSA).[3] As you move through this course, you will learn about the important laws and acts that affect your patients and your job so you can make sound decisions and follow the law.

Ethics

Often, we say people who obey a law have *ethics*. Likewise, when people keep important secrets or do not reveal confidential information, we say they are ethical. **Ethics** are moral principles that guide our decisions and behaviors. While ethics don't define what is legally right and wrong, they do influence what we think is good and bad. Ethics are almost like personal values and may also be like a code of conduct.

- What are your personal values?
- How do you expect your friends and loved ones to treat you?
- How do you want your doctor to treat you and your personal information?
- Which unethical behaviors do you think are unforgivable?

Understanding the appropriate legal and ethical behaviors is not hard—it just takes practice. By taking this course, you have already shown your commitment to providing quality, compassionate health care to your patients. You've also taken steps to show your future employer that you are a thoughtful, talented and skilled person they will be able to count on.

As an ethical professional, your patients and your team will be able to count on you.

Professional Code of Ethics

As you just learned, people behave according to a personal code of ethical standards. And just as many agencies (like the IRS and the SSA) have their own administrative laws, professional groups (like teachers, building contractors and medical professionals) also have high expectations for every group member. These expectations are called a *code of ethics*. Think of a **code of ethics** almost like you would a religious creed or any system of belief. A code of ethics calls for consistently responsible, compassionate, honorable behavior.

Because you will soon be working as a medical assistant, you will be expected to practice the *American Association of Medical Assistants (AAMA) Code of Ethics*. Consider the **AAMA Code of Ethics** like a pledge or a promise. The AAMA Code of Ethics says all medical assistants must serve their patients and the general public as a true professional, earning the deserved praise and trust of the medical profession and the world at large.[4]

The AAMA Code of Ethics reads,

> "Members of AAMA dedicated to the conscientious pursuit of their profession and thus desiring to merit the high regard of the entire medical profession and the respect of the general public which they serve, do pledge themselves to:
>
> A. Render service with full respect for the dignity of humanity;
>
> B. Respect confidential information obtained through employment unless legally authorized or required by responsible performance of duty to divulge such information;
>
> C. Uphold the honor and principles of the profession and accept its disciplines;

D. Seek to continually improve knowledge and skills of medical assistants for the benefit of patients and professional colleagues;

E. Participate in additional service activities aimed toward improving the health and well-being of the community."

> You can learn more about the AAMA at http://www.aamantl.org/about/code_creed.aspx.

In addition to the laws governing you and the expectations in the AAMA Code of Ethics, your employer may require you to follow additional ethical or professional standards. It is very important that you adhere to these laws and codes of conduct. First, they will protect your patients from undue harm. Also, they will protect you and your employer from legal entanglements. For instance, when medical professionals break the law or behave unethically—whether they intend to or not—they are legally responsible for any physical, emotional or financial harm their patients may experience. This legal responsibility is also known as **liability** and it is in your best interest to avoid it. That's why demonstrating your legal competence and professional ethics is so important. Over time, your knowledge, practical experience and ethical code of conduct will gain you job security. It will also enhance your status as a professional medical assistant.

Step 4 Patients' Rights and Responsibilities

- [ ] One of the most important aspects of your job as a medical assistant is protecting and upholding your patients' rights. You and every member of the healthcare team—from doctors to receptionists, from x-ray technicians to billing clerks—participate in the doctor-patient relationship. Therefore, you must respect a patient's right to confidentiality and privacy. A patient also has the right to safety and security in all aspects of the doctor-patient relationship. In addition to these rights, a patient has the right to be fully informed about his medical condition and treatment options, including the potential risks and side effects. Once informed, a patient must agree to any medical procedure before it begins. This agreement, whether verbal or written, is called **consent**. In the pages ahead, you'll learn more about consent, what it means and how and why to obtain it. Don't worry. The concept is very simple, and it is very much in line with how you protect your profession from liability while you advocate for your patients' rights.

Think about your visits to your doctor's office. How does your doctor or her team of medical professionals protect your rights? Does your examination take place in a private room? If your doctor wants you to see a specialist, does she ask for your signature on a medical release so she can send your records over to the specialist? What about when you go to the hospital? If you don't have a private room, does your doctor (or another healthcare professional like a nurse or a medical assistant) pull a curtain closed before she begins your examination? Or, if your doctor is removing stitches from your arm, he probably doesn't ask you to remove your clothing. Have you ever visited a parent or a friend in the hospital? Did you notice the doctors, nurses and medical assistants were careful not to discuss your loved one's case? It's likely they even asked you to step out of the room while they checked on their patient. That's right. There are lots of ways you can and must protect and serve your patients' rights.

The American Hospital Association (AHA) requires every physician and healthcare provider to post the AHA Patient's Bill of Rights. The AHA also allows hospitals and healthcare institutions to modify the document so the language makes sense to all their patients.

The following list identifies one version of the AHA Patient's Bill of Rights.

AHA Patient's Bill of Rights

1. The patient has the right to considerate and respectful care.
2. The patient has the right to and is encouraged to obtain from physicians and other direct caregivers relevant, current and understandable information concerning diagnosis, treatment and prognosis.
   - Except in emergencies when the patient lacks decision-making capacity and the need for treatment is urgent, the patient is entitled to the opportunity to discuss and request information related to the specific procedures and/or treatments, the risks involved, the possible length of recuperation and the medically reasonable alternatives and their accompanying risks and benefits.
   - Patients have the right to know the identity of physicians, nurses and others involved in their care, as well as when those involved are students, residents or other trainees. The patient also has the right to know the immediate and long-term financial implications of treatment choices, insofar as they are known.
3. The patient has the right to make decisions about the plan of care prior to and during the course of treatment and to refuse a recommended treatment or plan or care to the extent permitted by law and hospital policy and to be informed of the medical consequences of this action. In case of such refusal, the patient is entitled to other appropriate care and services that the hospital provides or transfer to another hospital. The hospital should notify patients of any policy that might affect patient choice within the institution.
4. The patient has the right to have an advance directive (such as a living will, health care proxy or durable power of attorney for health care) concerning treatment designating a surrogate decision maker with the expectation that the hospital will honor the intent of that directive to the extent permitted by law and hospital policy.
   - Healthcare institutions must advise patients of their rights under state law and hospital policy to make informed medical choices, ask if the patient has an advance directive and include that information in patient records. The patient has the right to timely information about hospital policy that may limit its ability to implement fully a legally valid advance directive.
5. The patient has the right to every consideration of privacy. Case discussion, consultations, examination and treatment should be conducted to protect each patient's privacy.

(Continued)

AHA Patient's Bill of Rights

6. The patient has the right to expect that all communications and records pertaining to her care will be treated as confidential by the hospital, except in cases such as suspected abuse and public health hazards when reporting is permitted or required by law. The patient has the right to expect that the hospital will emphasize the confidentiality of this information when it releases it to any other parties entitled to review information in these records.
7. The patient has the right to review the records pertaining to her medical care and to have the information explained or interpreted as necessary, except when restricted by law.
8. The patient has the right to expect that, within its capacity and policies, a hospital will make reasonable response to the request of a patient for appropriate and medically indicated care and services. The hospitals must provide evaluation, service and/or referral as indicated by the urgency of the case. When medically appropriate and legally permissible or when a patient has requested, a patient may be transferred to another facility. The institution to which the patient is to be transferred must first have accepted the patient for transfer. The patient must also have the benefit of complete information and explanation concerning the need for, risks, benefits and alternatives to such a transfer.
9. The patient has the right to ask and be informed of the existence of business relationships among the hospital, educational institutions, other healthcare providers or payers that may influence the patient's treatment and care.
10. The patient has the right to consent to or decline to participate in proposed research studies or human experimentation affecting health care and treatment or requiring direct patient involvement and to have those studies fully explained prior to consent. A patient who declines to participate in research or experimentation is entitled to the most effective care that the hospital can otherwise provide.
11. The patient has the right to expect reasonable continuity of care when appropriate and to be informed by physicians and other caregivers of available and realistic patient care options when hospital care is no longer appropriate.
12. The patient has the right to be informed of hospital policies and practices that relate to patient care, treatment and responsibilities. The patient has the right to be informed of available resources for resolving disputes, grievances and conflicts, such as ethics committees, patient representatives or other mechanisms available in the institution. The patient has the right to be informed of the hospital's charges for services and available payment methods.[5]

Be trustworthy and encourage your patients to be open and honest with you.

Just as a patient has many rights, a patient also has many responsibilities. For example, if a patient comes in to discuss one health concern, but he is not honest about a pre-existing medical condition, a medical professional could unknowingly prescribe a treatment for one problem without considering the full range of consequences for the patient. When a patient is not open about his medical history, he endangers his own health care and puts his medical team in an awful position.

However, you cannot rely on your patients to disclose all their important information on their own. Some may want to keep it private because they are embarrassed. Others may not want to talk about it because they are in a form of denial and they don't want the information to be true or real. Sometimes patients forget things or they don't realize the information they have is important for you to know. It's for these reasons you and your medical team must encourage patients to participate in an open, honest dialogue with their healthcare practitioners. You must speak and act so that you foster feelings of trust and care.

Remember a time you were with a medical professional and you felt uneasy or unsure. Now think of a time you felt really comfortable with a medical professional. Here's some food for thought. What made the difference for you? How do you think you can encourage your patients to talk with you openly and honestly? What can you do and say to make them feel more at ease? More trusting?

Please pause to complete online Practice Exercise 17-1.

Step 5 Laws and Regulations Affecting Health Care

- ❑ You just learned some of the concepts that define a patient's rights to privacy. You also checked on some of your own personal values as they relate to laws and ethics. You even had the chance to make some judgments about how to protect your patients when privacy and confidentiality are at risk. Now it's time to take a look at specific details that will teach you more about privacy, confidentiality and privileged communication. You'll also learn some key information about three laws that protect you and your patients.

Protecting confidentiality is important, both legally and ethically.

The Fourth Amendment

According to our Constitutional laws, the Fourth Amendment protects a person's rights to privacy and confidentiality. In the healthcare profession, respecting a patient's privacy and protecting his *confidentiality* are important, both legally and ethically. **Privacy** is freedom from intrusion or disturbance. It is also connected to secrecy and sometimes seclusion. **Confidentiality** refers to private matters and restricted information. Privileged communication is the confidential, private written and spoken words you hear, say and write down for your patient records.

Your medical office or healthcare facility will train you to follow their principles and procedures for handling privileged communication like patients' medical records. Keep in mind these best practices, though.

- Always obtain a patient's written permission, including his signature, before releasing any medical record.
- Only release the specific information requested. Be careful not to release unsolicited information. For example, if another medical office requests information between August 1, 2003 and July 31, 2004, do not send records prior to or after that time period. Likewise, if an insurance company requests information about a patient's recent diagnosis, you should not send any of the patient's unrelated or historical medical records.
- If a court ever subpoenas a patient's medical records, the patient doesn't need to sign a release. By law, you're mandated to send the records to the legal agency. However, you do need to tell your patient, in writing, that his records have been subpoenaed and sent to court.

Medical Practice Acts

Another type of law that governs the healthcare field are **medical practice acts**, which are regulations created by each state's board of medicine. These acts provide a definition of the practice of medicine in that state, licensing requirements, disciplinary actions, how physicians can use titles such as MD or DO and even how doctors are allowed to advertise. These acts also outline how medical complaints are investigated and usually set up a system for tracking physicians in the state whose practices have received complaints.[6]

Doctors can lose their license to practice for many reasons, including the following:

- **Fraud**—filing false claims, falsifying medical records or making unsubstantiated claims about medical treatments
- **Criminal activities**—murder, robbery, rape
- **Unprofessional conduct**—**fee splitting** with another doctor for a referral, violation of HIPAA's privacy laws or excessive alcohol or drug use
- **Incompetence**—senility or a mental disorder

If you notice any unethical or illegal activity in your office, it is your duty to report it to your state board of medicine.

Health Care Quality Improvement Act

In the early 1980s, the healthcare profession experienced an increase in lawsuits questioning the competence of medical practitioners, hospitals and medical peer review committees. A medical peer review committee is a group of medical professionals who study and evaluate the performance of their colleagues when concerns over malpractice or incompetence arise.

There are several electronic databases that keep track of illegal and unethical medical professionals and their practices.

In response to this increase in litigation, Congress passed the Health Care Quality Improvement Act (HCQIA) in 1986. This bill was designed to protect hospitals and medical professionals who serve on medical peer review boards. It outlines specific standards review boards must use when evaluating their peers. Also, it protects every review board member from blame and liability in lawsuits brought against their peers, regardless of the board's findings. Finally, the Health Care Quality Improvement Act established the *National Practitioner Data Bank (NPDB).* The **NPDB** is an interactive resource accessible to registered users. When a particular physician, dentist or healthcare professional is under review for an unethical, incompetent or illegal practice, her name is entered into the NPDB. This system allows for a discreet, confidential inquiry into the physician's "licensure, professional society memberships, medical malpractice payment history and record" of active and suspended clinical privileges.[7]

For example, a dentist in California is convicted on malpractice charges and pays out $25,000 to several patients who were harmed by his actions. To start afresh, he decides to move his practice into Nevada. Thanks to the HCQIA, the state of California is required to report the dentist's conviction and payout to the NPDB. If he is ever accused of malpractice in Nevada, there is a legal record of his medical mistakes. This information can be used to punish the dentist for his continued offenses.

Health Insurance Portability and Accountability Act

As you know, HIPAA as also passed in an effort to streamline and regulate fair health insurance practices. This legislation requires healthcare providers to set up procedural and eligibility standards for organizations that handle electronic healthcare transactions. HIPAA established the *Healthcare Integrity and Protection Data Bank (HIPDB).* The Healthcare Integrity and Protection Data Bank is similar to the National Practitioner Data Bank you just learned about. Like NPDB, **HIPDB** centralizes information about questionable healthcare practices. HIPDB flags physicians, nurses, medical assistants and other healthcare professionals, as well as healthcare providers and suppliers, if they are entangled in alleged wrongdoings. HIPDB serves to protect patients by reporting and tracking unsafe, poor quality healthcare practices. It also serves to protect patients, insurance carriers and other healthcare providers by reprimanding abuses and calling out insurance fraud.

Federal False Claims Act

In 1985, more than 10 years before the HIPAA and HIPDB came into play, Congress passed the *Federal False Claims Act (FFCA).* The **FFCA** was written to inspire a proactive partnership between citizens and law enforcement officials. Its mission is to report and prosecute people who commit fraud against the U.S. Government. Now, here's where the law gets really interesting. Under the FFCA, any person who knows about a fraud committed against the Government can file a lawsuit on behalf of the Government against the person or organization that committed the fraud. If the prosecution wins the case, the person who acted as the Government's plaintiff is awarded 20-30 percent of the recovered monies.[8]

The Federal False Claims Act is not limited to people

> "who intentionally misrepresent facts in order to obtain payments or other benefits from the Government; it also covers reckless conduct. Thus, if a defendant should have known that its representations to the Government were not true or accurate, but did not bother to check, such recklessness may constitute a violation of the Act. Likewise, if a defendant deliberately ignores information which may reveal the falsity of the information submitted to the Government, such 'deliberate ignorance' may constitute a violation" of the FFCA.[9]

The Good Samaritan Law

Another area of medical care where tort law comes into play is with the **Good Samaritan law**, which protects healthcare workers from negligence charges when they respond to an emergency. If the medical professional attempts to rescue or assist someone in imminent danger and the victim is harmed, the responder can not be sued for negligence.

For example, let's imagine that you encounter a single car accident on a deserted road. The victim is lying unconscious in the driver's seat and you can see flames burning the engine. You decide that the situation is dire enough for you to pull the victim out of the car without taking the time to assess for a spine or neck injury.

If later a neck injury is found, the victim can't find you at fault for moving him out of the car. It's clear that the danger of fire or an explosion was a more immediate concern than the patient's condition.

The purpose of the Good Samaritan law is to encourage people to help others when they see an emergency, without fear that if they help, they will be punished later.

There are some conditions for the Good Samaritan law to be used as a defense. First, the emergency help must be reasonable. Overreacting to a situation or being negligent are not protected by this law. Secondly, there has to be an actual emergency, and lastly, the emergency can not have been caused by the person who is trying to help.

The Uniform Anatomical Gift Act

All U. S. States have a **Uniform Anatomical Gift Act** (**UAGA**). These acts were passed in an effort to regulate and streamline the organ donation process. This law governs organ donation for transplantation and body donation for educational purposes.

The law outlines how these gifts can be made and who can authorize an anatomical donation in the absence of written permission from the deceased. The act also provides protection for healthcare workers who receive the anatomical gift in good faith, believing that the deceased intended his organs to be donated. And finally, the act prohibits the sale or purchase of anatomical gifts for transplant or therapy.

First drafted in 1968, UAGAs have been revised several times to make organ donation easier. When organ donation first became feasible, the patient had to create a formal document with witnesses. Now, it may be as easy as placing a checkmark in a box on your driver's license. Organ donation has saved thousands of lives, and there is a great shortage of organs compared to those who need them. This act benefits all of society by encouraging people to allow an anatomical gift after their death.

The Controlled Substances Act

The **Drug Enforcement Agency**, or **DEA**, enforces the **Controlled Substances Act**, which was passed in 1970 to regulate the manufacture, distribution and disposal of potentially abusive drugs. Physicians are required to register with the DEA if they keep a stock of these drugs in the office, and must follow other standards such as keeping the medications in a locked cabinet, out of view of patients, keeping the keys secure and special handling of the prescription pads used to prescribe this category of drugs. In addition, a daily inventory must be kept and signed by two employees of the medical office. The DEA checks these inventories every two years.

Controlled substances are classified into five levels called **schedules**.

- **Schedule I**—Drugs that have a high potential for addiction or abuse and no recognized medicinal value. These drugs include LSD and heroin. These drugs are not currently legal in the United States.

- **Schedule II**—Drugs that have a high potential for addiction or abuse, but have accepted medical value. Amphetamines, for example, may be used to treat narcolepsy. Since 1959, legal amphetamine use has required a prescription. Schedule II drugs require a written prescription and it cannot be refilled.

- **Schedule III**—Drugs that have a moderate potential for addiction but a very high potential for psychological dependency. One well-known example is codeine. These drugs can be refilled, but not more than five times every six months.

- **Schedule IV**—Drugs that have some potential for physiological or psychological abuse. One common example is chloral hydrate, a sleep aid. Like Schedule III drugs, these can only be refilled five times every six months.

- **Schedule V**—Schedule V drugs have the least potential for addiction or abuse among controlled substances. One example is Lomotil, an antidiarrheal drug manufactured by Pfizer. Refills of Schedule V drugs are also limited to five times within six months.

As a medical assistant, you must know the restrictions that apply to controlled substances because you may have several responsibilities in this regard. The doctor may depend on you to flag her DEA renewal date or you may assist in securing and inventorying controlled substances.

Medical Licensure, Certification and Registration

Sounds like a traffic stop doesn't it? "Let me see your license and registration, ma'am." Well, just like you can't drive without a license, physicians and nurses can't practice medicine without one either. As you read earlier, the state board of medicine issues licenses to physicians. There is also a state board of nursing to regulate and license the nurses practicing in that state.

Medical assistants may be either *registered* or *certified*. To be **registered** means that you have obtained the necessary education and passed a standardized exam to be qualified to practice as a medical assistant. The national Registered Medical Assistant (RMA) exam is offered by the American Medical Technologists association.

To be **certified** indicates that you have achieved the standards set by an authorized certifying body. You can receive the **Certified Medical Assistant** credential after passing the Certified Medical Assistant (CMA) exam offered by the American Association of Medical Assistants.

The National Healthcareer Association also offers certification through the **Certified Medical Administrative Assistant** (CMAA) exam, which you are eligible to sit for as soon as you successfully complete this course. After you are employed, and your employer verifies your phlebotomy experience, you will be able to sit for the **Certified Clinical Medical Assistant** (CCMA) exam.

All of these credentials are recognized in every state; however, states differ in what they allow a registered or certified MA to do, so if you move to another state, be sure to check the state regulations. Your employer can assist you with this.

Keep in mind that, because you aren't licensed, there are no restrictions on what tasks you can perform. Your employer is responsible for setting the limits of what you can do, and this falls under the legal concept of **respondeat superior**, which means "let the master answer." The physician is responsible for your actions, so long as you act within your *scope of practice*.

Scope of Practice

Your **scope of practice** is the collection of clinical tasks that you have been educated and trained to perform. In addition, it includes the tasks that your employer allows you to perform. If, for example, your physician does not allow you to give advice over the phone, doing so would be beyond your scope of practice. In this case, you would not be protected by respondeat superior, and you could be sued personally if you caused harm to someone by practicing outside of your scope of practice. For this reason, many medical assistants carry malpractice insurance, which is inexpensive and provides you peace of mind.

Step 6 Medical Records

- As you'll recall from Lesson 2, a medical record is an accumulation of private, health-related information. Since a medical record is considered a legal document, its contents are believed to contain the truth about a patient's care. For example, if a patient recalls that a medical assistant didn't take a urine sample, but the medical record indicates a urine sample was taken, then the court assumes the medical record is accurate and the patient is mistaken. Or, maybe a dermatology patient claims her physician didn't warn her about the dangers to a fetus when the mother is taking Accutane for acne treatment. Consequently, she got pregnant and her child was malformed, possibly due to the side effects of the Accutane drug. But, if the medical record shows the dermatologist requested a pregnancy test (which came back negative) before he wrote his patient that prescription and she signed a document saying she understood the risks and side effects of using the drug then the dermatologist probably won't be found at fault. In short, if a medical record says something was done, a court will assume it was. Conversely, if a medical record doesn't say something was done, a court will assume it wasn't.

  Because the medical record is given such importance, it's critical that the record be maintained carefully. Let's look at how healthcare providers ensure that medical records are accurate.

A patient must give consent before you can share or release his medical records.

The Five Cs

Keeping good medical records is like keeping a clean house. You stay on task and you keep it organized. You find a place for everything, and you keep everything in its place. And while there's no magic formula for keeping your house in order, there is an easy way to remember how to record information in a patient's medical record. It's called the "*Five Cs*." The **Five Cs** stand for *concise*, *complete*, *clear*, *correct* and *chronological*.[10]

Concise means keep your notes short and simple. Keep them focused and to the point. Just because correct medical records are concise, doesn't mean they don't tell the full story. **Complete** means be as thorough as possible and cover every detail accurately. And while this may seem incompatible with keeping the record concise, don't worry. You'll find a good compromise.

Make your marks so they are legible and **clear**. For example, if your 4s look like 9s, find a way to distinguish them. Or, if you tend to abbreviate longer words, make sure you and everybody else reading the record will understand what you mean. Make sure your handwriting is legible.

The information you record needs to be **correct**. That is, if the patient says he gets mild headaches every evening after he eats, you shouldn't write that the patient gets a little dizzy sometimes after he eats. If you're unsure what a patient means, it's your job to find out more. If she tells you her ears have been ringing, you need to know if they've been ringing or whistling or pounding. Is the ring tone high or low? How high—on a scale of 1 to 10, 10 being the loudest? Regular or irregular? And so on. You and your patient need to be on the same page, so to speak. Also, when your records are correct, you leave out subjective judgments and interpretations about your patient. Correct records are objective records.


Preserve the dates and times of healthcare contact in chronological order.

Finally, keep your records in **chronological** order, or in order by date, with newest information in the front. The timing and sequence of medical treatments must be preserved in a medical record.

Photographic, Video and Other Visual Documentation

With all the technological tools available to us, there may be times when you'll want to record patient data with photographs, video or other visual media. For example, one of your patients is having back surgery next week, and your office would like to record the procedure for the patient's medical records. They'd also like to show the video in a seminar at the local university medical school. You must obtain written consent to record the video for professional and educational review. If you don't, you're liable for an invasion of privacy lawsuit.

Some medical offices make a regular practice of taking photographs, video or digital images of patients and the care they receive. When this is the case, you should use a special consent form stating the following points.

- The patient knows the images are to document care.
- The patient accepts that the medical office (or another healthcare facility) owns the images.
- The patient knows she can get copies of the images or view them anytime she chooses.
- The medical office will store the records in a secure location for a set period of time.
- The images or copies of the images won't be released to a third party without written permission from the patient.[11]

If your office wants to use the photographs for other purposes, perhaps in a classroom or in advertisement, you should use another, separate consent form. It should state the explicit purpose of use.

Making Corrections

It's okay to make a correction to a patient's medical record. After all, "correct" is one of the Five C's. When making a correction, you need to keep the original record intact. For instance, if you blacked data out, someone could think you were trying to cover something up, literally. If the medical record ever landed in court as evidence, someone might think you falsified the record when all you wanted to do was emphasize the new or correct information. So, when you make a change to a medical record, you need to follow a set protocol.

1. Draw a thin line through the error you intend to correct. The original information needs to remain legible.
2. Write or type the correct information into the record. Place the correct information very near the original data—above it, below it or next to it in a margin.
3. ALWAYS indicate why you made the correction.
4. Add the date and time of your correction. Initial it.
5. Ask another member of your medical team to witness your correction and to initial next to the change you made, verifying it as a correction.[12]

More about the Release of Information

Typically, a medical record is released for three purposes: for insurance claims, to share with another consulting or treating physician and for use in court. Again, except when subpoenaed by a court of law, a medical facility cannot release a patient's medical records without express written permission from the patient. You'll learn more about gaining a patient's permission or his consent in the next session of this lesson. For now, you need to remember that a patient has every right to cancel his consent to release his medical records, too. You must respect the patient's right and make every effort to protect his files from what will now be an unauthorized, libelous release.

When medical records are released, the facility that owns the records sends copies of the requested data. When making and sending copies, you must use great care. Follow these guidelines.

Tips to Respect Patient Confidentiality

- Make sure you don't leave records behind in a copy, fax or printing machine.
- Extra or unnecessary copies must be shredded.
- If your copies jam up in a copier, fax or printer, you must remove and shred any partial copies that may be stuck inside the machine.
- Stay with confidential material while it copies, prints or faxes. Do not leave medical records unattended, in the open.
- When faxing records, use a cover sheet and mark it, "Confidential: To [addressee] only. Please return to sender if you receive this in error."
- If mailing records, mark the opaque envelope, "Confidential."
- Before you send the records, verify the name, address and/or fax number of your authorized contact in another medical facility.
- Never send medical records via e-mail. E-mail is not guaranteed to be private.

Step 7 Consent

- [ ] Earlier in this lesson, we touched on patients' rights. If you go back and look at the first three rights listed on the AHA Patient's Bill of Rights, you'll see they relate a patient's right to be informed of all the terms and conditions related to her health care. They also support a patient's right to make choices about her health care, and they protect the patient's right to give or deny consent for any health care she may receive. Giving consent is like giving permission. Consent signifies approval and agreement. If you nod your head up and down, you imply, "Yes." Similarly, if you say aloud, "Sure," you express consent. Likewise, when you sign your name or initials on a document, you express consent.

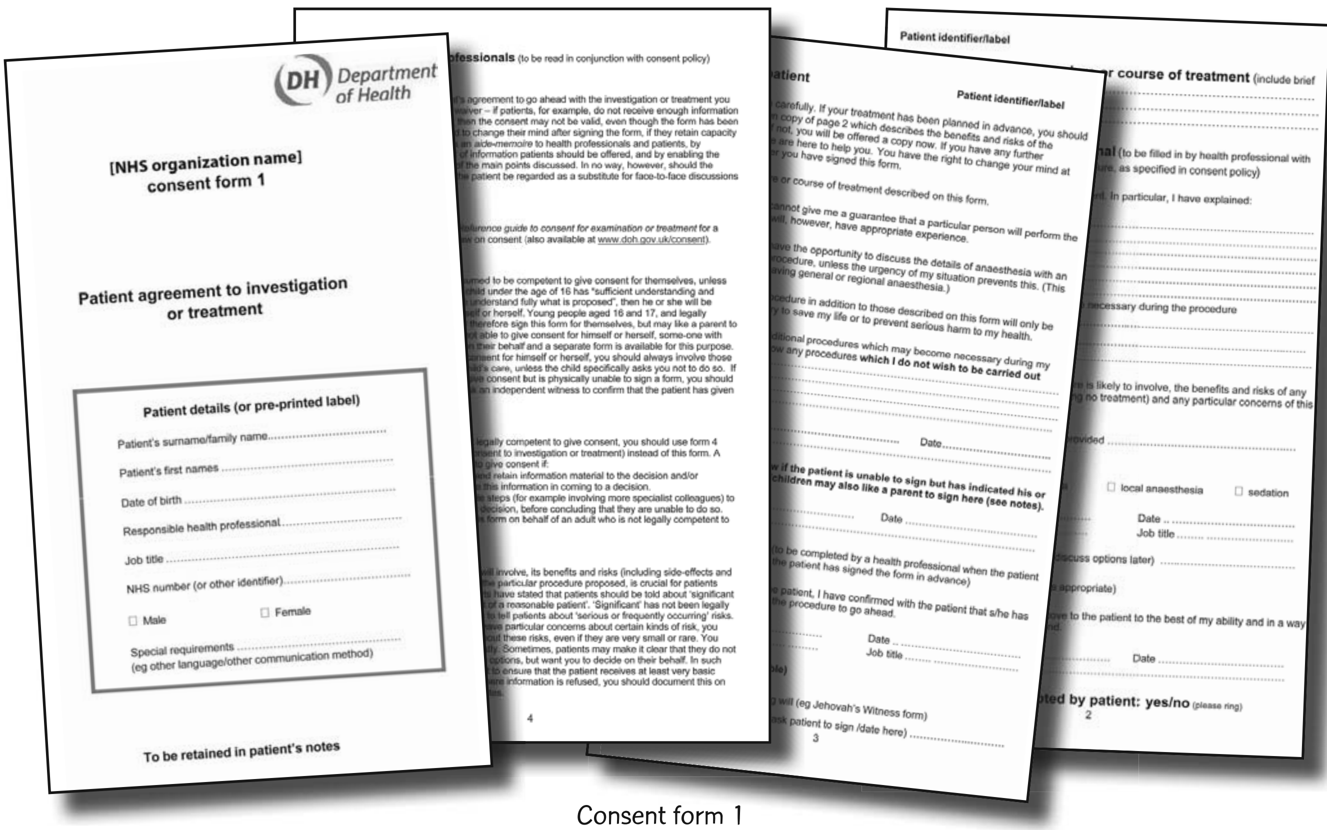
Consent shows approval and agreement.

So, when a patient gives permission, it can come in either of those forms, *implied* or *express consent*. **Implied consent** is an agreement made without words. Implied consent means the patient gives his permission, but he does so without writing anything down or saying, "Yes. It's okay to do that to me." For example, if you are sitting in a chair and a medical assistant wants you to sit on the examining table so she can take your blood pressure, she may just pat the top of the table and ask you to roll up your sleeves. By moving onto the table and rolling up your sleeves, even without saying a word, you are offering implied consent.

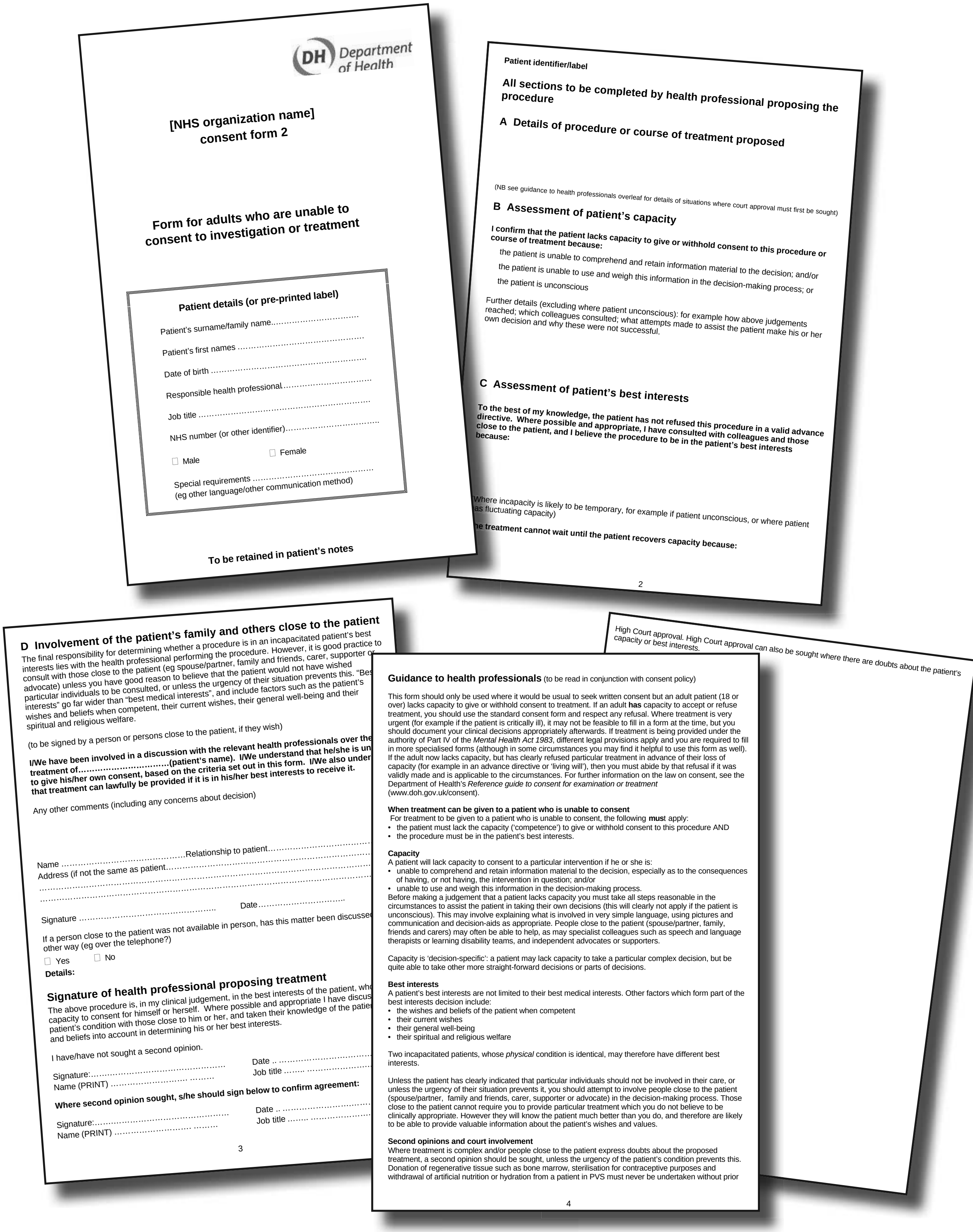
If the permission you get is from **express consent**, it may be as a verbal or written agreement. When obtained properly, both implied and express consent work like a contract. So how do you obtain consent properly? You make sure your patients have all the information they need to give informed consent. A patient gives informed consent when the following have occurred:

- A medical professional has explained all aspects of the patient's medical situation.
- A medical professional identifies the terms and conditions of the proposed treatments or procedures.
- A medical professional addresses any risks and potential outcomes from every possible treatment, including no treatment at all.
- The patient has the chance to ask as many questions as she chooses.
- The patient clearly understands what's to come after she chooses a specific course of treatment.

Whether a patient gives implied or express informed consent, you must document her consent and agreement to move forward with treatment. The best documentation for medical records and patient care is always a signed, written consent form. If a patient refuses treatment, she must sign a consent form then, too. Keep in mind, written consent is also needed to release medical records to another doctor or to an insurance company. As a medical assistant, many times, it will be your job to obtain and witness a patient's written consent. Your place of employment will have standard and special forms they'll train you to use, don't worry. In the meantime, refer to the two forms below and on the following page for two samples of consent forms from the Department of Health.



Consent form 1



Department of Health

[NHS organization name]
consent form 2

Form for adults who are unable to consent to investigation or treatment

Patient details (or pre-printed label)

Patient's surname/family name.................................
Patient's first names ....
Date of birth ....
Responsible health professional.................................
Job title ....
NHS number (or other identifier)..................................
☐ Male ☐ Female
Special requirements ....
(eg other language/other communication method)

To be retained in patient's notes

Patient identifier/label

All sections to be completed by health professional proposing the procedure

A Details of procedure or course of treatment proposed

(NB see guidance to health professionals overleaf for details of situations where court approval must first be sought)

B Assessment of patient's capacity

I confirm that the patient lacks capacity to give or withhold consent to this procedure or course of treatment because:

the patient is unable to comprehend and retain information material to the decision; and/or
the patient is unable to use and weigh this information in the decision-making process; or
the patient is unconscious

Further details (excluding where patient unconscious): for example how above judgements reached; which colleagues consulted; what attempts made to assist the patient make his or her own decision and why these were not successful.

C Assessment of patient's best interests

To the best of my knowledge, the patient has not refused this procedure in a valid advance directive. Where possible and appropriate, I have consulted with colleagues and those close to the patient, and I believe the procedure to be in the patient's best interests because:

Where incapacity is likely to be temporary, for example if patient unconscious, or where patient as fluctuating capacity)

he treatment cannot wait until the patient recovers capacity because:

2

D Involvement of the patient's family and others close to the patient

The final responsibility for determining whether a procedure is in an incapacitated patient's best interests lies with the health professional performing the procedure. However, it is good practice to consult with those close to the patient (eg spouse/partner, family and friends, carer, supporter or advocate) unless you have good reason to believe that the patient would not have wished particular individuals to be consulted, or unless the urgency of their situation prevents this. "Best interests" go far wider than "best medical interests", and include factors such as the patient's wishes and beliefs when competent, their current wishes, their general well-being and their spiritual and religious welfare.

(to be signed by a person or persons close to the patient, if they wish)

I/We have been involved in a discussion with the relevant health professionals over the treatment of..............................(patient's name). I/We understand that he/she is un to give his/her own consent, based on the criteria set out in this form. I/We also under that treatment can lawfully be provided if it is in his/her best interests to receive it.

Any other comments (including any concerns about decision)

Name ....Relationship to patient..............................
Address (if not the same as patient..
....
....
Signature .... Date...............................

If a person close to the patient was not available in person, has this matter been discusse other way (eg over the telephone?)

☐ Yes ☐ No

Details:

Signature of health professional proposing treatment

The above procedure is, in my clinical judgement, in the best interests of the patient, who capacity to consent for himself or herself. Where possible and appropriate I have discus patient's condition with those close to him or her, and taken their knowledge of the patie and beliefs into account in determining his or her best interests.

I have/have not sought a second opinion.

Signature:... Date .. ..
Name (PRINT) .... Job title ....

Where second opinion sought, s/he should sign below to confirm agreement:

Signature:... Date .. ..
Name (PRINT) .... Job title ....

3

High Court approval. High Court approval can also be sought where there are doubts about the patient's capacity or best interests.

Guidance to health professionals (to be read in conjunction with consent policy)

This form should only be used where it would be usual to seek written consent but an adult patient (18 or over) lacks capacity to give or withhold consent to treatment. If an adult **has** capacity to accept or refuse treatment, you should use the standard consent form and respect any refusal. Where treatment is very urgent (for example if the patient is critically ill), it may not be feasible to fill in a form at the time, but you should document your clinical decisions appropriately afterwards. If treatment is being provided under the authority of Part IV of the *Mental Health Act 1983*, different legal provisions apply and you are required to fill in more specialised forms (although in some circumstances you may find it helpful to use this form as well). If the adult now lacks capacity, but has clearly refused particular treatment in advance of their loss of capacity (for example in an advance directive or 'living will'), then you must abide by that refusal if it was validly made and is applicable to the circumstances. For further information on the law on consent, see the Department of Health's *Reference guide to consent for examination or treatment* (www.doh.gov.uk/consent).

When treatment can be given to a patient who is unable to consent
For treatment to be given to a patient who is unable to consent, the following **must** apply:
- the patient must lack the capacity ('competence') to give or withhold consent to this procedure AND
- the procedure must be in the patient's best interests.

Capacity
A patient will lack capacity to consent to a particular intervention if he or she is:
- unable to comprehend and retain information material to the decision, especially as to the consequences of having, or not having, the intervention in question; and/or
- unable to use and weigh this information in the decision-making process.

Before making a judgement that a patient lacks capacity you must take all steps reasonable in the circumstances to assist the patient in taking their own decisions (this will clearly not apply if the patient is unconscious). This may involve explaining what is involved in very simple language, using pictures and communication and decision-aids as appropriate. People close to the patient (spouse/partner, family, friends and carers) may often be able to help, as may specialist colleagues such as speech and language therapists or learning disability teams, and independent advocates or supporters.

Capacity is 'decision-specific': a patient may lack capacity to take a particular complex decision, but be quite able to take other more straight-forward decisions or parts of decisions.

Best interests
A patient's best interests are not limited to their best medical interests. Other factors which form part of the best interests decision include:
- the wishes and beliefs of the patient when competent
- their current wishes
- their general well-being
- their spiritual and religious welfare

Two incapacitated patients, whose *physical* condition is identical, may therefore have different best interests.

Unless the patient has clearly indicated that particular individuals should not be involved in their care, or unless the urgency of their situation prevents it, you should attempt to involve people close to the patient (spouse/partner, family and friends, carer, supporter or advocate) in the decision-making process. Those close to the patient cannot require you to provide particular treatment which you do not believe to be clinically appropriate. However they will know the patient much better than you do, and therefore are likely to be able to provide valuable information about the patient's wishes and values.

Second opinions and court involvement
Where treatment is complex and/or people close to the patient express doubts about the proposed treatment, a second opinion should be sought, unless the urgency of the patient's condition prevents this. Donation of regenerative tissue such as bone marrow, sterilisation for contraceptive purposes and withdrawal of artificial nutrition or hydration from a patient in PVS must never be undertaken without prior

4

Consent form 2

Remember, by signing a written consent, a patient states that she understands her condition, a procedure, treatment plans, risks and potential outcomes of the treatment. It also states that she gives her permission to the healthcare team to perform the work they've discussed.

When seeking consent, a patient must be told the following information in language she understands:

1. The reasons and nature of any procedure
2. How the procedure is to be performed
3. The risks associated with the procedure
4. The expected outcome of the procedure
5. Alternative treatment methods and their associated risks and potential outcomes
6. The risk if no treatment is given[13]

Take a moment now and think about a situation when you had to give your consent for a procedure or test. It could be for yourself or for one of your children. Who explained things to you? Did anyone or was it all written down on a form? Who asked you to sign the consent form? When you signed the form, how did you feel about it? Did the medical team answer all your questions? Were you 100 percent confident in your understanding?

A patient must feel as comfortable as possible with her treatment.

Consider what it will be like when you're working as a medical assistant. Say you work in an oncology department and one of your patients has breast cancer. She's finished her primary treatments and she's in today to discuss more medication options with the doctor. The doctor explains that several of her patients are participating in a study examining the benefits of a new cancer drug. Preliminary study results show the drug is 12 percent more effective in 65 percent of women than other, similar drugs used in the past. She tells the patient that some women do experience side effects including headaches and dizziness. She also tells her that only a small percentage of women have experienced temporary vision loss and mild seizures while using the drug. The doctor positions this new treatment option by saying, "While there are some risks, the trade-off for long-term health may be better."

When the doctor is finished explaining the options, the patient asks a few questions. You think the patient is leaning toward the traditional treatment because she says things like, "I'm concerned about the vision loss," and, "My mother died of an aneurysm." The doctor suggests, "Why don't we try the drug for six weeks? In the meantime, you can call me with any other questions or concerns you have once you start taking the drug. If you experience any side effects, we can talk about choosing another, more traditional form of treatment. You might find the headaches manageable and this course of treatment is short term. I think this medication has the potential to do great things for your long-term health." The patient says, "OK, I guess so. If you think this is my best option." So when the doctor leaves the room, it's time for you to obtain the patient's signature on several informed consent documents.

A patient gives consent when she has all the facts.

Do you think the patient is truly comfortable with the course of treatment she's about to agree to? Why or why not? Since you are administering her consent, do you feel comfortable signing your name as a witness? What else can you do alone or as a member of your team to make sure your patient is making the best decision for her physical and mental well-being?

What If?

Think about a situation now, where a patient might not be able to give informed consent. What if he was unconscious, in a state of dementia or disorientation? How would you obtain consent for treatment then? And what if his condition was a medical emergency? Life-threatening even? Sometimes your patients may not be mentally competent to make decisions about their health care. Depending on where you work, some of your patients may be insane. Medical assistants who work in hospitals often treat people under the heavy influence of drugs and alcohol. Often their decision-making skills and mental abilities are impaired or inadequate. Some patients are infants or minors who come in without a parent or guardian. What is a medical assistant's role in obtaining consent then?

By law, a person cannot give consent for treatment if he is *incompetent*. **Incompetence** "means that a patient is found by a court of law to be insane, inadequate or not to be an adult."[14] If one of your patients is incompetent, you must wait for him to regain competence before pursuing treatment. Or, you must obtain consent from the patient's parent or legal guardian. If you cannot locate a parent or guardian, the court may give consent on the patient's behalf. If a medical professional treats a patient without consent, she may be held liable for criminal charges of battery. Remember though, implied consent is still consent. A medical professional may treat a patient through implied consent if the patient is in a life-threatening emergency or if the patient is unconscious and unable to respond.[15]

Step 8 Negligence

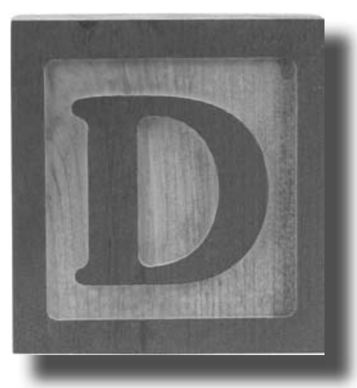
- **Negligence** refers to the unintentional or intentional failure to provide the highest quality of care and attention that a reasonable person would in similar circumstances. Typically, negligence is the most common liability in medical malpractice claims.[16] Negligence breaks down into three categories: *malfeasance, misfeasance* and *nonfeasance*.

  Malfeasance is when a medical professional does something harmful or illegal to a patient. It can happen even when the medical professional commits the wrong without knowing it. For example, a nurse treats several emergency patients with blood transfusions. The hospital is low on AB positive blood. Rather than use the blood type in short supply on a terminally ill patient, she chooses to use an incompatible blood type that is rarely used. Of course, this can be a life-threatening mistake. Regardless of the fact that the patient is terminally ill, she is liable for malfeasance.

  Misfeasance occurs when a medical professional does something completely legal to a patient, but he does it improperly or illegally. For instance, a medical assistant in a nursing home fills the prescription orders for several patients. When his colleague comes by to distribute the pills on rounds, he notices that one patient, Mrs. Reed, has four pills when usually she has five. Mrs. Reed notices the difference, too. It turns out the medical assistant who prepared Mrs. Reed's drugs made a counting error. His mistake, if not corrected, constitutes misfeasance.

  Nonfeasance means the medical professional didn't do her job—she failed to act when she should have. Think about a little girl who comes into the emergency room because she fell off the swings and hit her head really hard. She has a bump on her head and a cut that needs a few stitches. When asked if she lost consciousness at all, her brother who was with her at the time of the fall says, "No, she was awake the whole time. She started crying before she even hit the ground." The girl gets cleaned up and gets her stitches, and she stays in the ER for a few hours just for observation. But the attending physician did not order a CAT scan. Back home again, the girl falls asleep. Later that afternoon she wakes up vomiting. On her way back to the emergency room, she has a seizure. During the seizure, she splits open her lips and breaks her nose on the dashboard. It's likely that the doctor who saw her on her first visit committed nonfeasance because he didn't perform every check a reasonable person would have. He left out an important test, the CAT scan.

  As you know, following all the proper steps in treating a patient is so important—for the health and well-being of every patient and for the professional, financial well-being of a medical practice or hospital. If you are ever involved in a negligence claim, you need to remember that it is up to the plaintiff and his attorney to prove the accusation of negligence. When negligence comes up, it is evaluated according to something the industry calls the *"Four Ds."* The **Four Ds** are *duty, derelict, direct cause* and *damages*.



The four Ds are duty, derelict, direct cause and damages.

1. **Duty**—The person or group accused of negligence was responsible for the care of the accuser.
2. **Derelict**—Derelict is another word for abandoned or deserted. The person or group accused of negligence abandoned his duty to care for the accuser.

3. **Direct cause**—The derelict behavior was the reason or direct cause of the patient's injury and harm.
4. **Damages**—The harm or damage to the patient must be an injury recognized by a court of law.

Because healthcare providers are human, the industry recognizes that medical professionals make mistakes. And while the expectation is to avoid mistakes, there is a legal and ethical process you need to follow when mistakes occur. For example, if a mistake is made, it needs to be reported to attending physicians and supervisors. The mistake also needs to be documented in the patient's medical record. Then someone needs to tell the patient about the mistake and the harm or potential harm done. This process is designed to protect patients and medical professionals. If the mistake is not reported and it comes to light, the patient, the medical team and the healthcare facility run grave risks.

Sometimes a medical professional commits a truly obvious form of negligence. For example, a non-circumcised male goes in for a vasectomy and comes out circumcised. Or a woman goes in for a breast reduction and comes out with a radical mastectomy (her breasts have been removed). Those kinds of mistakes do not happen all that often, and when they do, it is usually because of a breakdown in communication. Still, because the negligence is un-debatable, we call it *res ipsa loquitur*. **Res ipsa loquitur** is a Latin phrase meaning "The thing speaks for itself." In modern times, we say res ipsa loquitur is a doctrine of "common knowledge." Think back to the example of the man who got an unwanted circumcision with his vasectomy. If he sued his surgeon and the hospital that performed the procedure, he would not need any expert witnesses to speak on his behalf or to provide more proof of negligence. This mistake is all too clear. Still, in a medical situation, the doctrine of res ipsa loquitur only applies under three conditions:

1. The accused person or group must have been directly responsible for the act of negligence. The accused must have had control over the action he performed.
2. The patient must not have contributed to the action he claims is negligent.
3. If the accused had exercised reasonable care and good sense, the patient would not have experienced any harm.

Reasonable care is the key to providing accurate, appropriate treatment to your patients. And as you may have guessed, reasonable care goes hand in hand with legal and ethical conduct. Remember earlier in this lesson when you learned about various laws like administrative laws and the professional codes of ethics? The Joint Commission is a healthcare administration agency that creates guidelines and requirements for healthcare practices. The Joint Commission regularly publishes updates to their Standards on Medical Mistakes and Patient Safety, and they survey healthcare organizations every year to make sure the organizations are following their guidelines. If you'd like to learn more about The Joint Commission, visit their Web site at www.jointcommission.org or arrange for an informational interview with any healthcare administrator at one of your local medical offices or hospitals. Let him know you are studying to be a medical assistant and you want to know more about the legal and ethical safeguards in patient care.

STOP **Please pause to complete online Practice Exercise 17-2.**

Step 9 Lesson Summary

- You've covered a lot of ground in this lesson. For instance, now you know laws are standards designed to regulate behavior and promote good conduct. When a person breaks the law, she may face a punishment that is often directly related to the severity of her crime. Unlike laws, ethics aren't regulated by a community, but we do judge a person's professional and human behavior according to her ethics.

  As a medical assistant, you are bound to practice the AAMA Code of Ethics. This code is your pledge to care for your patients while you protect the integrity of your profession. When you break the law or breach your code of ethics, you are liable for the harm that may come to your patients and your colleagues. Subsequently, one of the most important aspects of your job as a medical assistant is to protect and uphold your patients' rights. You and every member of the healthcare team—from doctors to billing clerks—participate in the doctor-patient relationship. Therefore, you must respect a patient's right to confidentiality and privacy.

  Part of a patient's right to privacy involves the care in which you handle her medical records. When you speak of and share medical records, you must keep the patient's confidential information private and secure. A medical record is a legal document, so a court can subpoena a medical record without the patient's consent. For this reason and for many other reasons, including the welfare of your patients, when you work with medical records you need to be sure your notations are concise, complete, clear, correct and in chronological order.

  Also, before you can complete a medical procedure or treatment, you must gain a patient's consent, either implied or express, and whenever possible, informed. Sometimes, even with informed consent, things go wrong. In an effort to protect patients from fraud and negligence, the federal government has several laws in place to identify and track medical professionals under investigation or convicted of malpractice. The HCQIA and HIPAA both sponsor electronic databases so people in every state can share information about medical professionals with questionable legal and ethical records. Meanwhile, the FFCA allows citizens to report crimes committed by medical professionals against the federal government as if they were reporting crimes against themselves. In cases where citizens and government prove wrongdoing, the citizen who brought the case to court is awarded approximately one-quarter of the winnings.

  In order to prove negligence—whether it be mal-, mis- or nonfeasance—the burden of proof lies with the plaintiff (accuser). Typically, negligence happens when a medical professional does not exercise reasonable care for her patients. A court of law will only convict a medical professional if the plaintiff can prove the person he's charged was responsible for the plaintiff's care (duty), abandoned his care (derelict), was directly responsible for the harm incurred and that the harm is a recognizable injury. Still, when the proof is obvious, we call that res ipsa loquitur—"the thing speaks for itself."

Take a few minutes to consider some of the legal and ethical responsibilities or issues that may occur when you're dealing with a patient's blood and bodily fluids. How important is it to keep a patient's blood test results private and confidential? How might you talk to a patient who has disturbing test results? How would you want a medical professional to handle your case? What personal and professional ethics might factor in to your expectations?

Please pause to complete an online Quiz.

Endnotes

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Just for Fun

A Note about Honorable Actions, Plus A Little Fun

Before you begin the next lesson, let's think about the organ systems you studied in Lessons 9 and 10. You've looked at diagrams of different systems like the respiratory, digestive and circulatory. But, you probably know that medical students don't just look at pictures of organ systems; they must dissect them, too. Would this work make you queasy? Don't worry. That's a natural response. After a few days, the feeling passes.

You may think working with organs, dissecting them, handling them and talking about them would desensitize a doctor. He could start to think of his patients as parts, not as people. But, an important part of every medical education is teaching the right attitude. You've heard people talk about a doctor's "bedside manner," right? They're talking about his attitude toward his patients and measuring his way of honoring life and his patients.

As a medical assistant, you'll meet a similar challenge. With all the patients you meet and treat, how do you express honor, respect and kindness with every single one—especially the cranky ones. How do you do this? You imagine or conjure up feelings that represent honor, respect and kindness. For example, imagine you just found out you won a prestigious award. Or imagine you are a firefighter who just rescued a child from a fire.

You'll probably take in a deep breath and smile inside. Do that right now. Take in a deep breath, look at that award, let that child hug you and think about how happy you are inside. It's such an honor to receive that award! It's such an honor to serve your community and look out for other people's lives.

Should a time come when you have the opportunity to look at or study organs, feel the honor bestowed upon you: you are witnessing and learning from the organs that belonged to another human being. Those organs supported that person's life. Treat the organs with the respect they deserve and make sure they are used with only the best of intentions. Allow yourself to feel and share these same feelings and acts of honor, respect and kindness with the patients who entrust their lives, their medical records and sometimes even their secrets to you.

Before we finish up this lesson, let's have a laugh. Here are some humorously named organs and the organ systems to which they belong.

ORGAN NAME	ORGAN SYSTEM
Bleeding heart	Cardiorrhagic
Busybody	Nasolingual
Copycat	Photoreproductive
Funny bone	Humerus
Gizzard	Gastropollo
Hardened heart	Cardiosclerotic
Liver-upper	Indigestive
Solar plexus	Astrologous

You see, your studies don't have to be all work and no play! Now, let's get started with your next lesson and learn about blood testing.

Lesson 18
Blood Testing

Step 1 Learning Objectives for Lesson 18

- [ ] When you have completed the instruction in this lesson, you will be trained to do the following:
    - Explain the regulatory bodies that govern the physician's office laboratory (POL).
    - Outline steps to maintain quality control in the laboratory.
    - Describe the role of phlebotomists and the equipment they use to draw blood.
    - Detail various methods to obtain venous blood.
    - Describe skin puncture procedures to obtain capillary blood specimens.
    - Describe how to puncture skin with sterile lancet.
    - Describe the various hematologic tests.
    - Explain how to use the *microhematocrit centrifuge, hemoglobinometer, hemocytometer* and *glucometer*.
    - Outline the importance of a Phenylketonuna (PKU) Test.
    - Explain how to screen glucose levels.
    - Explain cholesterol's function in the body and how to test cholesterol levels.
    - Discuss *erythrocyte sedimentation rate* (ESR).
    - Explain how to complete an ESR using the *Wintrobe method* and the *Westergren method*.
    - Fulfill OSHA requirements, and correctly follow standard precautions when working with blood.

Step 2 Lesson Preview

❑ Mike and Crystal welcomed their baby daughter, Ava, into the world two days ago and are getting ready to go home. Ava's doctor explained to Mike and Crystal that Ava's bilirubin levels were higher than normal. As a result, Ava would need to have her blood tested every day to make sure the levels were decreasing. Mike and Crystal asked the doctor a few questions to understand Ava's issue and then drove home with their new arrival.

A baby may need to have her blood drawn to check bilirubin levels.

The next morning, Mike, Crystal and Ava headed to a laboratory that performs blood testing. The medical technician, Betsy, called Mike, Crystal and Ava back into a room. She introduced herself and explained the procedure to the new parents. As new parents, Mike and Crystal were anxious about Ava's blood test, but Betsy eased their fears. First, Betsy applied a warm compress to Ava's heel for about five minutes and gently massaged the heel with her gloved hands. Next, Betsy cleaned Ava's heel with some rubbing alcohol and allowed it to air dry. Betsy picked up her pediatric lancet and pressed it firmly against the heel. The automatic device punctured the heel, but Ava didn't even cry. Betsy tossed the lancet into a biohazard container and then wiped away the first drop of blood on Ava's heel. Betsy then collected a few drops of blood in a special container for testing. Once Ava's heel was not bleeding, Betsy placed a bandage on the puncture. Then Betsy informed the parents that Ava's pediatrician would contact them about the test results. Lastly, Betsy took off her gloves and put them in the biohazard container and walked the parents and Ava out to the waiting room.

Where does your blood go after it is drawn?

Even if this situation isn't familiar to you, chances are you've had your blood drawn before for some sort of test. Did you ever wonder where your blood was going and how it was being tested? This lesson will answer all of your questions about blood testing. Let's get started!

Step 3 Laboratory Regulations

❑ Before we dive into a discussion about blood testing, let's discuss how tests are regulated and where the blood is tested. The *Department of Health and Human Services* is responsible for the creation of the *Clinical Laboratory Improvements Act of 1988,* which has impacted laboratory standards. This act specified where blood tests can be performed. We will look at the different types of testing facilities in a moment, but let's learn more about the Department of Health and Human Services and the CLIA '88.

Department of Health and Human Services (HHS)

The **Department of Health and Human Services** (**HHS**) is the United States government's principal agency for protecting the health of all Americans and providing essential human services, especially for those who are least able to help themselves.

HHS also oversees agencies such as the Centers for Disease Control and Prevention (CDC), National Institute of Health (NIH) and Centers for Medicare & Medicaid Services (CMS). The CMS, formerly the Health Care Financing Administration (HCFA), regulates all laboratory testing (except research) performed on humans in the U.S. through the **Clinical Laboratory Improvement Amendments** (**CLIA**).

Clinical Laboratory Improvement Amendments of 1988 (CLIA-88)

The **Clinical Laboratory Improvement Amendments of 1988,** or **CLIA '88,** regulates testing and laboratories to ensure that patients' results are accurate, reliable and timely. The objective of the CLIA '88 law is to protect the public by ensuring quality laboratory testing. Although all clinical laboratories must be properly certified to receive Medicare or Medicaid payments, CLIA has no direct Medicare or Medicaid program responsibilities.

Laboratory tests have ranges of complexities. Therefore, the CLIA established three categories of tests, *waived*, *moderate complexity* and *high complexity*. We'll discuss these categories more in a moment.

The CLIA '88 requires laboratories to participate in an accredited proficiency program for some tests. In order to test proficiency, a known sample is tested with some patient samples. Then another company evaluates the accuracy of the test and submits the records to the Health Care Financing Administration (HCFA) or a private accrediting organization. HCFA then determines CLIA '88 compliance.[1]

Testing under CLIA '88 Regulations

As we mentioned earlier, the CLIA '88 established three categories for tests, waived tests, moderate-complexity tests—which include *provider-performed microscopy (PPM)*—and high-complexity tests.

Waived Testing

Waived tests are simple tests that require a minimum level of interpretation and judgment. In addition, a test error in a waived test wouldn't harm a patient. Waived test lists are constantly updated and can be viewed online at www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfClia/analyteswaived.cfm. Some example tests in this category are total cholesterol, fecal occult blood, glucose, hematocrit and hemoglobin.

Most of the tests that medical assistants will perform will be in the waived category.

Moderately-complex and Highly-complex Testing

Moderate-complexity and **high-complexity tests** are categorized based on the following criteria:

- Degree of operator intervention
- Necessary knowledge and experience of the operator
- Degree of maintenance and troubleshooting to perform the tests

Other Federal and State Agencies

In addition to CLIA regulations and others, laboratories have to obey local, state and any other federal regulations that affect laboratory procedures. Usually each state has its own department of health that oversees the laboratories in its state.

Types of Laboratories

As we mentioned previously, the *Clinical Laboratory Improvements Act of 1988* also specified where blood tests can be performed. Laboratory facilities are categorized as a *Physician's Office Laboratory (POL),* a *Point-of-care testing (POCT)* or a *Provider Performed Microscopy (PPM).*

Physician's Office Laboratory (POL)

The **Physician's Office Laboratory** (**POL**) is a laboratory located within the medical office. Some common laboratory tests can be performed in the doctor's office. The convenience of having an on-site laboratory saves the physician's office time and money. In fact, you—the medical assistant—might perform some laboratory tests in your office. For example, some medical offices can easily test a patient's blood sugar level with a fingerstick instead of collecting blood and sending it off to a laboratory for testing.

POLs can perform waived and moderate tests, including some *PPM* or moderately-complex tests. If the POLs have sufficient training, credentialed personnel, equipment and approval, then they can perform tests in high-complexity tests as well.

Provider Performed Microscopy (PPM)

Provider Performed Microscopy, or **PPM**, is a subcategory of moderately-complex testing. Microscopic tests are necessary in many practices, so this category was added to the CLIA in order to allow nurse practitioners, nurse midwives and physician assistants to perform tests. These medical professionals have the training and expertise needed to perform PPM tests. Facilities with these personnel can perform the following tests:

Title: PPM Procedures

- All direct wet mount preparations for the presence or absence of bacteria, fungi, parasites and human cellular elements
- All potassium hydroxide (KOH) preparations
- Pinworm examinations
- Fern tests
- Post-coital direct, qualitative examinations of vaginal or cervical mucus
- Urine sediment examinations
- Nasal smears for granulocytes
- Fecal leukocyte examinations
- Qualitative semen analysis (limited to the presence or absence of sperm and detection of motility)

Point-of-care Testing (POCT)

Patients and physicians like to receive laboratory results quickly. As a result, POCT has emerged. **Point-of-care testing** (**POCT**) is the use of small instruments in order to provide rapid, accurate results. However, if the instruments are not used correctly or the medical staff member has not been properly trained, incorrect results can occur.

Facilities with laboratory staff members who have the education, experience and knowledge about laboratory testing can assist with POCT. Usually the laboratory staff at a medical facility will oversee POCT, offer advice and manage the quality.

No matter what type of facility is performing diagnostic tests, quality control is a critical component of its success.

Quality Control in the Laboratory

As you can imagine, accuracy is very important in the testing lab. No one wants to get inaccurate test results, especially if the health issue is serious and requires intensive and costly intervention. But sometimes, even if the medical staff is well trained and the equipment and supplies are in excellent condition, inaccurate results can occur. For example, if a test kit was exposed to extreme temperatures en route to the office or some of the chemicals in the test have expired, the lab may get inaccurate results. Because of these uncontrollable factors, you will help to ensure that test results are authentic.

One way you can ensure accurate results is through **control tests**, or samples that are tested together with the patient's sample. Lab personnel use control tests to make sure that the chemicals or reagents in the test are working correctly. The results of the control test are compared to the patient's test results. If the control test isn't accurate, then most likely the patient's test isn't either.

In addition to running control tests, there are several other methods to keep test quality high. You can assist in quality control when you perform the following steps:

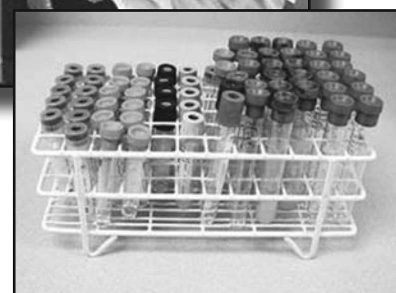
If chemical agents in a blood test become inactive, the control test will point out the problem.

- Prepare patients properly.
  - Inform patients of restrictions, such as fasting or fluid intake.
- Read the physician's orders and identify the patient.
  - If there are special instructions for specimen collection or for the test, they'll be in the laboratory instruction manual or you can contact the laboratory.
- Make sure the specimen, test kits and chemicals are handled properly.
  - Label the specimen with the patient's name, identification number, date of birth, date, type of specimen, time of collection and physician's name. Make sure the information is on the container, not the lid.
- Document tests in patients' medical records.
  - Document everything—including type of specimen, test ordered, laboratory location, even if it's POL and other important information in the patient's medical record.

As a medical assistant, you'll need to inform the patient of restrictions for taking a blood test—such as fasting.

Please pause to complete online Practice Exercise 18-1.

Step 4 Phlebotomy



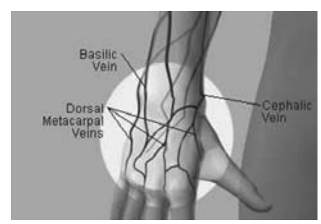
A phlebotomy tray

- **Phlebotomy** is the practice of collecting blood to make a diagnosis. After you have gained some on-the-job experience, you may begin taking patients' blood for testing. However, you're not a **phlebotomist**—someone who is trained to obtain blood specimens. The medical assistant's role in blood testing will vary between medical offices. In some offices, you may have direct contact with the patient while the specimen is being taken. In other offices, you may only prepare the phlebotomist's equipment. In either case, your training on the circulatory system in Lesson 10 will serve you well in your work. You may wish to review the cardiovascular system chapter in your supplement, *Anatomy and Physiology,* before we continue.

Blood Collection Sites

Blood is collected in three different ways:

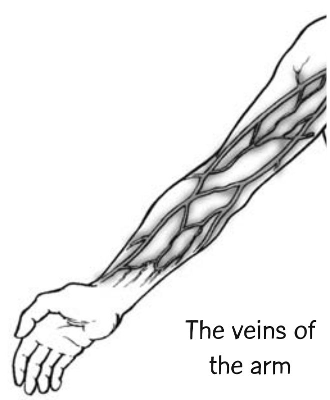
Forms of Blood Collection	
Name	**Site Of Collection**
Venipuncture	Veins
Capillary Puncture	Capillaries
Arterial Puncture	Arteries



The three types of blood vessels

To collect blood by **venipuncture**, or through a vein, you will need to find an acceptable vein. Usually, you'll use a vein on the inside of the patient's arm, between the wrist and elbow. Typically, these veins are close to the surface and large enough to collect blood.

Believe it or not, the veins in your arms have names. The **median cubital vein** is used for blood collection most of the time. You may also use the basilica, cephalic or median veins in the arms or the veins on the patient's hands, but this is more painful for the patient and may require a smaller needle.

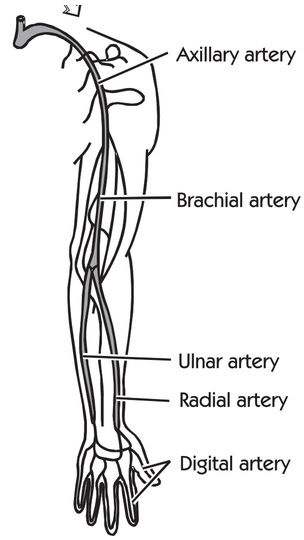


The veins of the arm

An alternative to venipuncture is **capillary puncture**, which obtains drops of blood through a skin puncture. Several tests can be run on drops of blood. We'll discuss capillary puncture in greater detail later in the lesson.

One blood collection method that the medical assistant is not allowed to perform is **arterial puncture**—blood collection through an artery. The arm has several arteries including the brachial, radial and ulnar arteries. These types of punctures require special training.

We will first discuss the different types of venipuncture methods, but before we begin, you need to be introduced to the equipment that you'll use.



The arteries of the arm

Equipment

One item you will use is a syringe with a needle. Syringes come in a variety of sizes, colors and designs. Syringes used for venipuncture are made of plastic and are between 5 and 10 ml. Like syringes, needles come in a variety of lengths and gauges. For venipuncture, you'll use a 20, 21 or 22 gauge needle that is 1 to 1.5 inches long. (The larger the number, the smaller the gauge.)

You'll use a special needle for the *vacuum tube method* of venipuncture. This needle is actually two needles—a long needle on one end to puncture the vein and a short needle on the other end to puncture the vacuum tube. This needle is also 20, 21 or 22 gauge and 1 to 1.5 inches long. This needle is also a **multidraw needle**—it has a rubber sheath that protects the short needle from blood leakage when you change tubes. This allows you to draw more than one tube of blood.

The last piece of equipment that you'll need to know about is the *winged infusion set* or the *butterfly collection system*. The **butterfly collection system** is what its name implies—it's used to collect blood using the *butterfly method*. These needles are smaller, so they're 21, 23 or 25 gauge.


The multidraw needle

Vacuum tubes are used for the vacuum tube method and are vacuum-packed test tubes that have rubber stoppers. They are usually plastic with a screw-on cap. Some vacuum tubes are empty, while others contain chemicals or substances for specific diagnostic tests. The rubber stoppers are color coded to identify the chemical in the tube. Colors are generally standard among different manufacturers. But to be safe, you should read the vacuum tube label.


A variety of vacuum tubes

A tourniquet

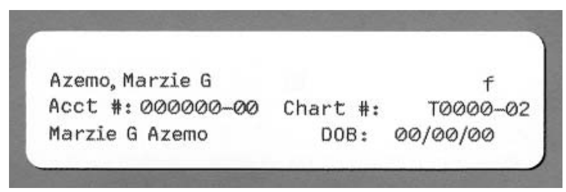
Another piece of equipment that you'll use in blood testing is a **tourniquet**, which is used to constrict the flow of blood in the patient's arm. This makes the veins more noticeable so you can locate them. The tourniquet is made of 1-inch-wide rubber or elastic and is 15 to 18 inches long. The tourniquet should be disinfected or discarded between patients.

The last piece of equipment that we'll discuss is a **blood testing tray**, which holds all of the supplies you'll need to take a blood sample. Because the tray transports blood, OSHA requires that the tray be red or have a biohazard symbol on it.

The color red indicates a biohazardous substance.

Step 5 Venipuncture

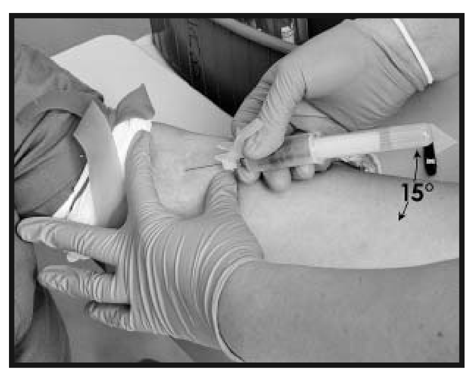
❑ When performing a venipuncture, you'll want to ensure that the patient's blood collection is not painful and that the specimen is good. Have all of your equipment and supplies ready before you begin the procedure. We'll review the procedure in a moment. After the blood is collected, make sure it is labeled correctly. Remember, place the label on the **primary container** or the container that holds the blood specimen. This way the label won't be separated from the specimen and the results will be reported correctly. Label the specimens while you're with the patient and make sure you use a permanent marker. Some offices use computer labels for blood specimens.



A computer-generated specimen label

Whatever kind of label your clinic uses, make sure it includes the following information:

- Patient's first and last name and middle initial
- Identification number if applicable
- Time of the collection
- Initials of the person who collected the blood.



The needle is inserted at a 15-degree angle for blood draw using venipuncture.

You can choose three different types of methods when you're using venipuncture to collect blood: the *syringe method*, *vacuum tube* and *butterfly method*. Some medical facilities will prefer you use one type of method over another, but it will change throughout your career. As a medical assistant, it's important to be familiar with all three methods.

Syringe Method

The **syringe method** is used to collect small volumes of blood from fragile or thin veins. The larger the syringe, the more suction it provides, so if there's too much suction, the vein can collapse. The syringe method is often used for pediatric and geriatric patients because they have thin and fragile veins. Use the syringe method if you need a sample of 12 ml or less. If you need more blood, you should use a different venipuncture method.

The correct hand position to draw blood using the syringe method

Believe it or not, the position of the needle can influence the amount of pain that your patient will feel. Insert the needle at a 15 to 30 degree angle with the patient's skin. In addition, hold the skin taut until you insert the needle. Also, make sure the bevel of the needle faces upward when you insert the needle into the vein.

The BD Vacutainer blood transfer device

When you use the syringe method, make sure the blood is in the correct container according to OSHA's rules. You cannot use a needle to transfer blood from a syringe to a container. Draw the blood into the syringe and then activate the safety mechanism. Remove the needle and throw it away. Then, connect the syringe to the transfer device and allow the blood to transfer. Don't push on the syringe or force the blood in any way. Lastly, you'll dispose of the syringe and the transfer device. Every office has different procedures for disposing of needles and biohazards, so make sure you're aware of your office's policies.

Another item to consider when you're using the syringe method is the order of draw or the sequencing of the transfer of the blood from the syringe to the vacuum tube. After transferring the blood to the tube(s) without additives, it is important to remember that the remaining blood may start clotting in the syringe. Therefore, you will transfer the blood to the anticoagulant tube(s) before transferring to the tube(s) containing silica gel or other additives.

Order of Filling Tubes Using the Syringe Method

1. Sterile tubes for blood culture
2. Tubes without additives (red-capped tubes)
3. Tubes for coagulation tests (light-blue tubes) Note: If you are only supposed to have a coagulation study, you should draw the red-capped tube first. This will prevent tissue from entering the light-blue tube
4. Other tubes that have anticoagulants (green and lavender tubes)
5. Tubes that have silica gel
6. Tubes with other additives

Identification of Tubes

Stopper Color	Additive	Test
Yellow	Sodium polyanethole sulfonate (SPS)	Blood culture
Plain red	None	Serum testing, immunology, serology, blood bank, chemistry
Light blue	Sodium citrate (anticoagulant)	Coagulation testing that uses plasma
Green	Sodium/lithium heparin (anticoagulant)	Plasma
Lavender	Ethylenediaminetetraacetic acid (EDTA) (anticoagulant)	Whole blood
Red/black marble	No additives, gel serum separator	Serum
Gray	Potassium oxalate/sodium fluoride (anticoagulant)	Plasma—glucose, alcohol levels

Turn now to your Procedure Guide to learn the first venipuncture procedure.

Steps to Take 18-1—Obtain Venous Blood with a Sterile Needle

1. Turn to Steps to Take 18-1 in your Procedure Guide.
2. Read the Steps to Take to obtain venous blood with a sterile needle.
3. Review this procedure until you can explain it without reading the steps.

Vacuum Tube Method

Instead of using a syringe to suction out the blood and then transferring the blood to the vacuum tubes as in the syringe method, the vacuum tube method already has the suction in the tube.

Hold the syringe the same way that you did in the syringe method. However, make sure that you leave enough room in the vacuum tube so that one tube can be pulled out and another can be inserted.

The correct hand position to hold a vacuum tube system

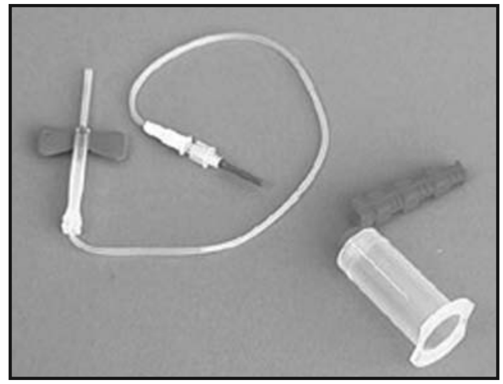
As with the syringe method, the order of filling the tubes is important. You don't want to cross contaminate tubes, so when you're filling plastic tubes, fill the following first: sterile, blue (citrate), red top and/or SST, green, lavender and gray. If you're unsure about the order, you can also contact the tube manufacturer to check.

Steps to Take 18-2—Obtain Venous Blood with a Vacuum Tube

1. Turn to Steps to Take 18-2 in your Procedure Guide.
2. Read the Steps to Take to obtain venous blood with a vacuum tube.
3. Review this procedure until you can explain it without reading the steps.

Butterfly Method

The butterfly method uses a 21 or 23 gauge needle with plastic wings that make it look like a butterfly. The wings with a needle and a syringe are connected with 6 to 12 inches of tubing. The **butterfly method** is used for small veins that cannot be punctured with other venipuncture methods, such as veins on the hand, wrist or foot. The butterfly method is also used for veins that could collapse. This system also is good for children because the tubing allows patients to move around without pulling the needle out.



The butterfly method is named for the winged needle it uses.

The correct hand position to hold a butterfly needle system

Let's go over the actual butterfly method. Insert the winged needle at a 5 to 10 degree angle. You'll thread the needle into the vein so that the needle is anchored in the center of the vein. In addition, you can either use a syringe or a vacuum tube or both to collect the blood. You could use the vacuum tube system if you need to collect a few tubes. Remember, it's important to collect the tubes in the correct order.

Steps to Take 18-3—Obtain Venous Blood with a Butterfly Needle Method

1. Turn to Steps to Take 18-3 in your Procedure Guide.
2. Read the Steps to Take to obtain venous blood with a butterfly needle.
3. Review this procedure until you can explain it without reading the steps.

Please pause to complete online Practice Exercise 18-2.

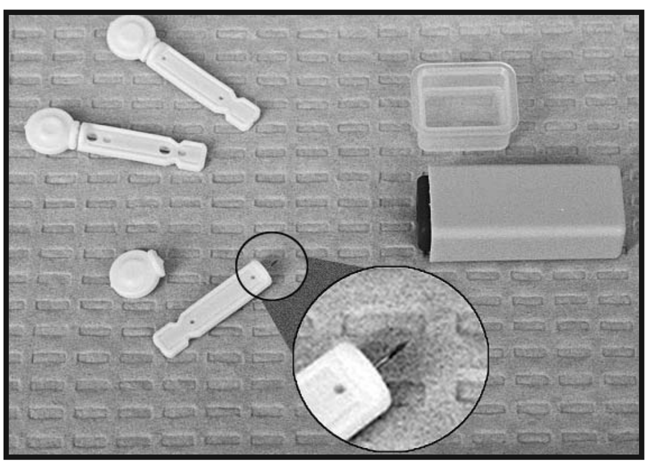
Step 6 Capillary Blood Testing

- ❑ As you learned earlier, capillary puncture collects drops of blood by puncturing the skin. Tests such as **complete blood count** (CBC), **RBC count**, **white blood cell** (WBC) **count**, **hemoglobin**, **glucose blood levels**, **phenylketonuria** (PKU) and **hematocrit** can be run from drops of blood. You cannot run tests on sedimentation rates, blood cultures or coagulation studies from capillary blood samples. Don't worry if you aren't familiar with these types of tests; we'll discuss them in a moment. For now, let's focus on capillary blood testing methods.

Capillary blood collection in adults is most often from the fingertip.

Capillary blood testing is used when you don't want to collect a lot of blood and when you may have trouble with veins, such as with burned or scarred patients. Capillary blood testing is also used for infants because you will only collect a small amount of blood.

A capillary blood specimen is most similar to arterial blood. However it is quite different from venous blood in that glucose, potassium, calcium and protein levels will be markedly different. For this reason, it is very important to label the blood draw as a capillary collection.



Lancets are available in different types for different purposes.

Most likely, you've had capillary blood taken before. Usually it's taken from the fingertip. In adults, you'll use a **lancet**, a small puncturing device, to puncture the fleshy tip of the ring finger because it's usually not as callused as the other fingers. In infants, capillary blood is taken from their heels, which is called a **heel stick**.

The fingers must be warm, which indicates good blood circulation, in order to get enough blood for a specimen. You can increase circulation by rubbing the fingers or applying a warm, moist towel or warm pack. Leave a towel or warm pack of 100 °F or less on for three to five minutes. While you collect the blood, you may also massage the patient's hand and fingers to increase the blood flow. However do not squeeze the fingertip with the puncture.

Collecting blood with a capillary tube

You will collect the blood in **capillary tubes** which are very thin glass or plastic tubes with openings on both ends. The tubes have a red, black or blue line on one end—red and black lines indicate that **heparin**, an anticoagulant, is contained in the tube, which will yield a nonclotted specimen. A blue line indicates that the tube contains no anticoagulant and the specimen will clot.

Steps to Take 18-4—Capillary Puncture
18-5—Capillary Puncture with a Heel Stick

1. Turn to Steps to Take 18-4 and 18-5 in your Procedure Guide.
2. Read the Steps to Take to perform a capillary puncture on an adult and on an infant using a heel stick.
3. Review these procedures until you can explain them without reading the steps.

As noted, once you've collected the blood in the capillary tubes, you will apply a cotton ball to the site for one to three minutes. However, if the patient is taking anticoagulants or aspirin, hold the cotton ball at the site for five minutes.

Now that you're familiar with capillary puncture, let's learn about hematologic tests.

Step 7 Hematologic Tests

❑ We've mentioned some *hematologic tests* earlier in the lesson, and now it's time to find out more about them. Have you had a hematologic test at your physician's office? Most likely you have because hematologic tests are the second most common tests performed in the Physician's Office Laboratory—urinalysis is the most common test.

Blood cell counts are moderate to highly complex, according to the CLIA. Although some of these tests may be done with automated analyzers and are in the POL, the testing, interpretation, maintenance of machinery, training and supervision of the personnel are done by a medical technician. So hematologic tests are not part of the medical assistant's job. However, you need to be familiar with these tests.

Hematologic tests are used to make a diagnosis, evaluate a patient's progress and regulate treatment. The *complete blood count (CBC)* is the most common laboratory test in hospitals. Usually a CBC will include the following:

- Hemoglobin determination (Hgb)
- Hematocrit determination (Hct)
- RBC count
- WBC count
- Differential WBC count

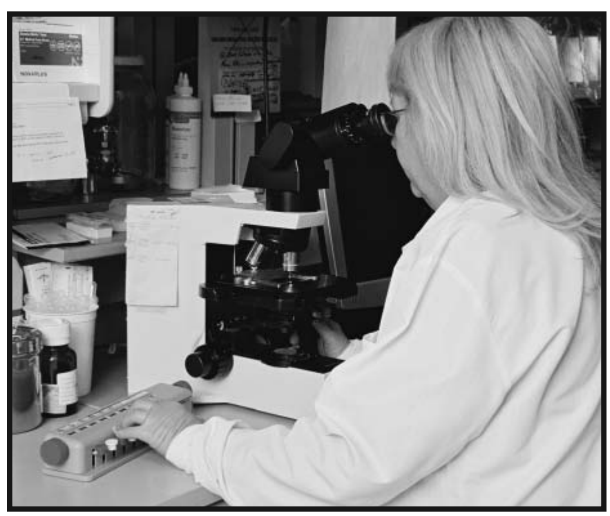
Before we discuss these tests in greater detail, let's go over the methods used to count blood.

A typical phlebotomy station

Blood Count Methods

Both automated and manual blood counts are popular. As you can imagine, red and white blood cells are concentrated in blood. Blood is diluted with fluid to allow the different types of cells to be counted.

One method involves placing the diluted blood on a **hemocytometer**—a heavy glass slide used to count blood cells. The hemocytometer has three depressions, two raised platforms and ruled lines that are etched in the glass. In addition, a **cover slip** is placed over the ruled portions to control the depth of the fluid. The ruled areas allow the red and white blood cells to be counted under a microscope.



Counting blood cells through a microscope

Another common way to examine blood is through a **blood smear** of either capillary or venous blood. Blood is smeared on a glass slide and then stained. Many offices use the **Wright's stain** which causes each different type of cell to show up in a different color. After staining, the slide is examined under a microscope. The red and white blood cells and platelets can be examined for size, shape and counts.

Steps to Take 18-6—Blood Smear

1. Turn to Steps to Take 18-6 in your Procedure Guide.
2. Read the Steps to Take to prepare a blood smear.
3. Review this procedure until you can explain it without reading the steps.

Many POLs use *automated cell counters*. An **automated cell counter** detects and counts blood cells through the use of electricity. The blood is diluted with an electrically charged fluid. As each cell of the diluted blood moves through the machine's counting chamber, it interrupts the flow of electricity. Each interruption is counted, thus determining the number of blood cells in the sample.

The hemocytometer and the automated cell counter are both used to count blood cells. However, there are many other types of tests that can be conducted on blood. Two of these are the *hemoglobin* and *hematocrit* tests.

Hemoglobin (Hgb) Test

The **hemoglobin test** is part of a complete blood count (CBC), but can also be ordered individually. Hemoglobin makes up 85 percent of the dry weight of normal red blood cells. The main function of **hemoglobin**, a protein molecule, is to transport oxygen and carbon dioxide to and from the lungs to the body's organ and tissue cells. Hemoglobin delivers about 95 percent of all oxygen to cells and returns about 27 percent of the body's carbon dioxide to the lungs to be removed.

The HemoCue device

Hemoglobin is measured using a **hemoglobinometer**, which measures the amount of hemoglobin in a fluid by comparing it with a solution of known strength and of normal color. Hemoglobinometers work by measuring the density of the hemoglobin pigment using light. The more hemoglobin, the more light is refracted. Most POLs use the automated HemoCue device.

Normal Hemoglobin Values	
Newborn	15-20 g/dl
Three months	9-14 g/dl
Ten months	12-14.5 g/dl
Adult woman	12-16 g/dl
Adult man	13-18 g/dl

Now let's look at another test that provides information on RBCs compared to the rest of the blood sample, the hematocrit.

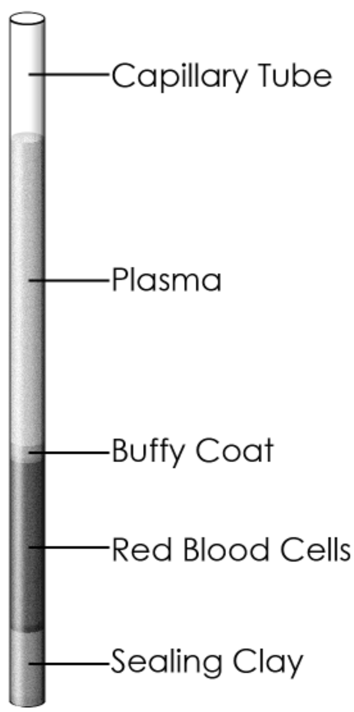
The microhematocrit centrifuge

Hematocrit (Hct) Test

Hematocrit is the ratio of the volume of packed RBCs in relation to the whole blood specimen.

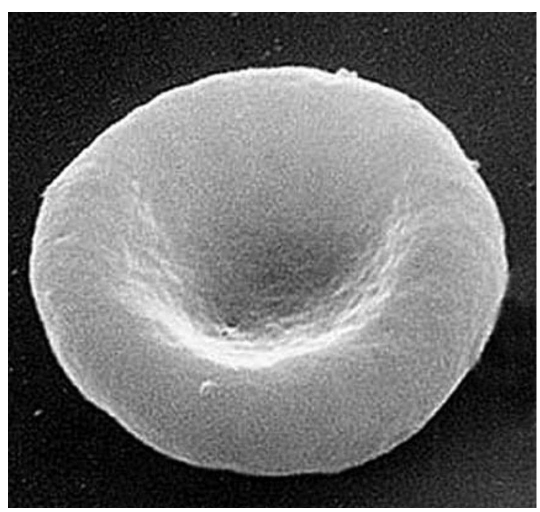
To test the hematocrit percentage, you could use a manual or automated test. Most medical practices use the manual method, which involves drawing a few drops of capillary blood into a microhematocrit tube. The tubes are then placed in a **micro-hematocrit centrifuge**.

Normal Hematocrit Values	
Newborn	45-60%
One year	27-44%
Adult female	36-46%
Adult male	40-55%



The layers of blood in a microhematocrit tube after centrifuge

In order to test for hematocrit levels, the blood specimen is centrifuged at high speeds. This allows the blood to separate into layers. The RBCs, by far the largest component of blood, fall to the bottom because they're the heaviest and will appear as a red layer. Second is the whitish-tan buffy coat, which is made up of white blood cells (WBCs) and platelets. Lastly, the plasma, which is almost colorless, lies on top and is often difficult to see.


Red blood cell

Virtual Lab 18-1 Determine Hemoglobin Levels Using HemoCue

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 18-1 Determine Hemoglobin Levels Using HemoCue. This will bring up the instructional video on performing the hemoglobin test.
3. Follow along with Virtual Lab 18-1 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the Virtual Lab.
4. Review this procedure and watch the Virtual Lab until you can describe the procedure without reading the steps or watching the lab.

Serum Collection

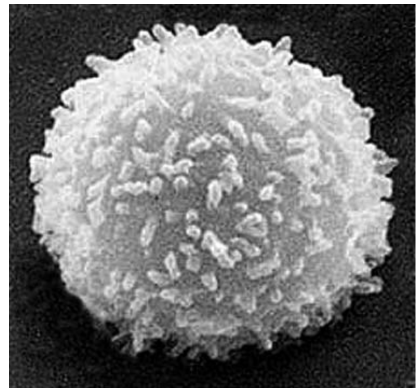
Serum is another common blood component that is used for testing. **Serum** is the liquid left over after blood has clotted. The clotting process converts fibrinogen in plasma into fibrin, which is the substance that holds the clot together. Serum is simply plasma after fibrinogen has been removed from it by the clotting process. It is also a whitish-tan color and requires the use of a centrifuge to collect. Follow along with Virtual Lab 18-2 to learn how serum is collected.

Virtual Lab 18-2 Obtain Serum from Whole Blood

1. Access the online portion of your course.
2. Click on Virtual Lab 18-2 Obtain Serum from Whole Blood. This will bring up the instructional video on separating serum from a blood sample.
3. Follow along with Virtual Lab 18-2 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the Virtual Lab.
4. Review this procedure and watch the Virtual Lab until you can describe the procedure without reading the steps or watching the lab.

Let's look at another blood count test using *white blood cells*.

White Blood Cells, or Leukocytes


White blood cell

White blood cells (WBCs), or **leukocytes**, fight infection and produce antibodies for the immune system. White blood cell counts can be done with automated machinery or manually. But like the hemoglobin and hematocrit tests, medical assistants cannot perform WBC counts. So, this section will cover the background and function of WBCs.

Unlike RBCs, WBCs leave the blood vessels to fight infection. There are five different types of white blood cells that are categorized as either *granulocytes* or *agranulocytes*. **Granulocytes** have granules—these are the neutrophils, basophils and eosinophils types. **Agranulocytes** don't have granules and consist of the lymphocytes and monocytes.

Leukocyte Count Values (Cells/mm^3)	
Newborn	9,000-30,000
One year	6,000-14,000
Six years	4,500-12,000
Adult	4,500-11,000

WBCs use *phagocytosis*, *detoxification*, *inflammation* and *immune response* to fight infection. Each of these functions performs a different method of defense:

- **Phagocytosis** is the process of engulfing bacteria or particles. The WBCs primarily involved in this are the neutrophils and monocytes, which then destroy the particle with enzymes.

- **Detoxification** occurs when eosinophils neutralize poisons and other harmful substances. Eosinophils use the detoxification process to control histamine production and resulting allergic reactions.

- **Inflammation** (swelling, heat, redness and pain) is the body's response to any foreign agent, whether it is a pathogen, a foreign body, trauma or extremes in temperature. Swelling is caused by increased plasma flow to the area that brings with it WBCs to fight the intruder. Basophils play a major role by releasing histamine to increase inflammation (bringing in more plasma with more leucocytes) and heparin to keep the plasma from clotting. Basophils also coordinate the entire inflammatory response so that the foreign agent is contained and eliminated, the area is cleaned of any dead tissue and healing can begin.

- The **immune response** is a complicated process of using specific antibodies to fight different antigens that invade the body. The immune system "remembers" these adapted antibodies so they are available if the pathogen returns. This memory process is known as **immunity**.

Abnormal WBC counts can be a sign of serious illness. The following table outlines illnesses associated with an increase in specific leukocyte counts.

Adult Differential Leukocyte Counts		
Leukocyte	**Normal value**	**Indicated disease when value rises**
Basophils	0-1%	polycythemia vera (stem cell disorder), chicken pox, ulcerative colitis
Eosinophils	1-3%	allergic reactions, hay fever, parasitic infections
Neutrophil Bands	3-5%	appendicitis, other diseases
Monocytes	3-7%	tuberculosis, monocytic leukemia
Lymphocytes	54-62%	infectious mononucleosis, lymphocytic leukemia, other viral diseases
Neutrophil Segs	54-62%	appendicitis, other diseases, usually infectious

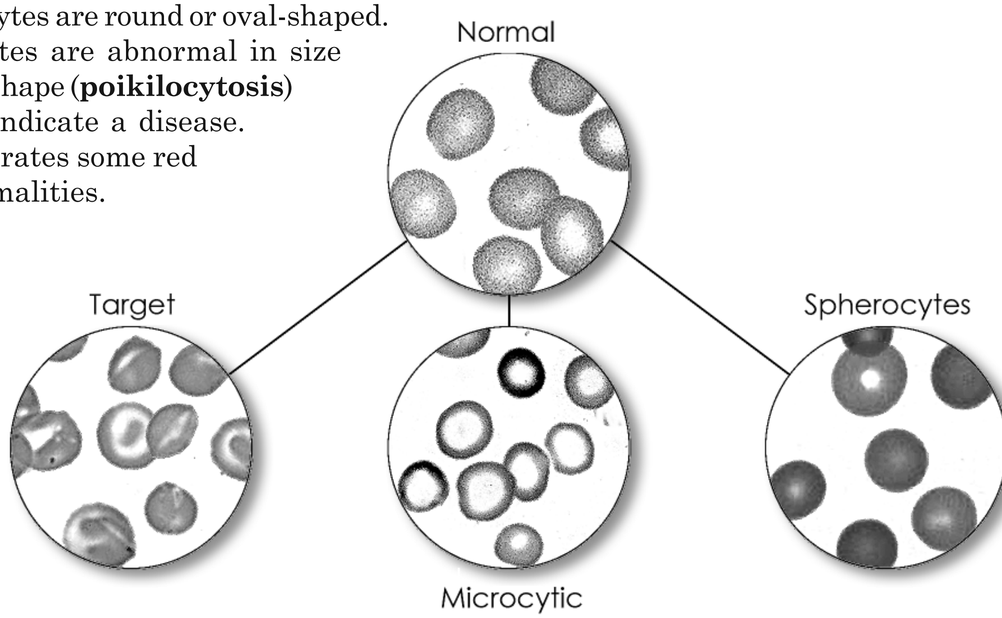
Another part of the CBC is a **differential cell count**, which identifies the quantity of each type of WBCs in a sample and compares the ratio of WBCs to platelets. Lab techs also use the differential cell count to examine blood cells for size and malformations. Most likely you will not perform a manual differential count, but it can be done with a blood smear. The tester counts 100 white blood cells under the microscope and then classifies and counts each type of leukocyte. She will then determine the ratios of each.

Now that you're familiar with white blood cells, let's talk more about red blood cells.

Red Blood Cells, or Erythrocytes

As you know, **red blood cells** (**RBCs**) or **erythrocytes**, carry oxygen to the body's cells and bring back carbon dioxide.

A normal-sized erythrocyte is called **normocytic**. Normal erythrocytes are round or oval-shaped. When erythrocytes are abnormal in size (**anisocytosis**), shape (**poikilocytosis**) or color, it can indicate a disease. This figure illustrates some red blood cell abnormalities.



As with WBCs, an abnormal RBC count could also indicate an illness or condition. For example, anemia and hemorrhage can be detected by an RBC count.

Let's take a look at normal RBC counts.

Normal RBC Counts	
Newborn	5.0-6.5 X $10^6/mm^3$
One year	$10^6/mm^3$
Adult woman	$10^6/mm^3$
Adult man	$10^6/mm^3$

As you've learned, RBCs are examined in a number of different tests. Let's go over one more important test.

Step 8 Phenylketonuria Test (PKU)

- **Phenylketonuria** (**PKU**) is a metabolic condition in which the body lacks the gene responsible for creating the enzyme **phenylalanine hydroxylase**. Without this enzyme, the body can't metabolize the amino acid phenylalanine, which is present in dairy and meat products, breast milk and formula. The resulting build-up of phenylalanine in the blood can cause mental retardation and loss of muscle control. To avoid these abnormalities, the patient will remain on a special diet that eliminates phenylalanine.

Most states require that infants be tested for PKU. Usually, newborns are tested in the hospital at the age of two days and again at seven to fourteen days. The second test is normally performed at the infant's two-week check-up in the doctor's office. Formula fed infants are tested before leaving the hospital; however, breast fed infants must wait until day four to nine to allow the mother's milk supply to come in. Otherwise, the test will be inaccurate because the colostrum and the first breast milk do not contain phenylalanine.

The **Guthrie screening test** screens for phenylalanine in the blood. The baby's heel is pricked; capillary blood is drawn and placed on a test card to be sent to a laboratory. Read the following Steps to Take to learn how to obtain capillary blood using the heel stick.

Steps to Take 18-7—Perform a Heel Stick for a PKU Test

1. Turn to Steps to Take 18-7 in your Procedure Guide.
2. Read the Steps to Take to perform a heel stick and prepare the sample for a PKU test.
3. Review this procedure until you can explain it without reading the steps.

The glucose test is another test that you need to be familiar with, so let's learn more!

Step 9 Blood Glucose

- **Glucose** is the principal carbohydrate found in blood and serves as an energy source. Glucose is also found in urine, cerebrospinal fluid and semen.

  Medical workers test glucose to screen for glucose disorders such as liver dysfunction and **hypoglycemia**—a low blood glucose level. Another glucose disorder is **hyperglycemia**, which is a high blood glucose level. Hyperglycemia indicates diabetes mellitus, Cushing's syndrome or an acute response to stress.

  You will use a variety of testing methods to diagnose, evaluate and monitor glucose. Let's discuss a few of these.

There are many portable glucose analyzers designed for both personal use and the medical office.

Fasting Blood Glucose

Examining a patient's **fasting blood glucose** (**FBG**) **levels** can screen for diabetes mellitus. A normal **fasting serum value** is between 70 and 110 mg/100 mL (110 mg/dL). According to the American Diabetes Association, the pre-diabetes range is between 100 mg/mL and 125 mg/ml. Hyperglycemia is indicated when the serum value is over 120 mg/mL.

Part of your job as a medical assistant is to educate patients for test preparation. In order to accurately test patients' FBG levels, they'll need to fast for 12 hours before the test. Patients can drink water, though. Some medications such as oral contraceptives, diuretics and steroids can alter the test results, so the physician may have patients avoid them if possible. Regardless, patients should have written and verbal instructions in order to properly prepare for the glucose test.

Two-hour Postprandial Blood Glucose

Blood glucose can also be tested after eating using the **two-hour postprandial blood glucose test**. The two-hour postprandial screens blood glucose levels for diabetes and can help monitor insulin dosage. Usually, the patient is asked to fast after midnight and prescribed a meal or solution with a certain number of carbohydrates. Two hours later, a blood specimen is drawn and tested for glucose levels.

If the patient doesn't have diabetes, the glucose levels should return to the fasting level or below it in the two hours between the meal and the test. According to the American Diabetes Association, a normal glucose level is less than 140 mg/dL in a two-hour postprandial test. If a patient has a level of 140 mg/dL or greater, he has a high risk of developing diabetes. If the patient has a level above 200 mg/dL, the test is positive for diabetes and the patient should be tested again another day.

Glucose Tolerance Test

The last glucose test that we'll discuss is the **glucose tolerance test** (**GTT**)—which is used to test insulin response and diagnose diabetes. Like other glucose tests, the patient needs to fast for the GTT. The patient should only have water for the 10 hours prior to the test.

In order to make sure the patient can take the GTT, you have to determine the patient's FBG level once he arrives for the test. If the level is less than 200 mg/dL, then you'll take a urine sample and draw blood through venipuncture. Make sure these specimens are labeled as fasting specimens along with the date and time of the draw. In addition, the physician should be notified.

If the FBG level is less than 200 mg/dl, then the patient can continue with the GTT. The patient must consume 75 to 100 g of glucose solution within five minutes. Note what time the patient has finished the solution. Then, the patient's urine and blood are tested at 30 minutes, 1 hour, 2 hours, 3 hours and sometimes 6 hours after ingestion. These tests will help determine how the patient deals with increased glucose.

During the three- to six-hour testing period the patient should not smoke, eat or chew gum. He may drink water. Otherwise, the test results could be incorrect.

After two or three hours, the patient may experience normal symptoms such as weakness, faintness and increased perspiration. However, if the patient complains of a headache, faints or is behaving and speaking oddly, the patient may be suffering from hypoglycemic shock—contact the physician immediately.

After two to three hours, a patient without diabetes will have a glucose level equal to his fasting level. A patient with diabetes will have increased glucose levels even at the end of the test.

Now that you know more about the actual tests, let's discuss what types of devices you'll be using.

Automated Glucose Analyzers

POLs can use a variety of automated devices to analyze glucose. Handheld, inexpensive **glucose meters**, instruments that measure glucose levels, provide rapid results. As with all instruments, make sure you use it correctly to get accurate results.

One type of glucose meter, or analyzer, uses *photometry* to measure glucose levels. **Photometry** is the science of the measurement of light, as perceived by the human eye. A **microcuvette**, or small plastic container holding reagents, fills with blood from a capillary puncture and is placed into the photometer. In 45 to 240 seconds, a glucose concentration is displayed. These systems don't require a lot of training, so they're used by POLs and POCTs.

Another system uses **reflectance photometry** for glucose testing. Blood is applied to a test strip, which reacts with reagents in the pad. The reaction causes a color to form. Usually the darker or more intense the color, the more glucose is present. Then, the test strip is inserted into a test chamber and a light shines on it. The photometer measures the amount of light that is reflected from the colored strip.

In addition to testing patients' glucose, you may also need to educate patients on how to use *glucometers*—short for glucose meters. There are a variety of different hand-held glucometers on the market that have unique features, but they all test in the same way. **Glucometers** are portable glucose meters that test a drop of blood on a test strip. These are convenient for the diabetic patient. As technological advances are made, the tests are becoming less painful, making testing compliance more consistent.

List of CLIA-waived Blood Tests for Glucose Testing[2]

Abaxis Piccolo Point of Care Chemistry Analyzer (Lipid Panel Plus Reagent Disc) (whole blood)

Arkray SPOTCHEM EZ Chemistry Analyzer (whole blood)

Cholestech L.D.X.

Diagnostic Test Group, Clarity Blood Glucose Monitoring System

HemoCue B-Glucose System

Hemocue Glucose 201 DM Analyzer

Hemocue Glucose 201 Microcuvettes and Glucose 201 Analyzer with Plasma Conversion

Polymer Technology Systems CardioChek PA Analyzer (PTS Panels CHOL+GLU Test Panel) (Professional Use)

Total Diagnostic Sales, Inc. Test Time Home Glucose Test

Any blood glucose monitoring device cleared by the FDA for home use.

Virtual Lab 18-3 Screen Glucose Level

1. Access the online portion of your course.
2. Click on Virtual Lab 18-3 Screen Glucose Level. This will bring up the instructional video on testing a patient's glucose level using a glucose analyzer.
3. Follow along with Virtual Lab 18-3 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the Virtual Lab.
4. Review this procedure and watch the Virtual Lab until you can describe the procedure without reading the steps or watching the lab.

Step 10 Cholesterol

- **Cholesterol** is a fatty compound that is found in blood and is essential for life functions. We get cholesterol through our food (meat, eggs and dairy) and our liver manufactures it. Babies and children need higher quantities of fat and cholesterol for growth and development. However, excess cholesterol in adults causes a higher risk for coronary artery disease. As a result, many adults have their blood cholesterol levels checked during an examination.

We obtain cholesterol in the diet by eating eggs, meat and dairy products.

Lipoproteins transport cholesterol through the blood in two ways—through *high-density lipoproteins* and *low-density lipoproteins*. **High-density lipoproteins** (**HDL**) carry cholesterol to the liver, where it becomes bile and then leaves the body in stool. **Low-density lipoproteins** (**LDL**) carry cholesterol to tissues and blood vessels. If too much cholesterol is stored, it can cause blocked arteries, obesity and a fatty liver. Lower LDL rates are recommended to reduce risk for heart disease and arterial disease. Risk factors such as age, heredity and exercise can influence blood cholesterol levels as well. The higher the risk, the lower the patient's LDLs should be.

Triglycerides are a term you'll hear when you discuss cholesterol. **Triglycerides** are lipids (fats) in the blood that are used by the body as an energy source. If triglyceride levels in the blood become too high, the body begins to deposit the excess in tissue.

Take a look at the following table for recommended cholesterol levels.

Ideal Cholesterol, HDL, LDL and Triglyceride Levels	
Total Cholesterol	
Ideal	160-200 mg/dL
Less Ideal	200-239 mg/dL
At risk	Greater than 240 mg/dL
Triglycerides	
Ideal	Less than 150 mg/dL
HDL	
Ideal	40-60 mg/dL
LDL	
Borderline high	130-159 mg/dL
High	160-189 mg/dL
Very high	190 mg/dL or higher

To prepare for a cholesterol test, the patient should fast for nine to twelve hours prior to the procedure. Fasting is important before the test because triglyceride levels can rise 20 to 30 percent after a meal, which will skew the test results. Alcohol also causes a triglyceride surge, so advise patients not to drink alcohol for 24 hours before a fasting cholesterol test. As with all fasting blood tests, the blood draw is normally done early in the morning, so the patient can fast overnight rather than during the day.

Step 11 Erythrocyte Sedimentation Rate

- **Erythrocyte sedimentation rate (ESR)** is the measurement of the rate that RBCs will settle toward the bottom of a vertical tube if the sample is well mixed and the blood is anticoagulated. The ESR is used for diagnosis and treatment of diseases because it is easy to perform, accurate and fairly inexpensive.

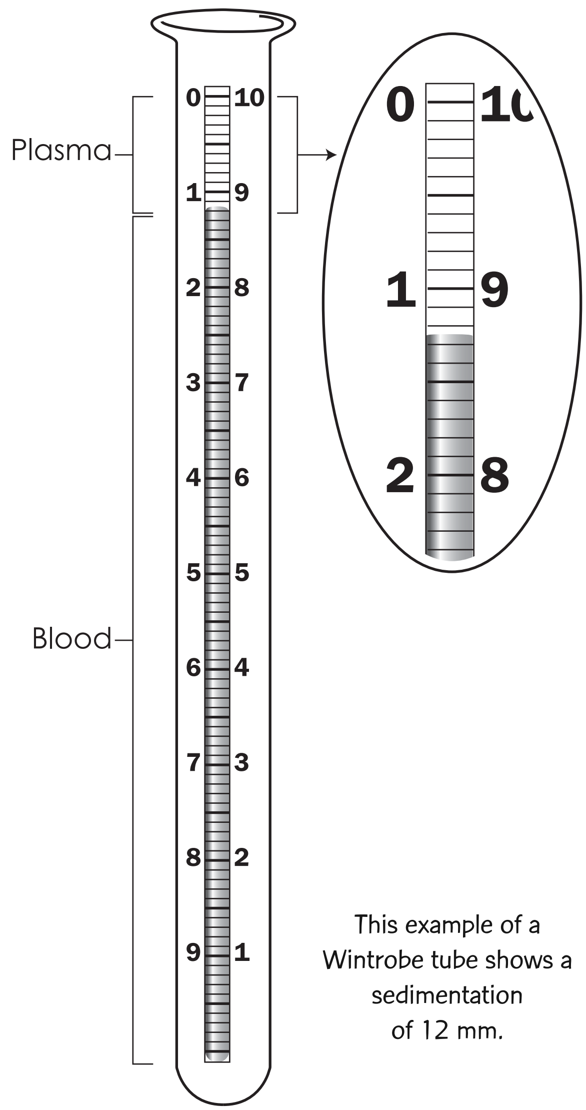
When the body has a disease, the plasma protein, fibrinogen, will be altered which will affect the sedimentation rate. Similarly, the surface of the RBC can be altered by disease and will affect the sedimentation rate.

Once you're in the medical field, you'll hear the ESR referred to as the **sed rate**. The sed rate is taken in two ways, by using either the Wintrobe method or the Westergren method.

The Wintrobe Method

In order to conduct an ESR test using the Wintrobe method, a venous blood sample is mixed well with an anticoagulant and transferred to a Wintrobe tube. A **Wintrobe tube** is a thick-walled glass tube with a flat bottom and millimeter marks from 0 to 105.[4]

The blood is filled to the zero at the top of the tube and there should be no air bubbles. The tube sits vertically in a rack for 60 minutes to allow the red blood cells and plasma to separate. The sed rate is the number of millimeters that the red blood cells have fallen from the zero mark. A normal value for men is 0 to 9 millimeters per hour (mm/hr) while a normal value for females is 0 to 20 mm/hr.



This example of a Wintrobe tube shows a sedimentation of 12 mm.

The Westergren Method

The Westergren method is similar to the Wintrobe method with the exception of the reagent used—the Westergren test calls for a 3.8 percent sodium citrate solution well mixed in the sample before transferring it to the tube.

The normal values for Westergren method results are as follows:

- Male patients older than 50 years should be between 0 and 20 mm/hr.
- Male patients younger than 50 years should be between 0 and 15 mm/hr.
- Female patients older than 50 years should be between 0 and 30 mm/hr.
- Female patients younger than 50 years should be between 0 and 20 mm/hr.

If the results are higher than normal in either the Westergren or Wintrobe methods, it could mean the patient has an infection, inflammatory disease or tissue destruction. Menstruation, pregnancy, myeloma and anemia can also cause a higher sed rate.

Decreased values can be the result of conditions such as sickle cell anemia, spherocytosis and polycythemia.

ESR may read normal in patients with conditions such as osteoarthritis, cirrhosis and malaria.

Step 12 Blood Safety Guidelines

- ❑ Once you start your career as a medical assistant, your office will inform you of its guidelines for blood safety. Usually these will be based on government regulations such as the Centers for Disease Control and Prevention's Standard Precautions, and Transmission-based Precautions. Blood safety is a primary concern for healthcare workers because of their frequent contact with blood samples and infected patients.

  Diseases that can be transmitted through blood include *HIV/AIDS, hepatitis B* and *hepatitis C*. **AIDS** is caused by **HIV**, human immunodeficiency virus, which acts by destroying the white blood cells that provide immunity to the body, called **T cells**. HIV is carried in the blood, all other body fluids and the mucous membranes.

  Like HIV, viral hepatitis is transmitted through direct contact with infected blood or fluid. Hepatitis is classified as *Hepatitis A (HAC), Hepatitis B (HBV), Hepatitis C (HCV), Hepatitis D (HDV)* and *Hepatitis E (HEV).* The three most common of these are HAV, HBV and HCV. HBV and HCV pose the most danger to healthcare workers—more so than HIV.

Healthcare employers are required to provide immunization for HBV to their personnel. Both **HBV** and **HCV** are progressive diseases carried in the blood and may become chronic. The virus may or may not result in any symptoms—infected individuals can carry the virus and transmit it to others for a lifetime without knowing they have it. HCV causes liver damage, cirrhosis and liver failure. HBV also damages the liver and has been linked to liver cancer. Symptoms of HBV include fatigue, nausea, headache, fever and **jaundice**, a yellow discoloration of the skin. HBV can remain **asymptomatic** (have no symptoms) for years while it is causing damage. There is no vaccine for HCV—it has been treated with antiviral drugs with limited success.

The following list identifies the most common ways that viral diseases are transmitted in the medical setting:

- Blood specimens during venipuncture
- Open wounds or lesions
- Nosebleeds
- Vaginal bleeding or menstruation
- Feces, vomit or other body fluids—even if they don't have visible blood

You may recall from Lesson 12 that both the Standard and Transmission-based Precautions guidelines recommend personal protective equipment, such as gloves, mask, gown and goggles. Although this protective equipment is essential, remember that it cannot prevent injuries such as needle sticks.

OSHA's Requirements

The Occupational Safety and Health Administration (OSHA) requires that safety needles be made available to medical employees. A variety of safety needles are available. In some safety needles, the needle is automatically covered when it's pulled out of its packaging. Other safety needles require the medical assistant to release a mechanism to make the needle pointed; otherwise it's blunt to prevent needle stick injuries.

A sharps container is puncture-proof.

Safety tube holders are also used to prevent needle stick injuries. **Safety tube holders** are locking plastic covers that enclose the needle to prevent accidental needle sticks.

OSHA also requires that employers train employees in safe needle handling and to keep a log of any injuries caused by contaminated sharps.

The Bloodborne Pathogen Standard

In March 1992, the **Bloodborne Pathogen Standard** became effective to limit medical employees' exposure to bloodborne pathogens. It covers employees who may come into contact with blood and other infectious materials as part of their job. This includes mental health workers, first-aid caregivers and all part-time and full-time medical personnel.

The Bloodborne Pathogen Standard applies not only to blood, but to any body fluid containing blood, saliva, semen, vaginal secretions, cerebrospinal fluid as well as unfixed tissues.

The scope of this standard is broad, ranging from laundry handling to medical records. A few requirements that deal directly with an exposure are listed below:

- **Exposure determination**—The employer must create a list of the jobs and employees who are exposed to infectious materials.
- **Plan to control exposure**—The employer must create a written exposure control plan, regularly update it and make it accessible to employees. The plan should contain the following:
    - An explanation of how exposure will be prevented
    - Information about receiving an HBV vaccination
    - How exposures will be reviewed and evaluated
    - Communication about hazards
- **Labeling**—The employer must label containers that are used to keep or transport blood or use a red bag if appropriate. The labels will be orange or orange-red and include the biohazard symbol.
- **Training**—Employees must receive annual training about exposure risks.

Let's look at an example of how you will use blood safety guidelines in your workplace. Let's say you accidentally receive a needle stick. First, you will report the incident to the supervisor. Create a confidential document of the incident including the following information:

- Incident's circumstances
- Exposure location
- Source of the exposure

In addition, under OSHA requirements, you should get tested for HBV and HIV. The source of the exposure (the patient who used the needle) can also be tested if she is willing. You will be offered an HBV vaccine and provided counseling about your exposure risks. OSHA also requires that your office file an OSHA 200 form.

Blood Spills

Another aspect of OSHA's blood safety regulations has to do with how blood spills are handled. Employers must have a procedure for cleaning and decontaminating an area that has been in contact with blood. If blood is spilled, blood spill kits should be available and will include the following items:

- Protective plastic safety apron
- Disposable gloves and a mask/faceshield combination
- Absorbent material, scraper and shovel
- Bottle of bleach solution
- Protective shoe coverings
- Hand-cleaning towelettes
- Biohazard disposal bags

Blood spills must be cleaned with a 10-percent bleach solution.

The employee cleaning up the blood spill must wear latex gloves. Paper towels or other materials that were used to clean up the spill must be placed in a biohazard container, and the area should be cleaned with a 10 percent bleach solution.

We're at the end of this lesson. You've learned some valuable blood drawing techniques and safety guidelines in this section.

Please pause to complete online Practice Exercise 18-3.

Step 13 Lesson Summary

- You've learned a lot about blood testing in this lesson! The lesson began with information on the regulations concerning laboratories—notably the CLIA '88. You then furthered your knowledge of blood and the circulation system. From there, you learned more about phlebotomy, including blood components.

An important aspect of this lesson is blood collection. You're now familiar with the procedures for capillary blood collection and venipuncture. You also learned that arterial blood collection requires special training. In addition, you learned about the equipment required to draw blood using the syringe method, vacuum method and butterfly needle method.

The lesson wrapped up with information on various blood tests and analyses including PKU, hemoglobin, hematocrit, glucose, cholesterol, WBCs, RBCs, ESR and differential counts. In addition, you learned more about a subject we touched on in Lesson 12—blood safety guidelines, needle stick injuries and blood spills.

We'll leave the back office for now to learn another administrative skill—bookkeeping.

Endnotes

1. "How do they affect my laboratory?" *hhs.gov*. Clinical Laboratory Improvement Amendment (CLIA). n.d. Web. 6 Oct. 2006.
2. "Currently Waived Analytes—Glucose." *fda.gov*. U.S. Food and Drug Administration. n.d. Web. 12 Oct. 2006.
3. "High Blood Cholesterol and Other Lipids—Statistics." *americanheart.org*. n.d. Web. 13 Oct. 2006.
4. "Wintrobe hematocrit t." *mercksource.com*. Dorland's Medical Dictionary. W.B. Saunders. 2004. Web. 11 Oct. 2006.

Lesson 19
Introduction to Bookkeeping Procedures

Step 1 Learning Objectives for Lesson 19

- ❑ When you have completed the instruction in this lesson, you will be trained to do the following:
  - List some common financial responsibilities for medical assistants.
  - Define common accounting terms and concepts.
  - Explain income statements and balance sheets.
  - Read journals and ledgers.
  - Describe the 10 features of a check.
  - Fill out deposit slips.
  - Reconcile check stubs with bank accounts.
  - Reconcile accounts.
  - Handle petty cash.
  - Assist with payroll duties, including completing:
    - Employment forms such as the I-9 and W-4
    - Paychecks
    - Monthly or quarterly tax deposits
    - Quarterly reports such as the 941
    - Year-end forms such as the W-2 and 1099

🕮 Step 2 Lesson Preview

- ❑ Medical assistants are a lot like one-stop shops that provide nearly anything you need. We've already seen them run the front office, schedule appointments, prepare patients for exams, locate and file medical records, process mail, take a patient's vital signs and much more. In this lesson, we're going to add "keeping the books" to that ever-growing list.

The "books" are a business's finances—a picture of how money comes into and goes out of a business. "Keeping the books" refers to keeping the books up to date and balanced so everyone knows the amount of money a business has and how much it is making.

While some medical offices have permanent accountants—or even entire accounting departments—a firm understanding of accounting concepts and duties is a valuable and very marketable skill for a medical assistant. For some small medical offices, the medical assistant will have accounting duties. This lesson will give you an overview of accounting. We'll also walk through the financial side of a medical office, from reading journals and ledgers to making deposits.

🕮 Step 3 Common Financial Responsibilities

- ❑ Before we tackle our overview of medical office finance, let's shadow Olivia, a medical assistant for Anderson Family Practice, a small medical practice. We'll watch how she uses accounting throughout her day and fulfills her financial duties. Knowing where we're going, we can make sure this lesson is a scenic drive—and not a crash course—through the world of finance.

Olivia helps with many of the accounts for Anderson Family Practice. She monitors all the money coming in to and going out of the office. Each day, she deposits the office's earnings at the bank and pays any bills that arrive—such as for utilities, rent and supplies. Also, the physician and Olivia's supervisor, Susan occasionally attend conferences and presentations and send back travel receipts for Olivia to compile into an expense report.

Let's take a closer look at what Olivia does. Don't worry about fully understanding all of the accounting terms used in the next few paragraphs. We'll cover all that soon enough. For now, just roll down the window and enjoy the scenery.

Financial duties are a large part of the administrative MA's job.

Keeping the Books

Olivia maintains the office's daily accounting journal and ledger entries. She checks that the accounts balance and helps maintain the books for the medical office.

Olivia keeps tabs on everyone who owes the company money with an accounts receivable account. She also tracks the money the Anderson Family Practice owes—to the company that delivers medical supplies every week, for example—with an accounts payable account.

Once a month, Olivia, Susan and Jason, the medical office's medical biller, sit down in a meeting. Olivia prepares a balance sheet and income statement for the office. The balance sheet shows the value of the practice's assets, liabilities and capital. The income statement shows how well the office is operating by subtracting expenses from revenue to show net income. Olivia, Susan and Jason use the balance sheets and income statements to analyze Anderson Family Practice's financial strengths and weaknesses, as well as its progress.

Making Deposits

Olivia writes company checks to pay the practice's bills and payroll expenses. She records each check, and when the monthly bank statement arrives, she reconciles her records with those of the bank. Every day she deposits the checks, cash and credit card slips that the practice has received at the bank. Also, she manages the office's **petty cash**, the small drawer of cash kept in the office to pay for little everyday things when a check won't work or is a hassle.

All money must be tracked—both incoming and outgoing.

While that may seem like a lot of confusing vocabulary, think of it this way. All Olivia does is keep track of how the money moves into and out of her employer's medical office. When money goes out of the business—like when she pays the electricity bill or buys a new piece of medical equipment—she makes note of how much money it was, who it went to, what it paid for, when it happened, where the money came from and why the purchase or payment was made. When money comes into the business—like when patients write a check for their copay or the practice receives a reimbursement check from an insurance company—she asks herself the same questions. Who? What? Where? When? Why? How? Easy as that!

Now that you know where we're going, let's take a closer look.

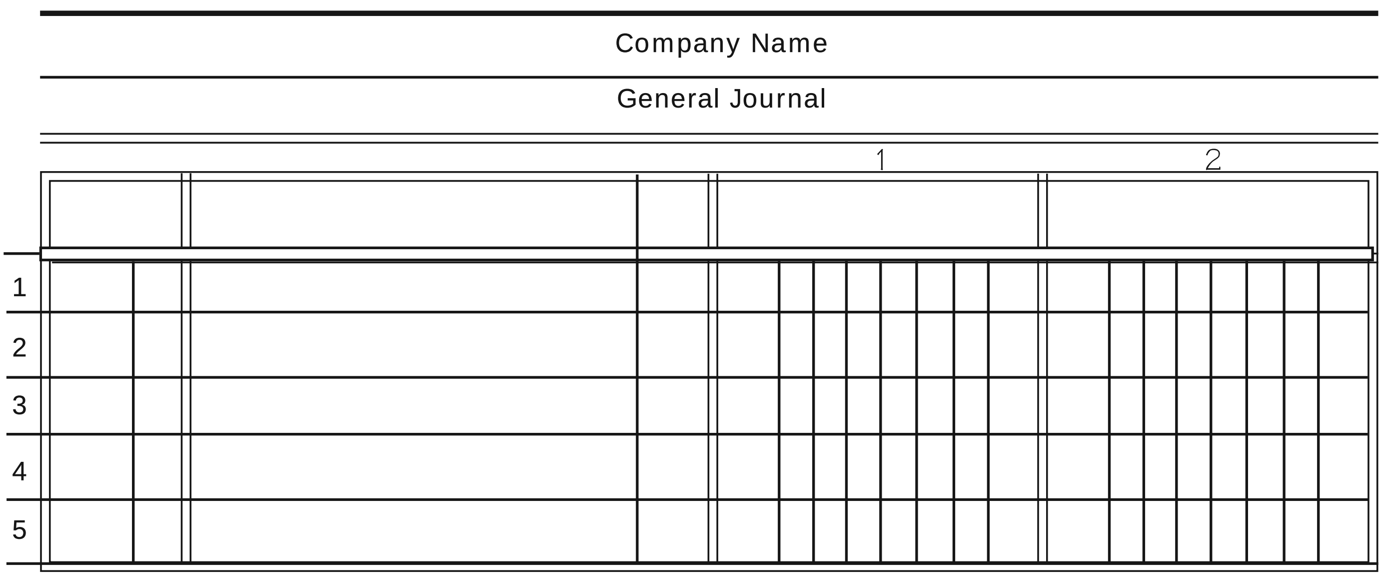
Step 4 Accounting in a Nutshell

❑ Here are those accounting terms again. We'll go over all of them in this lesson. You can make flashcards or a crib sheet for quick reference. Simple repetition will make them seem second-nature.

- *accounts*
- *accounts payable*
- *accounts receivable*
- *assets*
- *balance*
- *balance sheet*
- *bank statement*
- *capital*
- *deposit*
- *journal*
- *ledger*
- *liabilities*
- *net income*
- *income statement*
- *payroll*
- *petty cash*
- *reconcile*
- *record*
- *revenue*

The Start of the Paper Trail

The fancy name for any business dealing that involves money is a **transaction**. When Olivia pays for pens for her desk, when you pay a copay or when the physician's assistant collects her paycheck—these are examples of transactions. Every transaction, no matter what it is, money in or money out, is recorded in the **journal**. The journal is the starting point for any accounting system. It is the source of all of the financial data that is later moved about and analyzed. Here's what a journal looks like.



General journal

From the journal, information is transferred to accounts in the ledger. (The pages in a ledger and pages in a journal are formatted the same.) An **account** is a running tally of a specific type of transaction. For instance, all the money Anderson Family Practice spends on medical supplies is sorted into its Supplies Account. All the money that Anderson Family Practice earns in services is sorted into its Sales Account. The **ledger** is simply a notebook containing all of a business's different accounts.

All of the entries in the journal and the ledger are organized chronologically. Once all of the information is broken down into separate accounts, the account totals can be compared against each other. This is where financial reports—like the balance sheet and income statement—get their numbers.

The Five Types of Accounts

While there can be many different accounts, they all break down into five basic categories based on what type of information each one includes. They are *assets*, *liabilities*, *capital*, *revenues* and *expenses*.

Assets

Anything of value to a business is called an **asset**. This includes property that the business owns and such things as equipment, tools, cash, materials and supplies.

Liabilities

Liabilities include the money that the business owes to others. This includes the amount owed to the bank on equipment that is financed, the mortgage of the business, money owed to suppliers and money owed for taxes.

Capital

Capital is the amount of money the business owes to the owner of the business. Usually when a group of doctors start a practice, they use a certain amount of their own money. For example, when Susan started Anderson Family Practice, she took $3,000 out of her personal savings account and put it into a checking account for her new business. This is also called **owner's equity**. A **drawing account** is an account that keeps track of the amount of money the owner takes out of and puts into the capital.

Revenues

Revenues are what the business earns—the money that comes into the company as the result of selling its products or services. The revenue may be in the form of checks, cash, money orders, direct deposits from insurance companies or credit-card purchases.

Expenses

The **expenses** account lists the costs of doing business. This includes salaries paid to employees, advertising costs, purchase of supplies to make the business's product, rent payments and the cost of utilities such as electricity and telephone.

The following chart summarizes the account information.

Chart of Accounts Summary

Assets:
- Cash
- Accounts receivable (money owed to the business by its customers)
- Supplies (on hand)
- Inventory (products not yet sold, for example)
- Office equipment
- Building (if the business owns its building instead of paying rent)
- Prepaid insurance (insurance paid for in advance)

Liabilities:
- Accounts payable (money the business owes to other people, such as its suppliers)
- Mortgage payable (money the business owes on the residence of the business)
- Taxes payable (this includes taxes that have not yet been paid)
- Notes payable (money the business owes on a loan)

Capital:
- Owner's equity (net worth of the business)
- Drawing account

Revenues:
- Sales (money collected for selling a product)
- Service (money collected for performing a service)

Expenses:
- Purchases (items bought for resale)
- Salaries expense
- Rent expense
- Electricity expense
- Telephone expense

The Double-entry System

When accountants and medical assistants enter transactions into the journal or the ledger, they use a *double-entry system* of accounting. With a **double-entry system**, every transaction is recorded at least twice. This is because you need to record where the money in the transaction came from as well as where it went. (You would use more than two entries if the transaction involved taking money from more than one source or earning money in more than one way. For instance, if Olivia paid for half of a new computer with cash and half with credit, there would be three entries—one for the new equipment, one for the cash and one for the credit.)

The double-entry system is designed so that the books always balance. This way, if they don't balance, you know an error was made.

You know an error exists when you use the double-entry system and the books don't balance.

Credits and Debits

Every entry in the journal and the ledger is either a *credit* or a *debit*. They are the building blocks of accounting. A **credit** is always entered in the right-hand column and a **debit** in the left-hand column. (Credit and debit sometimes are abbreviated Cr. and Dr.) Using the double-entry system, each transaction is entered at least twice—once as a credit and once as a debit. Each credit and debit entry should balance the other out. But be careful when you look at credits and debits—the terms don't always mean subtraction and addition.

How can that be? "Credit" doesn't always mean add; and "debit" doesn't necessarily mean subtract. It's common to think that credits are always positive and debits are always negative, but this is not the case. (This is an example of the definitions of everyday language differing from the definitions of financial language.) Whether a credit or debit increases or decreases the amount in an account depends upon the type of account in question.

Let's look at the following chart:

Type of Account	Increases With	Decreases With
Assets	Debits	Credits
Expenses	Debits	Credits
Liabilities	Credits	Debits
Capital	Credits	Debits
Revenues	Credits	Debits

To use credits and debits correctly, accountants ask themselves the following questions as they enter each transaction in the journal:

1. What accounts does this transaction affect?
2. In what category do these accounts fit: assets, liabilities, capital, revenue or expenses?
3. How does the transaction affect these accounts? Does it increase or decrease them?

The answers to these questions tell the accountant whether to enter the transaction as a debit or credit, following the chart above.

If you're unsure how to record a transaction, ask the doctor's accountant.

Let's look at an example from Olivia's work for Anderson Family Practice. When you pay your $25 copay for a doctor's appointment, that information is entered in the journal. How is it entered? Olivia asks herself the three questions:

What accounts does this transaction affect? A cash sale has two parts: cash and sale. So the transaction affects the Cash Account and the Sales Account.

What types of accounts are these? Cash is an asset and sales are revenue.

How does this transaction affect these accounts? Common sense tells us that cash is increased with the addition of the $25. The revenue account is also increased with the addition of a sale.

So, since the Cash Account is an asset account and it has been increased, the chart tells us that asset accounts increase with debits. In other words, to increase an asset account, Olivia must enter a debit. So $25 would be entered on the debit side of the Cash Account. Sales, a revenue account, also increases. And using the rules, an increase in revenue requires a credit entry to that account. Therefore, Olivia credits the sales account $25 for the sale of the copay.

Remember: credits, debits, double-entries, different accounts—these are all simply ways of answering the basic questions: who, what, where, when, why and how!

Accounts Receivable and Accounts Payable

Accounts receivable and *accounts payable* are two special accounts in the ledger. The **accounts receivable** account keeps track of transactions that occur when the business provides the goods or services immediately but must wait for payment. For example, every month Anderson Family Practice staff spends an afternoon at a local senior center where they provide blood pressure checks and answer questions. The Senior Center has an account with Anderson Family Practice and pays for Anderson Family Practice supplies and services every six months, even though they receive services every month.

Correct accounting helps everyone on the medical team.

Accounts payable is the flip side of accounts receivable. The word "payable" means an expense that has incurred, but has not yet been paid by your company. On the Senior Center's books, the healthcare services are recorded in their accounts payable account because they have received the services but they have not paid Anderson Family Practice for them yet.

Income Statements

An **income statement** is a summary of a business's revenues, expenses and net income. It shows how much profit or loss a company sustained for a period of time. You're already familiar with revenue and expenses. Net income simply is what's left after the expenses are subtracted from the revenue.

Revenue – Expenses = Net Income

Hopefully your net income is a positive number, meaning that your company made a **net profit**. But if your expenses are greater than your revenue, then your company has a **net loss**—that is, it lost money.

Let's look at an example income statement from one of Anderson Family Practice's regular patients, Jerry of Jerry's TV Repair. Because Jerry sells goods as well as services, he has two revenue accounts. They are as follows:

Sales Revenue:	$2,000
Service Revenue:	1,000
Total:	$3,000

He also has several expense accounts. They are as follows:

Advertising Expense:	$100
Fuel Expense:	200
Salary Expense:	500
Utilities Expense:	50
Total:	$850

Jerry's income statement shows that, in the period examined, he made $2,150 net profit. $3,000 - $850 = $2,150.

Jerry's TV Repair
Income Statement
July 31, 20XX

REVENUES		
Sales Revenue		$2,000
Service Revenue		1,000
	Total Revenues	$3,000
EXPENSES		
Advertising Expense		$100
Fuel Expense		200
Salary Expense		500
Utilities Expense		50
	Total Expenses	$850
NET INCOME		$2,150

Balance Sheets

A **balance sheet** is a summary of a business's assets, liabilities and capital. It shows the financial condition of a company at a specific point in time (as of the date of the balance sheet). We already talked about assets, liabilities and capital. Balance sheets break assets and liabilities into smaller classifications: **current assets** and **fixed assets**, as well as *current liabilities* and *long-term liabilities*.

Classifying Assets

Current assets constantly change. The balance sheet lists them in order of their **liquidity**, or how fast they can be converted to cash. Current assets are items that either will become cash soon (they are intended for sale) or that the business will use within a year. Here's an example list of current assets:

- **Cash**: This is a business's total dollars, coins, money orders, checks, letters of credit and bank drafts that it has on hand or in accessible bank accounts.
- **Accounts Receivable**: This is an account that tracks transactions that occur when the business provides goods or services immediately but must wait for payment.
- **Inventories**: The dollar value of goods a company has in stock (for sale).
- **Supplies**: Materials used in the daily conduct of business. These include office and medical supplies.
- **Prepaid Items**: Items the company has purchased and paid for but has not received yet (insurance, for example).

A business uses fixed assets to produce its product or service. This includes everything from a computer system for producing invoices to a truck used to transport a finished product. Fixed assets include the following items:

- **Land**: The value of the land owned by the company (figured at actual purchase price).
- **Buildings**: The purchase price or construction cost of all structures owned by the company. This includes permit fees, engineering fees and surveys.
- **Equipment**: Machines and vehicles along with interior structures, such as shelving, medical equipment and office furniture.

Classifying Liabilities

Current liabilities must be paid within the current year. Examples of current liabilities include payroll, accounts payable and short-term loans. **Long-term liabilities** must be paid after the current year. Examples of long-term liabilities include mortgage payments and long-term loans.

Filling out Balance Sheets

Balance sheets are based on an easy accounting equation:

Assets = Liabilities + Capital

Let's look at a balance sheet for Jerry's TV Repair. His assets include a delivery van, his repair tools, five televisions he has for sale, the spare parts in his shop and the money in the cash register and the bank. He also has an accounts receivable account that is an asset. The breakdown of assets is as follows:

Cash	$ 1,000
(A/R) Accounts Rec.	250
Van	12,500
Tools	1,500
Televisions	1,500
Parts	800
Total:	$17,550

Now, the TV repair shop also has some liabilities. Jerry buys parts from a local supplier on account. These purchase expenses are kept in his accounts payable account. The company also owes the bank for a loan on the van. The company's liabilities break down like this:

Notes Payable:	10,400
(A/P) Accounts Payable:	1,400
Total:	$11,800

To find out Jerry's capital or owner's equity, the balancing equation can be rewritten like this:

Assets – Liabilities = Capital

So, let's figure the capital Jerry has in his business. Take his assets ($17,550), and subtract his liabilities ($11,800). What is the answer? Jerry has $5,750 worth of equity in his business. Let's plug the numbers into a balance sheet on the following page.

Jerry's TV Repair
Balance Sheet
July 31, 20XX

ASSETS			LIABILITIES		
CURRENT ASSETS			SHORT-TERM LIABILITIES		
Cash	$1,000		Accounts Payable	$1,400	
Accounts Rec.	250		Total Short-Term Liabilities		$1,400
Inventory	1,500				
Parts	800		LONG-TERM LIABILITIES		
Total Current Assets		$3,550	Notes Payable	$10,400	
FIXED ASSETS			Total Long-Term Liabilities		$10,400
Van	$12,500				
Tools	1,500		TOTAL LIABILITIES		$11,800
Total Fixed Assets		$14,000	CAPITAL		
			Owner's Equity	$5,750	
			Total Capital		$5,750
TOTAL ASSETS		$17,550	TOTAL LIABILITIES AND CAPITAL		$17,550

Jerry's assets balance with the total of his liabilities and capital. While the income statement shows a business's net income over a certain *period* of time, the balance statement shows a business's net worth at a certain *point* in time. Jerry's TV Repair balance sheet shows that the business has a net worth of $5,750.

Reading Journals and Ledgers

Now that we have an understanding of the basics of accounting, let's look again at that journal page.

Company Name

General Journal

					1	2
1						
2						
3						
4						
5						

The far left column is reserved for the date. The month is written on the left side, and the day is written on the right side. The date of a transaction is only entered when it is different from the previous entry. This makes finding a past transaction easier.

The "description" column contains a description of the accounts a transaction affects as well as a brief summary of the transaction. Since every transaction involves a debit and a credit, both are listed in the journal. (Debits are listed first, again to make reading easier.)

"**P/R**" stands for *posting* and *reference*. **Posting** refers to the act of copying transactions from the journal into the ledger. When the information is transferred from the journal into the ledger, this box is check marked in the journal to show that a certain transaction has been posted. In the ledger, when a transaction has been posted, a "J," (for "journal") and the transaction's journal page number are written in the "P/R" box. This is called a **reference**. The checkmarks and references allow anyone reading the books to see which entries have been posted and to track down previously posted transactions.

Posting refers to the act of copying transactions from the journal into the ledger.

The two large columns on the right, numbered 1 and 2, are for entering debits and credits. Remember: debits always go on the left, credits on the right. The debits and the credits of each entry *must* be equal. The double-entry system of accounting is based on balance.

Here are a few sample pages from Olivia's journal for Anderson Family Practice.

General Journal — Page 1

Date		Description	P/R	Dr (1)	Cr (2)
20XX					
1	1	Accounts Receivable		40 00	
		Sales			40 00
		charged sale			
	2	Telephone Expense		120 00	
		Cash			120 00
		paid phone bill			
	3	Accounts Payable		3000 00	
		Cash			3000 00
		paid creditor			
	4	Mortgage Payable		800 00	
		Cash			800 00
		paid mortgage			
	5	Salaries Expense		350 00	
		Cash			350 00
		paid salaries			
	6	Purchases		1000 00	
		Accounts Payable			1000 00
		credit purchase			
	7	Cash		50 00	
		Sales			50 00
		cash sale			
	8	Drawing		20 00	
		Cash			20 00
		cash draw			
	9	Purchases		150 00	
		Cash			150 00
		resale items			
	10	Electricity Expense		85 00	
		Cash			85 00
		paid electricity bill			

General Journal Page 2

Date		Description	P/R	Dr (1)	Cr (2)
20XX					
1	11	Cash		12 00	
		Sales			12 00
		cash sale			
	12	Prepaid Insurance		350 00	
		Cash			350 00
		paid premium			
	13	Accounts Receivable		50 00	
		Sales			50 00
		charged sale			
	14	Purchases		200 00	
		Accounts Payable			200 00
		credit purchase			
	15	Supplies		50 00	
		Cash			50 00
		bought supplies			
	16	Cash		50 00	
		Sales			50 00
		cash sale			
	17	Cash		150 00	
		Accounts Receivable			150 00
		customer payment			
	18	Rent Expense		120 00	
		Cash			120 00
		paid rent			
	19	Accounts payable		1500 00	
		Cash			1500 00
		paid creditor			
	20	Cash		2000 00	
		Capital			2000 00
		addition to capital			

The ledger is very similar to the journal. A ledger, you recall, is a collection of specific accounts. Each account tracks a specific type of transaction. Because there is already a description of the transaction in the journal, descriptions usually aren't written in accounts. The "P/R" column is very important, though. Notice that the first line is reserved for that account's beginning balance.

Here's a ledger page from Anderson Family Practice's cash account once the transactions listed in the journal above have been posted and referenced.

	Date		Description		1	2
	20XX		Cash Acct #10	P/R	Dr	Cr
1	1	1	Beginning Balance		10000 00	
2		2		J1		120 00
3		3		J1		3000 00
4		4		J1		800 00
5		5		J1		350 00
6		7		J1	50 00	
7		8		J1		20 00
8		9		J1		150 00
9		10		J1		85 00
10		11		J2	12 00	
11		12		J2		350 00
12		15		J2		50 00
13		16		J2	50 00	
14		17		J2	150 00	
15		18		J2		120 00
16		19		J2		1500 00
17		20		J2	2000 00	
18						
19						
20						

Once you understand the terminology and the layout, reading journals and ledgers (and balance sheets and income statements) is easy.

Please pause to complete online Practice Exercise 19-1.

Step 5 Skills You Can Bank On

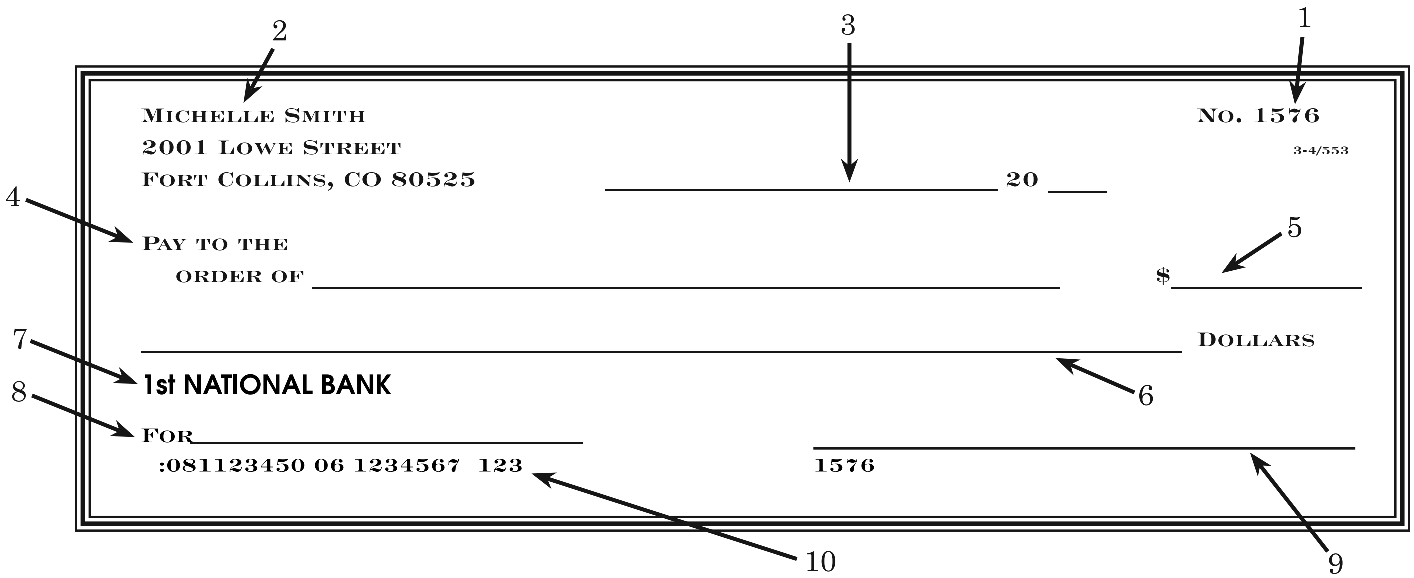
- Medical offices are businesses that have bank accounts just like everyone else. They have checking and savings accounts, and as a medical assistant, you may be responsible for managing those accounts. This entails making deposits, writing checks to pay bills and processing payroll. Just as accounts in the ledger need to be balanced, bank accounts need to be balanced or **reconciled**.

Whether you're putting money into an account or taking it out, you'll probably be working with checks, so let's start our review of banking duties there.

Checks

A **check** is a written financial instrument that involves three parties: the *drawer*, the *payee* and the bank. The person writing the check is called the **drawer** (pronounced DRAW-er). The drawer draws money from an account to be paid to the **payee**, the person receiving the check. When the bank receives the check, it pays the amount shown on it to the payee.

Let's take a close look at a check. There are usually 10 parts to a check. It doesn't matter if it's a business or personal check; it looks something like this:



The 10 parts of a check are these:

1. The check number
2. The name and address of the account holder
3. The date the check was written
4. The payee (who the check is made out to)
5. The amount of the check in numerals
6. The amount of the check written in words
7. The name of the bank
8. The "For" line (why the check was written)
9. The signature line
10. The account number and bank numbers

The date should be filled out with the month, the date and the year the check was written. You can write that as: "August 9," "8/9" or "8-9." The name of the payee—which can be a person or a business—is written on the line next to the words "Pay to the Order of."

Every part of the check must be complete for it to be cashed.

The amount of the check is written twice. First, to the right of the payee's name, it is written in numerals. Second, on the long line below the "pay to the order of" line, it is written using words. The correct format is to write out the number of dollars, then write the word "and" followed by a fraction showing the number of cents on top (the numerator) and 100 on the bottom (the denominator). The amount of $204.56 would be written as follows:

Two hundred four and 56/100

The extra space on this line should be filled in, either by a wavy line, entering "xxxx," or some other figure. This is a safety measure to prevent someone from altering the amount of the check.

The "For" line in the bottom left of the check is reserved for a description of why the check was issued. What the check paid for should be noted here. If the check paid an invoice or bill, write the invoice, bill number or account number here. This will ensure that your payment is credited to your account, even if it's separated from the invoice or bill.

After the check is completed, obtain the authorizing signature. If you are working for a business, more than one person's signature may be required, especially for large checks. No matter how many signatures are required, they all appear on the line or lines on the bottom right of the check. The signatures on these lines must match the signatures on file at the bank for that account.

Now you've filled out the check, but don't tear it out of the book and hand it over yet! You need to record that check on the check stub or in the check register.

Recording Checks

After writing a check, you must record that action in a *check register* or on a *check stub*. This way, you'll always know how much money is in your bank accounts as well as where all your checks went. The **check register** is a type of mini-journal to keep track of all your check transactions.

Most business checks have a **check stub** attached that acts as a register. The stub shows the check number, the date, the payee, what the check was for and the amount of the check. The check stub also contains a **balance forward** (showing how much money was in the account before the check was written) and a new balance (showing how much money is in the account after the check is written.)

CHECK STUB

NO. **1576** ____________________ 20_____

PAY TO

FOR

	Dollars	Cents
BALANCE FORWARD		
DEPOSITS		
TOTAL		
AMOUNT THIS CHECK		
BALANCE		

To fill out the stub, copy the date, payee and amount from the check. Also write in the reason for the check (invoice number, purchase description and so on). Then, subtract the amount of the check from the balance forward and record this number as the new balance. Keep in mind that you will be entering the information found on the check stub into the general journal. Make sure that your description of the expense is clear enough that you'll be able to make an accurate entry.

Deposits

We know how money is taken out of a checking account. The check is honored by the bank, which withdraws the check amount from the checking account and forwards it to the payee. In order for the bank to honor those checks, the business must have enough money in the account to pay the checks. To do this, the business makes *deposits*. A **deposit** is an amount of money put into a bank account.

You will also record deposits in the check register. There are usually lines available on each check stub to record one or two deposits. Even though these lines appear on a numbered check stub, fill them out as deposits occur. Simply enter the deposit amount on the stub for the first unwritten check in the checkbook. For example, if you have a $5,000 deposit and the last check you wrote was number 1576, enter the deposit on the stub for check number 1577. Then when you write check 1577, subtract the check amount from the balance forward, then add the deposit amount and enter this total as the new balance.

CHECK STUB

NO. **1576** ____________________ 20____

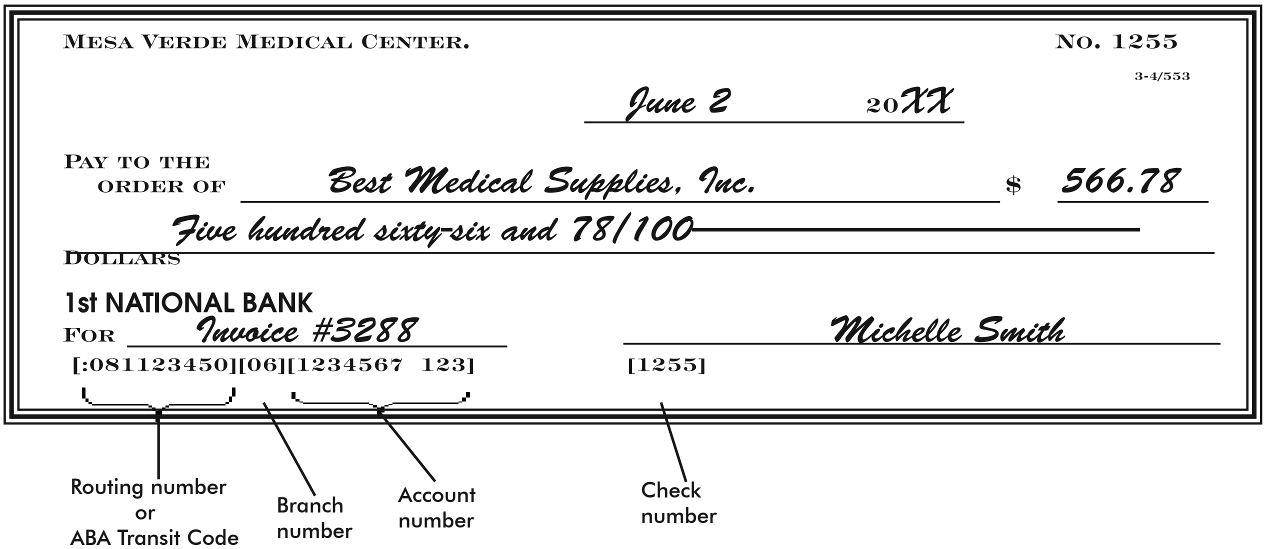
PAY TO

FOR

	Dollars	Cents
BALANCE FORWARD	*750*	*00*
DEPOSITS	*5000*	*00*
TOTAL	*5750*	*00*
AMOUNT THIS CHECK		
BALANCE		

Look at the complete process below:

On June 2, 20XX, Mesa Verde Medical Center issues check number 1255 for $566.78 to Best Medical Supplies, Inc. This check pays invoice number 3288 for supplies for the company. Before the check was written, there was a $3,689.98 balance forward. After the check is written, Mesa Verde Medical Center deposits, on June 3, $784.25 into the account.



Preparing Bank Deposits

So far, we have learned how to fill out a check and its corresponding check stub. Now let's discuss how deposits are made.

There are three steps to depositing checks in a bank account: endorse the checks, complete the deposit slip and give the deposit to the bank.

Endorsing Checks

The payee is the only person who can cash or deposit a check. A check made payable to a business must be cashed or deposited by someone authorized to access the company's checking account—an **authorized signatory**. The **authorized signature**, or signature of the payee, is called the *endorsement*. The **endorsement** is made on the back of the check in the space provided (the left side).

A check that has been endorsed can be deposited by anyone. You may be asking how that can be—didn't we just say the payee is the only person who can cash or deposit a check? That is the case. But when the payee endorses a check, the bank or other agency considers that endorsement as authorization for the bearer of the check to deposit it. Say, for example, you receive a check that is made out to you.

Be careful to keep track of all check numbers.

That is, you are the payee. You need to deposit this check, but you can't go to the bank. You can endorse the check and give it to a friend (along with a deposit slip) to deposit for you. As long as you have endorsed the check, the bank will allow your friend to make that deposit. In general, banks are much more careful about cashing an endorsed check, and require proper identification to verify that the person cashing the check is the payee.

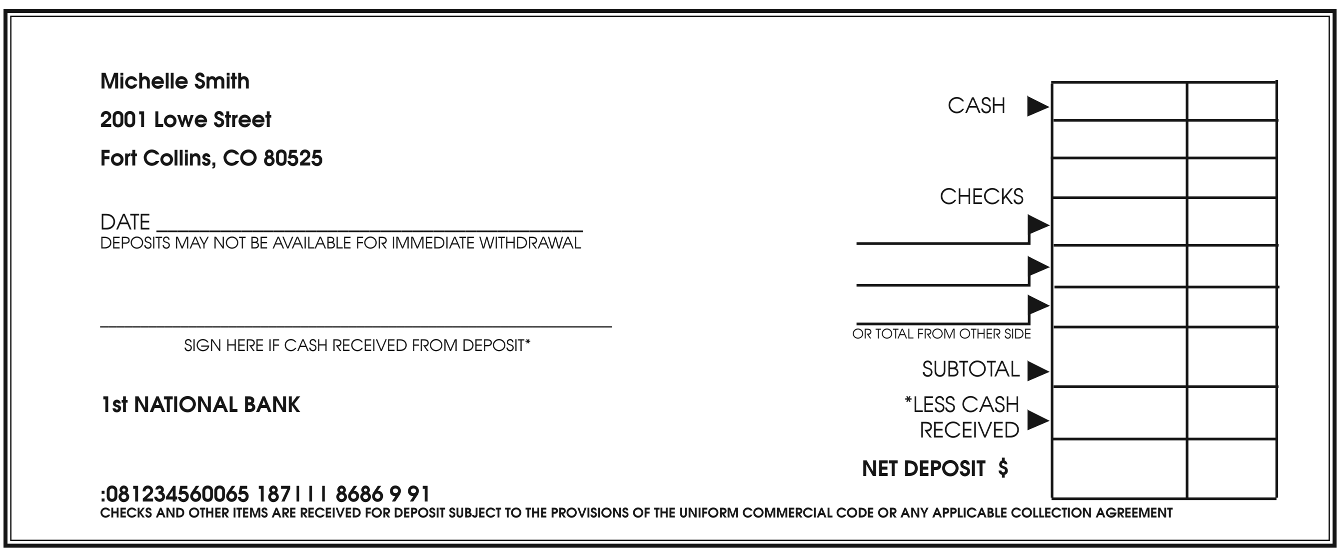
Endorsements are used to help prevent fraud, but it only works as well as the judgment of the bank teller who must determine if she should cash the check. An even better way to help prevent fraud is to endorse the check with the words "For Deposit Only," the checking account number and then your signature. This is known as a **restricted endorsement**. A restricted endorsement allows the bank to pay the money only if the conditions set out in the endorsement are met. Because the check is "For Deposit Only," it cannot be cashed; it can only be deposited into the account.

Most medical practices use a rubber stamp imprinted with a restricted endorsement to save time and allow the bookkeeper, who normally is not an authorized signatory on the account, to endorse all of the checks.

After you have endorsed all the checks, you are ready to complete the deposit slip.

Filling out the Deposit Slip

The deposit slip is an easy document to complete. Look at the example below:


Michelle Smith
2001 Lowe Street
Fort Collins, CO 80525

DATE ____________
DEPOSITS MAY NOT BE AVAILABLE FOR IMMEDIATE WITHDRAWAL

SIGN HERE IF CASH RECEIVED FROM DEPOSIT*

1st NATIONAL BANK

:081234560065 187| | | 8686 9 91
CHECKS AND OTHER ITEMS ARE RECEIVED FOR DEPOSIT SUBJECT TO THE PROVISIONS OF THE UNIFORM COMMERCIAL CODE OR ANY APPLICABLE COLLECTION AGREEMENT

CASH
CHECKS
OR TOTAL FROM OTHER SIDE
SUBTOTAL
*LESS CASH RECEIVED
NET DEPOSIT $

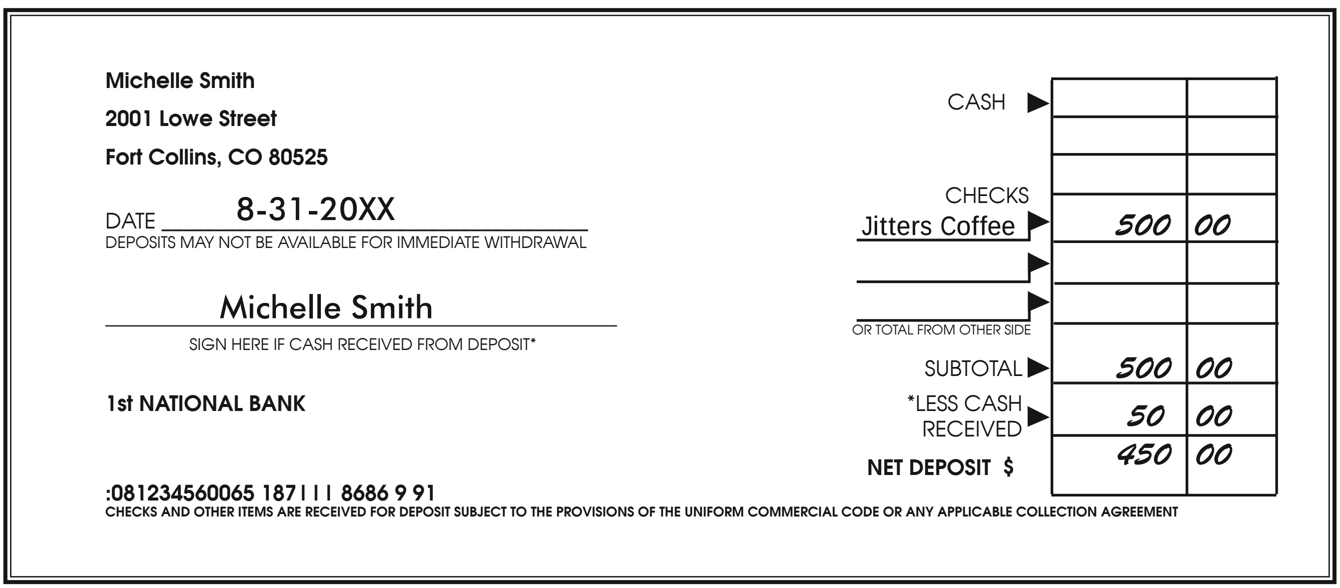
You can see the deposit slip has a space for the account holder's name, the account number (some deposit slips are preprinted with this information) and the date. Underneath this heading information are the spaces for you to record the amount of the deposit. Follow these steps to determine the amount of the deposit:

1. Count the *currency*, and enter that amount on the appropriate line. **Currency** is cash—both bills and coins. Some deposit slips have separate lines for bills and coins.
2. Enter each check to be deposited on its own line. Identify each check by either the name of the drawer or the bank ABA (American Bankers' Association) transit number from the check. If you look at a check, you will see a number in this format: 12 - 345
   1481

This number can have any digits in it, but will always be two digits, a hyphen and then three digits all over a four-digit number. The top number is the ABA transit number of the bank issuing the check. The first part of the number (the two-digit number) is the number for the city the bank is in. The second part of the number is the bank's individual code.

After you have entered every check on the deposit slip, you are ready to move on to step 3.

3. Next, subtotal the deposit. To do this, add the check amounts and the currency amounts. Enter this amount on the appropriate line.
4. This is the "less cash received" step. The term "less cash received" means you are taking this amount out of the deposit as cash. In other words, if you totaled the checks and currency and had $500 in the deposit and then took $50 in "less cash received," you would get $50 in cash back from the bank and the net deposit would be $450. Note: an authorized signature is required on the deposit slip to take cash from the deposit.
5. If you take money out as "less cash received," you will need to subtract this amount from the subtotal to total your deposit. This is known as the net deposit. Write this amount on the appropriate line on the deposit slip.



Making the Deposit

To deposit money in the bank, you must take the completed deposit slip along with all the currency, coin and checks included to the bank. Verify your totals before giving the slip and money to the bank teller. The teller will verify your figures and then give you a receipt for the deposit and any "less cash received" funds. Check the amount printed on the receipt to ensure it matches the amount of your deposit.

Bank Statements

Banks provide written documentation for any transaction that they process. If the transactions are the monthly activity of a checking account, the bank generates a monthly statement. This statement shows a beginning balance and an ending balance along with all of that month's transactions that affected the account.

What transactions affect the account? There are many different types. You know about deposits and withdrawals. Some banks withdraw a monthly service charge or pay interest on the balance of the account. Sometimes, deposited checks are returned unpaid for lack of funds or because the drawer stopped payment. When this happens, the bank will deduct the amount in the business's account by the amount of the returned check. Take a look at this sample bank statement for a checking account.

Humpty Dumpty Day Care 951 Alder Street Grayson, UT 80739	First National Bank of Summit Valley Middle Road Branch Parker, UT 80754

SUMMARY

Beginning Balance	2073.91	ACCOUNT NUMBER
Deposits	3076.00	374-950198
Withdrawals	3205.92	STATEMENT PERIOD
Service Fee	6.00	11-12-XX TO 12-10-XX
Ending Balance	1937.99	

CHECKING ACTIVITY

DEPOSITS

Posted	Amount	Description	Posted	Amount	Description
11-15	800.00	Deposit	12-2	747.00	Deposit
11-22	735.00	Deposit	12-6	794.00	Deposit

WITHDRAWALS

Ck #	Paid	Amount	Ck #	Paid	Amount
1642	11-14	1500.00	1648	11-29	839.12
1643	11-18	573.18	1649	12-3	59.62
1644	11-19	83.27	1650	12-4	38.70
*1647	11-26	16.23	1651	12-10	95.80

As you can see, there is a lot of information on the statement. In some cases, the bank will include with the statement all of the checks it has received for that account that month. Copies of deposit slips may also be returned with the statement. The bookkeeper uses these documents and the information on the bank statement to reconcile the account. **Reconciling** a bank account means to verify that all of the transactions that you entered on your books agree with the transactions that the bank recorded.

When transactions are missing from your books, you will make adjustments to the journal to record these. You will also make adjustments to the bank statement to record transactions that took place after the statement was issued and before it was received. If, for example, the bank issues the statement on February 1, mails it and then the business writes five checks on February 2, those checks won't be listed on the statement. They will, however, need to be accounted for in the reconciliation process so that your bank balance and the bank statement balance agree.

Reconciling Accounts

When the statement for an account comes in each month, it must be reconciled with the account. The reconciliation process consists of nine steps. If you are in charge of reconciling accounts, you must make sure to follow each step every month. If you fall behind in the reconciliation process, it is difficult to catch up.

Use the following steps to reconcile a bank statement. (Note: Many bank statements have a reconciliation form printed on the back. If yours does, use it.)

1. If your bank returns the paid checks and the deposit slips, sort the returned checks into numerical order and sort the deposit slips by date (earliest to latest). This way, if you need to refer to one of the items, it will be easy to locate. If your bank does not return these items, proceed to step 2.
2. Go through the statement item by item. Check off the check number on the statement and in the check register (or check stub) as you compare the amounts. The checkmark in the check register or on the check stub indicates that this check has been paid by the bank and has been accounted for on the statement. You will probably see a few breaks in the check sequence. If you receive checks number 455 and 457, you might not receive number 456. On a separate piece of paper (or on the form on the back of your bank statement) write down the numbers of the checks that have been written but do not appear on the bank statement. These checks are said to be "**outstanding**" or unpaid.
3. Return to the check register and check off the deposits shown on the bank statement. Make a list of the deposits not shown on the bank statement (for example, a deposit made the day after the statement was issued will not appear on the statement, even though the money is in the account) on a separate piece of paper or on the form on the back of the bank statement if provided.
4. Total the amount of the outstanding checks. Subtract this amount from the "Ending Balance" figure shown on the statement. Add any deposits shown in your check register but not listed on the statement. The resulting figure is your new reconciled balance.
5. Now, reconcile your check register with the bank statement. The first step is to record the last balance shown in your register. Usually, there is a space for this on the reverse side of the bank statement.
6. Add any interest earned or credits given to the account that do not appear in your check register.

7. Subtract any service charges or debits (debits could be checks you deposited that were returned).
8. This amount should match the balance found in step 4.
9. If the account balances do not match, go through the check book and make sure the math is correct. It is easy to mistake a “3” for a “5” or a “7” for a “1.” If you find an error, adjust the balances accordingly, and then compare the totals again. If there is still a problem, look for these errors:
    a. Compare the check amounts you have to the check amounts that the bank shows on the statement. Make sure they agree for each check.
    b. Recheck the reconciliation process to make sure you didn’t miss an outstanding check or deposit.

If you cannot find the error and your account balances do not match (reconcile), take all the information down to the bank and have the bank help you find the error. Chances are, between the two of you, you will locate and correct the error. It might be a bank error, or it might be your error. Do not rule anything out and never give up!

Let’s go through a sample reconciliation process:

	Statement date: June 30, 20XX		
Checks shown on statement:		656	$566.78
		657	$232.48
		659	$54.66
		661	$321.88
Beginning balance (June 1):	$2,987.44		
Deposits shown on statement:		June 4	$500.00
		June 15	$1,000.00
		June 28	$200.00
Service charge:			$6.00
Ending balance:			$3,505.64
Outstanding checks:		658	$288.56
		660	$76.12
Deposits not listed:		June 30	$2,850.50
Ending balance shown on your check stub:			$5,997.46

Reconciliation

1. Sort the checks.
2. Check off the checks returned. Add up the total outstanding checks.

   Total: $364.68

3. Add up deposits not listed on the statement.

   Total: $2,850.50

4. Take statement's ending balance; add deposits not listed; subtract outstanding checks:

   $3,505.64 + $2,850.50 - $364.68 = $5,991.46

5. Subtract bank's service charge from ending balance shown in your checkbook:

   $5,997.46 - $6.00 = $5,991.46

6. Compare your new checkbook balance with the bank's ending balance. The two figures should match:

   $5,991.46 = $5,991.46

Bank Reconciliation: June 30, 20XX			
Balance per Bank Statement:			$3,505.64
Deposits not listed on Statement:			$2,850.50
			$6,356.14
Less: Outstanding checks:	658	$288.56	
	660	$ 76.12	
Total outstanding checks:			$364.68
Adjusted bank balance:			$5,991.46
Balance per check book:			$5,997.46
Less: Service charges:			$6.00
Adjusted check book balance:			$5,991.46

Petty Cash

In addition to handling checks and deposits, most medical assistants manage the business's petty cash fund. The petty cash fund is a certain amount of cash, kept on hand that the business uses to pay for incidental expenses during the day.

For example, perhaps you discover that your office is out of staples. You already ordered a large quantity from the local office supply store, but the order won't be delivered until tomorrow. To get you through the day, you decide to use $2 from petty cash to buy a small package of staples. When you take out the $2, you fill out a petty cash slip to indicate how much you took. At the end of the day, you use the petty cash slips to **journalize**, or track, the money that was taken from petty cash. That amount is repaid by issuing a check to the person in charge of the petty cash—you, in this case—which you will cash and return to the petty cash fund.

PETTY CASH SLIP

Date: ____________ Amount: $ ____________

Description of Expense: ______________________

(attach receipt here)

Approved by ______________________________

Paid out by _______________________________

Petty cash slips are also called petty cash vouchers.

When it comes to petty cash, it is important to remember three things:

1. The petty cash must begin each day with the same amount of money in it.
2. Whenever money is removed from petty cash, it must be accounted for with a petty cash slip.
3. When change is made from the petty cash, the money must be replaced. In other words, employees should "buy" change from the fund—put in a $10 bill and remove two $5 bills, for example.

Step 6 Payroll

- Employees like to get paid for the work they perform; so it's important to keep accurate records to ensure that employees get paid the correct amount. Many medical offices have the medical assistant perform payroll duties. In this section, we'll discuss payroll records and payroll taxes.

Payroll Records

First, let's start with a medical office's required payroll records. Employers are legally responsible for payroll responsibilities including the following:

- withholding income taxes from salaries
- depositing taxes with federal and state agencies
- submitting quarterly and annual reports on withheld taxes
- providing reports for employees' taxes

Payroll reports and deposits MUST be received on or before the due date.

How do businesses keep track of all this information? When a physician begins a medical practice and hires employees, she becomes an employer, and she will receive a federal and state employer's tax number or **employer identification number**. She will use this number on forms and correspondence with the government. To keep track of employees, she will identify them by their Social Security numbers.

W-4 Form

Think back to when you started your last job. Probably one of the first things you did was fill out paperwork such as a *W-4 form*. A **W-4 form** establishes a payroll record for each employee. The W-4 provides the information that determines the amount to withhold from the employee's income for federal and state taxes. Marital status, number of allowances claimed and the office's pay periods affect the amount withheld.

Take a look at the following sample W-4 form.

Form W-4 (2010)

Purpose. Complete Form W-4 so that your employer can withhold the correct federal income tax from your pay. Consider completing a new Form W-4 each year and when your personal or financial situation changes.

Exemption from withholding. If you are exempt, complete **only** lines 1, 2, 3, 4, and 7 and sign the form to validate it. Your exemption for 2010 expires February 16, 2011. See Pub. 505, Tax Withholding and Estimated Tax.

Note. You cannot claim exemption from withholding if (a) your income exceeds $950 and includes more than $300 of unearned income (for example, interest and dividends) and (b) another person can claim you as a dependent on his or her tax return.

Basic instructions. If you are not exempt, complete the **Personal Allowances Worksheet** below. The worksheets on page 2 further adjust your withholding allowances based on itemized deductions, certain credits, adjustments to income, or two-earners/multiple jobs situations.

Complete all worksheets that apply. However, you may claim fewer (or zero) allowances. For regular wages, withholding must be based on allowances you claimed and may not be a flat amount or percentage of wages.

Head of household. Generally, you may claim head of household filing status on your tax return only if you are unmarried and pay more than 50% of the costs of keeping up a home for yourself and your dependent(s) or other qualifying individuals. See Pub. 501, Exemptions, Standard Deduction, and Filing Information, for information.

Tax credits. You can take projected tax credits into account in figuring your allowable number of withholding allowances. Credits for child or dependent care expenses and the child tax credit may be claimed using the **Personal Allowances Worksheet** below. See Pub. 919, How Do I Adjust My Tax Withholding, for information on converting your other credits into withholding allowances.

Nonwage income. If you have a large amount of nonwage income, such as interest or dividends, consider making estimated tax payments using Form 1040-ES, Estimated Tax for Individuals. Otherwise, you may owe additional tax. If you have pension or annuity income, see Pub. 919 to find out if you should adjust your withholding on Form W-4 or W-4P.

Two earners or multiple jobs. If you have a working spouse or more than one job, figure the total number of allowances you are entitled to claim on all jobs using worksheets from only one Form W-4. Your withholding usually will be most accurate when all allowances are claimed on the Form W-4 for the highest paying job and zero allowances are claimed on the others. See Pub. 919 for details.

Nonresident alien. If you are a nonresident alien, see Notice 1392, Supplemental Form W-4 Instructions for Nonresident Aliens, before completing this form.

Check your withholding. After your Form W-4 takes effect, use Pub. 919 to see how the amount you are having withheld compares to your projected total tax for 2010. See Pub. 919, especially if your earnings exceed $130,000 (Single) or $180,000 (Married).

Personal Allowances Worksheet (Keep for your records.)

A Enter "1" for **yourself** if no one else can claim you as a dependent . . . . **A** ______

B Enter "1" if:
- You are single and have only one job; or
- You are married, have only one job, and your spouse does not work; or
- Your wages from a second job or your spouse's wages (or the total of both) are $1,500 or less.

. . **B** ______

C Enter "1" for your **spouse.** But, you may choose to enter "-0-" if you are married and have either a working spouse or more than one job. (Entering "-0-" may help you avoid having too little tax withheld.) . . . . **C** ______

D Enter number of **dependents** (other than your spouse or yourself) you will claim on your tax return . . . . . . **D** ______

E Enter "1" if you will file as **head of household** on your tax return (see conditions under **Head of household** above) . **E** ______

F Enter "1" if you have at least $1,800 of **child or dependent care expenses** for which you plan to claim a credit . . **F** ______
(**Note.** Do **not** include child support payments. See Pub. 503, Child and Dependent Care Expenses, for details.)

G **Child Tax Credit** (including additional child tax credit). See Pub. 972, Child Tax Credit, for more information.
- If your total income will be less than $61,000 ($90,000 if married), enter "2" for each eligible child; then **less** "1" if you have three or more eligible children.
- If your total income will be between $61,000 and $84,000 ($90,000 and $119,000 if married), enter "1" for each eligible child plus "1" **additional** if you have six or more eligible children. **G** ______

H Add lines A through G and enter total here. (**Note.** This may be different from the number of exemptions you claim on your tax return.) ▶ **H** ______

For accuracy, **complete all worksheets that apply.**
- If you plan to **itemize or claim adjustments to income** and want to reduce your withholding, see the **Deductions and Adjustments Worksheet** on page 2.
- If you have **more than one job** or are **married and you and your spouse both work** and the combined earnings from all jobs exceed $18,000 ($32,000 if married), see the **Two-Earners/Multiple Jobs Worksheet** on page 2 to avoid having too little tax withheld.
- If **neither** of the above situations applies, **stop here** and enter the number from line H on line 5 of Form W-4 below.

Cut here and give Form W-4 to your employer. Keep the top part for your records.

Form **W-4**
Department of the Treasury
Internal Revenue Service

Employee's Withholding Allowance Certificate

▶ **Whether you are entitled to claim a certain number of allowances or exemption from withholding is subject to review by the IRS. Your employer may be required to send a copy of this form to the IRS.**

OMB No. 1545-0074
2010

1 Type or print your first name and middle initial. | Last name | **2 Your social security number**

Home address (number and street or rural route) | **3** ☐ Single ☐ Married ☐ Married, but withhold at higher Single rate.
Note. If married, but legally separated, or spouse is a nonresident alien, check the "Single" box.

City or town, state, and ZIP code | **4** **If your last name differs from that shown on your social security card, check here. You must call 1-800-772-1213 for a replacement card.** ▶ ☐

5 Total number of allowances you are claiming (from line **H** above **or** from the applicable worksheet on page 2) **5** ______

6 Additional amount, if any, you want withheld from each paycheck . . . . **6** $ ______

7 I claim exemption from withholding for 2010, and I certify that I meet **both** of the following conditions for exemption.
- Last year I had a right to a refund of **all** federal income tax withheld because I had **no** tax liability **and**
- This year I expect a refund of **all** federal income tax withheld because I expect to have **no** tax liability.

If you meet both conditions, write "Exempt" here . . . . ▶ **7** ______

Under penalties of perjury, I declare that I have examined this certificate and to the best of my knowledge and belief, it is true, correct, and complete.

Employee's signature
(Form is not valid unless you sign it.) ▶ **Date** ▶

8 Employer's name and address (Employer: Complete lines 8 and 10 only if sending to the IRS.) | **9** Office code (optional) | **10** Employer identification number (EIN)

For Privacy Act and Paperwork Reduction Act Notice, see page 2. Cat. No. 10220Q Form **W-4** (2010)

Form W-4 (2010) Page 2

Deductions and Adjustments Worksheet

Note. Use this worksheet *only* if you plan to itemize deductions or claim certain credits or adjustments to income.

1 Enter an estimate of your 2010 itemized deductions. These include qualifying home mortgage interest, charitable contributions, state and local taxes, medical expenses in excess of 7.5% of your income, and miscellaneous deductions . . . . . 1 $ ________

2 Enter: { $11,400 if married filing jointly or qualifying widow(er); $8,400 if head of household; $5,700 if single or married filing separately } . . . . . 2 $ ________

3 **Subtract** line 2 from line 1. If zero or less, enter "-0-" . . . . . 3 $ ________

4 Enter an estimate of your 2010 adjustments to income and any additional standard deduction. (Pub. 919) . . . . . 4 $ ________

5 **Add** lines 3 and 4 and enter the total. (Include any amount for credits from *Worksheet 6* in Pub. 919.) . 5 $ ________

6 Enter an estimate of your 2010 nonwage income (such as dividends or interest) . . . . . 6 $ ________

7 **Subtract** line 6 from line 5. If zero or less, enter "-0-" . . . . . 7 $ ________

8 **Divide** the amount on line 7 by $3,650 and enter the result here. Drop any fraction . . . . . 8 ________

9 Enter the number from the **Personal Allowances Worksheet,** line H, page 1 . . . . . 9 ________

10 **Add** lines 8 and 9 and enter the total here. If you plan to use the **Two-Earners/Multiple Jobs Worksheet,** also enter this total on line 1 below. Otherwise, **stop here** and enter this total on Form W-4, line 5, page 1 10

Two-Earners/Multiple Jobs Worksheet (See *Two earners or multiple jobs* on page 1.)

Note. Use this worksheet *only* if the instructions under line H on page 1 direct you here.

1 Enter the number from line H, page 1 (or from line 10 above if you used the **Deductions and Adjustments Worksheet**) 1 ________

2 Find the number in **Table 1** below that applies to the **LOWEST** paying job and enter it here. **However,** if you are married filing jointly and wages from the highest paying job are $65,000 or less, do not enter more than "3." . . . . . 2 ________

3 If line 1 is **more than or equal to** line 2, subtract line 2 from line 1. Enter the result here (if zero, enter "-0-") and on Form W-4, line 5, page 1. **Do not** use the rest of this worksheet . . . . . 3 ________

Note. If line 1 is ***less than*** line 2, enter "-0-" on Form W-4, line 5, page 1. Complete lines 4–9 below to figure the additional withholding amount necessary to avoid a year-end tax bill.

4 Enter the number from line 2 of this worksheet . . . . . 4 ________

5 Enter the number from line 1 of this worksheet . . . . . 5 ________

6 **Subtract** line 5 from line 4 . . . . . 6 ________

7 Find the amount in **Table 2** below that applies to the **HIGHEST** paying job and enter it here . . . . 7 $ ________

8 **Multiply** line 7 by line 6 and enter the result here. This is the additional annual withholding needed . . 8 $ ________

9 Divide line 8 by the number of pay periods remaining in 2010. For example, divide by 26 if you are paid every two weeks and you complete this form in December 2009. Enter the result here and on Form W-4, line 6, page 1. This is the additional amount to be withheld from each paycheck . . . . . 9 $

Table 1

Married Filing Jointly: If wages from **LOWEST** paying job are—	Enter on line 2 above	All Others: If wages from **LOWEST** paying job are—	Enter on line 2 above
$0 - $7,000 -	0	$0 - $6,000 -	0
7,001 - 10,000 -	1	6,001 - 12,000 -	1
10,001 - 16,000 -	2	12,001 - 19,000 -	2
16,001 - 22,000 -	3	19,001 - 26,000 -	3
22,001 - 27,000 -	4	26,001 - 35,000 -	4
27,001 - 35,000 -	5	35,001 - 50,000 -	5
35,001 - 44,000 -	6	50,001 - 65,000 -	6
44,001 - 50,000 -	7	65,001 - 80,000 -	7
50,001 - 55,000 -	8	80,001 - 90,000 -	8
55,001 - 65,000 -	9	90,001 -120,000 -	9
65,001 - 72,000 -	10	120,001 and over	10
72,001 - 85,000 -	11		
85,001 -105,000 -	12		
105,001 -115,000 -	13		
115,001 -130,000 -	14		
130,001 - and over	15		

Table 2

Married Filing Jointly: If wages from **HIGHEST** paying job are—	Enter on line 7 above	All Others: If wages from **HIGHEST** paying job are—	Enter on line 7 above
$0 - $65,000	$550	$0 - $35,000	$550
65,001 - 120,000	910	35,001 - 90,000	910
120,001 - 185,000	1,020	90,001 - 165,000	1,020
185,001 - 330,000	1,200	165,001 - 370,000	1,200
330,001 and over	1,280	370,001 and over	1,280

Privacy Act and Paperwork Reduction Act Notice. We ask for the information on this form to carry out the Internal Revenue laws of the United States. Internal Revenue Code sections 3402(f)(2) and 6109 and their regulations require you to provide this information; your employer uses it to determine your federal income tax withholding. Failure to provide a properly completed form will result in your being treated as a single person who claims no withholding allowances; providing fraudulent information may subject you to penalties. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation, to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their tax laws, and using it in the National Directory of New Hires. We may also disclose this information to other countries under a tax treaty, to federal and state agencies to enforce federal nontax criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism.

You are not required to provide the information requested on a form that is subject to the Paperwork Reduction Act unless the form displays a valid OMB control number. Books or records relating to a form or its instructions must be retained as long as their contents may become material in the administration of any Internal Revenue law. Generally, tax returns and return information are confidential, as required by Code section 6103.

The average time and expenses required to complete and file this form will vary depending on individual circumstances. For estimated averages, see the instructions for your income tax return.

If you have suggestions for making this form simpler, we would be happy to hear from you. See the instructions for your income tax return.

I-9 Form

In addition to the W-4, the U.S. Citizen and Immigration Services (USCIS) requires that employers maintain a file of *I-9 forms* for each individual they hire—both citizens and noncitizens. The **I-9 form** verifies employment eligibility and identity documents, normally a copy of your driver's license and Social Security card. Form I-9s must be kept by the employer either for three years after the date of hire or for one year after employment is terminated—whichever is later.[1]

Payroll Taxes

If you've ever thoroughly read one of your pay stubs, you know that a few different types of taxes are withheld. Let's take a look at taxes, such as federal and state income tax, FICA and Medicare, and then we'll look at how taxes are deposited.

A high number of employee allowances means more money on payday.

Federal Income Tax

As you know, employers are required by law to withhold and process federal taxes for every employee. Along with their employer identification number, or EIN, new businesses also receive *Circular E*. The **Circular E** is the federal employer's tax guide, which includes tables that allow the employers to determine the withheld income tax based on the employee's income, allowances and pay period.

State Income Tax

Similarly, most state governments also withhold portions of employees' paychecks. Some states don't collect employee taxes, so check with your state government if you are unsure. Usually the state tax board has tables similar to the tables in Circular E that help employers determine the correct amount to withhold.

FICA

Another tax that the government requires you withhold is the Federal Insurance Contributions Act *(FICA)* tax. **FICA** includes taxes such as Social Security tax. A percentage of the employee's salary is deducted from the employee's check each pay period. The employer is required to match that amount and forward the money either monthly or quarterly through a participating bank to the government. FICA rates can change from year to year, so to find the accurate percentage, you must check an up-to-date chart of withholdings in a Circular E.

Medicare

In addition to FICA, the government requires workers to contribute to Medicare. This is an additional percentage that must be taken out of paychecks. The amount is matched by the employer, like FICA, and paid in monthly or quarterly deposits.

Depositing Taxes

As we mentioned, the employer is required to deposit these federal taxes to a Federal Reserve Bank or authorized commercial bank on a monthly or quarterly basis, depending on how large the employer's payroll is. The employer completes a tax deposit form and submits it with each deposit. The employer's deposits will include the FICA and Medicare amounts withheld from its employees and its matching employer contribution. State taxes are deposited in the same way, either monthly or quarterly to a state tax agency.

What does quarterly mean?

The calendar year is divided into four quarters for tax purposes.

January through March—1st quarter

April through June—2nd quarter

July through September—3rd quarter

October through December—4th quarter

In addition to making deposits, the employer must file a Form 941 to report its payroll taxes on a quarterly basis.

Required Reports

As you know, the employer is required by the government to submit reports that verify the income of its employees and other service providers. We'll discuss two required IRS forms in particular, the *W-2 form* and the *1099-MISC form*.

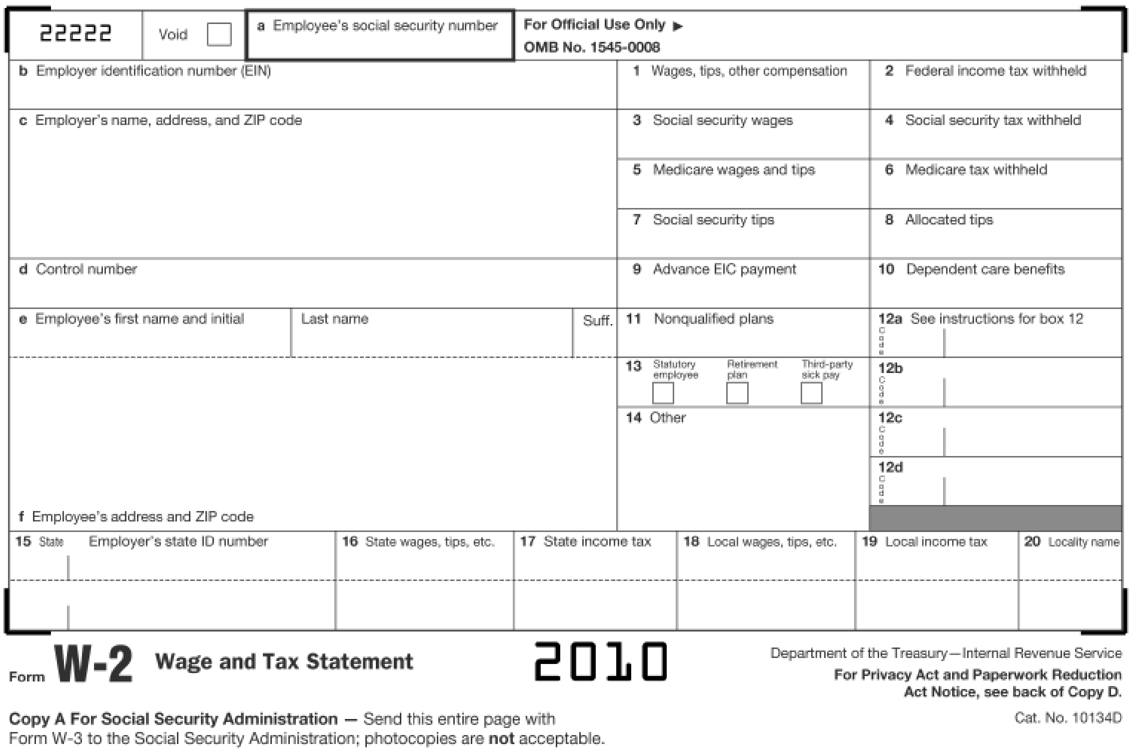
W-2 Form

At the beginning of each year, a company must issue IRS Form W-2 to every person who worked for the company as an employee during the previous year. The **W-2 form** lists the employee's gross wages and all withholdings for the entire year. The employee must be given this form no later than January 31.

The W-2 form consists of at least four copies. Two copies are for the employee: one for the employee's federal tax return and one for her personal records. The employer uses the other two copies. One is sent to the Social Security Administration, and one is kept in the employer's records.

If the state in which your business is located has state income taxes, then six copies of the W-2 are required. One additional copy is used by the employee to file with her state tax return. The employer sends one additional copy to the state tax agency.

Various locations throughout the country have city or county taxes that must also be reported on the W-2 form. If that is the case in your area, you will need to prepare enough copies of the form to meet the requirements to report and file these taxes.


22222 Void
a Employee's social security number
For Official Use Only ▶
OMB No. 1545-0008
b Employer identification number (EIN)
1 Wages, tips, other compensation
2 Federal income tax withheld
c Employer's name, address, and ZIP code
3 Social security wages
4 Social security tax withheld
5 Medicare wages and tips
6 Medicare tax withheld
7 Social security tips
8 Allocated tips
d Control number
9 Advance EIC payment
10 Dependent care benefits
e Employee's first name and initial
Last name
Suff.
11 Nonqualified plans
12a See instructions for box 12
13 Statutory employee Retirement plan Third-party sick pay
12b
14 Other
12c
12d
f Employee's address and ZIP code
15 State Employer's state ID number
16 State wages, tips, etc.
17 State income tax
18 Local wages, tips, etc.
19 Local income tax
20 Locality name

Form **W-2** **Wage and Tax Statement** 2010

Department of the Treasury—Internal Revenue Service
For Privacy Act and Paperwork Reduction Act Notice, see back of Copy D.
Cat. No. 10134D

Copy A For Social Security Administration — Send this entire page with Form W-3 to the Social Security Administration; photocopies are **not** acceptable.

Sample W-2 form

Form 1099-MISC

Just as employees receive W-2 forms each year, all non-employee contract workers must receive a report of income if the contractor is unincorporated and was paid more than $600 in one year. This income report is the IRS **1099-MISC Form**, and it lists the contractor's total earnings for the year from that company, as well as any taxes or other withholdings that the company might have made for the contractor. The basic requirements for completing IRS Form 1099-MISC are very much like those for completing the W-2 form. The number of copies of the 1099-MISC form you will need to supply to each individual depends on whether or not the contract worker will be filing state and/or local income tax documents. Individuals will need a copy of the 1099 for their federal tax returns and for their personal records. Your office will use two copies, one to send to the Social Security Administration and one for your records. You will need to supply additional copies if state and local income taxes are levied.

9595 ☐ VOID ☐ CORRECTED

PAYER'S name, street address, city, state, ZIP code, and telephone no.	1 Rents $ 2 Royalties $	OMB No. 1545-0115 2010 Form 1099-MISC	Miscellaneous Income
	3 Other income $	4 Federal income tax withheld $	Copy A For Internal Revenue Service Center File with Form 1096.
PAYER'S federal identification number / RECIPIENT'S identification number	5 Fishing boat proceeds $	6 Medical and health care payments $	
RECIPIENT'S name	7 Nonemployee compensation $	8 Substitute payments in lieu of dividends or interest $	For Privacy Act and Paperwork Reduction Act Notice, see the **2010 General Instructions for Certain Information Returns.**
Street address (including apt. no.)	9 Payer made direct sales of $5,000 or more of consumer products to a buyer (recipient) for resale ► ☐	10 Crop insurance proceeds $	
City, state, and ZIP code	11	12	
Account number (see instructions) / 2nd TIN not. ☐	13 Excess golden parachute payments $	14 Gross proceeds paid to an attorney $	
15a Section 409A deferrals $ / 15b Section 409A income $	16 State tax withheld $ $	17 State/Payer's state no.	18 State income $ $

Form 1099-MISC Cat. No. 14425J Department of the Treasury - Internal Revenue Service

Sample 1099 form

Payroll Services

If the thought of keeping track of each employee's withholdings makes your head spin, don't worry because many offices use payroll services. These service companies create the paychecks, deposit federal withholdings, produce monthly payroll records and produce quarterly tax returns and W-2 forms for medical practices. There is also very sophisticated payroll software available that many administrative medical assistants find makes payroll a breeze!

Please pause to complete online Practice Exercise 19-2.

Step 7 Lesson Summary

- ❑ When it comes to business, money makes the world go round. And yes, even medical offices are considered businesses. Think of business as a body. Money is the blood. It carries the nutrients that keep all the different body parts functioning. Accounting is the vascular system. It is the network that allows blood to move throughout the body. Without blood vessels, the blood would uselessly pool in our feet. Accountants and administrative medical assistants who manage the books, write reports, organize payroll paperwork and make deposits are the heart. They are the force that circulates the blood—all the money—to the places that need it.

If bookkeeping seems like a lot of work to you, you're right. Thank goodness for computers, which automate much of the number crunching described in this lesson! Computer software exists to manage a medical office's accounts, draw up financial reports with a click of the mouse, generate tax forms and reports and help reconcile your bank accounts.

Yet even the best computer program is no substitution for a solid understanding of bookkeeping. You certainly can use the knowledge and skills you've learned in this lesson to your advantage. You'll learn more about medical accounting software in the next lesson.

Please pause to complete an online Quiz.

Endnotes

1. "I-9 Employment Eligibility Verification." *uscis.gov*. U.S. Citizen and Immigration Services. n.d. Web. 15 Sept. 2006.

Just think, you're more than halfway through your introduction to medical assisting! It must give you a great feeling to look back at everything you've already accomplished. In this pack, you learned about medical insurance and medical ethics. You also learned some great techniques to help your patients before and during exams and to be a valuable assistant to the physician during a CPE. You've learned how experienced MAs draw blood and conduct blood tests. You've even practiced organizing the medical office's finances!

Hopefully, what you've learned about medical assisting thus far has left you eager to learn more. In the next pack of lessons, we're going to discuss how technology has changed the medical industry and how you can use it to your advantage. You'll walk beside other MAs as they perform clinical procedures such as collecting and testing body fluids and bacterial smears and cultures.

This pack will also introduce you to diagnostic and procedural coding. You'll learn about the history, rules and guidelines of coding, and we'll introduce you to the ICD-9-CM and CPT books, which you'll use to assign codes.

Now, before we move on to that pack, give yourself a little break. Maybe relax in a warm bath or treat yourself to a massage or manicure. You deserve it! You're so close to your new career. Think about all the advantages of becoming a medical assistant. You can work in an office, a hospital or in home health care. Medical assistants are in high demand as the field continues to grow. And, of course, there is the opportunity to earn a good salary while working in an exciting and fulfilling career!

Whatever your reasons for wanting to become a medical assistant, this course is designed to help you accomplish your goal. Don't forget, your instructors are available if you ever have questions, and the school offers assistance even after you graduate. Our counselors can answer your inquiries about everything from writing a resume to successful interviewing to finding a new job if you relocate.

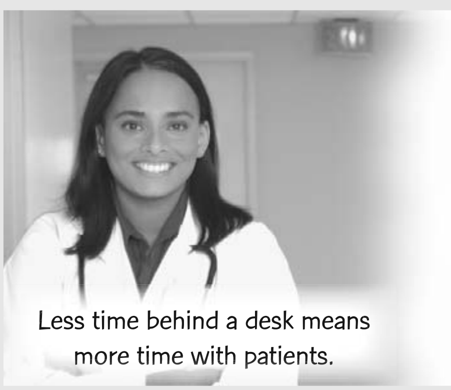
You're probably ready to continue with your education, so get going, and don't let anything stand in your way!

Lesson 20
Technology and Health Care

Step 1 Learning Objectives for Lesson 20

- When you have completed the instruction in this lesson, you will be trained to do the following:
  - Describe computer hardware and software.
  - Explain clearinghouses and the basics of electronic claims submission.
  - Outline the benefits of electronic claims submission.
  - Explain the basic concept of remote coding and transcription services.

Step 2 Lesson Preview


Less time behind a desk means more time with patients.

Another Success Story from Microsoft®

Founded in 2003, the Family Medicine Center provides primary and preventive medical care to people of all ages. Before joining the center, one new physician spent her three-year residency in a large medical clinic. Much of her time there was spent performing routine administrative tasks such as dictating patient reports, proofing and finally rereading them after transcription and signing off on them.

Determined to go paperless in her own practice, she has incorporated wireless laptops, pocket PC phones, electronic medical records and other software to streamline office tasks.

Not only has this allowed her to spend more time caring for and educating patients, but this solution saves her practice 70,000 dollars a year. Overall office efficiency has improved 60 percent. The doctor can spend more time out of the office and her employees' morale is high.[1]

As the cost of health care continues to skyrocket, both patients and caregivers are searching for ways to contain costs. The case study you just read illustrates one way that technology can help. It is estimated that the change from a paper system to an electronic system will eventually provide a cost savings of $81 billion or more nationwide. This is a real incentive for the medical profession to head into the electronic age. You'll be at an advantage if you have these high-tech skills when you begin your career as a medical assistant!

In this lesson, you will learn how computers work and explore the ways that they will simplify your job.

Now, let's get started!

Is there a limit to the rise
in healthcare costs?

Step 3 Computer Equipment

Fifty years ago, the medical office was managed much differently than it is today. The same goals had to be met but without the modern equipment we use now. Single-line telephones and typewriters were the only office equipment available. Patient information was gathered, documented, and stored manually, without the help of computers. Luckily, many advances have occurred in the last century to speed up administrative functions. As with any other business today, the medical industry relies heavily on the computer.

The Advent of Computers in the Medical Office

The use of computers has become so widespread that it is good to have a general understanding of basic computer terms. All computers have certain things in common, no matter the industry. Knowing more about computers in general helps you understand how they work in a medical office. Computers have streamlined the healthcare administrative process. More time can be spent on patient care, and less time on paperwork. Let's take a look at what makes these great little machines so helpful.

Computers have reduced some of the frustrations of healthcare paperwork.

Basic Computer Terms

When you sit in front of a computer, you may not realize how intricate the machine is. From the outside, the computer doesn't look very complicated and, until recently, wasn't very pretty either. The keyboard, mouse, monitor and printer are recognizable parts of the input-output design of a computer. You enter information with the keyboard or the mouse, and the monitor displays an image. You click a button and the printer produces a hard copy. These are examples of input and output. What you put into a computer can be taken back out!

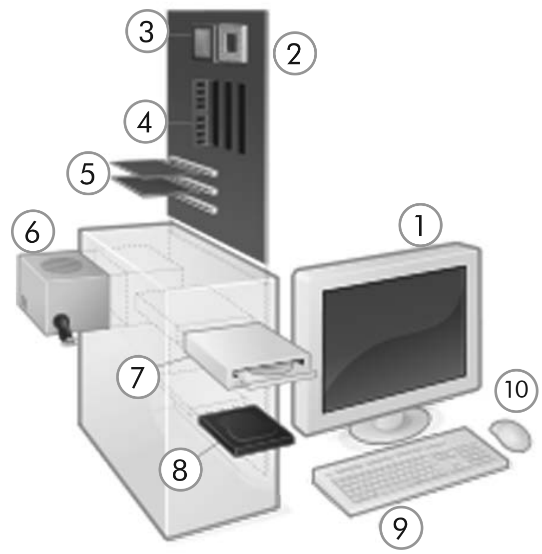
Computers in a medical office are usually in the same *network*. A **computer network** is a group of computers that are set up to communicate with each other and can access the same files and resources. Each computer has a certain amount of *memory* and *disk space*. These terms refer to the amount of information that can be stored and processed by that computer. Memory is measured in *gigabytes* and *megabytes*. A **byte** is a unit of measure of computer memory or disk storage space equal to that needed to store a single character. A **megabyte** is 1,048,576 bytes, and a **gigabyte** is 1,024 megabytes. When a computer is purchased, the amount of storage is a deciding factor. Most computer users want several gigabytes of storage capacity.

More than likely, you've used the Internet and e-mail functions of a computer. These allow offices to send correspondence and look up information quickly. They are wonderful tools and should be used for work purposes only when you are working. In the following pages, we'll learn about *hardware* and *software*. **Hardware** refers to the physical components that work together to keep a computer functioning. **Software** refers to applications, loaded into the computer, that give directions to the hardware. Without the software, the hardware doesn't know what to do!

Computer Hardware

Computer hardware are the physical pieces of equipment that sit on your desk. They are part of a team of components that work together, allowing the computer to perform necessary functions. Let's look first at the "brain" of the computer. The **central processing unit**, or **CPU**, houses all of the computer's circuitry. Memory size and computing speed determine the CPU's power.

How fast can you add 243 + 360? Five seconds? Ten? This is the speed of your brain's processor. The **processor** of a computer works the same way—it is the brain inside the computer. The processor takes the input it is given and uses software instructions to manipulate the data. The faster the processor, the faster the computer works. But speed means nothing if the computer can't retain the information.



An exploded view of a modern personal computer:

1. Display monitor
2. Motherboard
3. CPU (Microprocessor)
4. Primary storage (RAM)
5. Expansion cards
6. Power supply
7. Optical disc drive
8. Secondary storage (HD)
9. Keyboard
10. Mouse

Computer Memory

The amount of information a computer can hold depends on how much memory it has.

There are three different types of memory: *RAM (random access memory), ROM (read-only memory)* and *data storage memory*.

Random Access Memory

RAM is the memory that the computer uses to process what you are telling it to do at that particular moment. When you turn the computer off, the RAM empties itself. When you use the computer again, the RAM doesn't remember what you've done during previous uses.

Read-only Memory

ROM, on the other hand, holds the information that runs the computer. It stores the information that has been installed by the manufacturer to tell the computer what to do with all the attached hardware. This information is in permanent memory even when the computer is off. Because of the important data stored in ROM, its contents can't be altered. RAM and ROM sizes need to be large enough to operate the complicated medical software used in the healthcare industry.

RAM and ROM are chips which are attached to memory cards. These memory cards are attached to a circuit board called the *motherboard*. The **motherboard** acts as a relay center for the computer. It sends messages from the software to the hardware and then back again. The motherboard helps all the computer parts communicate with each other so the computer will work properly.

Data Storage Memory

Data storage memory is just that—the hardware devices that allow you to save large amounts of information that can be accessed when needed. It takes the place of rooms full of file cabinets, cabinets full of files, files full of papers and papers full of typewritten data. The days of intricate and eccentric filing methods are over. No longer can one person dominate the way that an office navigates its storage and filing needs. The computer is set up to store and manage information in a logical and user friendly format, which is an easy system to learn and maintain. The filing and storage software chosen by a particular office may differ from that of another office, but the purpose remains the same. Different computers using different software programs use the same hardware to save information.

Computers come with a *hard drive* and usually, a *CD-RW* or *DVD±RW drive* already installed. The **hard drive** is the main storage device, and is installed inside the computer. The hard drive stores all of the software applications that the user can access. Different programs used to be loaded into the computer each time they were needed. Now that they are stored in the computer on the hard drive, the programs are easier to use. The hard drive needs to have ample space available for storage purposes.

The **CD-RW** and **DVD±RW drives** are portable storage methods. Both are optical drives, but their formats are different. The CD or DVD drive records data from the computer onto a compact disk (CD), or a digital video/versatile disk (DVD). Either disk can then be taken to another computer with a compatible drive, and the disk can be read and saved by that computer.

Other storage devices are called *floppy drives*. **Floppy drives** are portable storage devices as well, but use different storage media. The most common of these is the 3.5" drive, which holds about 1.4 megabytes (MB) of data. There are also Zip drives®, Jaz drives®, flash drives and tape drives, which we will discuss in a moment. Each uses a different storage media, and holds varying amounts of information. Computer manufacturers are offering fewer models with floppy disk drives, as more customers increasingly prefer the CD-RW or DVD±RW drive. The DVD can hold substantially more data than any other type of portable storage drive—4.7 gigabytes (GB) or more. The CD can hold about 700 MB, and is used by most software companies, so you have to have a CD drive to load the software. There are now CD/DVD±RW drives, which can read and write to both CDs and DVDs. All of these devices can be added to the computer as an attachment, or **peripheral** device. Adding extra components can increase the data storage capabilities of a computer with limited storage space.

And Last, but Not Least

Backing up files can save them from disasters like lightning strikes and computer failure.

Back when all medical records were typewritten onto paper, it was difficult and time-consuming to make a duplicate of every document. It also required a tremendous amount of storage space. Since the advent of the computer and its impact on the medical industry, all of this has changed.

Since all of the office's information is now stored on the computer, it is imperative that office staff *back up* the information. We will talk more about computer backup a little later in this lesson, but for now all you need to know is that a **backup** is a copy of all the information on the computer's hard drive. Should the computer encounter any sort of difficulty, such as a power outage, lightning strike, mechanical system failure or a fire, the backup is used to restore all of the office's data. Backups are best kept away from the source computer, in a cool and dry place. A fireproof safe is a good place to store the backup media.

Backup storage employs different types of media than when you are merely transferring data or storing a small amount of information. **Magnetic tape** is a thin ribbon of plastic tape coated with iron oxide that can record data, just like the tape used in audio and video cassettes.[6] It is an economical way to store large amounts of information, but the backup process is very slow. Many businesses that use magnetic tape run their backup programs overnight. A **flash drive** can hold several gigabytes of data, yet is about the size of a tube of lipstick. It plugs into a Universal System Bus (USB) port, which makes it very user-friendly. Most computers are now sold with USB ports on the front of the CPU, or even on the monitor. **Zip drive** and **Jaz drive** disks are flat and square like a 3.5" disk, but are thicker and hold more information—anywhere from 100 to 2,000 MB of data.

The backup process should be performed on a daily basis. That way the patients' and the practice's vital information is never permanently lost. If the original file is damaged, the backup comes in to save the day!

Peripheral Hardware

When all of the inside hardware is working together, other pieces can be plugged into the computer to enhance its capabilities. You are probably already familiar with some of these devices, such as the monitor, keyboard, mouse and printer. These devices connect to the motherboard through different types of ports on the back of the CPU. These forms of computer hardware have become increasingly user oriented. Monitors can have antiglare screens that protect against eyestrain and keyboards have been designed to combat carpal tunnel syndrome. Printers have become more reliable and easier to use, and your mouse may even be wireless. Let's look at the other peripheral devices that are available to computer users.

Scanner

A *scanner* is a device that you may not be as familiar with. The **scanner** reads a document, much like a fax machine, and sends the image to the computer. Once in the computer, the image can be sent to other computers. The scanner can be used to read hard copies of patient records and charts. These can then be stored on the computer as part of the patient's electronic medical file. The scanner used to be quite expensive but is now widely available. It is often sold as part of an **all-in-one machine**, which combines a copier, fax machine, scanner and printer in one unit.

Telephone Lines

Telephone lines are in fact considered computer hardware when used in connection with a computer *modem*. The **modem** (short for modulator-demodulator) is like a translator for the computer that allows it to connect with the Internet. Information leaves the computer as a digital signal; however, telephone lines can only accept information as an analog signal. The modem converts the digital data to analog data so that it can be transmitted. When information is being sent *to* the computer, the modem turns the analog data into digital data so that the computer can process it. So, with information leaving and returning to the computer along them, telephone lines can be considered input and output devices! The modem itself can be inside the computer or set up as an attachment at a later time.

Cable and Satellite Connections

Some medical offices use modems, while others access the Internet through cables, satellite connections or through a wireless connection to another computer. Cable and satellite Internet are similar to cable television and satellite television subscription services used in many homes. They can be faster at processing the information than a modem and telephone line arrangement. Many offices are using a mixture of the options available. A computer can connect to the Internet via telephone lines and a modem. Other computers can then connect to the main computer wirelessly and also have access to the Internet.

It is easy to see how all of the equipment known as computer hardware works together. Like the human body, each part performs a very distinct and necessary function. If one component, such as the keyboard, is not working well, the whole computer can be affected. Other devices, such as the printer, may not seem as important, but when you need a hard copy of a patient's chart, a broken printer can bring the entire operation to a standstill. A computer is the sum of all its parts. When those parts are in good condition, the computer will be a faster and more efficient machine.

Step 4 Software and Computer Applications

- Computers have many applications from business to pleasure. Most physicians' offices use computers in some capacity or another, from scheduling patients to the submission of a claim form. In this section, we will introduce you to some different types of software programs and their applications.

Computer Software

When doctors first began operating from private practices, they had few resources to help them run a successful business. The appointment books were handwritten and, sometimes, the patients bartered for services. Having little money, they would offer whatever they could give, from clothes to livestock. Keeping accurate paperwork was nearly impossible and, surely, very time consuming. Fortunately, the technological advances made in the last century will help you in all aspects of your career as a medical assistant. Instead of tallying bills by hand, you simply enter the information into a computer and a specially designed software program calculates the totals for you. Today's medical assistant has access to the tools to excel in the areas of billing and scheduling. A large variety of tasks are made easier and more accurate by using the appropriate software.

Operating System Software

When you turn on a computer, a screen pops up and you begin your tasks. At that moment, you are interacting with the computer's *operating system*. The **operating system** is in charge of the routine functions of the computer. There are different types of operating system software, produced by competing companies. Microsoft® and Apple® make the two most popular operating systems.[2] Microsoft's Windows® operating system is used in most medical offices.[3] There are lively debates about which operating system performs best, but they are both able to achieve the goals of a medical practice.

The desktop that appears on the monitor allows you to give instructions to the computer.

These systems are so popular because of their user-friendly designs. They are both arranged to process and display information in a way that feels natural to the user—they think the way you do.

After you turn on the computer and it has finished its startup process, you will see a screen called the *desktop*. The **desktop** is a screen with graphic icons representing often-used software programs, files, folders and hardware managers, arranged in rows to make them easy to find. To access the information or program, you simply double-click on the icon and it opens the program or file that you requested. At the bottom of the screen is a **toolbar** that tells you what programs are running and what files are open on the computer.

You'll notice a *start button* on the left corner of the toolbar. The **start button** gives you access to all of the rest of the computer's contents—you don't want everything on your desktop or you won't be able to find anything! This is the place to go to find a program that does not appear on the desktop.

While you type data into the computer, you must *save* it frequently to avoid losing the information due to a power outage or other disruption. When you click on **save**, you have the option to save the new information on the hard drive, a disk, or another storage device, such as a flash drive. Do you recall Mr. Johnson, who was patiently waiting for his medical records? All of his records are divided into computer files that are located in a *computer folder*. Like a folder in an actual file cabinet that holds lots of different reports, notes, and charts, a **computer folder** organizes all of Mr. Johnson's files so you can access all of the information you have—billing information, medical charts, health history, even insurance information—on Mr. Johnson in one location.

Usually a folder is retrieved by opening the program that you plan to use the folder in, and then clicking on the folder name from a list. Another list appears, showing all of the files that are held inside of the folder. These files can be opened, edited, moved, printed or deleted. Be sure to choose the correct action for the desired result. You don't want to select **delete** if what you really wanted to do was **print**! To help Mr. Johnson get his records, you simply open his folder and print out each file onto paper. You know that the same information has been backed up on microfilm, but you find it quicker and easier to just print the files from the computer. Aren't MAs smart?

Scheduling Software

When office staff scheduled appointments without the aid of a computer, they often handwrote multiple copies of the office's patient schedule. The front desk needed a copy, the doctor wanted a copy and his nurse wanted a copy. They probably used a pencil to make preliminary appointments and then copied the list in pen, or with a typewriter, for permanent record keeping. Can you imagine how much time this took? Thank goodness those days are over! As you learned in Lesson 2, the computer now allows the MA to change the schedule quickly and easily by simply deleting or moving a patient's name and leaving the time slot open for someone else. (And now the doctor and the nurse can access the schedule on their own computers.) The computer can also automatically enter standing appointments, such as "Mr. Peterson every Wednesday at 9:00 a.m. for physical therapy." This way, the receptionist knows that the 9:00 a.m. time slot is not available to anyone else needing the physical therapist. The schedule can be saved on the computer and printed out as a hard copy to keep on the receptionist's desk for easy reference.

Physical therapy sessions can be entered automatically as "standing appointments."

Scheduling software is easy to navigate and keep organized. Patient information can be entered as needed or retrieved from the computer's *database*. A **database** is a software program that can hold and organize a large amount of information. We'll discuss databases more in just a bit.

Coding and Billing Software

Back in the days when Mr. Johnson could have paid his bill with a bushel of apples, medical practices kept track of the services they provided with a pegboard. The staff tallied treatment costs by hand and then calculated the appropriate totals. Today, this method is completely impractical. With such a wide variety of treatments performed by modern clinics, it is necessary to price each patient visit differently. Every patient receives specialized care that is determined by her particular ailments. Mrs. Jackson's appointment for a flu shot was coded and billed much differently than her physical therapy sessions. Let's review a few basic points about coding and billing.

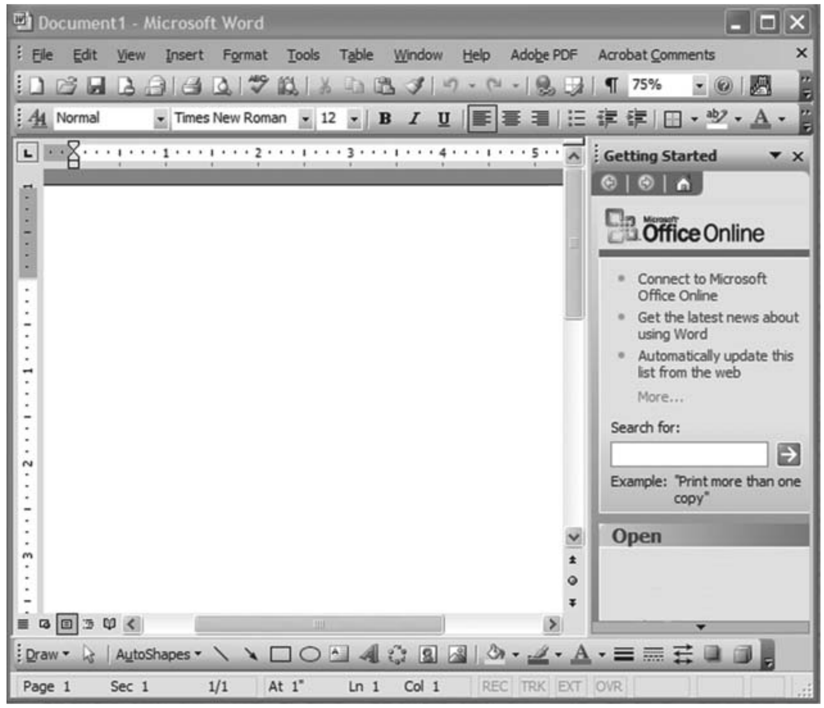
Medical coding refers to assigning standardized, unique numbers to every possible diagnosis and treatment that can occur. As you can imagine, coding manuals contain a lot of numbers! As a patient receives care, the physician usually uses a checklist for common diagnoses and procedures, or dictates notes that detail the diagnosis and prescribed treatment. After the notes have been transcribed, the medical coder converts the diagnoses and **procedures** (the treatment given) into codes to be submitted to the patient's insurance company. Coding ensures that the doctor is paid for the services she performs and that the patient is charged fairly and impartially. Software is available that checks the coder's work for inaccuracies, and can also suggest procedure code options for a particular diagnosis code.

The **medical billing** process consists of taking the codes and entering them in the appropriate places on an insurance claim form. Fortunately, the universal insurance claim form CMS-1500 has become fairly standard, but there are still several agencies, mostly governmental, that require a different format. There are several requirements that the physician's medical biller must fulfill before the bill can be submitted for payment. The procedure codes must "match" or be appropriate for the diagnosis code that is given, and other information must be submitted before the insurance company will pay the bill. The process is fairly complicated, and computers have become almost a necessity when it comes to fulfilling each insurance provider's requirements when submitting a bill.

Medical bills, known as **claims** when they are sent to an insurance company, are not on paper. Most are sent as electronic files over the Internet. To create an insurance claim, all of the appropriate codes and patient information are entered into the computer. The billing software then determines the amount of the claim by using the codes. Each code has a standardized cost associated with it. The program then adds all of the services together and creates the claim on the appropriate claim form. At this point, the program can also create a billing statement for the patient. The patient's statement reflects the amount due based on what the doctor expects to receive from the patient's insurance company, and the amount the patient is responsible for based on his particular insurance plan. Each plan has terms that specify how much the patient pays and how much the insurance provider pays for medical care. The billing software also accounts for the particular insurance plan's payment terms. Do you see how complicated billing can get? That's another reason why the computer is so valuable in the medical office.

Word Processing Software

Word processing programs allow you to create documents on the computer much like you would using a typewriter. On a computer, though, changes to the text and the addition of graphics are much, much easier. Typewriters require a lot of manual adjustments and corrections. When using a word processing program, spelling and grammar can be checked and corrected instantly. Whole documents can be formatted and aligned just by clicking a few buttons. These programs are widely used in the medical office.



Starting a new document using Microsoft® Word[4]

An icon on the computer's desktop represents the word processing program. It can also be located by using the computer's menu of programs by using the Start button. Usually the program automatically takes you to a blank document, surrounded by toolbars and help tools displayed on the screen. You then start typing and formatting your new document, save it and print it. Many times you will open an existing document, make a few changes to it to apply to the document you want, and then save and print it. This is called a *template*. Every time the document format is needed, the **template** acts as a shortcut—you just fill in different information in the same document each time.

When starting with a blank screen, certain default settings, such as text size, font style and margins are automatically set. Word processing programs allow the user to change these settings to fit her specific needs. An administrative letter is formatted much differently than an interoffice memo. Word processing programs make formatting and styling documents much simpler tasks. Whole sections of text can be moved after they have already been typed by using the **cut and paste** functions of the program. Graphics can be scanned in and appropriately placed. What used to take hours using a typewriter, scissors and glue can now be done in a fraction of the time.

As mentioned, word processing programs can be used for administrative documents, letters and reports. It is also the program of choice for medical transcription. If you have a computer at home, you likely have access to a word processing program. With just a little practice, these programs are easy to use and are very valuable tools.

Database Management Software

Databases are like a very long grocery list. Each item on the list—milk, eggs, lettuce—is an individual *record*. The database management program can look at each **record**, or item, compare it to the other records in the database, and arrange it according to the user's instructions. The record does not have to be one word. It can be a phrase, like "16 oz. can of cream of mushroom soup," or it can be a patient's home address. Within a record are *fields*. **Fields** are the individual pieces of the record. The patient's street address is a field, her city is a field, her state is a field and her ZIP code is a field. Each bit of information that you want to be able to sort has to be in its own field. This is how the program sorts the records. You tell it which field to search, and what to look for, and it will pull up the records containing the criteria in that particular field.

Because of the speed at which a database program can find and sort large amounts of information, it saves a tremendous amount of time. Databases are used as address books, calendars and telephone directories. As we mentioned previously, databases can hold huge amounts of data and can access all of this information quickly by using the *search* feature. The **search** function reads the user's instructions for what field to search, and for what word to search, and finds every record with that word in that field in a matter of seconds. For instance, you may need to contact every patient who needs to schedule his annual prostate exam. You can search the database for all male patients between the ages of 30 and 70, and the computer will give you all the records that fit that criteria. You can then print out the list. You can even merge the database records with your word processing program and print out a postcard to each patient!

Obviously, the database must be kept current, or it loses its effectiveness. New information should be entered into the database on a regular basis to create the most up-to-date information. Records regarding patients who are no longer treated by the practice can be marked appropriately so the computer knows that the file is no longer active. When used properly, a computer's database management program can organize and retrieve information in a way unmatched by other methods of storing data.

Spreadsheet Software

Spreadsheet software uses columns and rows to organize information. A spreadsheet can also perform mathematical equations, make comparisons and sort data. Spreadsheets are a good way to illustrate large amounts of information for easy reference. As a medical assistant, you may keep your insurance log or your timesheet on a spreadsheet.

Step 5 Backing Up Data

- What if that Monday after the extended holiday weekend had begun differently? Say a large thunderstorm had moved through the area, causing heavy rains and flooding. As you waded through the parking lot, you noticed that the building's power was out and the doors were locked. Two days later, the power is restored, and the office is up and running. When the receptionist turns on the equipment for the day, she notices that the computers won't start up. She calls the service technician, who looks over the system and informs Nancy that the power surges from the storm have destroyed the computer network and erased many programs and files. What happened to all of the practice's valuable information? Well, if the data was backed up and stored properly, then it is still safe from the flood. Though the main computers are down and all of their information is "lost," the technician can reinstall the software and load all of the office's data back onto the computers.

Backing Up Computer Data: How It's Done, How It's Stored, When It May Be Used

You can see how important it is to properly manage all of the data a medical practice receives and uses. What if there were no backup files? Then you lost all of your patients' medical records, your copies of insurance claims, even your patients' names and addresses! Imagine everyone in the office trying to recall each and every patient visit, their vital signs, notes transcribed, claims sent, bills paid and appointments scheduled from the previous day. Recreating just one day's worth of computer activity is a huge undertaking! Backing up the data stored on a computer should be done daily in order to keep the backups current—you don't want to lose even one day's worth of activity. Securely stored, these duplicates are available in case of an emergency like the one just described. But hopefully, you'll never have to use them!

The process of backing up computer data was once highly involved and technical. As computers became more user friendly, so did the task of saving and storing duplicate data. Peripheral devices that copy onto media such as CD-RWs, magnetic tapes and flash drives allow information to be transferred from one computer to another. For backup purposes, the media should be stored in a safe place until needed. So, if one computer is destroyed, the information can be transferred to a new unit. The importance of backing up computer data cannot be stressed enough.

Step 6 Connectivity

The *Internet* can be described as:

"A network of such [computers], connected to one another by wide-band communication lines" which provided "the functions of present-day libraries together with anticipated advances in information storage and retrieval and [other] symbiotic functions."—J.C.R. Licklider[5]

It's hard to believe that this description was written in 1960, thirty years before the Internet became common knowledge. A fundamental pioneer in the call for a global network, J.C.R. Licklider, articulated the idea in his January 1960 paper, "Man-Computer Symbiosis." And this definition still applies today. Worded a little differently, the **Internet** is a vast worldwide network of interconnected computer systems.

Initially, universities used it to share research information, but in 1979, CompuServe became the first service to offer electronic mail *(e-mail)* capabilities and technical support to personal computer users.[6] The Internet has now grown into a media that markets goods, provides information to the public and sells products online. As a medical assistant, you can use the Internet to keep abreast of changes in your profession or to research patients' questions.

Keeping in touch across the country has never been easier, thanks to the Internet.

E-mail is an electronic method of communicating. Via the Internet, you are able to send and receive messages from other Internet users. E-mail is a very efficient and effective way to communicate with physicians and insurance carriers.

Now it's time to get down to specifics. This lesson will teach you how to use common software that you'll find in the workplace.

Step 7 Combining the Computer and the Internet

- ☐ Until recently, most medical insurance claims were filled out by hand or typewriter and then physically mailed (**snail mailed**) to the insurance company for processing. Although paper claims are still relatively common, the medical claims and billing field is moving away from paper claims and toward electronic claims.

  Electronic claims are digitized insurance claims transmitted from a computer using a modem to the insurance company or a clearinghouse. What does *digitized* mean? Well, when data is entered into a computer record, you are **digitizing** the information. You can digitize data from a healthcare form simply by using software and entering the required information.

  Do you wonder how the digitizing of information and using a computer are beneficial? Consider this: Every year, tons and tons of paper are used to file medical insurance claims. This paper takes the form of letters and forms that are used once and then discarded. Digitized information can be stored more easily and stacks of paper are eliminated from the process—good for your filing system and the environment.

Electronic Transactions Save Money

Every instance where electronic transactions reduce the time spent processing transactions can, of course, be translated into cost savings for your office and your patients.

For instance, the estimated per-claim savings of processing claims electronically instead of manually is:

- $1.49 per claim for physicians
- $1 per claim for health plans
- $.86 per claim for hospitals
- $.83 per claim for others

Filing claims electronically can also save valuable time. It takes days for paper claims to be delivered through the mail system, not to mention that there is no proof when you send a claim that it was received. Once the claim is delivered, the insurance company must digitize the information for its system and then process the claim. Finally, the insurance company mails an EOB and the reimbursement.

In contrast, submitting a claim electronically is comparable to picking up the telephone and calling the insurance company. The claim is received instantly, already digitized. Processing can begin immediately. With electronic filing, you have proof of timely filing and can check the status of claims with just a few keystrokes on your computer. The reimbursement can be completed even more quickly with *direct deposit*.

Direct deposit is a process through which money is electronically deposited into a bank account. To pay a claim, the insurance company authorizes its bank to transfer funds into the physician's bank account. This is all done electronically, via computers, with no actual cash or checks changing hands.

The new world of electronic claims presents many opportunities for medical professionals. Software helps eliminate errors, track claims and other medical records and improves the speed of submission and reimbursement of claims. Electronic claims can make life in the medical office easier. Let's examine how it works.

Clearinghouses

It all starts when a medical claims and billing specialist takes the encounter forms from the previous day and enters their data in to the computer. Once all the codes and charges are entered, the claims are batched together and divided into groups. One group consists of claims that must be sent to the insurance companies; the other consists of bills that must be sent to patients.

Let's look at the claims that need to be sent to the insurance company first. Billers who work in a physician's office or hospital file claims to many different insurance companies or payers. Most of them want to receive their claims electronically. There are several options for filing claims electronically. The provider can either contract with a **clearinghouse**—a company that facilitates the processing of claims information in to standardized formats, then submits the claims to the appropriate insurance companies—or file directly to the insurance companies, which is called a **carrier-direct submission**. The claim information can also be directly entered in to the insurance carrier's Web site as a **Web-based claim submission**.

The first step in the electronic claims process is to enter data from the previous day's encounter forms into the computer.

If the provider uses a clearinghouse, the biller will prepare claims with medical billing software. Then, the program will convert the data the biller entered in to files on the computer. The software exports the files in to a format that the clearinghouse can receive. The provider's software must be compatible with the clearinghouse. Once the claims are exported in to the system, the software sorts them according to payers. Most clearinghouses have the ability to check for errors. If a claim has an error, the clearinghouse will send a report with the needed correction. The biller can then make the correction and resubmit the claim. A claim without errors is called **clean**. The clearinghouse then forwards the clean claims to the appropriate payers for processing.

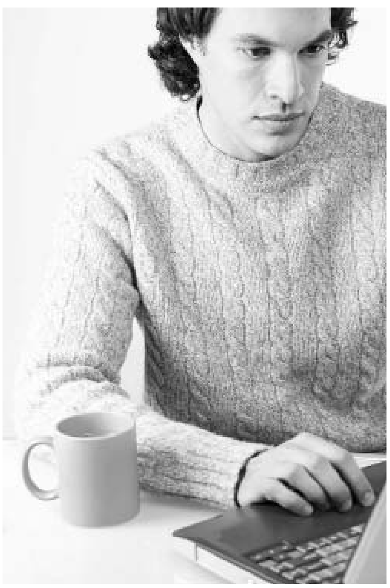
If there are claims that cannot be sent electronically, the biller can either print and send a paper claim or the clearinghouse can send the paper claim on the provider's behalf.

The clearinghouse downloads reports indicating how many claims it received and when the claims were forwarded to the payers. Insurance carriers will report to the clearinghouse when they receive the claims. These reports are important for timely filing and insurance claim follow-up.

After the insurance company receives the claim from the clearinghouse, it processes and pays (or rejects) that claim. Sometimes insurance companies notify the provider of a rejected claim on payment vouchers they send to providers. Other times, payers notify the provider of rejected claims through the electronic reports that are transmitted to the clearinghouse.

🕮 Step 8 Remote Services

❑ As you know, medical assistants, medical claims and billing specialists, medical coding specialists and medical transcriptionists depend on one another in their jobs. The roles of each specialist are like links in a chain. All are equally important and all are dependent on the others to succeed. Because the specialists' roles are intertwined, medical professionals have benefited from technology that remotely connects them no matter where they are. In fact, some medical transcriptionists and medical coders work from home, but are connected to the physician's office or to other medical professionals via the computer. Isn't technology amazing? Let's learn a little more about how technology connects these medical professionals by looking at a couple of examples.



Jack works full time in his home.

First, let's meet Jack. Jack has worked as a medical transcriptionist with his company for a few years. The transcription service works with several doctors' offices and medical clinics in his area, so he's always busy! Jack has seen the change in the medical transcription field and has moved from transcribing audio tapes to transcribing digital sound files. Some offices that Jack works for are paperless while others still use paper medical records.

After breakfast, Jack heads downstairs to his home office to begin his day at 9:00 a.m. Jack logs onto the shared drive that all the transcriptionists in his company have access to. The shared drive has folders for the transcription service's clients—various clinics and doctors' offices in the area. The physicians in many of the offices and clinics carry a digital hand-held device so they can dictate their information directly into it. These sound files are then loaded onto the shared drive and saved into the corresponding clinic or doctor's office folders. Jack opens up one of the sound files that he needs to transcribe. He uses a special program that is connected to the patients' electronic health records (EHRs). After Jack is finished typing it, he saves it to the patient's chart on the computer and moves the sound file into a folder for the finished reports. Once the transcribed report is saved in the patient's chart, it goes back to the physician for a signature. The physician opens up the report and signs it electronically. Then Jack is ready to start another report!

Jack appreciates this technology because he doesn't have to type all of the physician's notes. Most of the time, Jack only has to transcribe portions of the report. He also appreciates the time the technology saves. Jack no longer drives around town to pick up tapes from all the different doctors' office and clinics. In the same way, Jack doesn't have to drop off reports. Instead, everything is done electronically.

If an office uses paper charts rather than electronic health records, Jack and his transcription company use the sound files to transcribe, but then the office prints a copy of the report for the patient's paper chart.

Melanie likes the flexibility of her job; she can decide when and how much she wants to work.

Now let's meet Melanie, who is an independent medical coder. Melanie is one of many remote coders in her company who work online in distant locations. The company finds work for them to code. Melanie likes the flexibility of her job in that she can decide when and how much she wants to work. Melanie wakes up around 5:00 a.m. to get a few hours of work in before her two young children wake up. She brews a pot of coffee, pours a cup and sits down at her computer. Melanie checks her e-mail, which contains plenty of work for her day. She starts with a superbill indicating a patient came in for a broken finger, as well as transcription documenting how the x-ray was performed and the radiologist's reading of the x-ray. Melanie applies the correct codes for the diagnosis and the procedure and then sends these codes to the medical claims and billing specialist at the physician's office, who sends the codes to the insurance company.

Now you know how medical coding specialists and medical transcriptionists use technology to connect remotely and perform their jobs from home.

Please pause to complete online Practice Exercise 20-1.

Step 9 Lesson Summary

- There is a lot to learn about our technological world, but this lesson is a great start and has made you familiar with the computer, its jargon and software applications.

  The computer is made up of hardware and software applications. The most common operating system in use is Windows®[7]. It is from this system that applications are launched and utilized. The computer makes it possible for health records to be kept electronically. It allows providers to process claims and submit them electronically through a clearinghouse.

  Electronic claims submission can save time and money—both incentives for the use of this process. A provider may choose a clearinghouse that can assist in the process by checking claims for accuracy, formatting the claims and providing the ever-important proof of timely filing.

Endnotes

1. "Family MD Center Diversity Case Study." *download.microsoft.com*. Web. 4 June 2007.
2. *Microsoft®* is a registered trademark of Microsoft Corporation in the United States and/or other countries.
3. *Microsoft Windows®* is a registered trademark of Microsoft Corporation in the United States and/or other countries.
4. *Microsoft Word®* is a registered trademark of Microsoft Corporation in the United States and/or other countries.
5. "History of the Internet." *wikipedia.org*. Wikipedia. n.d. Web. 5 June 2007.
6. "Compuserve." *wikipedia.org*. Wikipedia. n.d. Web. 4 Apr. 2010.
7. *Windows 98®*, *Windows 2000®*, *Windows XP®* and *Windows NT®* are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Lesson 21
Bacterial Smears and Cultures

Step 1 Learning Objectives for Lesson 21

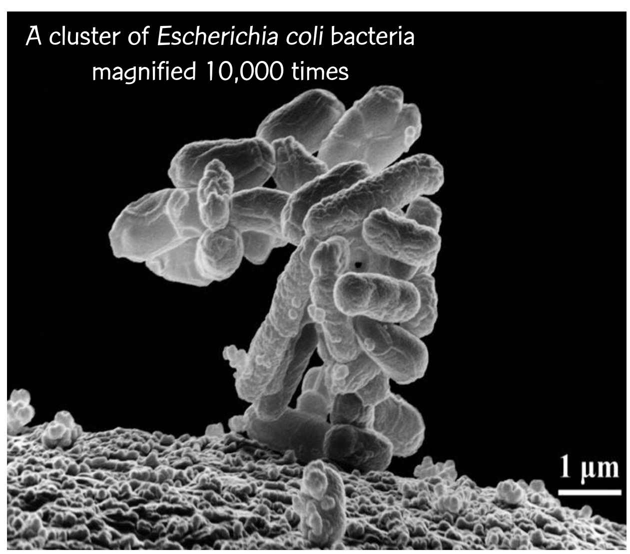
❑ When you have completed the instruction in this lesson, you will be trained to do the following:

- Explain the purpose of bacterial smears.
- Specify the procedure to examine bacterial smears.
- Describe how to prepare a Gram stain.
- Categorize diseases caused by Gram-positive and Gram-negative bacteria.
- Reconstruct the steps to obtain a throat culture and streak the agar plate.
- Describe growth media for cultures.
- Properly label specimens for analysis.
- Illustrate how to prepare a bacteriological smear.

Step 2 Lesson Preview

❑ For the majority of the history of life on Earth, microorganisms were the only living beings. Single-celled microorganisms developed approximately three to four billion years ago and remained the planet's sole inhabitants for three billion years. Bacteria, algae and fungi found in 220 million-year-old amber verifies that microorganisms have not changed much since the Triassic period—200 to 250 million years ago![1]

A cluster of *Escherichia coli* bacteria magnified 10,000 times



Bacteria are the most widespread group of microorganisms on Earth. Anywhere there is liquid water, there are bacteria. Besides the obvious locales of food and your gastrointestinal tract, it can live in sea water, the North and South poles, in geysers, deserts and rocks, and possibly even in outer space.

Bacteria cover *all* surfaces of our planet that are not sterilized! That includes the kitchen counter, your bath soap, car keys and your eyelashes. The number of bacteria in the world is estimated to be around five million trillion trillion.[2]

Since Anton van Leeuwenhoek's discovery of microorganisms in 1676, humans have been fascinated by these seemingly invisible life forms. Many scientists such as Louis Pasteur and Robert Koch took a keen interest in the microscopic world of bacteria. Louis Pasteur proved that bacteria traveled via dust to new locations. Robert Koch linked *Bacillus anthracis* to anthrax disease in cattle. From there, doctors and scientists examined ways to eliminate the pathogenic microorganisms. This led to significant decreases in death rates caused by bacterial infection, improving the quality of life for nearly all people!

As a medical assistant, you'll be given the opportunity to carry on this fine medical and scientific tradition. In this lesson, you'll learn how to prepare bacteriological smears and cultures. Medical assistants collect specimens, transport samples and prepare microscopic slides for viewing.

But what exactly is a bacteriological smear? Let's find out!

Step 3 Bacteriological Smears

- **Bacteriology** is the study of **bacteria**, microorganisms too small to see, that live in and on the body. All healthy individuals have a normal amount of bacteria called *flora*. Normal **flora** is bacteria that causes no harm to the person. **Bacteriological smears** are samples of material containing bacteria that are spread on a surface, such as a slide, in order to be examined. These help medical staff identify **pathogenic bacteria** that can cause infection and disease. Magnification and identification of these pathogenic microorganisms aid in diagnosis and treatment of many illnesses. The medical assistant plays a major role in this very important procedure.[3]

Medical Assistant Roles and Responsibilities

Medical assistants aid in the collection and handling of specimens and cultures. **Cultures**, which we will discuss further later in this lesson, are body fluids that are tested for bacterial growth. Medical assistants are responsible for both clinical and administrative duties related to bacteriological smears.

Clinical Duties

Microorganisms must be properly collected and prepared in order for bacteriological tests to be accurate. If you're careful to collect and process samples correctly, you'll be sure to get precise test results. This helps the doctor provide the appropriate diagnosis and treatment. You will collect the specimen and then place it in a container that holds a *culture medium*. **Culture mediums** are nutrient-rich substances that allow the bacteria to grow. A popular culture medium is **agar**, which is made from seaweed.

Once the sample has been collected, you will be responsible for performing the next appropriate task. Some samples may need to be prepared for viewing with a microscope. Often, *sensitivity tests* are performed. **Sensitivity tests** indicate which antibiotics will work most effectively against the growing bacteria. Throughout all of these procedures you must maintain a safe and clean environment so samples aren't contaminated and the pathogen isn't spread to other staff or patients.

Administrative Duties

Accurate sampling and testing documentation is an absolute must to prevent errors and mishaps! Properly identify patients and label all specimens. The label should include information such as the patient's name, the date, the time and the physician's name. If you are going to ship the sample to an outside laboratory for testing, you will package, label and transport the sample. Properly filling out the appropriate paperwork is very important.

CLIA has determined which tests can be performed in a **physician's office laboratory**, or **POL**. Now tests that once had to be shipped to an outside laboratory can be performed on-site. This allows the doctor to arrive at a diagnosis much faster and with less cost. The most common microbiological tests performed in a POL are for urine catalase, rapid strep A and *Helicobacter pylori*.[4]

You will also be responsible for safely operating the equipment needed to perform bacteriological smears. Let's learn more about that now.

Equipment

After specimens are obtained, the cultures grow in specific environments for at least 12 hours. Certain instruments and equipment are needed to provide the proper growing conditions. The equipment used to process bacterial smears are the autoclave, *safety hood,* microscope, *incubator, inoculation equipment,* an *incinerator* and a refrigerator.

Autoclave

As you've learned in previous lessons, the autoclave is a very important piece of equipment. Proper sterilization of used equipment lessens the risk of spreading infection and disease. In only twenty minutes, contaminated tools and materials can be sterilized and used again. Though some offices have moved to using disposable tools that do not require sterilization, most offices still utilize the autoclave for at least some of their sterilization needs.[5]

A laboratory autoclave

Safety Hood

Though not as common in a POL, many laboratories have a safety hood. **Safety hoods** are ventilators that suck out air and fumes created when samples with *aerosols* are being processed. **Aerosols** are tiny particles suspended in gas that can be released when culturing, causing harm. Tuberculosis is an aerosol. It can travel from person to person through the air, spreading infection along the way. Hoods are also used when handling particularly smelly samples. The ventilation system can reduce the odors and make the process more pleasant.

A laboratory safety hood

Microscope

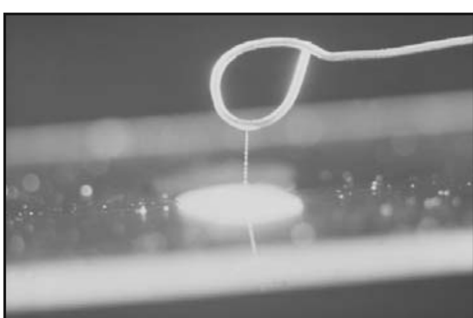
Microscopes enable you to see microorganisms that are invisible to the naked eye. They are used to examine prepared slides of patient samples. Each instrument is finely crafted and must be used properly. Follow directions for use and maintenance very carefully. Refer back to Lesson 8 for more information on microscopes.

An incubator used to cultivate microorganisms

Incubator

Incubators are devices that hold a constant temperature. This provides the correct environment for bacterial growth. The most common temperature used to incubate bacteria is between 35 and 37 degrees Celsius.

Inoculating Equipment



An inoculating loop

Inoculating is the act of transferring a specimen to a plate, such as a Petri dish, that contains a culture medium, such as agar. This is done in order to "plant" the bacteria into the medium. The nutrient-rich agar encourages the bacteria to grow. Tools used to perform this procedure are called **inoculating equipment**. Common inoculating tools are the *inoculating loop* and the *inoculating needle*. The **inoculating loop** is a piece of wire with a handle on one end and a little loop on the other. The loop is used to gather a sample for culturing. The **inoculating needle** is used to perform a *stab culture*. A **stab culture** uses the needle to stab the sample deeper into the culture medium.[6]

Incinerator

An **incinerator** is a device that uses heat to sterilize contaminated tools. An **electric incinerator** is one popular method of heat sterilization. **Bunsen burners** may also be used but present a hazard because of the open flame. Be sure to use extreme care and follow standard fire safety precautions.

Refrigerator

Culture media, such as agar, and certain test kits must remain at a low temperature. Refrigerators can keep and hold the items at temperatures between 2 and 8 degrees Celsius. These refrigerators should be utilized for medical storage purposes only and should never contain any consumable food or drinks.[7]

Proper use of all of the above equipment is an absolute priority. If the equipment is used incorrectly, test results may not be accurate. The equipment needs to be properly maintained. As a medical assistant, you'll be responsible for ensuring that the necessary equipment is ready and that the procedure is performed correctly.

Safety

Working with bacteriological smears and cultures requires following standard safety precautions. Contaminated body fluids pose a health risk to yourself and others. All specimens need to be considered pathogenic and handled with the proper care.

Use PPE, especially lab coats, gloves and safety goggles, when processing bacteriological smears and cultures to limit your exposure to specimens and reduce the risk of contamination. Remove them and dispose of properly before leaving the work area. Never eat or drink when working with samples and wash your hands often.

Other safety issues must also be considered. When dealing with samples received from outside the practice, make sure to note any errors in processing and shipping. The samples should be well labeled and contained securely. Also, the work area and all equipment should be kept clean and orderly. Areas should be disinfected before and after every procedure.

Like all other waste, immediately throw away any disposable items in the proper receptacle after you have completed a procedure.

Quality Control

Have you noticed that every aspect of working in a physician's office requires knowledge, dedication and skill? Dealing with contaminated samples is no exception. In fact, it requires even more concern for accuracy and safety. These samples can diagnose fatal diseases early so they can be treated. Properly handled and tested, bacteriological smears and cultures can save someone's life. When handled incorrectly, the specimens can prove harmful to the patient and others.

Many of the items you will use to perform these important procedures are delicate. Follow directions closely and note any deviation from the rules and regulations. Regular maintenance and daily checks of equipment will keep everything running smoothly. Check that all refrigerator temperatures are within the correct range and throw away any outdated items.

As you have learned, medical assistants are responsible for many of the aspects of a bacteriological smear or culture. From actually obtaining a specimen to maintaining a safe environment, you will perform a variety of tasks necessary to produce accurate results and ensure a healthy office.

Please pause to complete online Practice Exercise 21-1.

Step 4 Obtaining Specimens

- When the physician suspects a microorganism as the cause of a patient's ailment, she will order a culture test. Her ability to identify, diagnose and treat infections is determined by several factors, including the following:

  - Adequate specimen quantity
  - Proper specimen transportation
  - Speedy delivery to laboratory
  - Proper labeling of specimen container
  - Proper inoculation and incubation

  You may be the person with the greatest influence over these factors. Remember, you will obtain the specimen for the bacteriological smear and, if the tests will be done at an outside laboratory, you will also package the sample for off-site transport.

  Your medical office will have guidelines and procedures that you should follow closely, but here are some things to keep in mind:

  - Test results can be directly affected by the quality of the collected sample.
  - Test results can be directly affected by the quantity of the collected sample.
  - Many cultures are collected with a sterile swab and need to be kept moist until testing. These swabs are placed in a liquid-filled container to preserve the integrity of the specimen.
  - All patient samples must be labeled in detail to avoid confusion during laboratory testing.

  The most common bacteriological smears that doctors request are throat cultures, wound cultures, blood cultures and urine cultures.[8]

Throat Cultures

Obtaining a throat culture can be quite uncomfortable for a patient. A sore throat is tender and painful. You'll learn the steps to obtain a throat culture in the next lesson.

Rapid strep tests can identify Group A *Streptococcus*, the leading cause of sore throats. If left untreated, this microorganism can lead to other ailments, such as rheumatic fever. You'll learn more about these in the next lesson.

Wound Cultures

Many wound cultures require an *anaerobic* environment to thrive. **Anaerobic** refers to a lack of oxygen. *Pasteurella multocida*, common in animal bites, can't grow in an atmosphere of oxygen. Offices use devices to maintain the correct conditions for these special circumstances. Because many wound cultures do require anaerobic environments and **aerobic**, with oxygen, environments, prepare two cultures for the two different tests. You must swab the wound deeply to obtain a truly representative sample of the infected area.

The gas pack anaerobic system

Blood Cultures

You know all about blood collection from Lesson 18. A bacterial culture requires the use of sterile techniques at all times. It is very important that an outside source does not contaminate the blood. Clean the patient's skin with alcohol before cleaning again with iodine. After letting the site air-dry, collect the sample and transport to the laboratory immediately.

Urine Cultures

The two most common methods of obtaining a urine sample is either catheterization or the clean-catch midstream method. The patient obtains a clean-catch midstream specimen by urinating into a sterile container. Instruct the patient to clean the genitals before collection in order to provide an uncontaminated specimen for culturing. You'll learn more specifics about obtaining urine cultures in Lesson 22.

Step 5 Preparing the Culture

- ❑ After the specimen is collected, there are different methods of bacteriological tests that can be performed. Cultures require that the specimen be transplanted into culture media, such as agar. As discussed earlier, this inoculation procedure allows the bacteria to grow in a nutrient-rich environment. Gelatin-like agar is contained in a Petri dish. The specimen is then applied to the agar. Swabs are rolled across the surface of the agar while inoculating loops are used to transfer liquid specimens. The loop is moved across the plate in a sweeping motion, covering much of the surface area.

After the culture is inoculated, the specimen, held in the agar in the Petri dish, is incubated for 24 to 48 hours. The colonies of bacteria that grow are then examined. Different patterns and appearances indicate different forms of bacteria. Characteristics of bacteria that should be examined include the following:

- Shape
- Size
- Color
- Odor

If only a single form of bacteria is present, then the culture is considered **pure**. **Mixed cultures** consist of many different forms of bacteria. These mixed cultures are usually separated by bacteria type, creating many single pure cultures. This makes identifying specific micro-organisms much easier.[9]

Sensitivity Testing

As you learned earlier, a sensitivity test determines how well certain antibiotics will work as a treatment for the infection. The **Kirby Bauer method**, also called **diffusion**, plants an antibiotic in the Petri dish with the specimen. The antibiotic's effectiveness is determined by how much, if at all, the bacteria continue to grow. An automated procedure, called **dilution**, allows doctors to calculate the absolute lowest dose of antibiotic needed to inhibit bacterial growth.

Step 6 Preparing a Smear

- [ ] A bacteriological smear differs from a culture. Preparing a bacteriological smear requires that the specimen be transferred to a slide and then studied under a microscope. A *dry smear* is a common procedure that medical assistants often perform. The **dry smear** procedure requires that the specimen be properly transferred to the slide, fixed in place and ready for the next procedure, *staining*. Using a microscope, the doctor can study the effects of the **stain**, or dye, on the bacteria. The doctor then uses this information to identify the types of bacteria present.

Let's take a closer look!

Steps to Take 21-1—Prepare a Dry Smear for Staining

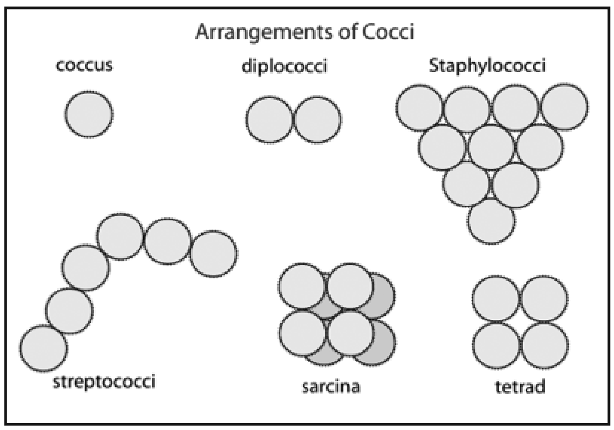
1. Turn to Steps to Take 21-1 in your Procedure Guide.
2. Read the Steps to Take to prepare a dry smear for staining.
3. Review this method until you can explain it without reading the steps.

Gram Stains

Dr. Hans Christian Gram invented the *Gram stain procedure* in 1884. The **Gram stain procedure** is categorized as a **differential stain** because the procedure uses two different stains to help identify microorganisms. The first dye can turn the bacteria purple while the second dye can turn it pink. The bacteria type is indicated by how the specimen reacts to the stains. Bacteria with a low lipid content are considered **Gram-positive** because they are stained and hold the first color, purple. Bacteria with high lipid levels are colored by the second stain, turning pink, and are considered **Gram-negative**.[10]

Gram-positive and Gram-negative Bacteria

Now that you know how bacteria are determined to be Gram-positive or Gram-negative, let's take a look at the bacteria itself. Gram-positive bacteria include *Streptococcus* and *Staphylococcus*. Gram-negative bacteria include *Escherichia* and *Neisseria gonorrhoeae*, the microorganism that causes gonorrhea.



Arrangements of cocci

As a medical assistant, you'll assist the doctor by obtaining specimens, preparing cultures and preparing dry smears for staining.

Please pause to complete online Practice Exercise 21-2.

Step 7 Lesson Summary

- As you've learned in this lesson, medical assistants are very important in the collection and preparation of bacteriological smears and cultures. Proper methods of collection, labeling, transportation, lab preparation and safety all fall under the scope of the medical assistant's responsibilities. The ability of a physician to identify, diagnose and treat infections depends greatly on the quality of work performed by the medical assistant. The health and safety of both staff and patients relies upon the medical assistant's dedication to following proper procedures and guidelines. In the next lesson, we'll stay in the laboratory to learn how to test body fluid specimens.

Please pause to complete an online Quiz.

Endnotes

1. "Microorganism." *Wikipedia.org*. Wikipedia. n.d. Web. 7 June 2007.
2. "Microorganism." *Wikipedia.org*. Wikipedia. n.d. Web. 7 June 2007.
3. Hunt, Sue A. and Zonderman, Jon H. *Fundamentals of Medical Assisting*. Philadelphia: Saunders, 2002. Print. 640.
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6. Lindh. *Comprehensive Medical Assisting*. 1135.
7. Lindh. *Comprehensive Medical Assisting*. 1136.
8. Lindh. *Comprehensive Medical Assisting*. 1138.
9. Lindh. *Comprehensive Medical Assisting*. 651.
10. Lindh. *Comprehensive Medical Assisting*. 1141.

Just For Fun

Context is the meaning a term has in a given sentence. Con/ means "with, together" and /text means "woven." The meaning of a word changes depending on what other words and sentences go along with it.

Which of the terms below would be used to fill in the blank?

cerebral cortex nephroptosis Renanolone

The right kidney was displaced by the mass. In the presence of ____________, evaluation of the renal pelvis is limited.

If you guessed nephroptosis, you would be right. In the context of these sentences, something related to the kidney is a good choice. The cerebral cortex is part of the brain and not the same as the renal cortex. Renanolone looks like it might be related to the kidney (ren/o), but Renanolone is an anesthetic, and the context doesn't give you any clues as to whether an anesthetic is meant.

The best intended dictation is often undone by context errors. And, if you're lucky, they can be funny. The following statements were found on patients' charts at major hospitals.

The skin was moist and dry.

The patient was in his usual state of good health until his airplane ran out of gas and crashed.

She is numb from her toes down.

Exam of genitalia was negative except for the right foot.

When she fainted, her eyes rolled around the room.

On the second day the knee was better and on the third day it had completely disappeared.

Discharge status: Alive but without permission.

The patient refused an autopsy.

Occasional, constant, infrequent headaches.

Rectal exam revealed a normal size thyroid.

Patient has two teenaged children, but no other abnormalities.

The pelvic examination will be done later on the floor.

Patient was alert and unresponsive.

Patient has left his white blood cells at another hospital.

Skin: Somewhat pale but present.

Lesson 22
Body Fluid Specimens

Step 1 Learning Objectives for Lesson 22

- When you have completed the instruction in this lesson, you will be trained to do the following:
  - Instruct a patient on the various methods of urine, sputum and stool collection.
  - Explain how to perform a pregnancy test.
  - Describe the steps to obtain a strep culture and how to take a sputum sample.
  - Reconstruct the procedure to perform a routine urinalysis.
  - Explain how to obtain the specific gravity of urine using the urinometer.
  - Specify the features of reagent strips used for chemical urinalysis.
  - Summarize the reason for proper storage of urine specimens until analysis can be performed.
  - Specify the process of collecting specimens for drug and/or alcohol analysis.
  - Explain how to perform a urine test using Multistix.
  - Reconstruct the steps to obtain urine sediment for microscopic examination.
  - Describe how to perform a Hemoccult® SENSA® test.

Step 2 Lesson Preview

- The MA transfers the sample to a test tube. The tube is placed in the centrifuge. When the centrifuge is balanced, the medical assistant spins the sample at 1500 rotations per minute. The soft whir of the machine is deceptive. The machine applies 400 gs of force to the sample, separating liquid from sediment! Next, the MA carefully transfers the sediment to a slide. Under the powerful gaze of the microscope, the secrets of the sample are revealed.

In this lesson, we'll discuss the diagnostic importance of body fluids. We'll begin with a common but surprisingly useful body fluid—urine. First, we'll review the function of a healthy urinary tract and briefly discuss the things that can go wrong in the tract. Then we'll look at the composition of urine and see how medical professionals examine urine to learn about the health of their patients.

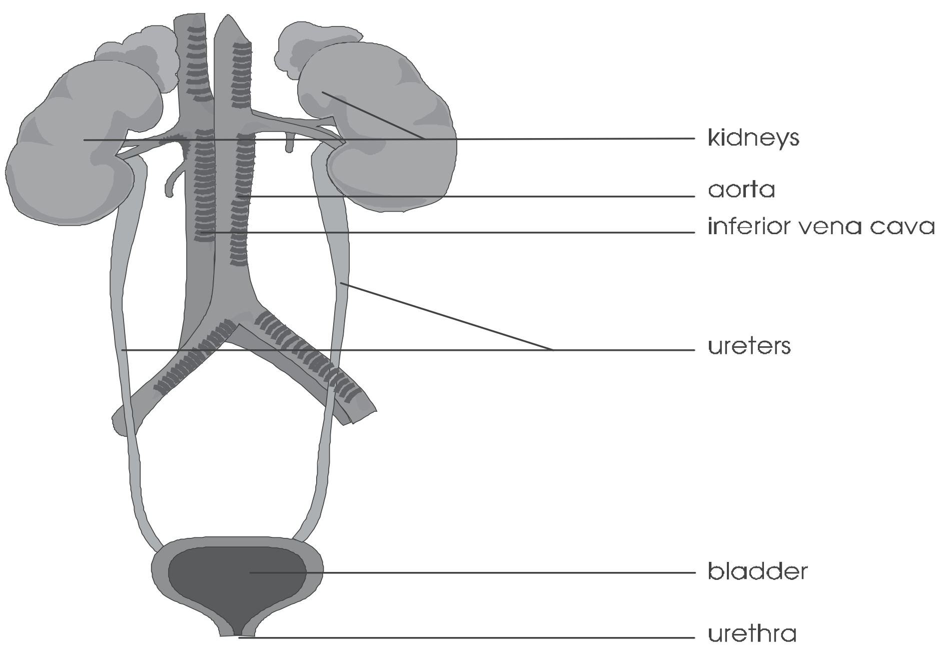
We'll discuss all three kinds of urine testing, including physical, chemical and microscopic testing, describing the role of the medical assistant for each. Along the way, you will take Virtual Labs that help put the information into action.

Then we'll look at other kinds of fluid specimens, starting with the fluids that result when you cough. Finally, we'll discuss occult blood testing. When you finish this lesson, you'll understand the importance of fluid testing and the medical assistant's role in obtaining specimens that physicians test.

The centrifuge is used to prepare the sample.

Step 3 Urinary Tract Health

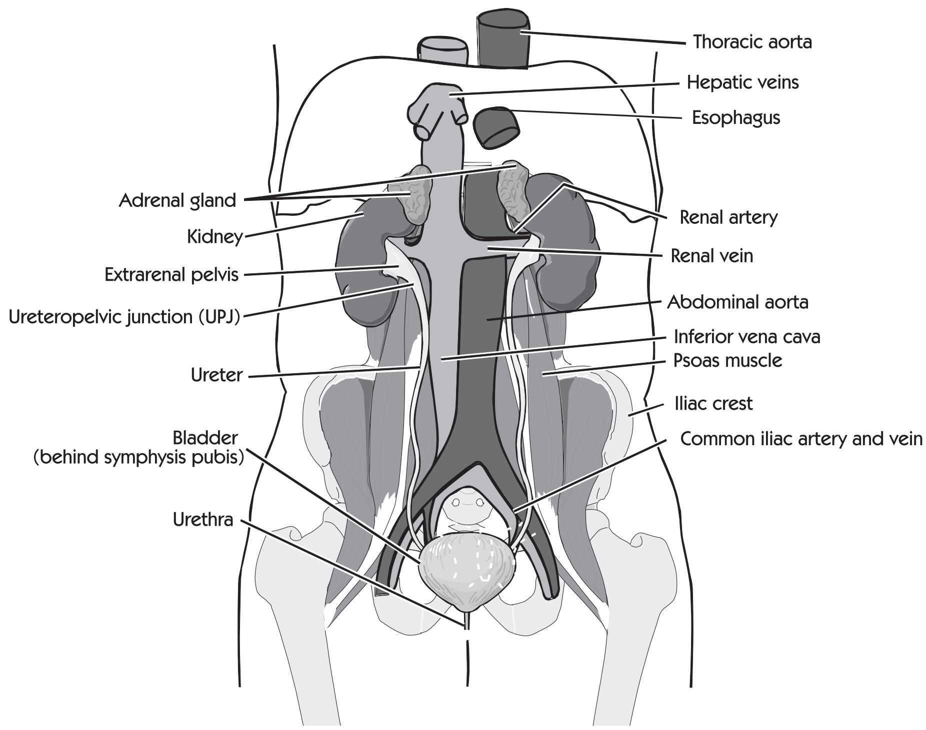
- ❑ The urinary system is comprised of the kidneys, ureters and the bladder. Healthy kidneys form **urine**, a liquid solution of waste products that need to be removed from the body. The kidneys also control the body's water balance, as well as maintain the body's acid-base balance.



Gross anatomy of the urinary system

The kidneys are retroperitoneal, bean-shaped organs, located anterior to the large psoas muscles of the back, lateral to the aorta and inferior vena cava. Almost a quarter of the body's oxygen supply flows through the kidneys, entering through renal arteries and exiting through the renal veins. During the process, blood is deoxygenated and toxins and some nutrients are filtered out. Normal adult kidneys can filter more than a thousand milliliters of blood per minute. The **nephron** is the body's filtration unit. Nephrons are small—each kidney contains more than a million of them!

Nephrons have two major parts. The **renal corpuscle** is the filter. It consists of a cup-shaped structure called the **Bowman's capsule** that is filled with a clump of tiny capillaries that filter the blood. The Bowman's capsule captures the filtrate and passes it into the **renal tubule**—a tube that passes the filtrate on. In the renal tubule, some filtered nutrients are reabsorbed for the body's use. The unabsorbed filtrate becomes urine.



Gross anatomy of the kidney

Urine is passed from the kidneys to the urinary bladder through long tubes called ureters.

The bladder is an elastic muscular sac that collects the urine, expanding as it fills up. Excretion of the urine is accomplished by the contraction of the bladder coupled with the relaxing of the **sphincters**, small ring-shaped muscle openings. An internal sphincter allows urine into the bladder. An external sphincter, which is controlled voluntarily, allows the urine to pass into the urethra.

In this segment, we'll talk about the things that can go wrong in the urinary tract. A trained medical assistant will often take an active part in urinary tract testing. In addition, the MA will educate and instruct the patient on the tests and how the patient needs to prepare for them.

Symptoms of Urinary Disorders

When the urinary system isn't working correctly, there will be indications. The urine may look "wrong," or the act of urinating may be difficult or painful. Let's look at some of the common symptoms that signal a urinary problem:

- **Dysuria** is the experience of pain or difficulty in the act of urinating.
- **Proteinuria** is the presence of protein in the urine.
- **Hematuria** is the presence of blood in the urine.
- **Pyuria** is the presence of pus in the urine.
- **Nocturia** is too much urination at night.
- **Oliguria** is an abnormally small production of urine.
- **Urinary malaise** means a general urinary discomfort.

In addition, patients may also experience problems with the **frequency**—the number of times a patient has to urinate—or **urgency**—the intensity of the need to urinate.

The most common urinary disorder is a *urinary tract infection (UTI).* A UTI can cause most of the symptoms listed above. A **urinary tract infection** can result from a fungus or a virus, but the predominant cause is bacteria. The urinary bladder is a common target of this kind of infection. A UTI can result from an infection passed on by the blood or the UTI can enter the urinary tract through the urethra. This kind of infection is called an **ascending infection**.

Patient Communication

When trying to identify the symptoms the patient is experiencing, the medical assistant can ask a series of open-ended questions that allow the patient to speak candidly about her discomfort. Some of the questions you might ask are as follows:

- Have you noticed any problems with voiding?
- Do you have any pain or burning with urination?
- Do you notice a pink or reddish color?
- Do you empty your bladder completely?
- Do you lose urine when sneezing or coughing?
- Do you experience uncontrolled stopping or starting of urinary streams?
- Do you get up during the night to urinate?

Step 4 Taking a Urine Sample

- In addition to providing information about what's going on in the patient's urinary tract, urine can provide information on a wide range of body functions. In the next segment, we'll discuss the various methods of urine sample collecting. But first, let's take a closer look at this body fluid.

What Is Urine?

Urine is 95 percent water. The rest is composed of organic and inorganic molecules. Organic materials include waste products, including the byproducts of protein metabolism and nitrogen-bearing waste such as ammonia. Other organic materials include uric acid and creatinine, a byproduct of muscle metabolism.

Inorganic components of urine are **ions**—charged particles that are eliminated from the body during excretion. These ions, including sodium and chloride, are important for electrolyte balance. Hydrogen ions help maintain the body's pH balance. Urine also contains hormones, enzymes and the metabolisms of any drug that the patient may be taking.

Urine is a sterile liquid until it reaches the urethra, where it comes into contact with bacteria and cells from the genital area.

Why is urine so important to medical professionals? Because the analysis of urine can detect diseases that go unnoticed because their symptoms aren't obvious. And, urinalysis is one of the most cost-effective procedures a medical professional can perform. Urinalysis begins with the sample. Let's take a look at how samples are collected.

Obtaining a Urine Sample

Urine can be obtained in several different ways. The physician will request a certain collection method, depending on the test to be performed. You will need to be familiar with all of the collection methods so you can match the collection procedure to the patient's needs.

Urine Containers

There are three common kinds of containers for urine specimens. These include **sterile cups**, **non-sterile cups** and **urine bottles**. The bottles are larger, meant for 24-hour collection and may already contain preservatives like boric acid or hydrochloric acid.

These containers must be labeled properly to ensure quality testing. Many medical facilities have a barcode system in place to confirm the patient's identity. Whether using a computer code or a hand-written label, you must list the patient's name, date and time of collection (some tests are time-sensitive) and initial the sample.

A urine sample starts with a urine cup.

Random Urine Specimens

A random urine specimen is used for a number of tests, including routine screening and pregnancy verification. The patient is given a specimen cup and instructed to fill it with 50-100 ml of urine. If the patient is unable to do so, encourage her to drink water and try again after the examination. Random samples are not recommended when the patient is suspected of having a UTI.

Clean-catch Urine Specimens

The **clean-catch midstream specimen** is the preferred method of most medical professionals. The specimen is collected from the middle of a urine stream, giving a sample that is as pure as possible. This method is indicated for most urine tests, including routine testing, chemical testing and microscopic testing. Since this is the preferred method, learn the steps to take to collect a clean-catch specimen.

Steps to Take 22-1—Collect a Clean-catch Urine Specimen

1. Turn to Steps to Take 22-1 in your Procedure Guide.
2. Read the Steps to Take to collect a clean-catch urine specimen.
3. Review this procedure until you can explain it without reading the steps.

First Morning Specimen

Pregnancy tests are more effective when the urine specimen is concentrated. For that reason, the physician will often request a **first morning specimen**, which is the first urination after awakening. If the patient isn't in the hospital or clinic overnight, then the patient will have to collect the sample at home. Because many tests are time sensitive, the morning sample should be delivered to the doctor within four hours after it's taken. Prior to being delivered, it should be refrigerated.

24-hour Urine Specimen

Some tests require 24-hours worth of urine from a patient. A preservative may be added to the collection bottle. The type and amount of preservative should be noted on the bottle label. In addition, female patients may be given a special toilet insert to help collect the urine.

The patient should avoid alcohol, vitamins and OTC drugs for 24 hours before collecting a 24-hour urine sample. The bottle itself should be kept in the refrigerator over the course of the sample collection. The patient should begin the test *after* the first morning void, collecting all urine until the following morning. The last sample collected should be the first morning specimen of the following day. Collecting the sample in this way avoids having two first morning specimens in the same 24-hour sample.

Catheter Specimen

Another way of getting a pure specimen of urine, uncontaminated by the bacteria present in the genital area, is to use a catheter. **Catheterization** is the insertion of a sterile tube into the urinary bladder. Let's look at the steps to take to perform a catheterization on female and male patients.

Steps to Take 22-2—Perform a Catheterization on a Female Patient

1. Turn to Steps to Take 22-2 in your Procedure Guide.
2. Read the Steps to Take to catheterize a female patient for urine collection.
3. Review this procedure until you can explain it without reading the steps.

Steps to Take 22-3—Perform a Catheterization on a Male Patient

1. Turn to Steps to Take 22-3 in your Procedure Guide.
2. Read the Steps to Take to catheterize a male patient for urine collection.
3. Review this procedure until you can explain it without reading the steps.

Urine Samples and Infants

Infant children can't provide a urine sample on command. In this special case, the doctor may provide a urine-catching device that is applied inside the diaper to collect a specimen. The diaper holds the device in place. Later, the bag can be removed and transferred to a conventional sample container.

Drug Screening

Drug screening adds another dimension to collecting urine samples. The added dimension is called the **chain of custody**—every person who is responsible for the sample is documented to assure that the results of the test can't be disputed. For example, in the case of traffic accidents, the urine sample may end up as evidence in court.

This kind of urine test may be observed. The patient will wear only a gown and the toilet where the sample is provided has colored water to prevent intentional dilution from distorting the test. The person receiving the sample is the first to initial the custody record. The sample is covered with a seal and initialed to prevent tampering. Anyone who handles the specimen must initial the record and inspect the seal.

Some companies use drug testing for employment screening purposes. The general principle of checking the patient and documenting each step of the process confirms that results are fair and irrefutable.

So far, we've discussed the healthy urinary tract and the symptoms that may indicate disorders. We've looked at how medical assistants collect samples of urine for testing. Next, we'll look at how those samples are analyzed.

Please pause to complete online Practice Exercise 22-1.

Step 5 Physical Urine Analysis

- [ ] Urine is used for a number of tests. Urine can be analyzed three ways, including physical analysis, chemical analysis and microscopic analysis. A clinical medical assistant is likely to be responsible for both the physical and chemical analysis. Microscopic analysis requires special training and is often performed either by the physician or by a lab. In the next few segments, we will discuss all three types of analysis.

Physical analysis provides data without the use of chemical analysis. Just as red blood cells are analyzed by shape, size and color, urine also has characteristics that can offer clues to the patient's health. Urine samples are tested for three specific physical properties. These properties include *color*, *clarity* and *specific gravity*. Let's take a moment to see how the physical attributes of urine samples are categorized.

Urine Color

Urine can be classified by color. The normal color of urine intensifies as the urine becomes more concentrated. There are four general color classifications:

- Colorless
- Straw
- Yellow
- Amber

Other colors may indicate problems. See the chart below.

Urine Color	Possible Condition
Red/Pink	Hematuria
Green	Bile in the blood
Brown	Melanoma
Orange	Hepatitis

Urine Clarity

Normal, healthy urine is clear. There are four general clarity classifications:

- Clear
- Hazy
- Cloudy
- Turbid (very cloudy)

Cloudiness in a fresh urine sample can be caused by the presence of blood cells, bacteria, yeast, mucus, sperm or skin cells. Be aware that urine samples that have been standing or have been refrigerated will become cloudy.

A urine sample is taken and evaluated for color, odor, pH, specific gravity, dissolved substances and formed or solid elements.

Specific Gravity of Urine

Specific gravity (**SG**) reveals the concentration of particles dissolved in the urine. SG is measured in relation to distilled water, which has a SG of 1000. Normal urine has an SG between 1.005 and 1.030.

The higher the concentration of urine, the higher the urinometer will float.

One way of measuring specific gravity is to use a **urinometer**—a narrow glass tube that floats in a container of urine. Although this test is rarely used now, it provides a good explanation of specific gravity.

The tube has been calibrated to room temperature distilled water, which contains no dissolved particles, to read 1.000 at the *meniscus*. The **meniscus** is the bottom of the curve formed when a liquid is poured into a narrow container. The urinometer displays measurement markings indicating where 1.000 is. When the urinometer is then placed in a container of urine, it will float higher because urine contains dissolved particles that make it more concentrated (or thicker) than distilled water. The markings will indicate a number higher than 1.000—between 1.005 and 1.030 if the urine is normal. Highly concentrated urine makes the instrument float higher in the water. This method requires a lot of urine, however, so many doctors use a *refractometer*.

A **refractometer** is an instrument that measures the refraction of light in a solution. The angle of light changes as it passes through the liquid. The bigger the angle, the higher the specific gravity. This method uses only one or two drops of urine. And unlike the urinometer, temperature differences don't affect the results of a refraction test.

Steps to Take 22-4—Obtain the Specific Gravity of Urine Using a Refractometer

1. Turn to Steps to Take 22-4 in your Procedure Guide.
2. Read the Steps to Take to measure SG using a refractometer.
3. Review this procedure until you can explain it without reading the steps.

Specific gravity varies with the amount of liquid a patient consumes. If the patient is drinking less water, the urine will be more concentrated. A high specific gravity might also indicate liver disease, adrenal problems, diabetes mellitus and heart problems. Low specific gravity can mean an increased intake of liquid. It can also mean chronic renal insufficiency, diabetes insipidus and malignant hypertension. To know more, the patient's urine should be subjected to chemical analysis.

Step 6 Chemical Analysis of Urine

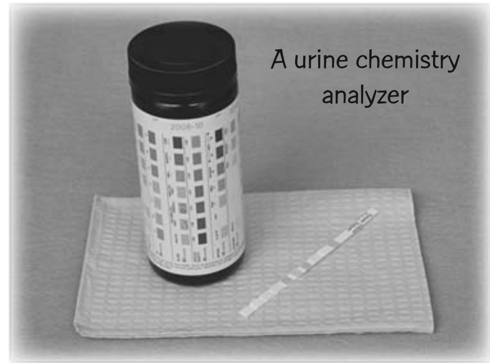
- The chemical analysis of urine is accomplished by testing a sample with **reagent strips**—strips treated with chemicals that react with the urine. Reagent strips—commonly known as **dipsticks**—help tell how much of a certain chemical agent is present in the urine. Because dipsticks measure quantities of certain agents, they are considered **quantitative tests**. By contrast, the analysis of color and clarity are **qualitative tests**, since they note the physical qualities of urine.

As mentioned in the lesson preview, a clinical MA will often be responsible for performing chemical analysis of a patient's urine sample. This can be accomplished in an efficient, cost-effective fashion thanks to multiple-test dipsticks. These special dipsticks—called **Multistix**—carry up to 10 individual test agents on a single strip. Dipsticks can be read manually or they can be put into an automated analyzer. Chemical analysis of urine is a cost effective way of getting a lot of information about what's going on inside a patient. Let's take a look at some of the tests that a Multistix contains, what the tests indicate (as well as the factors that might give false test results!)

Blood Test

One reagent strip test looks for blood in the urine. Free hemoglobin has a chemical that speeds the oxidation of the test strip's chemical, causing a color change. If the color changes, the presence of blood is indicated. A positive result may be caused by trauma, a UTI or renal disease. The test results are subject to false indicators. For example, menstrual blood can give a false positive. By contrast, some drugs, including captopril, can hide the presence of blood. The results of this test can be supported and clarified by microscopic analysis, something we'll discuss later in the lesson.

Leukocyte Test



If white blood cells are present in the urine, it will cause that portion of the test strip to turn purple. The presence of white blood cells is most often caused by a UTI. Drugs like tetracycline can hide positive results, however. Again, microscopic analysis can verify the results of this chemical test.

Nitrite Test

The presence of nitrites (compounds that contain hydrogen) is indicated when that portion of the test strip turns pink. A positive result indicates the presence of bacteria associated with a UTI. This bacterium comes from the genital area. You may recall that this sort of UTI is called an ascending infection. A positive test is more likely to occur with women, due to the short urethra and the close proximity of the urinary and gastrointestinal surfaces in the female urinary system. This test can show a false positive if the urine sample isn't fresh or the sample container is contaminated.

Protein Test

A range of colors on the test strip indicates the presence or absence of protein in the urine. Yellow means negative. Green or blue mean positive. Protein in the urine might indicate renal disease. Small amounts of protein can also indicate a UTI or kidney stones. Contaminants like bleach can cause a false positive on this test, as can some drugs. A high salt content in the urine can hide a positive result.

Glucose Test

Another test measures the amount of glucose in the urine sample. A more intense color means more glucose. The most common condition associated with glucose in the urine is diabetes mellitus. The presence of ascorbic acid in the urine or an elevated specific gravity of urine can hide a positive result.

Ketones Test

Ketones are the byproducts of fatty acid metabolism. They occur when the patient has limited glucose. A pink or purple color on the ketones portion of the strip indicates an elevated amount of ketones. This occurs during severe diarrhea, vomiting or pregnancy. It also occurs during starvation. Dark-colored urine can give a false positive indication. Failing to test the urine immediately can hide a positive test since ketones dissipate quickly at room temperature.

Bilirubin Test

Bilirubin is a breakdown product of hemoglobin. If bilirubin is present, it will turn that portion of the test strip tan or purple. A positive test indicates liver diseases like hepatitis or sclerosis of the liver. Intensely-colored urine might result in a false positive to this test. As with the ketones test, the urine must be tested immediately, since sunlight decreases the levels of bilirubin. Excess nitrites or ascorbic acid can also hide a positive result.

Urobilinogen Test

Urobilinogen is the breakdown product of bilirubin. Normally, bacteria break down any bilirubin in feces and urine. If too much urobilinogen is present, the strip will turn pink or red, indicating hepatitis. Below normal levels of urobilinogen can indicate obstructive jaundice.

pH Test

The relative acidity or alkalinity of the urine is known as **pH**. The term pH stands for "parts hydrogen." Normal urine will test at 6.0—slightly acidic. This natural acidity helps control bacteria.

The test strip will react to the urine sample, resulting in one of the colors of the color spectrum. Results vary from acidic urine (the red end of the scale) to alkaline (the blue end of the scale). Urine with high acidity occurs in patients who eat a lot of meat. Alkalinity occurs in patients who eat a lot of fruits and vegetables. Very high alkalinity, however, may indicate bacterial growth.

Specific Gravity Test

Some reagent strips include a specific gravity test. You may recall from earlier in the lesson that specific gravity measures the concentration of particles in the urine.

Other Chemical Tests

In addition to reagent strips, the physician can order additional tests, including *Clinitest, Acetest* and *Ictotest*. These are confirmatory tests to back up the results of the reagent strip tests.

Clinitest detects the presence of sugars other than glucose. You will recall that one of the reagent strip tests looks for glucose in urine. Clinitest looks for fructose, lactose and pentose. The test consists of dropping a tablet into urine. The color blue indicates a negative result. Colors from green to orange indicate the presence of sugars.

Because Clinitest tablets are susceptible to moisture, the medical assistant should check the expiration date and take care not to touch the contents of a new bottle.

Acetest confirms the presence of ketones. Ketones, you may recall, are produced by fatty acid metabolism where glucose is limited—starvation and diabetes mellitus, for example. To perform the test, a drop of urine is placed on the tablet. If the tablet doesn't change color, the test is negative—no ketones are present. If the tablet turns purple, the test is positive.

As with Clinitest, the tablet bottle should be checked for an expiration date. You should date and initial bottles when they are first opened. Acetest tablets cannot be stored in sunlight or they will become ineffective.

Ictotest confirms the presence of bilirubin in urine. Color change indicates that bilirubin is present. A blue or purple color means positive. Tan, pink or red means a negative. The test is performed by putting ten drops of urine on a test pad and then placing a tablet on the wet spot. As with Acetest, the Ictotest bottle can't be stored in sunlight. The bottle must be kept dry as well.

Physical and chemical analysis yields a great deal of information about the patient. But urine can also be analyzed under the microscope. In the next segment, we'll explore how the microscope can tell us even more about a patient and the patient's urine.

Step 7 Urine under the Microscope

- [ ] A microscopic analysis might be a routine part of a urinalysis. Or, the microscopic analysis may be ordered as a follow-up to abnormal results in a chemical urine analysis. In either case, a fresh urine sample yields the best results. If immediate testing isn't possible, the urine should be refrigerated and protected from light. This will maintain the sample's usefulness for up to eight hours.

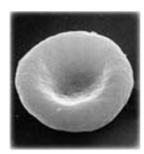
To examine the sediments in urine, a sample of not less than 12 ml is put in a centrifuge at 1500 RPM for five minutes. The centrifuge must be balanced by placing a tube of the same design and weight in the opposite side of the machine. This allows the machine to spin smoothly. After five minutes, the liquid portion of the sample is poured off. A drop of the remaining sediment is put on a slide using a pipette. The slide cannot be allowed to sit at room temperature. Bacteria grow and cellular material decomposes and the slide will become useless.

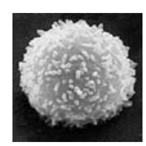
A doctor with a certificate of PPM procedures must conduct this kind of analysis. Or, a laboratory may conduct the test. Though you won't be qualified to do the analysis without additional training, you are often responsible for preparing the slide.

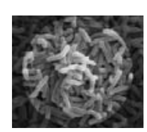
The sediment components may be normal or abnormal. When the doctor or lab technician views the slide, both *organized* and *unorganized* components are noted. All components are noted and counted. The physician can count each component by viewing the sediment in an **HPF** (high-powered microscope field) and counting individual components.

The **organized** components of urine sediment are:

- **Red blood cells**—It's normal to have from 0-3 red blood cells per HPF. More than that might indicate trauma, renal disease or a female patient during menstruation.
- **White blood cells**—More than .3 white blood cells per HPF might indicate a UTI.
- **Epithelial cells**—Too many epithelial cells may indicate kidney disease.
- **Bacteria**—These may look round, rod-shaped or have no shape at all. Doctors use the notations 1+, 2+ and 3+ to indicate that a few, moderate or many bacteria are present.

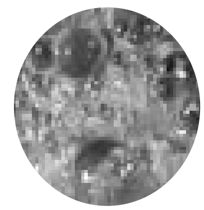

Red blood cell


White blood cell


Bacteria

- **Yeast—**The presence of large numbers of yeast cells may indicate a yeast infection. Because of the similar appearance of red blood cells and yeast, doctors may add a drop of acetic acid to the specimen, which will destroy the blood cells without harming the yeast cells.
- **Parasites—**Parasites are differentiated from other cells because they move around more. Some common parasites have flagella.

In addition to the other organized sediment types, the slide may show **casts**—cylindrical deposits that may indicate kidney disease (though the hyaline cast can be caused by fever, stress or heavy exercise). Some casts are made of protein. Other casts are made up of blood—both red and white blood cells can clump together into casts.



Blood cell casts can indicate injuries or scarring of the kidney due to infection.

Unorganized components include crystals and various chemical components without any regular shape. These aren't always significant, though in a few cases, some crystals can signal certain diseases.

The physician or lab that reports the results of a microscopic analysis of urine will document the time, date and the name of the person who performed the analysis. Results are then transferred to the patient's chart.

Now, let's review all of the material we've learned about urinalysis with a Virtual Lab!

Virtual Lab 22-1 Perform Routine Urinalysis

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 22-1 Perform Routine Urinalysis. This will bring up the instructional video on performing a urinalysis.
3. Follow along with Virtual Lab 22-1 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the Virtual Lab.
4. Review this procedure and watch the Virtual Lab until you can explain it without reading the steps or watching the lab.

Step 8 Pregnancy Testing

- There's still one special urine test that we haven't yet discussed—pregnancy testing. Believe it or not, pregnancy can be detected as early as five days after conception!

Pregnancy testing is based on detecting **human chorionic gonadotropin** (**hCG**)—a hormone secreted in the placenta. There are two testing methods that use urine to detect a pregnancy. A positive test doesn't always mean a pregnancy. The presence of hCG can also mean cancer of the lung, breast, colon or pancreas, as well as other conditions of the uterus.

Pregnancy testing requires the usual precautionary procedures, including checking the testing kits for an expiration date and a careful reading of instructions. The urine specimen cup used must be sterile. A disposable cup is preferred, since detergent residue can give false results. First morning urine specimens are preferred, since the initial morning void carries the highest concentration of hCG. If a refrigerated specimen is used for the test, the MA should allow both the urine and the kit to come to room temperature before proceeding with the test.

The **slide** test—also known as the *agglutination inhibition test*—involves putting the **antiserum** (an antibody that reacts with hCG) on the slide with the urine that may or may not contain hCG. If hCG is present, it reacts with the antiserum, forming a complex. Next, an **antigen** reagent containing latex beads coated with hCG is added to the slide. If hCG was initially present, the antiserum will have already been compounded. If **agglutination**—"clumping" that signals the forming of antibodies—does not occur, then the patient is pregnant.

The **enzyme immunoassay** (**EIA**) is more complex than the slide test. The test involves an antigen, an antibody to the antigen and a second antibody. Put as simply as possible, urine is dropped onto a membrane containing a reagent. As the sample moves across the membrane, it reacts with the reagent, changing color. The right color reaction indicates a pregnancy.

Let's look at another Virtual Lab.

Virtual Lab 22-2 Perform Pregnancy Test

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 22-2 Perform Pregnancy Test. This will bring up the instructional video about testing urine for hCG.
3. Follow along with Virtual Lab 22-2 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the Virtual Lab.
4. Review this procedure and watch the Virtual Lab until you can explain it without reading the steps or watching the lab.

As you can see, a wealth of information—from diagnostics to pregnancy detection—can be obtained from the different tests that can be performed on a urine sample. But urine is not the only body fluid that can be tested. In the next segment, we'll discuss other body fluid procedures.

Please pause to complete online Practice Exercise 22-2.

Step 9 Sputum Samples

- **Sputum** is a combination of saliva, phlegm, mucus and other materials that results when a patient coughs. That liquid can be tested to diagnose diseases of the lungs and lower respiratory tract, including pneumonia, tuberculosis and other infections.

  There are three methods for obtaining a sputum sample, including *expectoration, suctioning* and *bronchoscopy*. Whichever method is used, remember that sputum includes contagions. When collecting specimens, wear personal protective equipment (PPE).

  Expectoration means coughing up sputum. Expectoration is a relatively comfortable way to get a sputum sample, so when patients are able, this is the preferred method. The patient is instructed to drink plenty of liquids the night before the test and to avoid mouthwash or brushing teeth the morning of the test. In addition, the sample should be obtained before the patient eats. The patient should spit the sample directly into the laboratory cup.

The MA is now prepared to take a sputum sample.

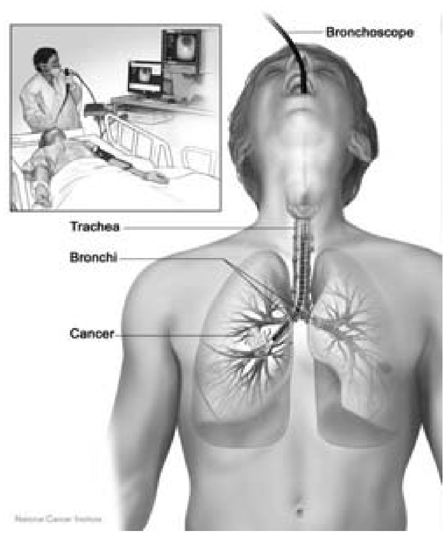
  If the suction method is used, the medical assistant will pass a sterile catheter through the patient's nose into the trachea. The machine then sucks sputum directly from the trachea. If the patient has a heart condition, this method should not be used.

  Bronchoscopy involves placing an instrument into the patient's throat and bronchus and removing sputum either with a bronchial brush or by secreting the sputum directly onto the instrument's tubing. A tissue sample is often collected at the same time. This procedure requires the use of anesthesia, so the patient must fast for at least six hours before the samples can be obtained.

  Sputum samples are sent to a laboratory to determine which bacterium is causing the patient's condition. The physician may also request a test for tuberculosis.

Strep Testing

Some respiratory infections can be diagnosed without elaborate collection equipment or laboratory analysis. Strep testing can be done in the physician's office, using a **rapid strep test**—the application of antibodies and antigens to a test swab. The patient's tonsils are swabbed and the sample is tested with a series of three reagents inside a test tube. When collecting the strep swab, the MA should take two samples—if the rapid test shows negative, the second swab can be sent to the laboratory for further analysis.



A bronchoscope

Let's take a look at another Virtual Lab to see how this sample is collected.

Virtual Lab 22-3 Obtain a Strep Culture

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 22-3 Obtain a Strep Culture. This will bring up the instructional videio about obtaining a strep culture.
3. Follow along with Virtual Lab 22-3 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the Virtual Lab.
4. Review this procedure and watch the Virtual Lab until you can explain the procedure without reading the steps or watching the lab.

As with any of the procedures listed in this lesson, it is critical that you use proper handling, labeling and documentation. Strep is very contagious!

Step 10 Blood Occult Testing

- ❑ Another source of information about the patient is fecal matter. A stool sample can help detect lesions in the gastrointestinal system. **Occult blood testing** is the attempt to find blood in the patient's stool.

The patient is given supplies that will help collect stool samples from three different bowel movements. If the patient does not have a regular daily bowel movement, the collection process may take several days.

When the samples are returned to the lab, the physician will test them with a developing solution. If the results are positive, the physician may order further tests to determine the source of the blood. In Lesson 29, you will learn about Sigmoidoscopy, a test that looks for actual lesions.

Let's take a look at another Virtual Lab.

Virtual Lab 22-4 Perform a Hemoccult® SENSA® Test

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 22-4 Perform a Hemoccult® SENSA® Test. This will bring up the instructional video about testing the stool for blood.
3. Follow along with Virtual Lab 22-4 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the Virtual Lab.
4. Review this procedure and watch the Virtual Lab until you can explain it without reading the steps or watching the lab.

The medical assistant's role in this test involves patient education. In general, patients without a regular bowel movement should not take laxatives, unless specified by the physician. In addition, the patient should follow these guidelines for 48 hours before beginning the collection of fecal samples:

- Avoid red meat, processed meat and liver. These products release hemoglobin and can give a false positive on the test.
- Avoid turnips, broccoli, melons and cauliflower. These foods can also result in a false positive.
- Avoid aspirin, vitamin C and iron supplements for *one week* before the test begins. These substances can cause gastric bleeding which can be mistaken as a lesion.
- Eat plenty of fiber. Fiber promotes bowel movements.
- Female patients should not begin the test until three days after menses.
- Patients should not begin tests if they suffer from hemorrhoids.
- Patients should drink plenty of fluids before and during the test.
- Sample slides should be kept at room temperature, out of the sunlight.

You've almost finished the lesson! Take a moment to review what you've learned in this lesson.

Please pause to complete online Practice Exercise 22-3.

Step 11 Lesson Summary

- [ ] In this lesson, we looked at the analysis of body fluids for the purpose of diagnosing illness. One cost-effective and diagnostic-efficient fluid is urine—the waste product of the body's urinary tract.

Urine can be analyzed physically, noting the color, clarity and specific gravity. Urine can also be analyzed chemically, using reagent test strips called dipsticks. Some dipsticks have multiple tests on a single strip. These Multistix can do up to ten different tests at once. Finally, urine can be analyzed microscopically.

Urine testing is also used to identify drug use, since the byproducts of metabolized drugs are expelled through the urinary tract. Urine is also used for pregnancy testing, since higher levels of hCG that occur during pregnancy can be found in urine.

Other body fluids are used for diagnostic purposes as well. Sputum—the combination of saliva, phlegm and mucus that result when a patient coughs—can be used to test the health of the respiratory system. Sputum can be collected by expectoration, suctioning or bronchoscopy. Strep testing can be done with a tonsil swab, using fast strep tests that are analyzed in the physician's office.

Occult blood testing looks for blood in the patient's stool. A fecal sample is tested with a reagent that turns color if blood is present.

In the next lesson, you will learn about patient therapies.

Lesson 23
Patient Therapies

Step 1 Learning Objectives for Lesson 23

- When you have completed the instruction in this lesson, you will be trained to do the following:
  - Define physical therapy and terms related to physical therapy.
  - Explain the role of the medical assistant in patient therapies.
  - Construct the steps that a physician or physical therapist will follow to assess the patient.
  - Describe the most common conditions that may be helped by physical therapy.
  - Categorize physical therapy modalities, how they are applied and the conditions that they are prescribed for.

Step 2 Lesson Preview

- John Benedict, a landscape designer in Dallas, Texas, woke one morning feeling miserable. He had a fever, headache, chills and joint pain. Assuming he had come down with the flu, he decided to stay in bed, and slept for the rest of the day. His girlfriend came by to see him that evening, and found John in a near-coma. She rushed him to the hospital, where the emergency department (ED) doctor diagnosed him with the most serious form of West Nile Virus—West Nile meningitis. Ten days passed as John slipped in and out of consciousness and his body fought off the virus.

John had a long and painful recovery ahead of him. The virus had attacked his nervous system, and he had lost a lot of his large muscle motor functions. He could no longer run, his back was in constant pain and his left abdominal muscles quit functioning. As the months passed, John didn't improve. He was always tired and in tremendous pain.

Rest and medicine can only go so far. Sometimes, the patient needs physical therapy to fully recover from an illness or injury.

John found a West Nile Virus support group online that helped him understand why he wasn't recovering. Barbara, the support group founder, suggested John call Dr. Stephen Bisetti, a local chiropractor who specialized in back pain. John began an intensive physical therapy program with Dr. Bisetti—first he received electrical stimulation therapy to stimulate the injured muscles. He then began exercising on a special weight machine that targets the back muscles. Although John will never completely regain his former muscle strength, the physical therapy has allowed him to run again and to lie flat on his back without pain. John says he no longer feels tired all the time so he has been able to return to work part-time.

John's story demonstrates that physical therapy can make a huge difference in a patient's recovery from illness or injury. And you, as a medical assistant, are part of the physical therapy equation. In this lesson, you'll learn how you can assist other professionals in providing physical therapy. You'll also explore the many types of physical therapy and when each is used. Let's begin the lesson by learning some basic terminology.

Step 3 What is Physical Therapy?

❑ **Physical therapy** is a type of patient therapy that focuses on helping patients recover physical strength, movement and function after an injury or illness. This branch of medicine, called **physical medicine**, or **physiatry**, uses physical devices to diagnose, treat, manage and prevent physical disabilities. When you are working with a patient to restore physical functions, it is often called **rehabilitation**. The specialists you will work with are **physiatrists** or **physical therapists**.

A physical therapist (PT) must have completed a four-year baccalaureate training program in physical therapy and be licensed by the state where he practices.

Occupational therapy is another specialty that seeks to restore a patient's ability to live independently and to perform **activities of daily living**, or **ADL**. You may work with an **occupational therapist** if you choose to work in a hospital or assisted living facility.

Another branch of physical therapy is **sports medicine**, the specialty of preventing or treating injuries caused by athletic competition. You can probably imagine several sports, such as football and boxing, that need **sports medicine specialists**!

In addition to these specialties, **speech therapy** is considered a physical therapy field. Many times after a traumatic injury or a stroke, patients lose some or all of their ability to speak. Often speech can be fully or partially restored through work with a **speech therapist**.

Step 4 The Medical Assistant's Role in Physical Therapy

- If you work in a large hospital or nursing home, you may be part of an interdisciplinary team of professionals—doctors, nurses, physical, occupational and speech therapists and other medical assistants—who provide therapy to patients. Or, you may work for an orthopedist, who specializes in musculoskeletal disorders. In either case, you will be able to work hands on with the patient.

You can assist a physical therapist by teaching patients basic exercises that they can perform at home.

Of course, the physician will prescribe any medications that the patient may need, but you may administer the medication. You can also assist a physical or occupational therapist by preparing the patient for a therapy session, teaching basic exercises, applying heat and cold therapies and demonstrating how to use mobility devices such as arm slings, canes, crutches, walkers and wheelchairs.

In other general or family medicine practices, you may be responsible for writing referrals for your patients to obtain specialized therapy from a PT, OT or orthopedist.

Imagine waking up one morning to find that you can't use your hands. How would you make breakfast, brush your teeth or put on clothes? Could you even open your bedroom door? This might make you feel frustrated or angry that you can no longer perform the simplest tasks. What other feelings might surface? Helplessness, vulnerability, discouragement and depression are other common feelings for patients with a physical impairment. To work effectively with patients who need physical therapy, it's helpful to understand what the patient is going through.

Perhaps the best way you can help patients during rehabilitation is by empathizing with their negative feelings. Don't minimize the patient's difficulties, but give him encouragement to keep trying. Try to understand the patient's frustration when he can't perform at his best. Show patience and compassion as he struggles to overcome obstacles and gain strength. And lastly, always treat the patient with respect. Help him to rebuild his self-confidence so he'll be mentally able to face the challenges ahead. Your attitude and perception of the patient can have a surprisingly large impact on how his recovery progresses.

Let's move on now to the actual process of beginning physical therapy. To begin a physical therapy program, the physician or physical therapist will assess the patient's condition so she can prescribe the most effective treatment.

Step 5 Assessing the Physical Therapy Patient

❑ Before developing a treatment program for a patient, the physical therapist will determine the patient's *fitness level.* The patient's **fitness level** can be measured in any of the following ways:

- *cardiomuscular strength*
- *electromyography (EMG)*
- *flexibility* (or *range of motion*)
- *gait*
- *muscle strength*
- *posture*

You'll explore each of these diagnostic tests in the sections below.

The American Heart Association recommends ECG treadmill testing as the first choice for patients with medium risk of coronary heart disease.[1]

Cardiomuscular Strength

Cardiomuscular strength indicates how hard the heart muscle can work. There are many ways to test the heart muscle, including the cardiac stress test, an ECG diagnostic, through physical examination and with radiography.

Electromyography (EMG)

Electromyography (EMG) uses a diagnostic machine called an **electromyograph** to test the amount of electrical activity that a muscle can produce in response to nerve or electrical stimuli. Often, the patient is sedated for this test. An electrode is inserted into the muscle and an electrical current stimulates the muscle. The electrical activity of the muscle is then recorded on an **electromyogram.**

An electromyogram

Flexibility or Range of Motion

As you probably recall from your anatomy lessons, the skeletal and muscular systems work together to support the body and to allow movement. We measure this ability to move by measuring a joint's **flexibility** or **range of motion** (**ROM**), which is the distance that a joint can move. Imagine you're in a yoga class, and the instructor tells everyone to reach to the floor and touch their toes. Can you just barely touch your toes with the tips of your fingers or can you put both palms on the floor? It all depends on how flexible the joints are that provide this movement—the joints' range of motion.

Your flexibility can improve with stretching exercises, but age, gender and genetics play a role in how flexible you can become.

ROM is measured in degrees with a *goniometer*. A **goniometer** is a hinged instrument with a movable pointer that measures a joint's range of motion in degrees.

Goniometer

You may be asked to assist with **goniometry**, or measurement using a goniometer. You will have the patient move specified joints as instructed by the PT while you hold the goniometer at the hinge of the joint. Then, by moving the pointer on the dial, you will match the two arms of the goniometer to the bones on either side of the joint. You'll then read the degrees of joint movement on the goniometer's dial.

The goniometer can measure many different types of joint movement, as outlined in the following table.

Table 23-1: Joint Movement Measured By Goniometry

Movement Term	Description	Example
Abduction	moving away from the midline of the body	 Abduction, shoulder and hip
Adduction	moving toward the midline of the body	 Adduction

Table 23-1: Joint Movement Measured By Goniometry

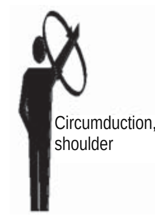
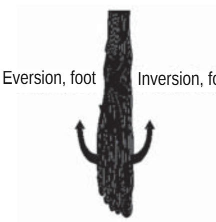
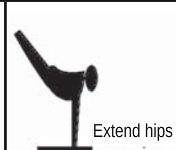
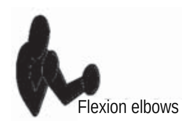
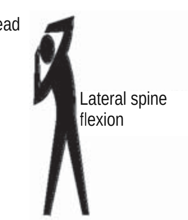
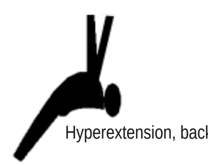
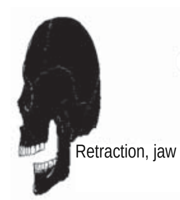
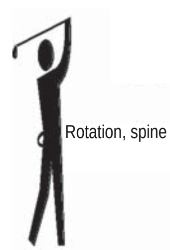
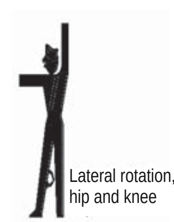
Movement Term	Description	Example
Circumduction	circular movement	
Dorsiflexion	moving the foot upward from the ankle joint	
Eversion	outward movement of a body part	
Extension	straightening a body part	  
Flexion	bending a body part	  
Hyperextension	extending a body part beyond its limits	
Inversion	moving a body part inward	

Table 23-1: Joint Movement Measured By Goniometry

Movement Term	Description	Example
Plantar flexion	moving the foot downward from the ankle joint	
Pronation	moving the arm to a palm down position	
Protraction	closing a hinge joint	
Retraction	opening a hinge joint	
Rotation	rotating a body part around its axis	 
Supination	moving the arm to a palm up position	

It will be helpful for you to know these terms if you work in the rehabilitation field so you can discuss patients' conditions with other healthcare professionals.

Gait

A patient's **gait** is his movement while walking. Did you know that walking has two phases? One leg is on the floor, supporting the body. This is the **stance**. The other leg is coming off the floor, swinging by the stationary leg, and moving back down to the floor. This is the **swing**. Walk around right now and see if you can identify each phase of your gait. Both phases are occurring at the same time, on opposite legs.

To assess the patient's gait, the doctor or PT will ask the patient to walk away from her, turn, then walk back towards her. She will evaluate the patient's balance, coordination, direction of feet and knees and length of stride.

A patient's gait can be restored after a spinal cord injury with exercises such as this treadmill training regimen.

Muscular Strength

Muscular strength means how hard a muscle can work—how much weight it can move and how long it can maintain that weight. This is tested by asking the patient to resist pressure that the MA or physical therapist applies to each muscle. Strength is rated on a zero to five scale as follows:

Table 23-2: Measurement of Muscle Strength

Rating	Muscle Response	Diagnosis
0	none	paralysis
1	slight contraction	severe weakness
2	passive ROM when resistance is removed	moderate weakness
3 or 4	active ROM against gravity or light resistance	mild weakness
5	active ROM against heavy resistance	normal strength

Posture

You've probably been told to "sit up straight" by your mother enough times to know what posture is. However, Mom wasn't quite right about being "straight." The spine actually has three natural curves—at the top of the spine in the cervical area, the thoracic region and the lumbar region. For you to have good posture the three curves of the spine are present and your body forms a straight line through the ears, shoulders, hips, knees and ankles. In this position, your body is balanced and your breathing and circulation are at their most efficient.

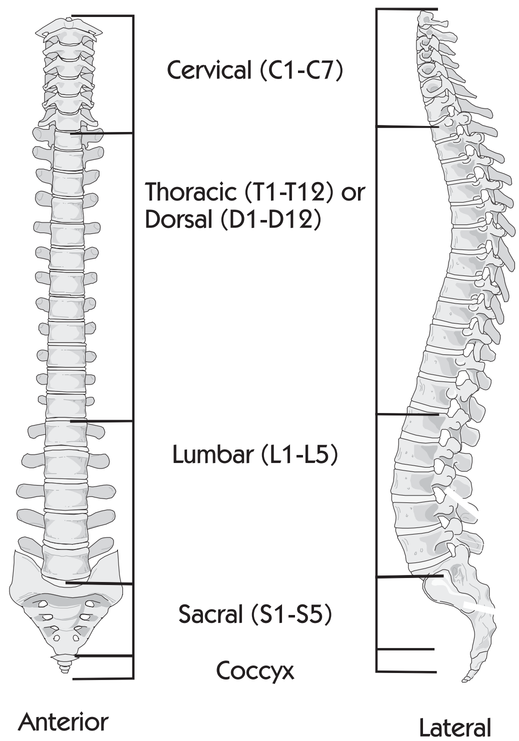


Figure 23-1: Anterior and lateral vertebral column

To assess a patient's posture, the physician or physical therapist will examine the patient's spine from the front, back and sides. She will also have the patient bend forward and examine his back to check that the spine is straight. She'll also check the alignment of the hips, knees and shoulders.

Now that you know what the physical therapist uses to assess the patient, let's look at the conditions she may find.

Step 6 Conditions Requiring Physical Therapy

- ❑ There are many conditions that can be improved by physical therapy, including rehabilitation after a serious illness or accident. In addition to these, some conditions are genetic or are the result of a birth defect. We'll review several of these conditions.

Bone and Tendon Disorders

Luxation is dislocation of a joint. The end of a bone has been completely displaced from its position in the joint. This can be caused by illness, trauma or a congenital malformation. **Subluxation** is a similar condition; however, the bone has been partially displaced. After the bone has been replaced in the joint, patient therapies include devices to immobilize the joint and exercises to strengthen the surrounding muscle.

Osteoporosis is a condition in which the bones become porous due to a deficiency of calcium and phosphorus. This makes the bones brittle and easy to break. Osteoporosis often occurs in postmenopausal women when the lack of the hormone estrogen inhibits absorption of calcium. It can also be caused by a dietary deficiency, inactivity, alcoholism and other chronic diseases. In addition to medical treatment, doctors often recommend exercises to strengthen the patient's muscles. This will help support the bone structure and hopefully, prevent fractures.

Tendonitis is inflammation of the tendons, which connect the muscle to a bone. Tendonitis is usually caused by some kind of injury, such as a sprain, strain or overuse of a muscle. It can also be caused by calcium deposits. In addition to medical treatment, there are many physical therapies to assist in healing, including heat and cold treatments, ultrasound and massage.

You can prevent osteoporosis by exercising more, especially walking, taking supplements like calcium and vitamin D and building your muscles to help prevent falls.

Paralysis

Paralysis involves one or more groups of muscles that have lost all function. Paralysis can be mild to severe, and can be the result of disease, trauma or a congenital defect. Following are several common conditions that involve paralysis.

Cerebral palsy is a neuromuscular disorder resulting from damage to the central nervous system before, during or just after birth. Severity of the condition varies widely, but it can include mild to severe paralysis or motor dysfunction, developmental delays as the child grows, seizures, speech disorders and mental disabilities. Therapeutic treatment includes ROM exercises and mobility devices such as leg braces. In severe cases the patient must use a motorized wheelchair.

Hemiplegia is paralysis affecting one side of the body, while **hemiparesis** is muscle weakness on one side of the body. These conditions are caused by trauma to one side of the brain, a tumor or a cerebrovascular accident. The paralysis or muscle weakness occurs on the opposite side of the body from where the brain damage occurred.

Paraplegia is paralysis of the lower portion of the body. This can be caused by a spinal cord injury because of a serious fall, gunshot wound, motor vehicle accident or sports-related injury, as well as disease, such as tumors on the spinal cord. *Quadriplegia* is similar, but more severe. **Quadriplegia** involves paralysis of all four limbs, usually as the result of trauma to the fifth to seventh cervical vertebrae of the spine. **Monoplegia** is the term used when only one limb is affected by paralysis.

Patients with these conditions will use mobility devices suited to their condition. Many patients must spend their waking lives in a wheelchair. Others with milder forms of the condition may be able to walk with the assistance of mobility devices such as canes, crutches or walkers.

Incontinence is a problem for paraplegics and quadriplegics. In addition to a catheter, enemas or suppositories, patients may use **bowel stimulation therapy** to maintain regular bowel movements.

Other treatments helpful for patients with paralysis are daily physical exercises. A physical therapist who specializes in spinal cord damage will develop an exercise plan for each patient on an individual basis.

Spinal Disorders

There are other spinal disorders that don't involve paralysis.

Kyphosis is severe convex curvature of the thoracic portion of the spine. You may have heard this condition referred to as dowager's hump or hunchback.

Lordosis is an unusually deep anterior curve in the lumbar region of the spine. This is commonly known as swayback.

Scoliosis is a condition that involves sideways, or lateral, curvature of the spine.

Physical therapy for all of these conditions usually includes the patient wearing a **brace**, an assistive device made of hard plastic or metal and worn around the torso, to correct the shape of the spine. The physiatrist may also use muscle stimulation to train the patient's muscles to straighten the spine.

Scoliosis affects around seven million people in the United States.[2]

Please pause to complete online Practice Exercise 23-1.

Step 7 Types of Patient Therapy

- [ ] The physical therapist has assessed the patient and consulted with his doctor. She has developed a treatment plan to help the patient recover to the best of his ability. It's now time to put the treatment plan into action. In the remainder of this lesson, we'll look at **modalities**, or the physical agents such as heat, cold, electricity and water, that the PT may prescribe for patient therapies.

Heat Therapy

Heat therapy, or **thermotherapy**, refers to treating an injury or disease with the application of heat. When heat is applied to an area, it will cause the blood vessels to dilate (**vasodilation**).This increases the blood flow to the affected area and helps it to heal faster. However, this heat will also speed up the inflammatory process, causing swelling and more bleeding, so it's important to apply heat therapy only for the time prescribed by the doctor. Vasodilation also speeds up the delivery of nutrients to the area and removal of wastes.

General guidelines:

- Heat should be in the range of 95 to 115 degrees Fahrenheit. Temperatures over 115 degrees Fahrenheit can cause burns.
- Apply heat only for the length of time prescribed by the physician or PT.
- Instruct patients that heat therapy is still effective even if their body has become accustomed to the temperature.
- Areas of the body with thin skin and few nerves are more sensitive to heat than other areas.
- Be especially mindful of the temperature with infants, elderly patients and others who can't speak to let you know if the application is too hot.

Therapeutic effects:

- increase drainage from an infected area
- relax muscle spasms
- relax the muscles to prepare for ROM exercises
- relieve congestion, such as in the sinuses
- relieve pain in the muscles and joints
- speed up tissue repair

Cautions:

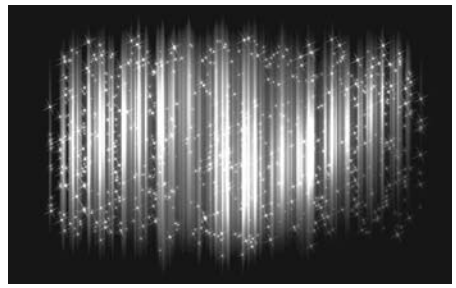
- Do not use heat therapy:
    - on acute inflammation—this will cause more inflammation
    - on noninflammatory edema—vasodilation will cause more tissue fluids to form
    - on an injury that occurred within 24 hours—this will increase bleeding
    - on areas affected by erythema or vesicles—it will worsen the condition
    - over metallic implants—have patients remove all jewelry and make sure they are not on a metal surface—the heat will build up in the metal and burn the patient
    - over the uterus of a pregnant or menstruating patient—this may cause contractions or bleeding

There are three main types of heat therapy. These are *diathermy, dry heat* and *moist heat*.

Diathermy

Diathermy is the application of high frequency electrical current to stimulate heat production in the body tissues. Physicians apply diathermy with microwaves, shortwave and ultrasound.

Microwaves



During **microwave therapy**, heat is generated by electromagnetic radiation. Microwaves should never be used on patients with pacemakers, in combination with wet dressings or near metal implants.

Shortwave

Shortwave therapy causes heat to develop deep in the body tissues with the application of radio waves. Shortwave therapy is effective in treating arthritis, bursitis, sinusitis and other conditions.

Ultrasound

You're probably familiar with the use of ultrasound to monitor fetal development. **Ultrasound** is also the most commonly used form of diathermy. It's used to heat muscle tissue by high frequency sound waves.

General guidelines:

- Ultrasound can't travel through air. You'll use a special gel on the skin so the applicator can transmit sound waves.
- Ultrasound travels best through water, so it works well on areas like the uterus and muscles.
- Areas without much water, such as bones, can't be treated by ultrasound.

Therapeutic effects:

- loosen ligaments and tendons
- relax muscle spasms
- relieve chronic pain
- relieve muscle strain and sprains
- stimulate circulation

Cautions:

- Always keep the applicator moving in a circular motion so tissues aren't damaged by a high level of sound waves.
- Do not use in bony areas of the body, such as knees, elbows or feet.

Dry Heat

Dry heat is the application of heat without moisture. It is most commonly used to relieve pain in the joints or muscles. You can apply dry heat using a *chemical hot pack, fluidized therapy*, heat lamp, heating pad or hot water bottle.

- **Chemical hot pack—**plastic pouches containing a gel that can remain hot for up to an hour. The heat in a chemical hot pack is activated when you break a seal inside the bag to allow the chemicals to mix. These are usually applied to small areas for 20 to 30 minutes. Disposable hot packs are used once, then thrown away. Reusable hot packs can be microwaved and used several times.
- **Fluidized therapy—**a high intensity heat modality consisting of a dry whirlpool of fine glass beads or other similar particles suspended in a heated air stream. The heated beads flow around the patient's hand or foot providing both heat and massage.[3]
- **Heat lamp—**a portable lamp with an ultraviolet or infrared bulb that is placed two to four feet away from the treatment area. Apply for 20 to 30 minutes.
- **Heating pad—**a plastic pouch containing heat coils and wrapped with fabric. Plug the pad into a nearby electrical outlet and set the temperature to low or medium—never hot.
- **Hot water bottle—**a plastic pouch that you fill with hot water, seal, wrap with a towel and place on the treatment area.

General guidelines:

- Dry heat doesn't penetrate the tissues as well as moist heat.
- Most dry heat therapies can be performed at home.

Therapeutic effects:

- assist in wound healing
- improve circulation
- relax muscles and muscle spasms
- relieve swelling

Cautions:

- Chemical hot packs:
  - Check reusable hot packs for leaks before each use, and remove immediately if a leak appears. If you observe spilled chemical on the patient's skin, immediately flush the area with water.
- Fluidized therapy:
  - Fluidized therapy shouldn't be used on areas of localized sensory loss or open wounds.

- Heat lamp:
  - Do not use this treatment on children, the elderly and others who can't communicate when the temperature is too high.
  - Do not use on areas with sensory loss.
  - Do not use over metal implants, as this could cause internal burns.
- Heating pad:
  - Never allow the patient to lie on top of a heating pad.
  - The patient should not fall asleep while using the pad.
- Hot water bottle:
  - Water should be less than 115 degrees F for children and the elderly and less than 125 degrees F for adults.
  - The bottle should be filled one-half to two-thirds full, then any air should be expelled before inserting the seal.

Moist Heat

Moist heat combines heat with liquid to penetrate the treatment area. You can apply moist heat with a *compress, hot pack, paraffin bath* or a *soak.*

Compress

A **compress** is gauze or other material that is soaked in hot water, squeezed of excess moisture and placed on the treatment area. Then cover the compress with plastic to help retain heat.

General guidelines:

- Soak the compress in water no hotter than 110 degrees F.
- You may place a hot water bottle over the compress to keep it hot or remove and resoak the compress frequently.
- The patient can apply compresses at home.

Therapeutic effects:

- aid in joint mobility
- improve circulation
- relax muscles
- used on small areas of infection, boils or cysts to draw out fluids and reduce swelling

Cautions:

- If you are placing the compress over an open wound, be sure to use sterile gauze, solution and instruments.

Hot Pack

A **hot pack** is a pouch containing heat-absorbing gel that is warmed in hot water. You'll then remove the hot pack from the water with tongs, wrap it in a towel and apply to the treatment area. Hot packs are generally used in the physician's office or clinic.

General guidelines:

- Hot packs are used for larger areas, such as the shoulders and back.

Therapeutic effects:

- aid in joint mobility
- improve circulation
- relax muscles

Cautions:

- Be sure to follow the physician's instructions on where to place the pack, the warming temperature and the length of time the treatment should be applied.

Paraffin Bath

A **paraffin bath** is a mixture of seven parts paraffin wax and one part liquid paraffin (mineral oil). This mixture is heated to the boiling point, then used in two ways. If the treatment area is small, such as a hand or foot, the patient can dip it into the paraffin to coat the area. For larger areas such as a knee, you will apply the paraffin directly to the skin. The outer coating of the paraffin dries to a hard shell, while the mixture on the skin retains heat for up to 30 minutes.

General guidelines:

- The boiling point for a paraffin bath is 127 °F.
- Treatment time is generally 30 minutes.
- The paraffin will be hardened, so you'll be able to peel it off to remove.

Therapeutic effects:

- aid in joint mobility
- improve circulation
- reduce muscle spasms
- relax muscles to prepare for ROM exercise
- relieve pain from chronic joint diseases, such as rheumatoid arthritis—the effects can last up to three to four hours.

Cautions:

- Paraffin baths must be ordered by a physician and are administered by a professional therapist.

Soak

A **soak** in warm water is a soothing moist heat treatment that can range from a full body bath to simply soaking an infected finger.

General guidelines:

- Add Epsom salts to warm water to soak infections. The Epsom salts will help to pull infected fluids from the tissue and reduce swelling.
- To treat a bad back, the PT may have the patient soak in a whirlpool bath in the PT clinic. In addition to the effects of warm water, the jet action of the whirlpool massages the treatment area.

Therapeutic effects:

- aid in joint mobility
- improve circulation
- relax muscles to prepare for ROM exercise

Cautions:

- A pregnant woman should never be placed in a hot bath—the heat could cause contractions.

Another type of therapy used is cold therapy.

Cold Therapy

Cold therapy, or **cryotherapy**, refers to treating an injury or disease with the application of cold. When cold treatments are applied to an area, it will cause the blood vessels to constrict (**vasoconstriction**). This decreases or stops blood flow to the affected area. It also slows the movement of all fluids and microorganisms in the area so pus formation and inflammation are decreased. The cold treatment also provides an **anesthetic effect** (pain relief) to the area.

When you administer a cold therapy, ask the patient how it feels. Check his skin color, feeling and pain frequently. Leave the treatment on the area for the prescribed time. If you observe numbness, pain or blue or pale skin notify the doctor immediately. After treatment, check for reduced inflammation, pain and redness.

General guidelines:

- Most cold therapies can be applied in the patient's home.
- Cold therapy is most effective when it is applied often—apply therapy for 20 minutes each hour for the first 48 hours after the injury.

Therapeutic effects:

- control or stop bleeding
- lower body temperature
- prevent swelling
- reduce inflammation and pus formation
- relieve pain

Cautions:

- Sensitivity to cold will vary with each patient. Always ask the patient if the treatment is too cold.
- Check on the patient regularly—do not leave him alone.

Cold therapy can be applied as *dry cold* or *moist cold*. Let's discuss each.

Dry Cold

Dry cold therapy is more effective than moist cold at controlling bleeding and on acute injuries. Dry cold therapy can be administered using *ice bags, ice collars* and *chemical ice packs*.

- **Ice bags—**thick, waterproof pouches that hold ice chips or small ice cubes. Fill the bag two-thirds with ice, then squeeze out excess air, close and cover with a towel. The ice bag can then be placed on the treatment area. Ice bags are useful for bruises, burns, sprains or strains.
- **Ice collars—**very similar to ice bags, however they are shaped to fit around the patient's neck or throat.
- **Chemical ice packs—**plastic pouches filled with a chemical that retains cold. Shake or squeeze the pack to activate the chemicals inside. Then cover it with a towel before applying. When cold, the pack remains flexible so it can be fitted to the treatment area. The pack will stay cold up to one hour. Some ice packs can be frozen and reused, others are disposable after one use. Be sure to check packs for leaks before using.

Moist Cold

Moist cold therapy penetrates the patient's tissues better than dry cold. It's used to reduce body temperature and relieve swelling, edema, pain and tenderness. Moist cold can be applied with a *cold compress* or *ice massage*.

- **Cold compress—**used for small treatment areas. Gauze or other material is soaked in cold water and ice, squeezed to remove excess moisture and applied directly to the treatment area. You will need to remove and resoak the compress approximately every three minutes to keep it cold. Therapy generally lasts for 20 minutes, and will eventually numb the affected area.
- **Ice massage—**uses the effectiveness of cold with massage to treat injured areas. Place an ice cube in a plastic bag and massage the treatment area.

Other Patient Therapies

There are a few other types of therapy that you should be familiar with as a medical assistant. We'll review each of these briefly.

Electrical Stimulation Therapy

Do you remember our friend, John, from the beginning of this lesson? You'll recall that he used **electrical stimulation therapy** to try to "wake up" his damaged muscles after contracting West Nile virus. The stimulation is provided by a regulated amount of low-voltage electrical current. This current is aimed at motor and sensory nerves to stimulate the muscles, and is often used to rejuvenate damaged or diseased muscle.

Exercise Therapy

A physician will prescribe **exercise therapy** to help patients regain body functions and movement, repair and improve muscle strength and resume their activities of daily living. In addition, exercise can prevent deformities, maintain neuromuscular coordination and stimulate circulation.

There are many types of exercise therapy. These include *isometric, mobility, range of motion* and *resistance exercises*.

Isometric Exercises

Right now, relax your left arm. Now, without moving or bending your arm, tense your left bicep quickly. Now relax again. This is an isometric exercise. **Isometric exercises** involve the patient alternately relaxing and contracting a muscle. This enables the muscle to stay toned without moving a damaged joint.

Mobility Exercises

Mobility exercises work to strengthen muscles and improve function by moving body parts. Depending on the amount of muscle damage, a patient can perform active, aided or passive mobility exercises.

- **Active mobility exercises—**the patient exercises unassisted on equipment such as a recumbent bike, treadmill or stair stepper.
- **Aided mobility exercises—**the patient exercises using partial assistance of an exercise machine, therapy pool or physical therapist.
- **Passive mobility exercises—**the patient exercises by having a machine or the physical therapist move the body part.

Range of Motion Exercises

Since you know quite a bit about range of motion already, you can probably picture this type of exercise. The patient slowly moves a joint through its entire range of motion. Depending on the amount of injury the patient has, these exercises can be performed with the assistance of another person or machine (passive) or by the patient alone (active). Any of the joint movements that you studied earlier in the lesson can be exercised using range of motion exercises.

Resistance Exercises

Resistance exercises use the patient's own muscles pushing against a form of resistance to exercise and strengthen the muscle. A physical therapist or special machines provide the resistance.

Massage Therapy

Massage therapy is one of the oldest known therapeutic treatments. **Massage** can include kneading, rolling, rubbing, stroking or tapping the body and can range from intense pressure to a very light touch. A trained massage therapist should always perform massage therapy. Massage therapy has been shown to improve muscle tone, increase circulation, relax muscles, relieve tension and remove waste products from injured tissue.

Passive Therapies

Passive therapies are those done TO the patient, rather than done BY the patient. These include *immobilization, manipulation* and *traction.*

Immobilization

As you can imagine, **immobilization** involves eliminating any movement of a joint, muscle or other body part to ensure proper healing. Casts, slings and splints are forms of immobilization.

Manipulation

Manipulation is performed by a physician. The doctor uses a rapid, thrusting motion to reposition, stabilize or stretch a joint.

Traction

Traction is a technique used to reposition the patient's body to facilitate healing. A device consisting of harnesses (to hold the patient's body), pulleys (to pull the body part into the correct position) and weights (to maintain the pulley position) hold the patient's body in a stationary position. Physicians prescribe traction for patients with back spasms, complex fractures, compressed vertebral joints, dislocated or stiffened joints, improper bone alignment, physical deformities or shortened muscles.

Water Therapy

Water therapy, or **hydrotherapy**, refers to the use of water as a therapeutic treatment. Water therapy can be provided using a bath, pool, *wet sheet pack*, a shower or a whirlpool.

- **Bath—**A therapeutic **contrast bath** is performed by repeatedly moving the injured body part from a cold bath to a hot bath. This technique has been shown to improve mobility, relax the muscles and joints and stimulate circulation.
- **Pool—**Patients with arthritis, burns or joint injury are helped by performing underwater exercises in a very warm swimming pool.
- **Wet sheet pack—**A **wet sheet pack** is performed by wetting a full length sheet in cold water. The patient is then rolled into the wet sheet, then covered by a dry blanket. A wet cloth also covers the patient's head. This therapy induces sweating and is said to help draw toxins out of the body.
- **Shower—**A shower spray can be directed toward any part of the body to massage and warm an injured area. This will relax muscles and joints and stimulate circulation in the area.
- **Whirlpool—**A whirlpool, or jetted tub, shoots pressurized water around the body to massage muscles and joints. This therapy can improve circulation and relax muscles.

Please pause to complete online Practice Exercise 23-2.

Step 8 Lesson Summary

- ❑ Patient therapy is an interesting field. You may not have realized how effective many simple home-care therapies can be at healing joints, muscles and nerves after an injury or illness.

You learned that the first step in beginning any physical therapy treatment is to assess the patient's fitness level. This is done by measuring cardiomuscular strength, flexibility, gait, muscle strength and posture. In addition, professionals use electromyography to test the amount of electrical activity that a muscle can produce in response to nerve or electrical stimuli.

Many conditions can be treated by physical therapy, including luxation (dislocation of a joint), osteoporosis (porous bones), tendonitis (inflammation of the tendons), paralysis and spinal disorders.

After the assessment, a physical therapist or physician will develop a therapy plan. This can include thermotherapy—diathermy, dry heat and moist heat; cryotherapy—dry and moist cold; hydrotherapy—water therapy; electrical stimulation; exercise—isometric, mobility, range of motion or resistance; or massage therapy. Patients with severe injuries may begin with passive therapy, where the PT performs the therapy on the patient.

Most of the therapies you learned in this lesson can be performed at home by the patient and his caregivers. It's possible you may be responsible for providing instructions to the patient on how to perform these therapies or you may assist a PT, OT or physician in actually performing the therapy. Either way, this is valuable information that will help you become a better medical assistant.

After another quiz, next up is your pharmacology lesson, where you'll explore how drugs have improved treatment options for many common diseases!

Please pause to complete an online Quiz.

Endnotes

1. "Exercise Stress Test." *Heart.org*. American Heart Association. n.d. Web. 25 Jan. 2010.
2. Good, Christopher, M.D. "The Genetic Basis of Adolescent Idiopathic Scoliosis." *Journal of the Spinal Research Foundation* (Spring 2009) Vol 4.1. Web. Jan. 2010.
3. "Clinical Policy Bulletin: Fluidized Therapy." *Aetna.com*. Aetna. 25 Aug. 2009. Web. 27 Jan. 2010.

Lesson 24
Pharmacology

Step 1 Learning Objectives for Lesson 24

- When you have completed the instruction in this lesson, you will be trained to do the following:
  - Define pharmacology and terms related to pharmacology.
  - Explain the objective of drug therapy.
  - Differentiate among the various classes of drugs.
  - Explain how to use a *Physician's Desk Reference* to research both nonprescription and prescription medications.
  - Discard drugs using proper procedures.
  - Discuss the considerations of drug actions and interactions in the body.
  - Describe drug actions in terms of receptors and site of action.
  - Explain the five sources of drugs.
  - Describe the factors that affect *human variability* in drug response.
  - Identify patient risk factors for negative drug interaction.
  - Differentiate between *side effects* and *adverse effects*.
  - Explain the four ways multiple drugs can interact with each other.
  - Summarize the types of drugs and their therapeutic use on the following body systems:
    - Musculoskeletal
    - Central nervous
    - Cardiovascular
    - Respiratory
    - Endocrine
    - Gastrointestinal
    - Urinary
    - Reproductive
    - Immune
    - Integumentary

Step 2 Lesson Preview

- Since before written history, humans used herbs to cure medical complaints. By trial and error, they discovered that some plants were good to eat, some were poisonous and others could help in the treatment of ailments. The Sumerians documented the medicinal properties of laurel, caraway and thyme more than 5,000 years ago. These early medicines were used for magic, music and psychotherapy, as well as for internal and external remedies. They were even used for early surgery, including bleeding and amputations.[1]

  Today, patients receive the benefits of a full range of medications. Some are synthesized in the laboratory. Some, like insulin, are produced from animals. Others are derived from plants. Quinine, first used to treat malaria, is derived from the bark of a cinchona tree.

  In this lesson, we'll look at these medicines. We'll start by learning the terminology you'll use when working with *pharmaceuticals* and examining what changes they affect in the human body. How do they work? What kinds of *drugs* are there? How are they discovered? How are they regulated?

  And what happens when a drug encounters other drugs, both prescription and over the counter, that a patient may be taking? Are the combined drug actions predictable as well?

  In this lesson, we'll look at how drugs work. We'll look at where drugs come from and the different types of drug actions. Then we'll look at how drugs are absorbed into the body—and how they exit the body.

  Then we'll look at the variables that must be considered when prescribing drugs. How do foods affect drug actions? Gender? Age? We'll finish the lesson by examining drugs that affect each organ system. By the end of the lesson, you'll have a good idea of how drugs produce desired—and undesired—actions in patients' bodies.

In 2700 B.C., the Chinese produced an herb book that catalogued the medical uses of 365 different plants.

Step 3 What Is Pharmacology?

- **Pharmacology** is the study of **pharmaceuticals**, or drugs, including where they come from, how they are used and how they work. You may think of a **pharmacy** as being a drug store, but it also means the process of prescribing, compounding, preparing and dispensing drugs for medical use. **Polypharmacy** is the situation of having several drug prescriptions. This can become dangerous for elderly patients who tend to take a lot of different drugs.

  Pharmacology is also concerned with the **efficacy** of a drug—its therapeutic value; the **potency** of a drug—the amount of the drug a patient must take to produce the needed effect; and the **half-life** of a drug—the amount of time it takes 50 percent of the drug to be eliminated from the body.

In your work as a medical assistant, you'll probably hear someone refer to a drug as a **prophylactic**, which is any drug used to prevent disease.

Within pharmacology there are several specialties. A few of these are listed below:

- **Pharmacodynamics**—The study of the actions or effects of drugs
- **Pharmacognosy**—The study of natural drugs
- **Pharmacokinetics**—The study of how drugs move and metabolize in the body
- **Posology**—The study of how much of a drug must be taken to produce the desired effect
- **Toxicology**—The study of poisons

The Federal Food, Drug and Cosmetic Act defines a drug as being a substance "intended for use in the diagnosis, cure, mitigation, treatment or prevention of disease in man or other animals."[2]

Where Do Drugs Come From?

The first drugs were herbs and other plant material, but today's drugs come from five basic sources, including plants, animals, minerals, chemicals and engineered substances.

Many drugs are still derived from plants. Plant materials are combined with acids to form salts with medicinal properties. One example is morphine sulfate, which is used in pain relief. Digoxin, an extract of the Foxglove flower, is used to treat congestive heart failure.

The body fluids and glands of animals are also used as drugs. The most well known of these drugs is probably insulin, which is a hormone secreted by the pancreas.

Minerals provide therapeutic benefits. Did you know that gold helps prevent severe rheumatoid arthritis? Gold salts, taken in intramuscular injections, are more effective than pain relievers because they actually impede the disease instead of just treating the symptoms.

Chemical or synthetic drugs are developed from knowledge of chemistry, biology and computer science. The resulting artificial substances have revolutionized medicine. One group of examples of chemical-source drugs is oral contraceptives. Chemical drugs can come from organic or inorganic substances. Their therapeutic value comes from changes made in the laboratory.

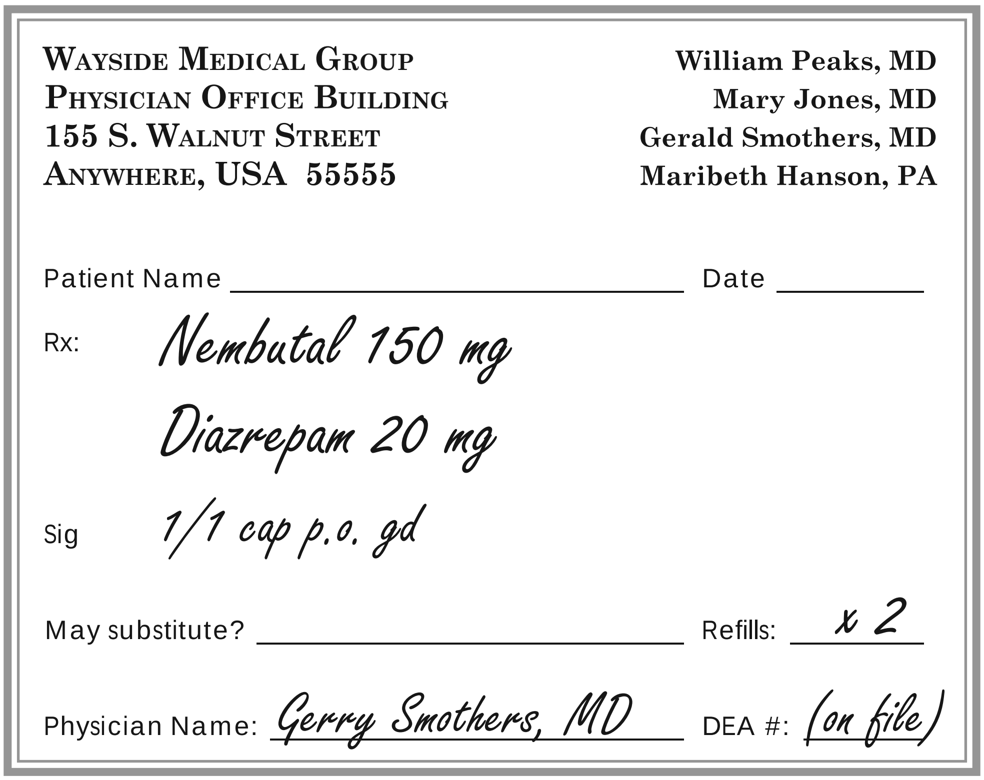
The final category of drug sources is engineered drugs. Unlike chemical drugs, which are designed chemically, engineered drugs are designed genetically. Some of the newer insulin substitutes are examples of engineered drugs.

Evidence suggests that Neanderthals living 60,000 years ago used plants for medicinal purposes.[3]

How are Drugs Controlled?

In a previous lesson, you learned that drugs that have a potential for abuse are controlled by the Drug Enforcement Agency. These aren't the only drugs that have limited availability. In fact, all drugs are controlled in one way or another.

When a drug is used over a long period, the patient can develop a **tolerance** to it; that is, the body no longer responds as well to the effects of the drug. Or, a patient may develop **dependence** on the drug. The patient relies on the drug either physically or psychologically and can't stop taking it. For these reasons, drug use must be monitored by a medical professional so she can regularly evaluate the drug's effectiveness or potential harm to her patient.


WAYSIDE MEDICAL GROUP
PHYSICIAN OFFICE BUILDING
155 S. WALNUT STREET
ANYWHERE, USA 55555

William Peaks, MD
Mary Jones, MD
Gerald Smothers, MD
Maribeth Hanson, PA

Patient Name ______ Date ______

Rx: Nembutal 150 mg
Diazrepam 20 mg

Sig 1/1 cap p.o. qd

May substitute? ______ Refills: x 2

Physician Name: Gerry Smothers, MD DEA #: (on file)

A typical prescription

Some drugs are available only with a *prescription*. Other drugs are available *over the counter (OTC)*. And some drugs are illegal.

- A **prescription** is an order for a drug issued from a doctor to a pharmacist. State and federal laws require doctors to prescribe controlled substances and other medications such as cardiac drugs. The doctor must sign the prescription to ensure its validity. There are four parts in a prescription:
  - **Superscription**—date the prescription was written, patient name and address, the symbol Rx, which stands for the Latin word "recipe," or "take thou."

- **Inscription**— name of the drug, along with its form and potency. In addition, the doctor may indicate whether a generic medication can be substituted.
- **Subscription**— directions to the pharmacist on the amount of the drug to be dispensed and how to prepare it
- **Signature**— Instructions to the patient.

- **Over the counter (OTC)** drugs are considered safe enough to use without a doctor's advice. When recording a patient's medical history, it's important for you to ask the patient about any OTC drugs she may be taking. OTC drugs can interact with prescription drugs, causing adverse effects.

In addition to writing prescriptions, doctors must keep accurate documentation about the drugs they keep in their office. **Dispensing records** keep track of any drug that was administered or dispensed by medical personnel. **Inventory records** contain a complete list of the quantities of all drugs in the office. You may be responsible for maintaining the drug inventory records in your office. Drugs should always be kept in their original containers with all labels intact. Be sure to read the labels and other drug inserts to find out how the drug should be stored. Many drugs, such as antibiotics, must be refrigerated.

Classification of Drugs

How are drugs classified? There are four main methods of classification. Drugs can be classified by the extent of their effect, by the desired action, by the body system they affect and by their chemical structure.

- **Extent of effect**—does the drug act locally, or does it affect the entire body? A drug that acts in the area where it's applied, such as eye drops, is said to have **topical action**. Some drugs work on a specific organ. For example, diuretics prevent water absorption in the kidneys. This type of effect is called **remote action**. Other drugs work on cells throughout the whole body, and are considered to have **systemic action**.

- **Desired action**—what does the drug do to the body? For example, some drugs affect mood. These are called *antidepressants*. *Analgesics* are drugs that lessen pain. Some drugs work on certain tissue types. One common example is an *antacid*, which reduces stomach acidity in the gastrointestinal system.

- **Body system**—what organ system does the drug affect? For example, some drugs only work in the respiratory system. Others cause activity only in the cardiovascular system.

- **Chemical structure**—what chemicals make up the drug? One example of this type of classification is a hormone, a natural substance with a specific molecular structure unlike any other substance.

How Are Drugs Researched?

One of the physicians in your clinic may ask you to investigate a particular aspect of a drug, or you may want to find out how to safely handle a new medication. In these cases, you will need to do some research. There are a number of sources available, including the **United States Pharmacopeia/ National Formulary** (**USP/NF**) and the **Compendium of Drug Therapy**.

One well-known and respected resource for drug information and drug standards is the **Physician's Desk Reference** (**PDR**). This reference is divided into useful sections, covering brand names and generic names, classification of the drug and product information.

Using the PDR is easy. If you know a drug's brand name, look the drug up alphabetically. Page numbers that identify the product and give information will follow the manufacturer's name. Or, if you know how the drug is classified, find it under the drug type in the category section. Either way, the PDR lists a great deal of information on the drugs it catalogues:

- Drug names—the chemical, generic and trade names used for the drug
- Description—the chemical composition of a drug
- Effects—the effect of the drug, the part of the body affected and the process by which the drug works
- Indications—the conditions, diseases and bacteria or viruses for which the drug is used
- Contraindications—under what conditions should the drug *not* be used?
- Warnings—the dangers of using the drug
- Precautions—what the patient should do to avoid the dangers
- Adverse reactions—negative side effects that can occur when taking the drug
- Dosage—how much of the drug should be taken, and how often
- Drug forms—the forms that the drug comes in, such as tablet, liquid, cream or intravenous solution

You received a PDR pocket guide with this course. As you learn about different drugs in this lesson, practice looking them up in your PDR pocket guide.

When Do You Dispose of Drugs?

Because drugs age and can become toxic or ineffective, all drugs have an expiration date. These are generally found on the drug's label. Drug inventories in the clinic must be rotated so that the oldest drugs are dispensed before newer batches. When a drug has passed its expiration date or is defective in some way, you must dispose of it properly to avoid an accidental poisoning.

It is safe to flush medications in liquid, powder, ointment, pill and capsule form in a toilet or to pour them down a sink drain. The sewage system will destroy them. Obviously, ointments, vials and ampules must be opened and only the medication is flushed.

Researchers are concerned with the effect that flushed medications have on water quality. You may learn a new procedure for drug disposal in the near future.

Unlike these types of drugs, when controlled substances expire or become defective, they must be returned to the pharmacy that supplied them. If a Schedule II drug is spilled or otherwise destroyed, documentation must be supplied to the DEA. In the event of loss or theft, the DEA and the police must both be notified.

As you know, used syringes are disposed of in rigid biohazard containers to prevent personnel from an accidental stick or reusing a contaminated needle.

How are Drugs Used?

Why do people need drugs anyway? What's the purpose? The fact is—people get sick. Drugs can help make them well. The purpose of drug therapy is to deliver the right drug in the right amount at the right time to the right place in the body to have a positive effect. Remember this "mission statement" for drugs. We'll refer to it often in the first part of this lesson.

The Mission of Drug Therapy

To deliver the right drug in the right amount at the right time to the right place in the body to have a positive effect.

Drugs are used as therapy, but they are also used for many other reasons, including the following:

Table 24-1: Drug Uses

Use	Purpose	Example
Diagnostic	to diagnose disease	barium and dyes used with diagnostic imaging equipment
Palliative	to relieve symptoms	ibuprofen, cough syrup, vapor rub
Preventive	to prevent certain conditions	high blood pressure medication, cholesterol-lowering drugs
Replacement	to replace substances that the body isn't providing	antidepressants, thyroid medication
Therapeutic	to cure disease	antibiotics, antifungals, chemotherapy

In this segment, we explored the basics of pharmacology. We discussed the kinds and classifications of drugs. Next, we'll get specific about drugs' **mechanism of action**, or how they produce the desired effect.

Step 4 How Drugs Work

- ❑ You read that the mission of drug therapy is to deliver the right drug in the right amount at the right time to the right place in the body to have a positive effect. The "right place" means getting the drug to the **site of action**. Heart medication must get to the heart. Kidney medication must get to the kidney. How is that accomplished? Let's look at how drugs get to where they're needed in the body.

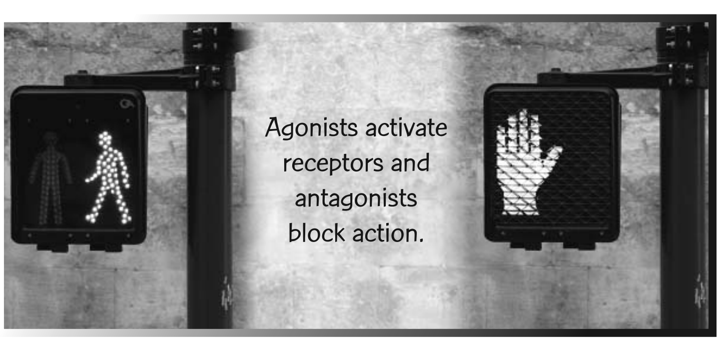
What is Selective Action?

Picture a lock and key. If you want to open the lock, you need a key that fits that particular lock. Drugs target a site of action the way a key targets a lock. When a drug enters the bloodstream, it eventually finds its way to the site of action. Drugs act on a cellular level. The cellular material that interacts with the drug is called the **receptor**. The drug is able to bind to the receptor, like a key opens a lock.

Specific drugs are able to bind to specific cellular materials. Though the drug may enter the bloodstream and travel throughout the body, it only binds to certain cellular materials. Drugs are **selective**—they only act on certain kinds of cell tissue. Certain drugs match certain receptors. That is how drugs are able to target certain parts of the body. Though drugs that enter the bloodstream go everywhere, they only act in certain locations.

When a drug stimulates a receptor, one of two things happens. Either cellular functions speed up, or they are slowed. **Agonists** are drugs that either speed or slow the cell processes. For example, alcohol is a central nervous system depressant. Nicotine is a central nervous system stimulant. Both alcohol and nicotine act as agonists on the central nervous system.

Antagonists are drugs that attach themselves to receptors without stimulating or slowing cellular processes. Instead, they block action by preventing other drugs or substances from activating them. That is, they keep other drugs or substances from speeding or slowing cellular processes.



What Effect Does Drug Concentration Have?

Remember that the purpose of drug therapy is to deliver the right drug in the right amount at the right time to the right place in the body to have a positive effect. So what is the "right amount" of a drug?

Finding the right amount is more difficult than you think. It's hard to measure the amount of a drug at the site of action. For example, if you take an oral kidney medication, it's difficult to tell how much of the medication actually reaches the kidneys.

So how is concentration measured? One way to measure concentration is a *dose-response curve.* A **dose-response curve** shows the effect of a drug at the site of action as the dose increases. (See Figure 24-1).

Unfortunately, dose-response curves show an average of all patient responses. Individuals have different reactions to drugs, depending on their age, gender, weight and other differences. We'll discuss these variables later in the lesson. Because of these individual differences, however, doctors need a better way of measuring a drug's concentration.

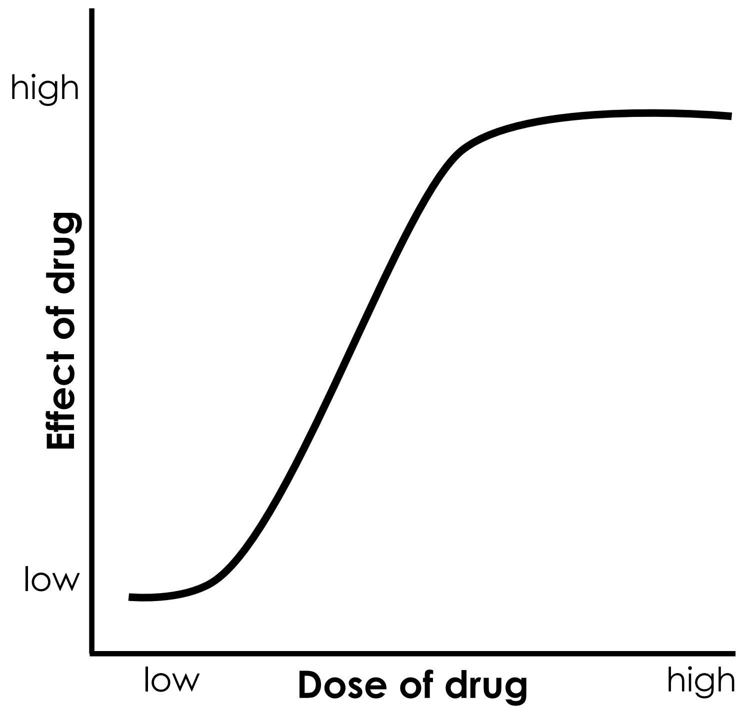


Figure 24-1: Dose-Response Curve

That better way is called *blood concentration.* **Blood concentration** measures the amount of a drug in the bloodstream. There are three good reasons for using this method. First, the circulatory system delivers the drug to the part of the body that needs it. If the drug isn't in the bloodstream, it won't reach the site of action. Second, drugs shift quickly from site of administration to the site of action. That is, whether the drug is oral or injected, once in the bloodstream, it quickly spreads in even amounts throughout the body. Finally, blood concentration can be monitored continuously because blood samples can be taken multiple times.

Let's learn the terms medical professionals use to talk about drug concentration. The **minimum effective concentration** (**MEC**) is the smallest blood concentration necessary to produce the desired response from the drug. The **minimum toxic concentration** (**MTC**) is the ceiling on a desired response. Any more, and the drug may have an adverse effect. The **duration of action** is the length of time the drug concentration is above the MEC and below the MTC. Using the blood-concentration method, doctors are able to know the "right amount" and the "right time" for drugs that they prescribe.

What are ADME Processes?

The fact that drugs can be traced in the blood demonstrates that the body takes drugs in and uses them. This process happens in four steps. In this segment, we'll look at *absorption, distribution, metabolism* and *excretion*. These four steps are sometimes called the **ADME processes**—an acronym for the four processes.

Absorption refers to how a drug is broken down in the body. There are several different ways to administer a drug. How a person takes the drug will affect how quickly it breaks down in the body. In fact, some drugs are timed for a slower absorption. For example, oral drugs might be coated with a transport substance that allows them to break down in a specific part of the gastrointestinal system. You may have seen drugs that boast of being "time-released." These drugs are engineered to be absorbed over a period of time, rather than being absorbed immediately.

Distribution refers to the way the drug gets from the place it enters the body to the part of the body it's meant to affect. If the drug is a topical drug, it is already "in place." With remote action it's important to know how much of the drug will reach the part of the body that needs help.

The time you eat can affect gastric emptying time.

For example, if the drug is a pain reliever, it needs to cross the blood-brain barrier—the barrier between capillaries and brain tissue—in sufficient amounts to accomplish the goal. Another example involves pregnancy. When a pregnant woman takes a drug, how much of the medication will cross over to the fetus?

Action is the effect of a drug on the cells and tissues of the body. Drugs cause cellular change. Some changes are temporary, and some are permanent. Some drugs bind to target cells and prevent certain biochemical processes. Some drugs prevent enzyme interaction with the cells. Other drugs affect the cells of invading microorganisms. In every case, the effect of the drug on cells is the action.

Metabolism refers to the way the drug is eventually broken down into harmless byproducts of the cellular reactions. Most of the time, this process happens in the liver. Once the drug is metabolized, the byproducts are sent to the kidneys.

Excretion is the process of eliminating the metabolized byproducts from the body. Most excretion happens via the urinary system. That's why people who perform drug tests use urine as the testing sample. The chances are, if an illegal drug has been used, analysis of the urine will find the byproducts.

Please pause to complete online Practice Exercise 24-1.

Step 5 Factors that Influence Drug Action

The action of a drug is generally predictable. This doesn't mean that a drug works the same in every case. **Human variability**, that is, the way drugs affect one person differently than another person, and external factors can influence the way drugs work in the human body. In this segment, we'll examine the factors that influence the action of drugs.

Amount of Medication

First, the amount of medication will affect the action. In general, more of a drug means a greater effect. This isn't always the case. For example, Ibuprofen has an **effect ceiling**, the point at which pain relief won't improve with more medication. In addition, a greater effect doesn't always mean a good effect. More is not always better!

Age

The age of the patient will affect the action of a drug. Children have fast metabolisms and drugs are distributed quickly. Elderly patients have a slower metabolism so drugs take much longer to work.

Size

The patient's size, both body surface area and weight, factor into how a drug works. In general, a larger person needs a larger dose. This makes pediatric dosing difficult to calculate, since children have a higher ratio of body surface area to weight than adults.

Body weight is the major determinant in dosage size for infants.

Gender

The patient's gender is also a factor. Drugs work differently in men and women. Their hormone levels are different. And women have less blood circulation to their muscle tissue, so muscular injections remain in their muscle tissue longer.

Disease

Another factor is the nature of the disease the drugs are meant to affect. Diseases can affect absorption, distribution or one of the other stages of drug action. For example, if the drug is treating a kidney disease, the excretion stage may take longer.

Tolerance

Tolerance to a drug requires additional time to achieve the same results. Eventually, a larger dose may be required.

Genetics

Genetics determines the proteins that are produced in the body. Since many drugs interact with proteins in blood plasma and body tissues, individual genetics will affect the ADME processes. The process most influenced by genetics is metabolism. Some people are unable to metabolize drugs that others can metabolize easily. Sometimes the therapeutic effect of the drug is negated because the patient metabolizes the drug at an abnormally fast rate.

The Placebo Effect

When doctors wish to test the effectiveness of a new drug, they test the drug on two groups of patients. One group gets the test drug. The other group may get a **placebo**—a sugar pill that has no medicinal value. Surprisingly, patients taking placebos often show therapeutic improvement, and even adverse effects from the pretend medication. This phenomenon is called the **placebo effect**. The very real results show that physiological changes can result from psychological factors. That is, the mind can affect the body in unpredictable ways!

The History of Placebos

Nearly everyone has heard of acupuncture. But consider this—it may well be that the use of unsterilized needles led to the death of more people than acupuncture ever helped. Homologous serum jaundice, caused by unsterilized needles, was epidemic in China for centuries. And did you know that the Egyptians treated illness with the excrement of humans and 18 other animals?[4]

Galen, the famous Roman father of pharmacy said, "He cures most, in whom most are confident."[5] It may be that the only weapon in the arsenal of ancient healers was the faith of their victims. It was common in the Middle Ages to find something that worked and then use it for everything. Opium was prescribed for fever, cholera, diabetes, urinary incontinence, malaria, shock, nymphomania and insanity. Indeed, researchers Arthur and Elaine Shapiro concluded that the history of ancient medicine was the history of placebos.[6]

Perhaps Voltaire said it best, when he noted, "The art of medicine is to amuse the patient while nature cures the illness."[7]

Psychology

One important psychological factor that varies the effect of drugs is the patient's willingness to follow dosage regimens. **Patient compliance** is the willingness of the patient to follow directions and stick to a dosage schedule. One recent study of adult epileptics showed that less than 60 percent of the patients completely followed their drug regimen. Reasons that patients fail to comply included misunderstanding of instructions, forgetfulness and economic concerns.[8] No matter how effective a drug is, if the patient won't take it, the illness won't improve.

Stress is another example of a psychological factor that can alter drug performance. When the human body is confronted with stress—any situation that disrupts the body's normal stability—it reacts by shifting blood flow from the digestive system and other organs to the large muscles, preparing the body for the "fight or flight" response. At the same time, the body steps up production and release of hormones. Both of these physical changes can affect the action of a drug on the body.

The mind can affect the body in unpredictable ways.

Diet Interactions

Another human variability involves what people eat. Food affects how drugs act in the body. Absorption is changed when the patient's diet affects the **gastric emptying time** (the time a drug stays in the stomach until it gets moved into the small intestine). Intestinal motility can also change because of diet. The **bioavailability** of a drug is the amount of a drug available at the site of action, and how fast it can get there. The bioavailability of some drugs increases in the presence of food. The bioavailability of most drugs, however, decreases in the presence of food.

High fat diets increase the level of fatty acids in the blood. Fatty acids bind to the proteins that might otherwise bind to the drug molecules. This leaves a higher percentage of unbound drug molecules in the blood, which means the drug has a more concentrated effect.

Low carbohydrate, high protein diets mean quicker drug metabolism. Low protein, high carbohydrate diets mean slower drug metabolism. In general, decreasing calorie intake decreases metabolism. Fats, however, don't affect metabolism as much as it affects distribution.

Some foods react with specific drugs, causing possible adverse effects. For example, brussels sprouts stimulate the metabolism of some drugs. Spinach contains vitamin K, which inhibits the action of blood anticoagulants.

So far, we've discussed the normal action of drugs and the factors that might affect that action. Next, we'll look at the possibility of negative results. What can go wrong? What should an MA look for?

High-fat diets mean less protein binding.

What Are the Additional Effects of Drugs?

Drugs result in a predictable action in the patients who take them. But that therapeutic action isn't always the only action that occurs. What are the additional effects of drugs? There are four types of drug effects that a medical assistant should look for, including side effects, allergies, *teratogenic* effects and drug interaction. We'll discuss drug interaction later in the lesson, but let's look at the other effects of drug use.

Side Effects

Side effects are effects associated with a specific drug other than the desired therapeutic effect. Most side effects are mild. They may include drowsiness, dry mouth and headaches. If the side effects are more drastic, they are called **adverse effects**. On rare occasion, a side effect may cause death. This is called a **significant adverse effect**. Even after the FDA approves a drug for use, safety studies continue to track results. When a drug causes adverse reactions, they must be reported to the drug manufacturer, who passes on the information to the FDA.

Allergies

An allergic response to a drug may be mild. For example, the patient may develop a rash. A more severe effect may result in anaphylaxis. Whenever a patient has an allergy to a specific drug, penicillin for example, that information must be noted *in red ink* on her chart and medical record.

Because different drugs are related, they may cause similar allergic reactions. This is called **cross-sensitivity**. Knowledge of the patient's allergies and the nature of the drugs being prescribed is important to minimize allergic reactions.

Teratogenic Effects

Teratogenic effects are those that might prevent a fetus from developing normally. Earlier in the lesson, we talked about the information in the PDR. You may remember that contraindications are situations in which a drug should *not* be used. Drugs that risk a teratogenic effect are contraindicated in the PDR. For this reason, it's extremely important for any patient who is pregnant to inform the doctor or MA of her condition before accepting any medications.

As a medical assistant, you should be aware of the signs and symptoms of allergies or adverse effects to the medications you administer. Always inform the doctor of any reactions so that appropriate action can be taken. If the additional effects are severe—anaphylaxis, for example—the doctor can administer a shot of epinephrine, followed by an antihistamine. This process usually reverses the most life-threatening symptoms.

The important thing to remember is that drug action depends on both the drug and the individual. Drugs vary by source, administration route and even the specifics of manufacture. Individuals vary by age, diet, gender, genetics and weight. To predict the precise action of a drug, you need a lot of information about both the drug and the patient.

Step 6 Drug Interaction

- **Drug interaction** is what happens when a patient takes two or more drugs together. As mentioned earlier in the segment on OTC drugs, it's important to know what drugs a patient is taking and how the drugs will react with each other when taken together. Drugs can interact four ways.

Drugs can interact and cause different reactions.

When drugs have an **additive effect**, it means that their combined drug action is equal to the sum of their actions. Because their combined action is what is expected, and because this is the most common kind of drug interaction, this is how most people believe drugs will react.

Potentiation occurs when one drug multiplies the action of another drug. For example, acetaminophen can be combined with a small amount of narcotic to multiply the effects of pain relief without increasing narcotic use. This is how Tylenol #3 works.

Synergism occurs when two drugs work to enhance each other. For example, doctors may use drugs that have a **synergistic interaction** for cancer treatments.

Antagonism occurs when one drug reduces the effectiveness of another drug. If the reduction is significant enough, the first drug may be regarded as an **antidote** to the action of the second drug. The idea of one drug canceling another has been around for centuries. The action of poisons can be stopped by the antagonism of an antidote. For example, the effects of cyanide can be negated by the antagonism of amyl nitrate.

One way of looking at drug interaction is to translate the four kinds of interaction into math equations. (See Table 24-2)

Table 24-2: Math Metaphors for Drug Interaction

Interaction Type	Equation
Addition	1 + 1 = 2
Synergism	1 + 1 = 5
Potentiation	A + B = 2B
Antagonism	1 + 1 = 0

Reducing the Risk of Negative Drug Interactions

What are the steps that a medical professional can take to minimize the risk of negative drug interactions? Remember the Medical History Form? It will come in handy now when the physician needs to determine drug interactions. The steps include:

- Identify risk factors.
- Obtain drug history.
- Understand drug actions.
- Consider alternative treatments.
- Refrain from complex drug regimens.
- Educate the patient.

The first step may be the most important—identify patient risk factors. The patient's age is one identifiable risk factor. The very young and the very old are at risk for drug interaction.

Alcohol use and smoking are both risk factors. Chronic use of alcohol increases the metabolism of many drugs by increasing the activity of the liver. And the combination of alcohol and sedatives results in an extreme depressive drug action. Smoking increases the activity of the liver, metabolizing drugs sooner than with non-smokers. The therapeutic effects of some drugs are reduced for smokers as a result.

Patients who are very old or very young are at risk for drug interactions.

The second step in reducing risk is getting a thorough patient drug history. As we learned in the last section, this means getting information on both prescription and over the counter drugs. Knowing all of the potentials for interaction is an important step in avoiding negative interactions.

The third step involves thoroughly understanding the actions of drugs, including primary and secondary functions. As you will recall, an overlap of secondary functions can result in unexpected drug addition effects.

Considering alternative treatments means looking at the available drugs that perform similar actions and selecting the drug with the least chance of negative interaction.

Another strategy in the quest to avoid drug interaction is avoiding complex drug regimens. The higher the number of medications a patient takes, the more of a chance there is for negative drug interaction. Drugs that have a longer duration of action—meaning fewer administrations—reduce the risk of a timing issue that might lead to negative drug interaction. Finally, complex drug regimens are harder for the patient to comply with.

The last step is to assist in the education of the patient, passing on important information about the risks of drug therapy. An informed patient will be more compliant, because the risks of non-compliance will be understood. An informed patient will be able to safeguard against foods that might affect drug therapy. And, the informed patient will know the signs of an unexpected drug action and report it to a doctor who can address the negative effects immediately.

Please pause to complete online Practice Exercise 24-2.

Step 7 A Drug for Every Body System

- ❑ You previously learned that drugs can be classified by the body system they act on. In this section, we'll briefly review the problems that can arise in each body system and describe how pharmaceuticals are used to treat them. Let's begin with the musculoskeletal system.

Step 8 Musculoskeletal System

- ❑ Drugs that work on the musculoskeletal system include skeletal drugs and muscle relaxants.

Skeletal Drugs

Skeletal drugs treat gout, osteoporosis and arthritis.

Gout, or **gouty arthritis**, is a joint disease caused by the body's inability to metabolize uric acid, causing inflammation.

Osteoporosis is a bone disease that occurs when more phosphorus salts and calcium are lost into the blood than are replaced from nutrients, causing bone loss and brittle bones.

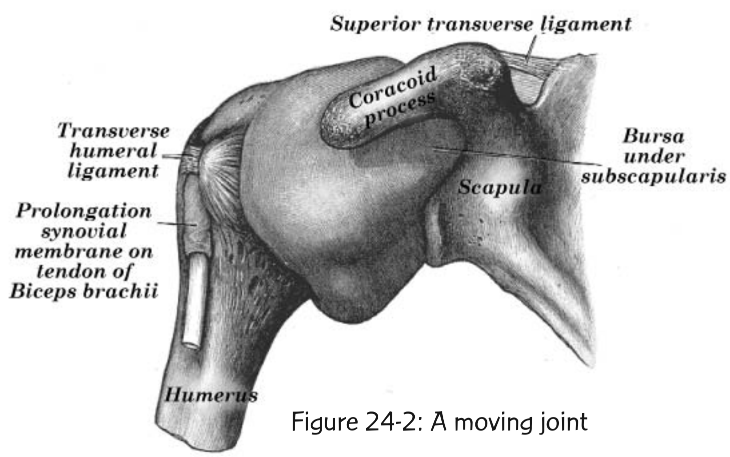


Figure 24-2: A moving joint

Arthritis is a group of conditions involving damage and inflammation of the joints. There are two major types of arthritis:

- **Osteoarthritis** is the most common form of arthritis and is a degenerative joint disease. It can result from aging or damage to the joints. Treatment for osteoarthritis includes rest, physical therapy and pain relievers.

- **Rheumatoid arthritis** is a more serious, chronic condition among the elderly. RA is an autoimmune disease—the body's immune system attacks the joints.

Common skeletal drugs are listed below.

Generic Name	Trade Name
Gout	
Colchicine	Generic only
Allopurinol	Zyloprim
Osteoporosis	
Bone retention agents	
Estrogen	Congest
Vitamin D	Generic only
Calcium	Generic only
Bone resorption agents	
Calcitonin	Cibacalcin, Calcimar
Biophosphonates	
Alendronate	Fosamax
Antirheumatics	
Auranofin	Ridaura
Gold	Generic only
Anti-inflammatory/Antirheumatics	
Penicillamine	Depen

Muscle Relaxants

There are two broad categories of muscle pain. The first, strains, are temporary. They can be treated with rest, physical therapy and aspirin. The other category of muscle pain is called **spasticity**—muscle contractions resulting from head injuries, stroke, cerebral palsy, multiple sclerosis and other neurological disorders. This second category of muscle pain requires long-term use of *muscle relaxants*. **Muscle relaxants** block nerve impulses by depressing the neurons. This eases contractions, which in turn reduces pain.

There are several types of relaxants, and each of these acts on the body differently. These are *neuromuscular blocking agents, centrally acting skeletal muscle relaxants* and *direct-acting skeletal muscle relaxants*.

Neuromuscular blocking agents are chemicals that interfere with neuron stimulation of muscles.

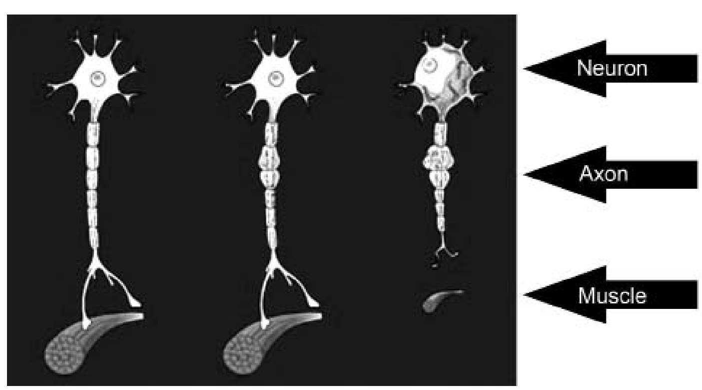


Figure 24-3: Neurons stimulating muscles

Centrally acting skeletal muscle relaxants may act as a central nervous system depressant.

Direct-acting skeletal muscle relaxants work directly on spastic muscles, rather than calming them through the central nervous system.

A list of the most common muscle relaxants appears below.

Generic Name	Trade Name
Neuromuscular blocking agents	
Succinylcholine	Anectine
Cisatracurium	Nimbex
Centrally acting skeletal muscle relaxants	
Baclofen	Lioresal
Carisoprodol	Soma
Chlorzoxazone	Paraflex
Diazepam	Valium
Metaxalone	Skelaxin
Methocarbamol	Robasin
Orphenadrine citrate	Orfro, Norflex
Direct-acting skeletal muscle relaxants	
Dantrolene sodium	Dantrium

Step 9 Central Nervous System

- Central nervous system (CNS) drugs include *sedatives* and *hypnotics, antipsychotics, antianxiety drugs, antidepressants, stimulants, lithium therapy, Alzheimer's drugs, antiepileptic drugs, antiparkinsonism drugs* and *anesthetics*.

Sedatives and Hypnotics

Sedatives and **hypnotic** drugs affect the central nervous system by inhibiting transmission of nerve impulses. **Sedation** causes decreased anxiety, motor activity and mental acuity. Sedative drugs are used to produce calmness. **Hypnotic drugs** are used to create drowsiness or sleep. Drugs that are classified as sedatives and hypnotics can be helpful in the treatment of insomnia. Sedatives and hypnotics include *barbiturates, benzodiazepines* and hypnotic drugs.

Barbiturates have a depressant effect on the CNS. The extent of effect may range from mild sedation to deep anesthesia.

Benzodiazepines (**BZD**) are the most common drugs used to treat anxiety, hypnosis and insomnia. These drugs should not be taken when pregnant.

Hypnotic drugs also include some types of barbiturates and BZDs. They are used to treat anxiety and sleep disorders.

A few of the most commonly used sedatives and hypnotic drugs are listed below.

Generic name	Trade name
Barbiturates	
Methohexital	Brevital
Pentobarbital	Nembutal, Luminal
Phenobarbital	Solfoton
Secobarbital	Seconal
Benzodiazapines	
Diazepam	Valium
Temazepam	Restoril
Clonazepam	Klonopin
Hypnotics	
Secobarbital	Seconal
Estazolam	ProSom
Zolpidem	Ambien
Temazepam	Restorile

Antipsychotics

Antipsychotic drugs are used to treat *neurosis* and *psychosis*. A **neurosis** is a disease of the nerves or a mental disorder. A **psychosis** is a mental illness that causes bizarre behavior and changes in personality. This is coupled with a failure to perceive reality. The two forms of psychosis are *severe depression* and *schizophrenia*. Medications make a big difference in the care of both of these illnesses.

The most common antipsychotic drugs are listed below.

Generic Name	Trade Name
Paroxetine	Paxil
Paroxetine	Paxil CR
Risperidone	Risperdal
Quetiapine	Seroquel
Olanzapine	Zyprexa, Zydis

Antianxiety Drugs

Anxiety is a condition in which the individual has a persistent and irrational fear of an object, activity or situation. Antianxiety drugs are used to decrease the frequency and intensity of generalized anxiety disorders and panic attacks.

Common antianxiety drugs are listed below.

Generic Name	Trade Name
Lorazepam	Ativan
Doxipin	Adapin
Nefazodone	Serzone
Alprazolam	Xanax

Antidepressants

The condition of **depression** is characterized by intense feelings of sadness, helplessness and worthlessness. Depression can be severe enough to impair the ability to function in daily life. Antidepressants act on chemicals in the brain to alleviate depression symptoms.

The most commonly prescribed antidepressant drug classes include the following:

- *monoamine oxidase inhibitors (MAOIs)*
- *norepinephrine-dopamine reuptake inhibitors (NDRIs)*
- *serotonin-norepinephrine reuptake inhibitors (SNRIs)*
- *selective serotonin reuptake inhibitors (SSRIs)*
- *tetracyclic antidepressants (TeCAs)*
- *tricyclic antidepressants (TCAs)*

MAOIs are usually used when TCAs are ineffective. They are also used to treat narcolepsy.

NDRIs are used when other types of antidepressants have been ineffective.

SNRIs are used in the treatment of major depression, anxiety disorders, obsessive-compulsive disorder (OCD), attention deficit hyperactivity disorder (ADHD) and for the relief of menopausal symptoms.

SSRIs are used primarily to treat major depression.

TeCAs are used when other types of antidepressants have been ineffective.

TCAs are used mainly to treat the symptoms of depression that seem to have no known cause.

The most common antidepressants are listed below.

Generic Name	Trade Name
MAOIs	
Phenylzine	Nardil
NDRIs	
Bupropion HCL	Wellbutrin SR
SNRIs	
Venlafaxine	Effexor XR
SSRIs	
Fluoxetine	Prozac
Sertraline	Zoloft
Citalopram	Celexa
TeCAs	
Trazodone	Dexyrel
TCAs	
Amitriptyline	Elavil

Stimulants

Stimulants act on chemicals in the brain to treat chronic fatigue syndrome, obesity, narcolepsy, attention deficit disorder, depression and to treat the side effects of narcotics in terminally ill patients.

Stimulants include **amphetamine**, **cocaine**, **methamphetamine**, **ephedrine** and **mephentermine.** At low oral doses, these drugs increase wakefulness, alertness, self-confidence and the ability to concentrate. These drugs also decrease appetite. When taken intravenously, these drugs can lead to extreme euphoria and mental alertness. All stimulants can become addictive over time and the risk of abuse is high.

Common stimulants are listed below.

Generic Name	Trade Name
Methylphenidate XR	Concerta
Amphetamines and Amphetamine mixed salts	Generic only

Lithium Therapy for Bipolar Disorder

Bipolar disorder, also called **manic–depressive disorder**, is generally characterized by intense mood swings. Individuals with this disorder go up and down, between a **manic**, or excited state and a depressed state. Manic states of bipolar disorder have typically been treated with *lithium*. **Lithium** is also taken as a maintenance drug to prevent episodes.

Other drugs are used to treat bipolar disorder, as listed below.

Generic Name	Trade Name
Lithium	Eskalith
Carbamazepine	Tegretol
Valproic acid	Depakote

Alzheimer's Drugs

Alzheimer's disease is currently an incurable illness that results in progressive memory impairment, confused thinking, personality changes, agitation, speech disturbances and the inability to perform usual tasks. Medications can improve memory deficits, slow the progress of the disease and alleviate some of the symptoms.

Alzheimer's drugs are listed below.

Generic Name	Trade Name
Tacrine	Cognex
Donepezil	Aricept

Antiepileptic Drugs

Epilepsy is a class of disorders of the central nervous system typified by extreme excitement in the brain. This can lead to seizures, which are brief episodes of brain dysfunction. Anticonvulsants reduce seizure episodes by reducing the excitability of the nerve cells in the brain.

The most common antiepileptic drugs are listed below.

Generic Name	Trade Name
Fosphenytoin	Cerebyx
Paramethadione	Paradione
Ethosuximide	Zarontin

Antiparkinsonism Drugs

Parkinson's disease results in resting tremor, resistance to passive movement, **akinesia** (loss of movement) and loss of postural reflexes. Unfortunately, Parkinson's disease is not curable. Drug therapy is provided to reduce symptoms and increase life expectancy of Parkinson's disease sufferers.

The most common antiparkinsonism drugs are listed below.

Generic Name	Trade Name
Levodopa	Lanodopa
Entacapone	Comtan

Anesthetics

Anesthesia is the condition of reversible unconsciousness or a lack of sensation. This condition is created by chemical substances called **anesthetics**. Anesthesia causes unconsciousness, **analgesia** (loss of the sensation of pain), immobility and **amnesia** (loss of memory) without causing harm to the cardiovascular or respiratory functions. There are two types of anesthesia—*local* and *general*.

Local anesthesia is applied to a specific part of the body to relieve pain. It works on the nerve membrane to produce a brief and reversible loss of sensation with no loss of consciousness.

General anesthesia affects the entire body. The effects of general anesthesia are divided into stages based on drug levels and progression of the condition. There are four stages of anesthesia:

- Stage I—Analgesia begins when the agent is administered and lasts until loss of consciousness.
- Stage II—Delirium begins with loss of consciousness. There may be excitement and unintentional muscular motion. Breathing becomes irregular and there is the risk of hypertension and tachycardia.
- Stage III—Continued loss of consciousness and loss of natural respiration. This is a critical stage, therefore, it is further divided into four planes based on the patient's respiration, size of pupils, reflex characteristics and eye movements and monitored closely.
- Stage IV—In this deepest stage of anesthesia, brain function declines and respiration and circulation stop. The pupils are fixed and dilated with no lid or corneal reflexes.

The most common anesthetics are listed below.

Generic Name	Trade Name
Local	
Lidocaine	Xylocaine
Mepivacaine	Polocaine
Procaine	Novocaine
Chloroprocaine	Nesacaine
Benzocaine	Americaine
General	
Nitrous oxide	Nitronox

Please pause to complete online Practice Exercise 24-3.

Step 10 Cardiovascular System

- As you recall from your anatomy lessons, the cardiovascular system consists of the heart and all the blood vessels, including arteries, veins and capillaries. The heart is a complex and vital organ—without it, we can't live. Many conditions affect the heart, and most of these can be treated with drug therapy. The first group of drugs we'll look at are those used for *antianginal therapy.*

Antianginal Therapy

Antianginal therapy refers to therapy used to treat *angina*, a type of *ischemic heart disease*. **Ischemic heart disease** is a condition where the heart muscle cannot get enough oxygen. The cause of angina is typically plaque on the inside of blood vessels consisting of fatty deposits and other substances that narrow the coronary arteries.

The purpose of all angina treatments is to reduce the risk of sudden death, prevent myocardial infarction, increase oxygen supply to the heart and reduce pain and anxiety from an angina attack.

There are three types of antianginal drugs—*nitrates, beta-blockers* and *calcium channel blockers.*

Nitrates relax the smooth muscles in the blood vessels to dilate the arteries and veins. Nitrates also dilate the coronary arteries of the heart itself, allowing more blood to flow, which reduces the work of the left ventricle.

The sympathetic nervous system causes the heart and lungs to operate automatically, without conscious control. In stressful situations, the sympathetic nervous system automatically activates the heart to beat faster and pump more blood throughout the body. **ß-Adrenergic blockers** (or "**Beta-blockers**") interfere with the sympathetic nervous system and reverse the rapid heart actions caused by exercise, stress or physical exertion.

Calcium moves in and out of cells to conduct nerve impulses that contract muscles. **Calcium channel blockers** prevent this movement of calcium, which decreases the force of the heart contractions. Additionally, calcium channel blockers block the contractions of the smooth muscle in the blood vessels, resulting in blood vessel dilation.

The most common antianginal drugs are listed below.

Generic Name	Trade Name
Nitrates	
Isosorbide dinitrate	Coronex, Isordil, Sorbitate
Isosorbide mononitrate	Imdur
Nifedipine	Procardia
Nitroglycerin	Nitrodisc, Nitroquick, Nitrostat IV
Verapamil	Calan, Isoptin
Beta-blockers	
Atenolol	Tenormin
Carvedilol	Coreg
Metoprolol succinate	Toprol XL
Metoprolol tartarate	Lopressor
Propranolol	Inderal
Calcium channel blockers	
Amlodipine	Norvasc
Diltiazem	Cartia XT
Felodipine	Plendil
Nifedipine	Procardia XL

Antihypertensive Therapy

Hypertension or high blood pressure is the abnormal increase in arterial blood pressure. If left untreated, high blood pressure increases the risk of stroke, coronary artery disease, congestive heart failure and kidney failure.

Antihypertensive drugs only control hypertension; they do NOT cure it. There are five types of antihypertensive drugs that lower blood pressure by different mechanisms—*diuretics, sympatholytics, angiotensin-converting enzyme (ACE) inhibitors, vasodilators* and *angiotensin II receptor antagonists.*

Diuretics, commonly called "water pills," flush excess sodium and water from the body. Diuretics work on the kidneys to increase urination and the excretion of sodium, chloride and water. This reduces the blood volume, which helps lower blood pressure.

Sympatholytics are drugs that act on the central nervous system to reduce sympathetic activity.

ACE inhibitors prevent the production of certain chemicals in the blood that cause blood vessels to constrict and cause retention of sodium and water.

Vasodilators relax or dilate vessels (both veins and arteries) throughout the body.

Angiotensin II receptor antagonists prevent constriction of the blood vessels and the release of aldosterone, a substance that usually causes fluid and sodium retention.

Below is a list of the most common antihypertensive drugs.

Generic Name	Trade Name
Diuretics	
Hydrochlorothiazide	HydroDiuril
Furosemide	Lasix
Triamterene/ hydrochlorothiazide (HCTZ)	Dyazide
Losartan	Cozaar
Losartan/HCTZ	Hyzaar
Sympatholytics	
Metoprolol	Lopressor
Propranolol	Inderal
Clonidine	Catapres
Methyldopa	Aldomet
Guanadrel	Hylorel
ACE inhibitors	
Amlodipine/benazepril	Lotrel
Enalapril	Vasotec
Fosinopril	Monopril
Lisinopril	Prinivil, Zestril
Quinapril	Accupril
Vasodilators	
Hydralazine	Apresoline
Minoxidil	Loniten
Angiotensin II receptor antagonists	
Candesartan cilexetil	Atacand
Irbesartan	Avapro

Myocardial Infarction Drugs

Myocardial infarction, or heart attack, occurs when the blood supply to part of the heart muscle, the myocardium, is severely reduced or stopped. This results in the death of an area of the heart. A myocardial infarction typically occurs because of an obstruction in the coronary artery. Physicians treat emergent myocardial infarction with *reperfusion therapy*, or as a last resort, coronary bypass surgery.

Reperfusion Therapy

The goal of **reperfusion therapy** is to restore blood flow. It must be administered as soon after the heart attack as possible because **thrombi** (blood clots) may be blocking blood flow, killing tissue in the heart.

The two types of reperfusion therapies are *percutaneous coronary intervention* and *thrombolytic therapy*.

Doctors prefer to use a procedure known as **percutaneous coronary intervention** (**Primary PCI**) over thrombolytic therapy, but the artery must be opened within 90 minutes from the time the patient enters the emergency room—known as the **door to balloon** time. In addition to the primary PCI, doctors administer drugs that assist in the patient's recovery.

Thrombolitic therapy is a group of drugs that can be administered up to 12 hours after the infarction. **Antithrombotic agents** help eliminate blood clots and include anticoagulants and antiplatelet drugs. The benefits are greatest when these medications are given within two hours of the onset of pain.

A list of the most common reperfusion therapy drugs appears below.

Generic Name	Trade Name
Primary PCI drugs	
Aspirin	Bayer
Clopidogrel	Plavix
Glycoprotein IIb/IIIa inhibitors	Integrilin, Angiomax
Heparin IV	Heparin Sodium, Hep-Lock
Antithrombotics	
Alteplase	Cathflo Activase
Reteplase	Retavase
Streptokinase	Streptase
Tenecteplase	TNKase
Urokinase	Abbokinase, Kinlytic
Dalteparin (UFH)	Fragmin
Enoxaparin (LMWH)	Lovenox
Warfarin	Coumadin, Dicumaro
Aspirin	Bayer

Arrhythmia Treatment

Arrhythmias are abnormal heart rhythms or heart rates. They may include rapid, too slow or unsynchronized heart muscle contractions.

Dysrhythmias refer to abnormal heart rhythms that originate from the sinoatrial node. These include tachycardia, bradycardia and cardiac arrest.

Antiarrhythmic agents do not cure dysrhythmia, but they do try to restore normal cardiac heart function.

A list of the most common antiarrhythmic drugs appears below.

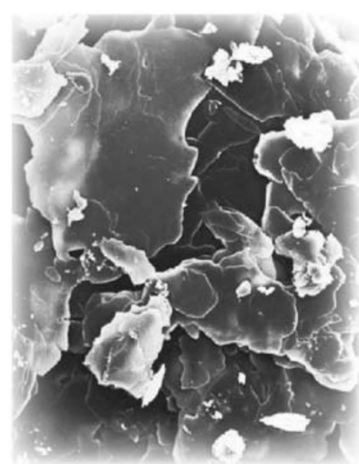
Generic Name	Trade Name
Class I (fast channel blockers)	
Flecainide	Tambocor
Quinidine	Duraquin, Cardioquin
Lidocaine	Xylocaine
Class II (Beta-blockers)	
Esmolol	Brevibloc
Propranolol	Inderal
Class III (interfere with potassium outflow)	
Amiodarone	Cordarone
Bretylium	Bretylol
Class IV (calcium channel blockers)	
Verapamil	Calan, Isoptin
Others	
Digoxin	Lanoxin

Antihyperlipidemic Drugs

Hyperlipidemia refers to increased levels of *cholesterol* in the blood that can block blood vessels to the heart and brain and cause **atherosclerotic coronary disease** (narrowing of the arteries) and myocardial infarction.

Cholesterol and **triglycerides** are the fats that cause heart disease. Total cholesterol includes low-density lipoprotein (LDL), the "bad" cholesterol, as well as high-density lipoprotein (HDL), the "good cholesterol."

Initially, hyperlipidemia is treated with diet and exercise. If that fails, drugs are added to prevent stroke and heart attack. **Antihyperlipidemic** (lipid-lowering) drugs are selected based on which types of fats are too high in a patient, as well as the side effects of the drugs.


Crystals of cholesterol

A list of the most common antihyperlipidemic drugs appears below.

Generic Name	Trade Name
Bile acid sequestrants	
Cholestyramine	Questran, LoCholest, Prevalite
Fibric acid derivatives	
Clofibrate	Atromid-S
Fenofibrate	Tricor
Gemfibrozil	Lopid
Nicotinic acid	
Immediate release	Niacor
Sustained release	Niaspan, Slo-Niacin
Statins	
Atorvastatin	Lipitor
Pravastatin	Pravachol
Simvastatin	Zocor
Ezetimibe	Zetia

Anticoagulant Drugs

Blood coagulation (clot formation) is essential to prevent people from bleeding to death. However, abnormal blood clot formation within blood vessels can cause heart attack, stroke or **pulmonary embolism** (blood clot in the lungs). **Anticoagulants**, commonly known as "blood thinners," prevent thrombi from forming.

A list of the most common anticoagulants appears below.

Generic Name	Trade Name
Warfarin	Coumadin, Dicumaro
Heparin	Hep-Lock

Antiplatelet Agents

Antiplatelet agents reduce the number of small thrombi that normally form from fragments of blood cells called platelets by delaying, decreasing or altering how platelets combine.

Platelets clump together to form a blood clot.

A list of the most common antiplatelets appears below:

Generic Name	Trade Name
Aspirin	Bayer, St. Joseph
Clopidogrel	Plavix
Tirofiban	Aggrastat

Step 11 Respiratory System

- The respiratory system consists of the nasal cavity, larynx, trachea, bronchi and lungs. Many drugs can provide treatment for respiratory conditions. Let's begin with *antihistamines.*

Histamines and Antihistamines

Histamine is a chemical substance found in all body tissues that protects the body from the "invasion" of foreign substances by producing allergic and inflammatory reactions. These reactions are supposed to kill or expel the foreign substances. However, in allergic reactions, the immune system overreacts and the histamine actually causes serious problems for the body. **Antihistamines** are the drugs that counteract the actions of histamines. Antihistamines are used to treat allergic rhinitis (along with decongestants and nasal preparations), insect bites, contact dermatitis, nausea, vomiting and motion sickness.

Antihistamines dry up runny noses and prevent itchy eyes.

A list of the most common antihistamines appears below.

Generic Name	Trade Name
First-generation drugs	
Diphenydramine	Benadryl
Fexofenadine	Allegra
Promethazine	Phenergan
Second-generation drugs	
Cetirizine	Zyrtec
Ranitidine HCL	Zantac
Second-generation drugs with decongestant	
Cetrizine pseudoephedrine	Zyrtec-D
Fexofenadine pseudoephedrine	Allegra D
Olopatadine	Patanol

Antitussives

When the mucous membranes of the bronchi are irritated, the bronchi constrict, causing coughing. **Antitussives** are drugs that relieve or suppress coughing. They are also known as cough suppressants. There are two classes of antitussives: opioid and nonopioid. Each type works differently to suppress coughing.

A list of the most common antitussives appears below.

	Generic Name	Trade Name
Opioids		
	Codeine	Various
	Hydrocodone/ Chlorpheniramine	Tussionex
Nonopioids		
	Dextromethorphan	Sucrets Cough, Benylin DM, Robitussin DM
	Diphenhydramine	Benadryl, Benylin

Corticosteroids

Corticosteroids are the most potent anti-inflammatory agents available. They act as **immunosuppressives**, which means they suppress the immune system to prevent allergic reactions, such as inflammation. Inhaling corticosteroids is the most effective way to control asthma.

A list of the most common corticosteroids appears below.

Generic Name	Trade Name
Budesonide	Pulmicort, Rhinocort Aqua
Beclomethasone	Vanceril, Beclovent
Fluticasone	Flonase
Mometasone	Nasonex
Prednisone	Deltasone
Prednisolone	Prelone
Salmeterol/fluticasone	Advair

Bronchodilators

Bronchodilators are agents that dilate the bronchial tubes, causing them to widen so more air can get through. Bronchodilators are used to treat asthma, often in combination with corticosteroids.

Inhalers are a familiar type of bronchodilator.

A list of the most common bronchodilators appears below.

	Generic Name	Trade Name
	Epinephrine	Adrenalin, Bronkaid, Medihaler, Primatene
	Ephedrine	Vantronol
	Ipratropium/Albuterol	Combivent
	Isoproterenol	Isuprel
	Salmeterol	Serevent
	Salmeterol/fluticasone	Advair
Methylxanthines		
	Theophylline/aminophylline	Elixophyllin, Slo-Phyllin, Aminophyllin
	Dyphylline	Dilor, Lufyllin
Combination bronchodilators		
	Ipratropium/albuterol	Cobivent
	Fluticasone	Advair

Asthma Prophylactics

Asthma prophylactics are drugs that prevent asthma symptoms and improve airway functions for people with mild persistent asthma or exercise-induced asthma.

A list of the most common asthma prophylactics appears below.

Generic Name	Trade Name
Cromolyn	Aarane, Intal, Crolom, Nasalcrom
Montelukast	Singulair
Nedocromil	Tilade
Zafirlukast	Accolate
Zileuton	Zyflo

Leukotriene Antagonists

Leukotriene antagonists block the action of *leukotrienes*. **Leukotrienes** are compounds that occur naturally in leukocytes and produce allergic and inflammatory reactions similar to those of histamine. Leukotrienes are responsible for the development of allergic and auto-allergic diseases such as asthma and rheumatoid arthritis.

A list of the most common leukotriene antagonists appears below.

Generic Name	Trade Name
Montelukast	Singulair
Zafirlukast	Accolate
Zileuton	Zyflo

Xanthine Derivatives

Xanthine derivatives work by relaxing the smooth muscles of the bronchial tree and stimulating the cardiac muscle and central nervous system. They are used to prevent and treat bronchial asthma, emphysema and bronchitis.

A list of the most common xanthine derivatives appears below.

Generic Name	Trade Name
Theophylline / aminophylline	Elixophyllin, Slo-Phyllin, Aminophyllin
Dyphylline	Dilor, Lufyllin

ß-Adrenergic Agents

ß-Adrenergic agents (the ß is pronounced beta) are drugs and hormones that act as cardiac and respiratory agonists. They bind to beta receptors in the body and allow the heart to relax and beat more slowly thereby reducing the amount of blood that the heart must pump. **ß $_1$-receptor drugs** typically increase contractile force and heart rate. **ß $_2$-receptor drugs** cause vascular and nonvascular smooth muscles to relax. ß-adrenergic agents are used to treat hypertension, asthma and bronchitis.

A list of the most common ß-adrenergic agents appears below.

Generic Name	Trade Name
Salmeterol	Serevent
Epinephrine	Asthmahaler, Primatene Mist
Ephedrine	Generic only

Expectorants

Expectorants are agents that help remove mucous secretions from the lungs, bronchi and trachea by coughing. Dornase alfa is an expectorant used for cystic fibrosis and to reduce risk of respiratory infections.

A list of the most common expectorants appears below.

Generic Name	Trade Name
Guaifenesin	Hytuss, Robitussin, Dura-Tuss
Dornase alfa	Pulmozyme

Decongestants

Decongestants are agents that narrow blood vessels, reducing the blood supply to nasal mucous membranes, thus relieving stuffy noses. The most common uses of decongestants are to relieve nasal congestion due to infection or allergy and to relieve itchy, inflamed eyes. Decongestants also help relieve respiratory distress of bronchial asthma, chronic bronchitis and emphysema.

A list of the most common decongestants appears below.

Generic Name	Trade Name
Ephedrine	Vantronol
Epinephrine	Adrenalin
Epinephrine	Bronkaid, Medihaler, Primatene
Pseudoephedrine	Sudafed
Pseudoephedrine / chlorpheniramine	Chlor-Trimeton

Please pause to complete online Practice Exercise 24-4.

Step 12 Endocrine System

- The endocrine system and the nervous system pass chemicals and hormones back and forth between organs, exchanging information to regulate the body's metabolic activities and to maintain **homeostasis**, or equilibrium. **Hormones** are the chemical messengers that the endocrine glands secrete into the bloodstream to send messages.

  The endocrine system can sometimes malfunction. If this happens, doctors will prescribe synthetic or animal-based hormones to help our bodies find balance once again.

  In this section we'll discuss five hormones that are used in replacement therapy—*ACTH, TSH, glucocorticoids, ADH* and *insulin.*

Adrenocorticotropic Hormone (ACTH)

The anterior pituitary gland releases **ACTH** to stimulate the adrenal glands to secrete corticosteroids. You learned in a previous step that corticosteroids are an effective treatment for asthma by suppressing the immune system. They perform many other tasks as well. Corticosteroids regulate many body functions including stress response, immune response to infection, salt and water balance and the breakdown of glucose, fat, proteins and carbohydrates. Synthetic corticosteroids are prescribed when there is a deficiency, such as with Addison's disease.

Thyroid-stimulating Hormone (TSH)

The anterior pituitary gland also secretes **TSH**, which travels to the thyroid and helps it function normally. Specifically, TSH stimulates the thyroid gland to take in iodine and produce the thyroid hormones T3 and T4. Doctors use synthetic TSH or **thyrotropin** to supplement inadequate TSH levels—**hypothyroidism**. Too much TSH production—**hyperthyroidism**—calls for treatment with antithyroid drugs (iodine or iodide).

Glucocorticoids

The adrenal gland produces **glucocorticoids** that help to control anti-inflammatory and immune responses within the body. The synthetic form of glucocorticoid is used to treat inflammatory diseases such as rheumatoid arthritis**.**

ADH

The posterior pituitary releases the hormone **ADH** that acts on the kidneys to make them more permeable to water. Because they absorb more water, there is less urine. If this hormone is low, a rare form of diabetes called **diabetes insipidus** can occur. This chronic disease causes frequent urination, thirst, weakness, dehydration and dry skin. Doctors use synthetic ADH to treat diabetes insipidus.

Insulin

The pancreas regulates blood glucose levels by producing the hormones *insulin* and *glucagon***.** **Insulin** lowers blood sugar levels and **glucagon** raises them. **Diabetes mellitus** occurs when the pancreas doesn't produce enough insulin or the body can't use the insulin it makes. Insulin interacts with all body cells and facilitates the transport of glucose across cell membranes, converting glucose to cell energy. Insulin also helps the body store glucose as either glycogen or fat.

Without insulin, blood sugar levels remain high and serious problems occur, including death. Treatment for diabetes runs in this typical order: dietary changes, exercise, oral antidiabetic agents and lastly, insulin replacement.

Insulin replacement therapy uses common insulin preparations made from cows, pigs and humans. These natural sources of insulin match up with cell receptor sites to stimulate the uptake of glucose within the cells, especially in muscles and fat.

A list of the most common synthetic hormones appears below.

Generic Name	Trade Name
Adrenocortical hormones (ACTH)	
Corticotropin	Acthar, ACTH
Cosyntropin	Cortrosyn
Thyroid-stimulating hormones (TSH)	
Thyroid replacement hormones	
Natural thyroid hormones, desiccated thyroid (T-3, T-4)	Armour Thyroid
Synthetic thyroid replacement hormones	
Levothryroxine (thyroxine, T-4)	Synthroid, Levoxyl, Unithroid, Levothroid, Levo-T
Liothyronine (triiodothyronine, T-3)	Cytomel
Liotrix (T-3, T-4)	Cytomel, Thyrolar
Thyroglubulin (T-3, T-4)	Euthroid, Proloid
Antithyroid hormones	
Methimazole	Tapazole
Potassium iodide, iodine	Lugol's, SSKI Solution
Propylthiouracil	Propyl-Thyracil, Propylthiour
Glucocorticosteroids	
Betamethasone	Celestone
Cortisone	Cortone Acetate
Dexamethasone	Decadron
Fluocinolone	Synalar, Synalar-HP, Synemol
Flurandrenolide	Cordran
Fluticasone	Flonase, Flovent, Canceril, Beclovent
Hydrocortisone	Ala-Cort, Cetacort, Cortaid, Cortef, Cortizone-5, Lanacort, A-Hydrocort
Methylprednisolone	Cortisol, Cortef, Medrol
Paramethasone	Depo-Medrol, Solu-Medrol
Prednisone	Haldrone
Prednisolone	Prelone
Triamcinolone	Aristocort, Axmacort, Colisone, Deltasone, Kenacort, Nasacort AQ (as prescribed), Predcor

Generic Name	Trade Name
ADH	
Vasopressin	Pitressin
Desmopressin	DDAVP
Lypressin	Diapid
Insulin replacement therapy	
Rapid-acting insulin	
Insulin	Lispro, Aspart
Insulin	Humulin R, Novolin K, Velosulin
Short-acting insulin	
Insulin	Humalog, Humulin, Novolin, Apidra, Iletin
Crystalline zinc	Crystalline zinc
Prompt insulin-zinc	Semilente
Intermediate-acting insulin	
Isophane insulin	NPH, Novolin N, Humulin N
Porcine insulin (pork)	NPH-N, NPH Iletin II
Insulin zinc (Lente)	Humulin L, Novolin L
Long-acting insulin	
Protamine zinc insulin	PZI
Extended insulin zinc	Ultralente
Glargine	Lantus

Step 13 Gastrointestinal System

- The digestive tract is a production line that turns food into energy for every cell in the body. When the system gets backed up or gets going too fast, problems occur. These ailments are called **gastrointestinal** (**GI**) or digestive system problems. We'll discuss four types of drugs used to treat the GI system—*antacids, antisecretory drugs, laxatives* and *cathartics*.

Antacids

Antacids are medications that neutralize stomach acid. They are mineral based, derived from aluminum, calcium, sodium or magnesium. People commonly use antacids to relieve pain from heartburn, acid indigestion and *dyspepsia*. **Dyspepsia** is a general term meaning imperfect digestion. Antacids do not stop the production of gastric acid in the stomach. Instead, they neutralize the hydrochloric acid. By doing so, the pH level in the stomach rises and the stomach becomes less acidic. When taken in large amounts, antacids are also sometimes used to treat ulcers and GERD and to prevent some types of kidney stones.

Listed below are some of the most commonly used antacids.

Generic Name	Trade Name
Sodium bicarbonate (baking soda)	Alka Seltzer
Aluminum hydroxide	Amphojel
Calcium carbonate	Tums, Rolaids Calcium Rich
Magnesium hydroxide and aluminum hydroxide	Gaviscon, Mylanta, Rulox, Mintox
Magaldrate	Riopan, Iosopan
Simethicone	Gas-X, Mylanta Gas, Mylicon, Phazyme

Antisecretory Drugs

The purpose of **antisecretory drugs** is to heal and prevent ulcers by blocking secretions of acids, hormones or digestive enzymes into the stomach. There are several ways to do this, and we'll discuss the most common.

Anticholinergics

Anticholinergics inhibit acid secretion by blocking nerve impulses in the **parasympathetic nerve system** (governs involuntary movement). This relaxes the stomach muscles and decreases acid secretion.

Antihistamines

Usually when we think of histamines, we think of allergies like runny noses and bee stings. Yet there are other histamine-producing activities in our bodies. **Histamine-2** or **H_2** helps stimulate the secretion of gastric acid in our stomachs. Antihistamines will block this histamine and give patients relief from peptic ulcer disease (PUD) and gastroesophageal reflux disease (GERD).

Prostaglandins

Prostaglandins are hormones generated by the prostate gland. Synthetic prostaglandins are used to treat ulcers because they relax the muscles similarly to anticholinergics. In addition, prostaglandins increase mucous production in the stomach lining, which protects the stomach walls from acids.

Proton Pump Inhibitors

Proton pump inhibitors block the release of stomach acid by interrupting the final stage of gastric acid secretion. This stage is called the proton pump, where an enzyme is introduced to stimulate the release of gastric acid. Proton pump inhibitors block this enzyme. Physicians use proton pump inhibitors to treat gastric and duodenal ulcers as well as GERD and Zollinger-Ellison syndrome.

Listed below are some of the most commonly used antisecretory drugs.

Generic Name	Trade Name
Anticholinergics	
Atropine	Donnatal
Dicyclomine	Bentyl
Ipratropium bromide	Atrovent
Oxitropium bromide	Oxivent
Tiotropium	Spiriva
Antihistamines	
Cimetidine	Tagamet
Famotidine	Pepcid
Nizatidine	Axid
Ranitidine	Zantac
Prostaglandins	
Misoprostal	Cytotec
Proton pump inhibitors	
Rabeprazole	Aciphex
Omeprazole	Prilosec
Pantoprazole	Protonix
Esomeprazole	Nexium
Lansoprazole	Prevacid

Laxatives and Cathartics

Laxatives are used when constipation moves from being uncomfortable to being serious or chronic. There are several types of laxatives—bulk-forming laxatives; chloride channel activators; lubricants, osmotic and saline laxatives; stimulants; and stool and fecal softeners.

While laxatives encourage bowel movements, **cathartics** accelerate bowel movements. Cathartics are used to clean the bowels before surgery or diagnostic tests.

Listed below are some of the most commonly used laxatives and cathartics.

Generic Name	Trade Name
Bulk-forming laxatives	
Polycarbophil	Equalactin, Mitrolan, Fiberall Chewables, Fibercon, Mitrolan
Psyllium	Hydrocil, Konsyl, Metamucil, Perdiem, Effer-syllium, Fiberall
Methylcellulose	Citrucel, Unifiber

Chloride channel activators	
Lubriprostone	Amitiza
Lubricants	
Mineral oil	Kondremul, Agoral, Petrolagar
Saline and osmotic laxatives	
Glycerin	Colace Pediatric and Sani-Supp
Magnesium citrate	Citrate of Magnesia
Magnesium hydroxide	Phillips Milk of Magnesia
Polyethylene glycol (PEG)	Miralax, CoLyte, GoLYTELY
Sodium phosphate	Fleet Enema, Fleet, Phospho-Soda
Sorbitol	Cephulac
Stimulants	
Bisacodyl	Dulcolax, Modane
Cascara sagrada (bitter dark)	Generic only
Castor oil	Emulsoil, Purge
Senna	Senokot
Stool and fecal softeners	
Docusate calcium	Surfak
Docusate sodium	Colace
Docusate potassium	Dialose
Cathartics	
Magnesium citrate	Citrate of Magnesia, LiquiPrep
Magnesium sulfate	Generic only
Sorbitol	Generic only

Step 14 Urinary System

- The **urinary system** has one purpose—to make and excrete urine. This process maintains the internal chemical balance in your body by regulating the volume and composition of fluids. Because your body is approximately 55 to 60 percent water, you can imagine that this balancing act affects all of the body systems. So diuretics can be used to treat a variety of illnesses, including cirrhosis of the liver, heart failure, hypertension and some kidney diseases. We'll discuss three types of diuretics—*loop diuretics, potassium-sparing diuretics* and *thiazide diuretics.* Each of these acts in different ways on the body.

Loop Diuretics

As liquids pass through the kidneys, sodium is reabsorbed in the Loop of Henle. The kidneys must also reabsorb a certain amount of water to help the body handle the sodium. **Loop diuretics** inhibit the Loop of Henle from absorbing sodium, so the kidney needs less water. This in turn lowers blood volume. Loop diuretics are used to treat cirrhosis of the liver, congestive heart failure, hypercalcemia and nephrotic syndrome.

Potassium-sparing Diuretics

When the adrenal glands overproduce the hormone aldosterone, it causes the kidneys to retain too much sodium, and of course, too much water. It also releases too much potassium from the body, causing **hyperkalemia** (low potassium). **Potassium-sparing diuretics** are antagonists of aldosterone receptors, so they block overproduction. Potassium-sparing diuretics are used to treat cirrhosis of the liver, congestive heart failure, **edema** (fluid retention), hypertension and nephrotic syndrome.

Thiazide Diuretics

Thiazide and **thiazide-type diuretics** help release sodium, chloride and potassium from the body, which in turn releases water and lowers blood pressure. In addition, thiazides are vasodilators, which further improves high blood pressure. Thiazides are used to treat calcium stones, congestive heart failure, diabetes insipidus and hypertension.

A list of the most common diuretics appears below.

Generic Name	Trade Name
Loop diuretics	
Bumetanide	Bumex
Ethacrynic acid	Edecrin
Furosemide	Lasix
Torsemide	Demedex
Potassium-sparing diuretics	
Amiloride	Midamor
Spironolactone	Aldactone
Triamterene	Dyrenium
Thiazide and thiazide-type diuretics	
Benzthiazide	Exna
Chlorothiazide	Diuril, Diurigen
Hydrochlorothiazide	Esidrix
Trichlormethiazide	Metahydrin, Naqua, Diurese

Step 15 Reproductive System

- **Gonads**—or sex glands—produce sex hormones in both men and women. In men, the gonad is the testes; in women, the ovaries. We'll discuss the female hormones first, followed by male hormones.

Hormones of the Ovaries and Drugs Used in the Female Reproductive System

The ovaries produce **estrogen** and **progesterone**. These two hormones regulate reproduction, including female sexual maturity, egg formation, ovulation and pregnancy.

Estrogen

Doctors use estrogens to treat a variety of conditions; mostly in women, some in men. Estrogens play a role in conserving calcium and phosphorus within the body. Estrogens are used to treat the following conditions:

- atrophic vaginitis
- atrophic urethritis
- abnormal uterine bleeding
- amenorrhea (lack of menstruation)
- breast engorgement
- contraception
- hirsutism (excessive hair growth)
- hormone replacement therapy
- hypogonadism
- menopause symptoms
- osteoporosis—preventive
- ovarian failure
- pain relief with breast and prostate cancer
- prostate cancer
- stunted female height—prevention

Progesterone

At ovulation, the ovaries secrete **progesterone** until the end of a woman's menstrual cycle. If conception and implantation occur, progesterone helps the body form a placenta and develop mammary glands.

Doctors use a synthetic form of progesterone for treatment because natural progesterone would be inactivated in the liver. Synthetic progesterones are called **progestins**.

The most common estrogens and progestins appear in the list below.

Generic Name	Trade Name
Estrogens	
Estradiol (natural/midcronized)	Estrace, Gynodiol, Alora, Climara, Estraderm
Conjugated estrogen (esterified)	Premarin, Premphase, Prempro, Cenestin
Ethinyl estradiol (synthetic)	Alesse-28
Non-steroid estrogens	Chlorotrianisene, Dienestrol
Transdermal creams	Climara, Estraderm, Vivelle
Progestins	
Medroxyprogesterone	Provera
Norethindrone	Norlutin
Norethindrone acetate	Norlutate
Progesterone	Gesterol

Uses of Female Gonadal Hormones

Synthetic forms of estrogen and progesterone are used in *hormone replacement therapy,* birth control and fertility treatments.

Hormone Replacement Therapy (HRT)

Most likely, you know an older woman on **hormone replacement therapy**, which supplements the lack of estrogen and progesterone after menopause. Doing so has many benefits, including delaying and lessening osteoporosis, keeping the vagina supple and, some believe, holding aging at bay—but that's highly debated. HRT is usually a combination of two hormones; occasionally just estrogen is given. Because breast cancer can be associated with HRT, women and their doctors are not using HRT as often as they used to. The verdict is still out on whether or not benefits outweigh risks.

In addition, children may need HRT for the conditions hypogonadism, primary ovarian failure or dysfunctional puberty development, which can cause inadequate bone growth.

Birth Control

Birth control, or **contraception**, drugs are often a combination of estrogen and progestin. Estrogen blocks ovulation. Progestins increase the thickness of cervical secretions to impede sperm, making implantation difficult. Progestins can also prevent ovulation by inhibiting the release of another hormone, LH. When used properly, they can prevent pregnancy close to 100 percent of the time.

The four main types of contraceptives are discussed below in order of most common to least.

Oral Contraceptives

Oral contraception, commonly known as birth control pills or "the pill," is the most common form of contraception available. These agents mostly follow the woman's cycle, releasing different levels of estrogen and progestin at different times of the month. Some contraceptives contain only progestin to reduce the health risks that estrogen can cause; these are referred to as minipills and women take them continuously, not cyclically.

Different Hormone for Different Times of the Month

Birth control pills come in three combinations: **monophasic**, which means the amounts of estrogen and progestin are equal throughout a 28-day cycle; **biphasic**, where amounts differ during the first and second halves of the cycle and **triphasic**, where hormone amounts differ in three stages of the cycle. You'll notice that some pill names have numbers after them indicating their type. For example, Alesse-28 is a monophasic agent, Ortho-Novum 10/11 is biphasic and Ortho-Novum 7/7/7 is triphasic.

Implants and Long-acting Injectables

One of the newer forms of contraception is the **levonorgestrel subdermal implant**, known as Norplant. A practitioner surgically implants six small capsules under the skin of a woman's upper arm. The implants slowly release progestin into the bloodstream and provide constant protection from pregnancy. They work for up to five years.

Another long-acting progestin is the **depot-medroxyprogesterone acetate injectable** or Depo-Provera. While new in the United States, it has been used in other countries for decades. One injection every three months provides continuous contraception. It is viewed as safe, relatively inexpensive and highly convenient.

The Morning-after Pill

The morning-after pill, **RU 486**, is an **abortifacient**—it acts after the egg is fertilized. RU486 is called an antiprogestin and works by blocking the release of progesterone after conception. It is used in Europe and is now available on the U.S. market.

A list of the most common contraceptive agents appears on the following page.

Generic Name	Trade Name
Oral contraceptives ***Estrogen-progestin combination agents***	
Estinyl estradiol/ethynodiol diacetate	Demulen
Estinyl estradiol/norgestrel	Lo/Ovral, Ogestrel, Ovral
Estrogen/progestin	Alesse-28, Necon 1/35,Ortho-Novum 1/135
Ethinyl estradiol/desogestrel	Apri, Desogen, Mircette, Ortho-Cept
Ethinyl estradiol/drospirenone	Yasmin, Yasmin 28
Ethinyl estradiol/levonorgestrel	Alesse, Aviane, Levlen, Levlite, Levora, Nordette
Ethinyl estradiol/levonorgestrel (triphasic)	Tri-Levlen, Triphasil, Triphasil 28, Trivora 28
Ethinyl estradiol/norethindrone	Brevicon, Genora, Loestrin, Modicon, Nee, Necon, Norinyl, Ortho-Novum
Ethinyl estradiol/norethindrone (biphasic)	Nelova 10/11, Ortho-Novum 10/11
Ethinyl estradiol/norethindrone (triphasic)	Tri/Norinyl, Ortho-Novum 7/7/7
Ethinyl estradiol/norethindrone (estrophasic)	Estrostep
Ethinyl estradiol/norethindrone/ ferrous fomarate	Loestrin Fe 1/20, Microgestin Fe 1/20
Ethinyl estradiol/norgestimate	Ortho Tri-cyclen
Mestranol/norethindrone	Genora 1/50, Norinyl, Norethrin, Ortho-Novum
Progestin-only agents (Mini-pill)	
Norethindrone	Micronor, Nor-QD
Norgestrel	Ovrette
Transdermal agents (Patch)	
Ethinyl estradiol/norelgestromin	Ortho-Evra
Long-acting injectables	
Levonorgestrel	Norplant
Medroxyprogesterone	Depo-Provera, Depo-subQ Provera 104
Medroxyprogesterone/estradiol	Lunelle
Morning-after pill	
Mifepristone, followed by misoprostol	RU 486

Whew! That was a lot of information. Hang in there—we're almost done learning about reproductive system drugs.

Labor, Delivery and Fertility Drugs

As you might guess, labor and delivery drugs either speed up or slow down contractions. They are called *uterine stimulants* and *uterine relaxants*.

Uterine stimulants, or **oxytocic agents**, activate the smooth muscles of the uterus, causing contractions during labor and delivery and managing bleeding after abortion or miscarriage.

Uterine relaxants work to stop contractions in the uterus to prevent premature delivery. These **tocolytics** include **ß** $_2$ agonists normally used as bronchodilators, calcium channel blockers and oxytocin antagonists.

Fertility drugs improve the chances of pregnancy. They are not hormones, but they do act on endocrine organs. They stimulate the pituitary to release FSH and LH to promote ovulation.

The most common labor, delivery and fertility agents are listed below.

Generic Name	Trade Name
Uterine stimulants	
Synthetic oxytocins	Pitocin, Syntocinon
Misoprostol (prostaglandin)	Cytotec
Uterine relaxants	
Terbutaline	Brethine, Bricanyl
Nifedipine	Adalat CC, Procardia XL
Atosiban	Generic only
Indometacin	Generic only
Fertility agents	
Clomiphene citrate	Clomiphene Citrate, Serophene, Clomid
Menotropin	Menopur (followed by hCG)
Urofollitropin (followed by hCG)	Fertinex, Metrodin

Now, let's move on to the male side of this discussion—androgens.

Hormones of the Testes and Drugs Used in the Male Reproductive System

The hypothalamus, anterior pituitary gland and the testes secrete male reproductive hormones called **androgens**. There are two types of androgens—**testosterone** and **androsterone**. These are responsible for producing sperm, enhancing the function of the penis and other sex organs and developing male secondary sex characteristics, such as facial hair, muscle mass and vocal chords.

Uses of Male Gonadal Hormones

When the pituitary fails to produce enough hormones to stimulate androgen production, problems occur. **Androgen therapy** is used to treat low testosterone levels by stimulating testosterone production in the testes.

Synthetic androgens are given to treat **hypogonadism** (the testes do not function), **cryptorchidism** (failure of testes to extend), breast cancer in postmenopausal women and delayed puberty in males. Hypogonadism in men can cause symptoms of impotence and decreased sexual interest, fatigue, lowered bone density and lowered lean body mass.

Problems with Erection

Another common problem among men is impotence or **erectile dysfunction**—an inability to achieve or sustain an erection. It usually has a physical cause, such as disease, injury or drug side effects; hormonal abnormalities may also play a role. Some 15 to 25 percent of men over 65 have some degree of erectile dysfunction.[9] Oral and injected drugs treat erectile dysfunction. A common choice is Viagra. Oral testosterone is also sometimes used.

The most common male hormone drugs are listed below.

Generic Name	Trade Name
Testosterone/androgen agents	
Fluxymesterone	Android-F, Halotestin
Methyltestosterone	Android orETON Methyl, Testred, Virilon
Synthetic Testosterone	Androgel androderm andronate andryl 200, Delatest, Deatestryl, Depotest, Everone 200, T-Cypionate, Testamone 100, Testaqua, Virilon IM
Testosterone buccal system	Striant
Erectile dysfunction agents	
Sildenafil citrate	Viagra
Alprostadil (prostaglandin)	Alprostadil, Caverject, Edex, Muse

Please pause to complete online Practice Exercise 24-5.

Step 16 Immune System

- The immune system is a collection of white blood cells, the thymus, lymph nodes and lymph channels. These components work together to protect your body against infections and foreign substances. It seeks and kills invaders that may be carrying disease. It also jumps into action when cells are altered by cancer.

Your body is constantly being invaded by *bacteria, viruses, fungi* and **protozoa** (single-cell organisms). Over thousands of years, doctors have discovered the diseases these pathogens cause and have tried to develop therapies to help the immune system fight them. While the vaccines you learned about in a previous lesson *prevent* disease, the agents you'll study here, *antibacterials, antifungals, antiprotozoals, antituberculars* and *antivirals,* help to *cure* disease.

All of these **anti-infective agents** control infections by suppressing the disease to a level where the host's immune system can manage it. The drugs in the healthcare arsenal that treat pathogenic microorganisms are *antibiotics* and *antimicrobials*. **Antibiotics** are made from natural substances and **antimicrobials** are made from synthetic substances.

The **antibiotic spectrum** of a drug is how many types of pathogens it can kill. For instance, a **broad-spectrum** antibiotic works on a wide range of pathogens, while a **narrow-spectrum** antibiotic works on only a few types of microorganisms.

Let's begin our study of anti-infectives by looking at the little one-celled bacterium.

Antibacterial Agents

Pathogenic bacteria cause many different illnesses such as pneumonia, urinary tract infections and gonorrhea, just to name a few. **Bacteria**, (plural for bacterium), are single-celled organisms that rely on their host for food. **Antibacterial agents** fight infections caused by bacteria.

There are several classes of antibacterial agents, and each class plays a unique role in the fight against bacterial infections. In this section, we'll cover the *aminoglycosides, cephalosporins, macrolides, penicillins, sulfonamides, tetracylines* and *fluoroquinolones*.

Aminoglycosides

Aminoglycosides are used to treat serious infections such as tuberculosis and meningitis. They are very toxic. Aminoglycosides are **bactericidal** (they kill bacteria) by inhibiting the protein synthesis process. In addition to tuberculosis and meningitis, healthcare professionals use aminoglycosides to treat serious illnesses caused by enterobacter and *Klebsiella* bacteria.

Listed below are the most commonly used aminoglycosides.

Generic Name	Trade Name
Streptomycin	Generic only
Amikacin	Amikin
Tobramycin	Nebcin

Cephalosporins

Semisynthetic cephalosporins, also known as **B-lactam antibiotics**, are similar to penicillins; however, cephalosporins are more effective against gram-negative organisms, such as the bacteria that cause strep throat. Cephalosporins are classified into four "generations."

- First generation cephalosporins treat most gram-positive organisms and some gram-negative organisms.
- Second generation cephalosporins treat the same organisms as the first, but treat *Haemophilus influenzae* and several Proteus strains as well.
- Third generation cephalosporins treat a greater number of gram-positive organisms than the first and second but fewer gram-negative organisms.
- Fourth generation cephalosporins work the best against gram-positive organisms but offer very little protection against gram-negative organisms.

Cephalosporins attach themselves to certain enzymes called penicillin-binding proteins. From there, they inhibit the growth of the bacterial cell wall. Cephalosporins mainly treat infections of the skin, soft tissue, respiratory tract and urinary tract.

Listed below are the most commonly used cephalosporins.

Generic Name	Trade Name	Class
Cephalexin	Kelfex	First generation
Cefoxitin	Mefoxin	Second generation
Cefotaxime	Claforan	Third generation moxalactam
Cefprozil	Cefzil	Third generation
Cefepime	Maxipime	Fourth generation

Macrolides

Medical workers often use **macrolides** as an alternative anti-infective drug for patients who are allergic to penicillin. At normal dosage levels, macrolides are *bacteriostatic*. **Bacteriostatic** drugs stop bacterial growth. At high doses, macrolides become bactericidal and actually kill the bacteria rather than just slow down its reproduction. Macrolides work like many other antibacterial drugs. They block protein synthesis. They work better against gram-positive than against gram-negative bacteria. Because macrolides can be used instead of penicillin, doctors prescribe them to treat syphilis, gonorrhea and pneumococcal pneumonia in penicillin-allergic patients. Healthcare workers also use macrolides to treat Legionnaires' disease, pertussis and chlamydia infections.[10]

Listed below are the most commonly used macrolides.

Generic Name	Trade Name
Clarithromycin	Biaxin
Azithromycin	Zithromax
Erythromycin	Eryc
Dirithromycin	Dynabac
Troleandomycin	Tao

Penicillins

Penicillin is made from the fungus *Penicillium* and can be either natural or synthetic. The medical community prescribes penicillin more than any other anti-infective drug. Like cephalosporins, penicillin kills bacteria by making it hard for the bacteria to build cell walls. Doctors use penicillins to treat streptococcal infections, syphilis, gonorrhea and rheumatic fever.

You've learned that penicillins can either be natural or synthetic. There are also categories of *penicillinase-resistant penicillins, extended spectrum penicillins, semisynthetic penicillins* and *amoxicillin/clavulanate potassium*. Let's look at these unique kinds of penicillin.

Penicillinase-resistant Penicillins

Staphylococci bacteria produce an enzyme called **penicillinase** which makes it immune to penicillin treatments. **Penicillinase-resistant penicillins** were developed to fight these organisms. Healthcare workers treat most staphylococci with penicillinase-resistant penicillins such as oxacillin, cloxacillin, dicloxacillin and methicillin.[11]

Extended Spectrum Penicillins

Of all the penicillins, **extended spectrum penicillins** such as carboxypenicillins and ureidopenicillins work against the largest number of gram-negative microorganisms. These penicillins treat serious infections like sepsis, pneumonia and osteomyelitis.

Semisynthetic Penicillins

The medical community uses **semisynthetic penicillins** to treat gonococcal infections, urinary tract infections and upper respiratory infections. Amoxicillin, ampicillin and cyclacillin are all semisynthetic penicillins. These drugs don't work against organisms that produce penicillinase.

Amoxicillin/Clavulanate Potassium

This penicillin was the first antibiotic approved by the U.S. Food and Drug Administration for treatment against the bacterium *s. pneumonia. S. pneumonia* is the culprit in infections like acute bacterial sinusitis and pneumonia.

Listed below are the most commonly used penicillins.

Generic Name	Trade Name
Natural penicillins	
Penicillin G	Pen, Pfizerpen
Penicillin V	Beepen, Ledercillin
Penicillinase-resistant penicillins	
Oxacillin	Bactocill
Cloxacillin	Cloxapen
Dicloxacillin	Dycill, Dynapen
Methicillin	Generic only
Extended spectrum penicillins	
Carbenicillin	Geocillin
Tircarcillin	Ticar
Mezocillin	Mezlin
Piperacillin	Pipracil
Semisynthetic penicillins	
Amoxicillin	Amoxil, Trimox
Ampicillin	Ominpen
Cyclacillin	Bastocillin

Sulfonamides

Sulfonamides, also called "sulfa drugs," were the first class of drugs that successfully treated human bacterial infections but their use dropped off after researchers developed penicillin. Doctors originally used sulfonamides to treat a wide variety of infections but they are used less and less now as bacteria develop a resistance to them. Sulfonamides block folate synthesis. Without folate, cells can't divide and multiply. Sulfonamides vary in how long they remain active. They are classified as short acting, intermediate acting and long acting. Though not as medically useful as they were in the past, sulfonamides are still the best treatment option for cases of *E. coli* that are caused by urinary tract infections.

The most commonly used sulfonamides are listed below.

Generic Name	Trade Name
Short acting	
Sulfamethizole	Methazol
Long acting	
Sulfadoxine	Fansidar

Tetracylines

Healthcare workers use broad spectrum **tetracyclines** when bacteria become resistant to other drugs. Tetracyclines inhibit bacterial growth by restricting bacterial protein synthesis. Tetracyclines are the preferred treatment for chlamydia, cholera, Rocky Mountain spotted fever and amebiasis. They fight microorganisms such as Rickettsia, spirochetes and some protozoa. Doctors can use them instead of penicillin for patients who are allergic to penicillin.[12]

The most commonly used tetracyclines are listed below.

Generic Name	Trade Name
Demeclocycline hydrochloride	Declomycin
Minocycline hydrochloride	Minocin
Tetracycline hydrochloride	Achromycin

Fluoroquinolones

Fluoroquinolones are bactericidal, killing bacteria by restricting the function of DNA enzymes within the cell. Healthcare workers use flouroquinolones to treat urinary tract infections, gonococcal infections, prostatitis and lower respiratory tract infections.

The most commonly used fluoroquinolones are listed below.

Generic Name	Trade Name
Ciprofloxacin	Cipro
Moxifloxacin	Avelox
Cinoxacin	Cinobac

Other Antibacterial Agents

Some antibacterial drugs don't fit easily into any one category but they're very important and helpful in fighting infections. These are *chloramphenicol, clindamycin, dapsone* and *vancomycin.*

Chloramphenicol

Chloramphenicol is a good treatment option for pregnant women with Rickettsial infections and for patients with meningococcal infections who are allergic to cephalosporins. It is also used to treat typhoid fever.

Clindamycin

Doctors only prescribe **clindamycin** if other antibacterials won't be effective. Clindamycin can be highly toxic and may cause serious illnesses like **leukopenia** (very low white blood cell count) and **thrombocytopenia** (a persistent decrease in the number of platelets in the blood often associated with bleeding).

Dapsone

Dapsone is the most effective known drug to treat leprosy. It can also be used to prevent and treat malaria. Dapsone inhibits bacterial growth by restricting bacterial folic acid synthesis.

Vancomycin

Vancomycin works against infections such as osteomyelitis, methicillin-resistant staphylococci, endocarditis and staphylococcal pneumonia. Doctors may also use it with patients who are allergic to cephalosporins and penicillin.

Listed below are the most common forms of these miscellaneous antibacterial agents.

Generic Name	Trade Name
Chloramphenicol	Chloramex
Clindamycin	Dalacin
Dapsone	Aczone
Vancomycin	Vancocin

Antiprotozoal Agents

Pathogenic protozoa such as sporozoa, amoebae and flagellates can cause serious human illnesses. **Antiprotozoal drugs**, classified into two different groups, treat these harmful microorganisms. The first class of antiprotozoal drugs, which healthcare workers use to treat amoebic and trichomonal infections, includes **amebicides** and **trichomonacides**. Doctors use the second group (*antimalarial agents*) to treat malaria.

The most commonly used antiprotozoal agents are listed on the next page.

Mosquitoes are responsible for the spread of malaria.

Generic Name	Trade Name
Metronidazole	Flagyl
Paromomycin	Humatin
Chloroquine	Aralen
Mefloquine	Lariam

Antifungal Agents

A *fungus* usually infects individuals with a compromised immune system. It targets the host's hair, nails, skin and mucous membranes. Growing in either single cells or in colonies, a **fungus** relies on living organisms and organic matter for food.

Listed below are the most common antifungal agents.

Generic Name	Trade Name
Amphotericin B	Fungizone
Caspofungin	Cancidas
Clioquinol	Torofor, Vioform
Clotrimazole	Mycelex, Lotrimin
Econazole	Spestazole
Fluconazole	Diflucan
Griseofulvin	Grifulvin, Fulvicin
Itaconazole	Sporanox
Ketoconazole	Nizoral
Naftifine	Naftin
Nystatin	Mycostatin
Oxiconazole	Oxistat
Terbinafine	Lamisil
Tolnaftate	Tinactin
Undecylenic Acid	Blis-To-Sol
Voriconazole	Vfend

Antitubercular Agents

Tuberculosis (TB) is a potentially fatal bacterial infection that attacks the lungs. The type of bacteria—called **mycobacteria**—that cause tuberculosis can develop drug resistance very quickly. **Combination drug therapy**—using many different kinds of drugs at the same time—can overcome this resistance.

The standard treatment for TB is *ethambutol, isoniazid, pyrazinamide* and *rifampin* for two months, then isoniazid and rifampin alone for an additional four months. The patient is considered cured at six months. When doctors suspect that the TB strain may be resistant to the typical regimen, they may replace one of the drugs with *streptomycin* or add the drug to the combination. Antitubercular drugs can be both bacteriostatic and bactericidal. We'll briefly examine these agents.

- **Ethambutol—**is a water-based synthetic antitubercular drug. Ethambutol is used in combination with other antitubercular drugs to treat pulmonary tuberculosis.
- **Isoniazid—**is included in all tuberculosis treatments. It is combined with either rifampin or streptomycin. The two drugs are then combined with either pyrazinamide or ethambutol. Isoniazid is both bacteriostatic and bactericidal. Isoniazid is widely prescribed to treat patients with tuberculosis and to help them avoid drug-resistant tuberculosis. Isoniazids are also given to patients with weak immune systems to help them avoid getting tuberculosis. It is used more than any other antitubercular drug and is usually taken for at least six months.
- **Pyrazinamide**—is a bactericidal agent. It is included in the first regimen of drug therapy for TB.
- **Rifampin**—is bactericidal in nature and can be combined with dapsone to treat leprosy. It's often used with isoniazid to treat tuberculosis.
- **Streptomycin—**kills sensitive bacteria by stopping the production of proteins needed by the bacteria. It's used when doctors fear the TB strain may be resistant to isoniazid.

Listed below are the most commonly used antitubercular agents.

Generic Name	Trade Name
Ethambutol	Myambutol
Isoniazid	Nydrazid
Pyrazinamide	Generic only
Rifampin	Rifadin
Streptomycin	Generic only

Antiviral Agents

A **virus** is a tiny, yet powerful disease causing agent. A virus can only survive inside a host's cells, where it uses the cell's ability to divide to produce more virus. Influenza, hepatitis, HIV, West Nile, genital herpes and measles are viral infections. Scientists categorize viruses as being either **DNA viruses** or **RNA viruses**. Examples of DNA viruses are varicella-zoster virus, herpes simplex virus and influenza A virus. RNA viruses include AIDS, rabies, polio, measles and mumps, among other diseases. Anti-viral drugs work within the host cell where the viruses reproduce to treat these infections. Let's review the most commonly used antiviral agents.

Acyclovir

Acyclovir is used to treat many different herpes viruses, such as VZV (shingles), varicella (chicken pox) and CMV (cytomegalovirus). It also works very well against herpes simplex type 1 (HSV-1) and herpes simplex type 2 (HSV-2). Acyclovir is absorbed by the viral DNA of infected cells. From there, the drug restricts viral reproduction.

Doctors use acyclovir to treat neonatal HSV, HSV encephalitis and serious cases of HSV and VZV in patients with weakened immune systems. Physicians also use the drug to treat genital herpes and herpes simplex keratitis. It is most effective against HSV-1 and HSV-2.

Amantadine

Healthcare practitioners use **amantadine** primarily to treat the flu and other respiratory infections. This drug is most effective in the first stages of a viral infection. Amantadine is also used to treat Parkinson's disease.

Famciclovir

Famciclovir is a *prodrug* of a different drug, penciclovir. A **prodrug** is an inactive drug that is metabolized by the body, changing it into an active, but different, drug.[13] Once famciclovir is inside an infected cell, an enzyme called viral thymidine changes famciclovir into active penciclovir. Penciclovir prevents the virus from duplicating. Doctors use famciclovir to manage VZV and genital herpes infections. It is also used to treat HSV-1 and HSV-2.

Ganciclovir

Healthcare workers use ganciclovir to treat CMV infections. The patient's body changes ganciclovir into ganciclovir triphosphate. Then it is absorbed by viral DNA, where it makes it hard for the virus to reproduce. This antiviral drug treats CMV infections, including retinitis and pneumonia.

Ganciclovir has been given a **black box warning**. The FDA issues these warnings when a drug has serious side effects. The warnings help alert medical staff to potential treatment problems.[14]

Other drugs with black box warnings include antidepressants, Depo-Provera and Celebrex.

Oseltamivir Phosphate

In cases of early influenza detection, doctors can use **oseltamivir phosphate** in children as young as one year old. Oseltamivir phosphate can't be used if the patient has had the infection for more than two days. For patients 13 years and older, this anti-viral drug also works as a prophylactic. Oseltamivir phosphate works by making it hard for the virus to leave its cell and spread to other cells. Oseltamivir phosphate helps relieve the terrible symptoms of the flu such as sore throat, **myalgia** (muscle pain), cough, nasal symptoms, chills, fatigue, headache, sweats and malaise.

Ribavirin

Ribavirin works against a variety of RNA and DNA viruses. In T lymphocyte cultures, ribavirin stops HIV reproduction. Along with HIV, ribavirin is also used to treat influenza A. To treat babies with viral pneumonia, healthcare workers use ribavirin as an aerosol while working inside an oxygen hood.

Valtrex

Physicians use **valaciclovir**, more commonly known as **Valtrex**, to treat herpes simplex and herpes zoster. Like ganciclovir, Valtrex is absorbed by viral DNA, where it makes it hard for the virus to reproduce. Aside from herpes simplex and herpes zoster, Valtrex also treats the varicella zoster and Epstein-Barr viruses.

Zanamivir

This influenza treatment must by administered with an inhaler. **Zanamivir** works in the same way as oseltamivir phosphate works, by making it hard for the virus to leave its cell and spread to other cells. This anti-viral drug can't be used in patients under 12 or in patients who've been sick for more than two days.

Listed below are the most common non-HIV antiviral agents.

Generic Name	Trade Name
Acyclovir	Zovirax
Amantadine	Symmetrel
Famciclovir	Famvir
Ganciclovir	Cytovene
Oseltamivir phosphate	Tamiflu
Ribaviran	Copegus
Rimantadine	Flumadine
Valaciclovir	Valtrex
Zanamivir	Relenza

HIV Antiviral Agents

HIV, or **human immunodeficiency virus,** is classified as an RNA virus. Doctors treat HIV by using a group of drugs as a combination drug therapy. The Food and Drug Administration has approved three different categories of HIV antiviral agents for this type of use. These categories are the **NRTIs** (**nucleoside reverse transcriptase inhibitors**), the **NNRTIs** (**non-nucleoside reverse trancriptase inhibitors**) and the **PIs** (**protease inhibitors**.)[15]

Some of the most common HIV antiviral agents are listed below.

	Generic Name	Trade Name
NRTIs		
	Didanosine	Videx
	Lamivudine	Epivir
	Zalcitabine	Hivid
	Zidovudine	Retrovir
NNRTIs		
	Efavirenz	Sustiva
	Etravirine	Intelence
PIs		
	Indinavir	Crixivan
	Nelfinavir	Viracept
	Ritonavir	Norvir
	Saquinavir	Invirase
Others		
	Tenofovir	Viread
	Valganciclovir hydrochloride	Generic only

Step 17 Integumentary System

- The **integumentary system** includes the skin, hair, nails and glands associated with the skin, including sweat and sebaceous glands. Skin covers the entire body, acting as a protective shell to keep our organs and muscles safe. As you well know, skin can really take a beating. Burns, insect bites, cuts, bruises and swelling are just a few of the indignities our outermost layer endures. You'll notice with most skin injuries and infections that **erythema**, or redness, is a common symptom. Other common symptoms of skin injuries include swelling, itching, bleeding or pus discharge.

In this section we'll discuss the drugs that are used to treat the integumentary system—*anti-inflammatory* and *antipruritic* drugs, *antiseptics, astringents, keratolytics* and vasoconstrictors.

Anti-inflammatory Agents

When skin becomes inflamed from an injury or due to a condition such as dermatitis, eczema, psoriasis or urticaria, an anti-inflammatory drug will suppress inflammatory response to relieve pain and swelling. The two most common anti-inflammatories are steroids and non-steroidal anti-inflammatory drugs (NSAIDs). You can review the many types of corticosteroids in the Respiratory System step.

Antipruritic Agents

Antipruritics relieve itching and other allergy symptoms caused by poison ivy and other skin irritants. Antipruritics also act as a mild sedative and a drying agent. Antipruritics are used to treat many forms of contact dermatitis such as burns, insect bites, allergic reactions, eczema and psoriasis.

Antiseptics

When you sustain a cut, burn or other skin wound, it breaks the skin's protective barrier. Pathogens can invade the body through this opening and cause infection. **Antiseptics** kill pathogens on open wounds to prevent them from entering the body.

Hydrogen peroxide is a common antiseptic that you've probably used on a scrape or scratch.

Astringents

Astringents dry the skin, relieve itching and sooth mild burns. Astringents can be used on sunburns, insect bites and poison ivy.

Keratolytics

Calluses, corns and ulcers are all caused by too much pressure on the skin. Excess tissue will form to protect the injured area and can cause more pain if the pressure isn't relieved. **Keratolytics** soften and smooth this excess skin so it can be removed.

Vasoconstrictors

As you know, a vasoconstrictor constricts the blood vessels, slowing blood flow to an area. This reduces the amount of fluids in the area and decreases swelling. Vasoconstrictors include antihistamines, decongestants and stimulants and are used to treat dermal ulcers. Refer to the Respiratory and Nervous System steps to review these types of drugs.

The most common drugs used to treat the integumentary system appear below.

Generic Name	Trade Name
Anti-inflammatory agents	
Steroids	
Corticosteroids	
NSAIDs	
Aspirin	Bayer
Ibuprofen	Motrin, Advil
Naproxen	Aleve, Midol XR
Antipruritic agents	
Crotamiton	Eurax
Menthol/Zinc oxide	Generic only
Antiseptics	
Alcohol	
Ethanol	Generic only
1-propanol	Generic only
2-propanol/isopropanol	Generic only
Boric acid	Collyrium Fresh (ophthalmic)
Brilliant green	Generic only
Hydrogen pyroxide	Generic only
Iodine	Iodex, Iodoflex
Quaternary ammonium compounds (Quats)	
Benzalkonium chloride	Generic only
Astringents	
Zinc oxide	Desitin, Balmex
Witch hazel	Generic only
Alum	Generic only
Keratolytics	
Allantoin	Tegrin
Lactic acid	Lac-Hydrin, Lactinol
Urea	Carmol 40, Keralac

Whew! This ends our exploration of drugs that affect the major body systems. It's time for a review before we move on to special examinations.

Please pause to complete online Practice Exercise 24-6.

Step 18 Lesson Summary

- This lesson explored pharmacology—the study of where drugs, or pharmaceuticals, come from, how they are used and how they work. Drugs come from five sources, including plants, animals, minerals, chemicals and engineered materials. All drugs have actions. Those actions are site specific, thanks to selective action. Drug molecules fit certain receptors so that once a drug reaches the bloodstream it can affect any targeted organ.

  Drugs tend to be agonists or antagonists. Agonists activate receptors, causing them to speed or slow cellular processes. Antagonists block action, making certain that other substances can't activate the receptors. To be effective, a drug must reach the desired receptors in a sufficient amount to have an effect. One effective way to monitor the amount of drug is the blood concentration level.

  Once in the body, drugs undergo a series of changes. These changes are called the ADME processes—absorption, distribution, metabolism and excretion. Knowing how the ADME processes interact helps predict drug action, but individual patients have human variability. These factors include age, diet, weight, genetics, other diseases and psychological factors.

  A second kind of variable is drug interaction. Drugs can add their effect; have synergism (multiplied effect), potentiation (prolonging the duration of action) or antagonism (negating the drug action). Some drug interactions can be helpful to treatment. However, accidental drug interaction can cause negative reactions. The risk of drug interaction can be reduced through a series of steps that include identifying patient risks, studying the patient's drug history, knowing all facets of drug interactions, considering alternative medicines or simpler drug regimens and educating the patient.

  Another sort of negative drug reaction is called the side effect or adverse reaction. Side effects are usually mild, but adverse reactions can be life threatening, so it is important for the patient to know the risks so she can inform the doctor of any complications that arise. Practice using your PDR pocket guide by looking up the side effects and adverse effects of the drugs you learned about in this lesson. You can also visit Web sites such as www.drugs.com to research almost any drug in the world. In the next lesson, you'll learn how to assist the doctor with special examinations.

Please pause to complete an online Quiz.

Endnotes

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Lesson 25
Assisting with Special Examinations

Step 1 Learning Objectives for Lesson 25

- When you have completed the instruction in this lesson, you will be trained to do the following:
  - Explain the purpose of a cervical Pap test and instruct a female patient in preparing for a Pap test and pelvic examination.
  - Specify the necessary instruments and supplies needed for a Pap test and pelvic examination.
  - Summarize the proper way to prepare the Pap test specimen for laboratory analysis.
  - Describe the medical assistant's role in sigmoidoscopy and spirometry tests.
  - Instruct a patient to prepare for a sigmoidoscopy and explain its purpose and related equipment.
  - Explain how to perform a breast self-examination.
  - Outline how doctors test visual and auditory acuity.
  - Specify the necessary instruments and equipment for a spirometry test.
  - Describe the purpose of diagnostic imaging, nuclear medicine and radiation therapy.
  - Discuss safety concerns related to the use of radiation.
  - Prescribe patient positions for x-ray views used in x-ray examinations and summarize contraindications to x-rays.
  - Outline the main components of an x-ray machine.
  - Summarize the purpose of and preparation for the following commonly ordered radiological studies: the upper and lower GI series; the intravenous pyelogram; mammography; and the CAT scan.
  - Explain the purpose of sonographic studies, including echocardiography and abdominopelvic studies.
  - Document the purpose of magnetic resonance imaging.
  - Describe how to prepare a patient for an MRI.

Step 2 Lesson Preview

- Often, medical assistants have the opportunity to work for a specialized medical practice where you can assist with procedures like pelvic examinations, breast examinations and sigmoidoscopy.

  In this lesson, you'll explore these and other special exams and your role in these procedures. You'll learn to identify x-ray views and patient positions. Other radiation diagnostics don't use x-rays. We'll explore these, as well as non-radioactive imaging.

  With each of these procedures, you'll discover the equipment and supplies you'll use, as well as how to educate and prepare the patient. If the actual procedure is one that you may assist in, we'll examine your role in the examining room.

  Let's get started with a look at *Pap smears*.

Step 3 Pap Smear and Bimanual Pelvic Exams

- Nearly 5,000 women die of cervical cancer in the United States every year.[1] As with many kinds of cancer, early detection is the key to treatment and survival. The **Pap smear test** was developed to detect cervical cancer. The conventional Pap smear involves scraping a tissue sample from the patient's cervix with a vaginal speculum (a spatula) and a cytology brush. The collected cells are smeared on a slide, sprayed with a fixative solution and then sent to the lab.

  The **ThinPrep Pap test** is a variation of the conventional test. Instead of placing the tissue sample on a slide, the sample is inserted in a vial of fluid that suspends the cervical cells, separating them from the blood, mucus and other cells that cloud a conventional slide. Though the original Pap test has saved countless lives, the ThinPrep Pap test is considerably more effective.

  With either test, the sample is sent to a reference laboratory where a pathologist analyzes it and returns the results to the physician on a cytology report form.

  Today, the Pap smear is part of the female patient's annual checkup. As a medical assistant, you will have six duties when you're assisting with a Pap smear. These duties include the following:

  1. Provide patient instruction before the test.
  2. Help position the patient for the test.
  3. Assist the doctor with equipment and supplies.
  4. Prepare the documentation.
  5. Prepare the patient.
  6. Assist the doctor with the examination.

  Let's go over each of these duties in detail.

Information and Instruction

Whether the patient sets an appointment specifically for a Pap smear or the test is part of the patient's physical, you will be responsible for providing the patient with instruction at the time the appointment is made. A patient may not douche or use any vaginal medication for at least 24 hours before the test. In addition, the patient must refrain from sexual intercourse for at least 48 hours before the test. Finally, the test must not occur while the patient is menstruating. These elements take planning and you will provide the information necessary for the patient to plan properly.

Positioning

The patient is positioned in the lithotomy position with feet in stirrups for a Pap test. The patient wears a gown covered by a drape—since the Pap is often part of an annual exam, the doctor will likely do a breast exam at the same time.

Equipment and Supplies

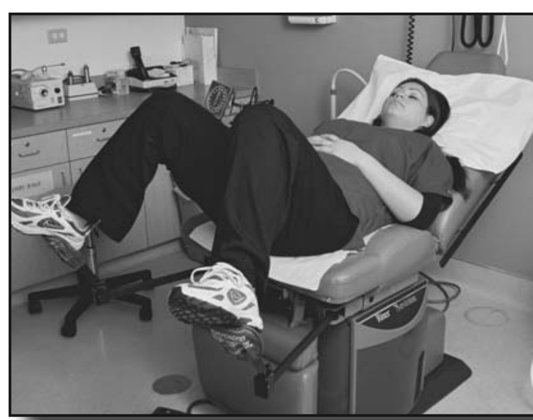
The Pap smear procedure requires a vaginal speculum which comes in age-appropriate sizes for teens and women. It also requires gloves, a water-soluble lubricant, swabs or a cervical brush. The doctor will also need a gooseneck lamp and a slide or a container with ThinPrep solution. The equipment should be prepared on a cart or on a counter near the examination table. In addition, the patient will require a gown and drape.

Preparing the Documentation

Before the exam, you will help the patient fill out the cytology lab form. Ask the patient her age and the first day of her **LMP**—last menstrual period. If the date of the LMP is more than a month, you'll need to ask the patient if she could be pregnant or post-menopausal. This information is transferred to the cytology lab form. Also, note if the patient is taking hormone treatments (including birth control). Record the results of the previous Pap smear along with any pertinent medical history, such as cervical surgery.

Preparing the Patient

You will prep the patient for the actual exam by providing a gown and a flat drape to lay over her lap. The physician usually reviews health history with the patient while she is sitting on the end of the exam table. In addition, the physical exam of the upper body is accomplished prior to the pelvic exam. When it is time for the Pap smear, assist the patient to a reclining position and help her place her heels in the stirrups. You or the doctor will ask the patient to slide her hips down to the edge of the exam table to facilitate the pelvic exam.



The correct position for a pelvic exam.

The Examination

During the examination, the doctor will use a vaginal speculum. Warm the instrument on a heating pad before the procedure for the patient's comfort. If the doctor uses a slide, you will prepare the cell by spraying a fixative on it and allowing it to air dry. If the doctor performs a ThinPrep procedure, you will hold the open container and receive the tissue sample. The Pap exam is usually performed with a *bimanual pelvic exam*. We'll discuss this in a moment.

Turn now to your Procedure Guide to learn how to put this information into practice.

Steps to Take 25-1 Prepare a Female Patient for a Pap Test and Pelvic Exam

1. Turn to Steps to Take 25-1 in your Procedure Guide.
2. Read the Steps to Take to prepare a patient for a Pap test and pelvic exam.
3. Review this information until you can describe it without reading the steps.

As mentioned earlier in this segment, the doctor performs a **bimanual pelvic exam** at the same time as the Pap smear. The doctor applies a water-soluble lubricant to her examination gloves and inserts two fingers into the patient's vagina. The doctor's other hand is placed on the patient's abdomen, feeling for the ovaries, the uterus and any abnormal masses or positioning.

At this point, the doctor will often proceed with a rectal exam. We will discuss these kinds of special examinations in the next segment of the lesson.

After the exam, the Pap smear is sent to a cytology lab. The Pap smear doesn't result in a "positive" or "negative" result. The culture shows changes in the cells. Some changes are gradual. **Dysplasia** indicates abnormal cells that aren't yet cancerous. **Carcinoma in situ** means cancerous changes have begun in surface cells, but have not spread to the surrounding tissues. **Squamous cell carcinoma** refers to surface cells that have become cancerous and are invading surrounding tissues. These results help the physician decide on the correct treatment to pursue.

Step 4 Rectal Exams and Sigmoidoscopy

❑ Rectal exams look for signs of gastrointestinal diseases like colon cancer and inflammatory bowel disease. Using instruments, the doctor can examine both the rectum and the first 30 centimeters of colon above the rectum.

When performing a rectal exam, the doctor moves the patient into a Sims' position and inserts an **anoscope** into the rectum. The anoscope has a rounded end called an **obturator**—designed for the patient's comfort. When the instrument is in place, the doctor can spot hemorrhoids through lateral apertures.

The doctor also inserts a finger into the rectum, feeling for fissures and herniation. This part of the exam usually results in a small portion of stool on the tip of the glove. The physician applies this small sample to a cardboard hemoccult test folder and it is tested for occult blood. You probably remember this procedure from a previous lesson. A small amount of blood in the stool can be an early sign of colon cancer.


Anoscope

A **sigmoidoscope** is an instrument that is inserted into the body to view the internal structure of the colon. The sigmoidoscope has a light, a tube to inject liquids and blades to remove biopsy tissue samples. Some sigmoidoscopes are rigid and some are flexible. The doctor can either look into the tube directly or view the colon through a video camera. The procedure that uses the sigmoidoscope is called **sigmoidoscopy**.

You will have three specific duties when performing a sigmoidoscopy. They include:

1. Instruct the patient.
2. Assist during the sigmoidoscopy.
3. Care for the flexible sigmoidoscope.

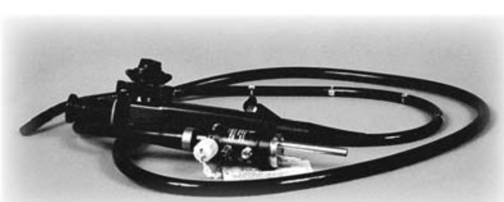
Let's look at each of these steps in depth.

Instruct the Patient

You may be responsible for instructing the patient at the time the sigmoidoscopy appointment is made. The colon must be cleaned so that the doctor can see the colon walls. Advise the patient to eat a light lunch the day before the exam, followed by a liquid dinner. After dinner, the patient can only consume water. The patient should take a non-prescription laxative to eliminate as much stool as possible. On the morning of the exam, the patient must administer an enema to empty the colon. Consult the doctor on the type of enema your office uses and directions for administration so you can instruct the patient.

Rigid Sigmoidoscopy

Some offices use a rigid sigmoidoscope, a ten-inch plastic or metal instrument that is inserted with an obturator. The patient kneels on the steps in front of a special examining table. The handle of the sigmoidoscope has a light source to allow the physician to clearly see the interior of the colon. A swab or biopsy forceps can be passed through the tube as needed.


Rigid sigmoidoscope

During the procedure, air is pumped into the colon via an **insufflator** for a better view. This may cause some cramping for the patient and it is your job to provide support by encouraging him to take slow deep breaths to enable him to tolerate the procedure better.

Flexible Sigmoidoscopy

The flexible sigmoidoscope uses fiber optics and an air system, often a hand-held bulb pump. There is no evidence to suggest any difference in the detection rate between flexible and rigid instruments. The main difference lies in the patient's comfort. Since the flexible sigmoidoscope is much more comfortable for the patient, the rigid sigmoidoscope may eventually fall out of use.

To understand the sigmoidoscopy procedure, turn to your Procedure Guide.

Steps to Take 25-2 Assist with a Sigmoidoscopy

1. Turn to Steps to Take 25-2 in your Procedure Guide.
2. Read the Steps to Take to assist the physician and the patient during a sigmoidoscopy.
3. Review this information until you can describe it without reading the steps.

Care of the Flexible Sigmoidoscope

You will clean the flexible sigmoidoscope using soap and water, followed by chemical sterilization. The interior of the instrument is filled with disinfectant using a syringe. Then the entire apparatus is soaked for several hours in disinfectant. Finally, the instrument is rinsed with sterile water before use.

Step 5 Breast Exams

❑ Doctors give female patients a breast exam as a part of any annual physical. This exam is accomplished by lightly pressing the breasts in a sequence of locations, searching for a growth or abnormality. Early detection of breast cancer increases survival chances. Though breast cancer is the leading cause of death in women aged 35 to 50, women who get early treatment have a 90 percent survival rate.[2]

Because the treatment of breast cancer requires early detection, the patient should learn how to perform a self-examination. Instruct the patient to perform a self-exam every month.

Explain the self-examination, step-by-step. Also, provide literature with how-to diagrams for the patient's use. Written materials are easy to use and can be referred to long after the patient leaves the office.

One useful method of patient instruction is to review the brochure with the patient, mentioning each of the key points. Since the self-exam should be done monthly, help the patient identify a day of each month that the exam can be performed. This will help her remember to do it. Answer any questions the patient may have. Offer the patient a phone number to call, both to answer further questions or to report any breast abnormality.

Whether you are a man or a woman, the best way to teach the breast self-exam procedure is by knowing how to do it yourself, so turn to your Procedure Guide to learn and practice the steps.

Steps to Take 25-3 Conduct a Breast Self-exam

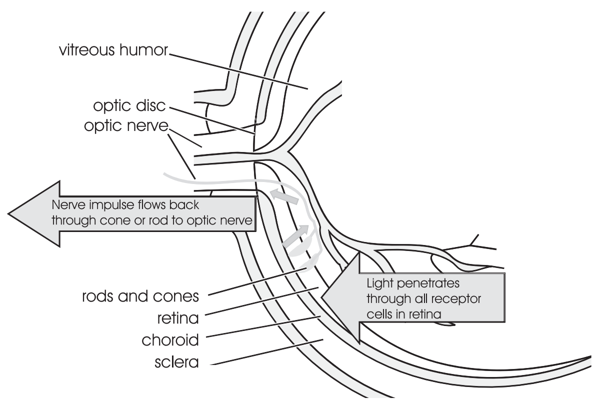
1. Turn to Steps to Take 25-3 in your Procedure Guide.
2. Read the Steps to Take to learn how to conduct a breast self-exam.
3. Review and practice the steps until you can teach them without referring to this guide.

Step 6 Examining the Special Senses

- ❑ Primary caregivers are responsible for screening their patients for eye and ear problems that may require a specialist. For that reason, it's important for you to understand the tests that provide that information.

Vision Tests

Doctors commonly screen their patients for **visual acuity**—the ability to see clearly. Acuity has two facets. Vision is measured for distance and for close-in viewing. Doctors also test for color blindness.



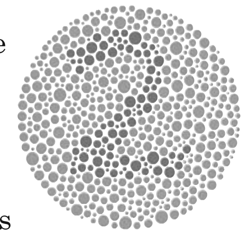
The human eye is a complex organ.

The eye has a lens that bends and focuses light on the wall of the retina. If the focal point is in front of the retina, vision will be blurry. This condition is called **myopia**. If the focal point is behind the retina, the patient is far-sighted, a condition called **hyperopia**. Testing for these conditions is done with **Snellen eye charts**—charts with letters or symbols in decreasing sizes. The patient is positioned 20 feet from the chart. The lowest row of readable letters will indicate the patient's acuity. That acuity is measured as a ratio. A ratio of 20/40 means that the patient can see at 20 feet what a normal person could see at 40. If the patient has great acuity, she might have 20/10 vision, meaning that at 20 feet she can see what a normal eye would see at 10 feet!

Snellen eye chart

Distance acuity is measured one eye at a time, since each eye doesn't see the same. The patient can't simply close one eye, however, because that artificially improves the vision in the eye being tested. The doctor blocks the vision of the eye not being tested with an **occluder**—this keeps both eyes working during the test.

Close-in acuity is tested with a test card. Like the Snellen test, the close-in vision test is done one eye at a time. Difficulty in focusing at close distances is called **presbyopia.** Presbyopia is a common problem for older patients. You may have noticed that many people over the age of 40 need reading glasses. This is because the eye loses its ability to focus as we age.



Ishihara plate

Color vision is tested using the **Ishihara test.** People who are color blind can't read the numbers in the test cards, because they can't differentiate the colors that outline those numbers. Though it's uncommon for general practitioners to give an Ishihara test, some employers request the test as a part of employment screening.

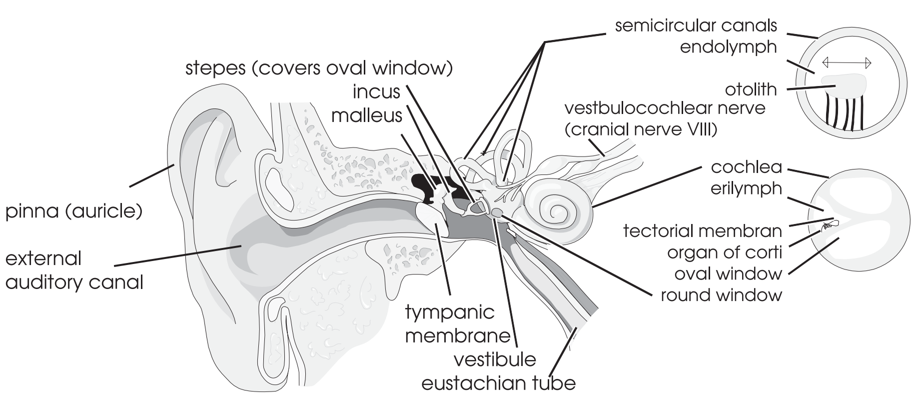
Take a moment to review the Ishihara test in your Procedure Guide.

Steps to Take 25-4 Determine Color Vision Using the Ishihara Method

1. Turn to Steps to Take 25-4 in your Procedure Guide.
2. Read the Steps to Take to conduct an Ishihara test.
3. Review the steps until you can describe them without reading the steps.

Hearing Tests

Doctors begin an ear examination by looking inside the ear with an **otoscope**, an instrument that lets doctors see inside the ear canal, looking for buildup of earwax, ear infections or punctures of the eardrum.



The ear

There are several kinds of hearing loss that a doctor might diagnose. **Conductive hearing loss** means that the ear can't conduct sounds into the cochlea, where sounds are turned into nerve impulses. **Perceptual hearing loss** occurs when the nervous system is having problems transmitting nerve impulses. Some patients have a combination of both problems. Testing identifies patients with a significant hearing loss so the doctor can refer the patient to a hearing specialist.

Measuring hearing is done with an audiometer—an instrument that measures hearing in degrees of loudness called **decibels**. You can review the audiometer testing procedure in Virtual Lab 8-2 Use an Audiometer in your Procedure Guide 1.

Treatment for hearing loss includes the use of a **hearing aid**—a small device that amplifies sounds so that the patient can hear more clearly.

Step 7 Spirometry

- ❑ Spirometry measures the ability to breathe. The test uses a spirometer—an instrument that measures an individual's lung capacity. The instrument has a mouthpiece and hose that the patient blows into. The results are measured in volume and time. The results are graphed. The y-coordinate measures volume and the x-coordinate measures seconds.

Spirometry exam results

The patient is asked to take as deep a breath as possible and then blow into a spirometer for as long as possible. Since the test requires the patient's efforts—and effort can vary—you should repeat the test until you have three good efforts to get valid results. Depending on the design of the spirometer, the patient may be asked to wear a soft nose clip to prevent air from escaping through the nose.

Spirometry tests can detect illnesses like asthma and cystic fibrosis. Because of the interactive nature of the test, spirometry does not work well with children under the age of five.

In the first half of this lesson, we covered some of the special examinations that you may be a part of as a trained medical assistant. In the next segment, we'll look at radiology.

Please pause to complete online Practice Exercise 25-1.

Step 8 Radiology

- **Radiology** is the use of radioactive materials for medical purposes. This field is divided into three specialties, including *diagnostic imaging*, *nuclear medicine* and *radiation therapy*. In this segment, we'll look at **diagnostic imaging**—the use of radioactive materials to discover and diagnose illness.

  We'll begin by discussing safety measures, for both the patient and the medical professional. You'll learn your role in diagnostic imaging, including instruction and patient positioning. And you will become familiar with the various types of equipment used in doctor's offices and clinics, as well as the most common diagnostic imaging procedures.

X-rays: Piercing the Opaque World

The first diagnostic imaging device was the x-ray machine. Wilhelm Roentgen discovered x-rays in 1895. The Victorian era—the time when Wilhelm Roentgen discovered x-rays—was very different from our world. It was an era of layered clothing, covering people from ankle to neck. Even bathing suits were full-body affairs! Full-length mirrors were a rare luxury. People seldom saw their own bodies. The idea of a ray that could pierce the body and make the invisible appear visible was revolutionary. Author Bettyanne Kevles notes, "The discovery of x-rays was one of the nails in the coffin of Victorian prudery."[3]

Wilhelm Roentgen

The notion of invisible rays was not new. Philosopher Roger Bacon speculated on their nature in the thirteenth century. But Wilhelm Roentgen's accidental discovery verified the speculation. Roentgen had been exploring the properties of cathode rays when he noticed a soft glow on a fluorescent screen some distance from the cathode. He had boxed the cathode tube in cardboard, so the glow was unexpected. How did the rays get through the cardboard? Curious, he began experimenting. The fluorescent screen registered "shadow images" of items inside opaque containers, such as coins in a box. For weeks, Roentgen abandoned his other research to explore the properties of these new, invisible rays that could "see through things." Roentgen became the first person to see the shadow of his own bones when he experimented with his hand! Bones absorb some of the rays, so they appear as silhouettes on the fluorescent screen.

Roentgen called the rays "x-rays" because he didn't know what they were. The discovery rocked the scientific world. The medical sciences began experimenting with the rays immediately. In 1896, doctors experimented with the hand of a corpse. They had filled the arterial vessels with a mixture of chalk, cinnabar and paraffin, creating the first angiocardiogram!

Roentgen received the first Nobel Prize in physics for his discovery. The revelation that the hidden could be uncovered would inform both science and culture for years to come.

Radiation Safety

Though x-rays are invisible, they are extremely powerful. Exposure can damage tissue, causing permanent harm to eyes, bone marrow and skin. X-rays are used because the diagnostic benefits outweigh the risks. It's important, therefore, to minimize those risks through safe practices and procedures.

One important precaution to remember is that x-rays are almost never taken of a pregnant patient. The rays can do serious damage to the fetus. The first trimester is the most critical time, because exposure to radiation can cause congenital defects. Before taking an x-ray of a female patient, always ask if there is any possibility that the patient could be pregnant.

Because repeated exposure to x-rays is dangerous, radiologists take care to use the lowest possible dose of radiation possible to acquire a useful image. Parts of the body that are not required for the images are shielded with lead aprons, since x-rays cannot penetrate lead.

Most states require medical assistants to be licensed to assist with an x-ray procedure. Certification is mandated because of the real possibility of damage if proper procedures aren't followed. Some states limit MA assistance to extremity imagery (arms, legs etc.) called **skeletal films**.

Medical personnel taking x-rays must wear a **dosimeter**—a small badge worn above the waist that measures the amount of x-rays the person has been exposed to. These rays may come directly from the x-ray beam or from scattered rays that go through the patient.

The control panel of an x-ray machine is located behind a lead wall, so lead aprons and gloves are not necessary for the medical professional performing the procedure. In addition, most imaging rooms have lead-lined walls to stop stray rays from penetrating into other rooms.

Positioning the Patient

Without special education and training, your role in x-ray procedures is limited to patient preparation and information. You must ensure that the patient understands the process. This is accomplished by supplementing a verbal explanation with written materials. Properly done, you can relieve the patient of any apprehension she might have.

You may also position the patient for the procedure. The position will be determined by the part of the body being diagnosed. An x-ray machine works by aiming x-rays through a body part to a sheet of film. Images of different organs require different positions. The following views and positions may be indicated:

- **Anteroposterior (AP)**—the anterior of the body faces the x-ray tube. The rays pass through the anterior to the posterior before striking the film. The patient lies in the supine position.
- **Posteroanterior (PA)**—the posterior of the body faces the x-ray tube. The rays pass through the posterior to the anterior before striking the film. The patient lies in the prone position.

- **Lateral (lat)**—the side of the body faces the x-ray tube. The rays pass through the patient's lateral sides before striking the film. The doctor may request a **right-lateral view**—rays directed from the left side of the body to the right or a **left-lateral view**—rays directed from the right side to the left. The patient is in a lateral position.

- **Oblique**—the doctor may want the x-ray beam to be angled through the targeted organ. Oblique views may pass front to back or back to front. The doctor's instructions will indicate if the patient is to be positioned in the supine or prone position.

Diagnostic Imaging Equipment

In this segment, we'll take a brief look at the equipment and supplies used in diagnostic imaging. We'll begin with the x-ray machine, the most common of the imaging instruments. An x-ray machine has three main components, the table, the x-ray tube and the control panel. The tube is where the x-rays are produced. The tube is shielded with lead except for the spot where the rays exit the tube. This focuses the rays in a beam. The table is moveable to accommodate various patient positions. The control panel is situated behind a lead wall for the protection of the medical professional. Photographic materials are placed behind or to the side of the patient.

A **fluoroscope** is a kind of x-ray machine that provides a constant, moveable x-ray image by positioning the patient between the x-ray tube and a screen. This allows doctors to see an organ in motion, rather than in a flat, stationary photo.

The clarity of an x-ray image is facilitated by the use of **contrast media**—substances like iodine and liquid barium that the patient ingests before the x-ray. X-rays penetrate different objects to different degrees. Bones absorb some of the rays, so they appear white on the film. Skin is less dense and rays pass through to turn the film dark.

Some internal structures don't show up as sharply as bones do in an x-ray photo, so doctors inject a high-contrast substance into the organs that they need to examine. The contrast media absorb x-rays, making the veins and organs that contain the media stand out.

Iodine is a common contrast medium. Some patients are allergic to iodine. One clue to an iodine allergy is an allergy to shellfish, like shrimp and crab, which have a high percentage of iodine. Remember to ask the patient about allergies while scheduling any diagnostic procedures that will involve contrast media.

Common X-ray Procedures

In this segment, we'll look at the different procedures that utilize x-rays or fluoroscopy. These procedures are usually performed in hospitals or radiological clinics, but the appointments are scheduled by medical assistants who must understand the procedures and prepare the patient for them. These preparations may include the use of laxatives, an enema and restricted meals the evening before. Post-procedural instructions may include increased liquids and the use of milk of magnesia. Specific instructions will be provided to you by the radiologist so you can inform the patient.

Upper GI Series

The **upper gastrointestinal series** helps diagnose problems in the upper GI tract, including difficulty swallowing and chronic heartburn. Barium sulfate is used as contrast media. The patient must be **NPO** the night before the test—no food or liquid ingested—so the stomach is empty for the test. After the test is completed, the patient may take a laxative, milk of magnesia and drink additional fluids to force the barium out of his system. Inform the patient that barium may turn his stools white for a few days.

Barium Enema

Earlier in this lesson, we discussed sigmoidoscopy. If the doctor needs to examine beyond the colon, into the small and large intestine, a **barium enema**, also known as a **lower GI series** will be performed. The barium is delivered into the patient with an enema tube. The patient holds the barium in while being placed in various positions. The doctor may also pump air to inflate the large intestine—this provides a better view.

Barium enema x-ray

Gallbladder Studies

Although you can't perform this test, understanding the procedure will help you prepare and educate the patient.

The gallbladder stores **bile**, a fluid produced by the liver. During digestion, the gallbladder contracts, squirting bile into the large intestine to help break down fats. The salts that help form bile can form into solid masses, called **gallstones**. These cause the bladder to inflame. To diagnose the problem, iodine is usually taken orally the night before to act as the contrast medium. In some cases, the iodine is injected directly into the bile ducts. The procedure using x-rays to study the gallbladder is called a **cholecystogram**.

Urinary Studies

The urinary system includes the kidneys, ureters and bladder. The kidneys excrete urea, a waste product that needs to be removed from the body. Mixed with water from the kidneys, urea becomes urine. The urine travels through the ureters to the bladder, where it is eliminated from the body.

The **intravenous pyelogram (IVP)** is a procedure that shows the entire urinary tract. The contrast medium, usually iodine, is injected just before the test. Remember to question the patient about any allergies to iodine before proceeding. To provide a clear picture of the urinary system, the patient should be NPO from midnight before the test. During the test, the patient may have a metallic taste in her mouth or feel flushed. Warning the patient of these side effects will reduce her concerns during the actual procedure.

In some cases, the iodine is injected directly into the bladder with a catheter through the urethra. This test is called a **retrograde pyelogram**.

Mammography

Mammography is a specialized x-ray study of female breast tissue. Equipment compresses and flattens the breast to a more uniform thickness, allowing doctors to spot abnormal masses in the breast tissue. This allows doctors to spot abnormalities even before doctor- or self-exams. Biannual mammograms are recommended for female patients over the age of 40. After 50, they should be part of the annual checkup.

Female patients should be instructed not to wear deodorant or powder the day of the procedure. The active ingredients in these substances include metals that can interfere with the image. Though the test is uncomfortable to some people, you can support the patient by reminding her of the advantages of early detection.

Angiography

Angiography uses iodine to study whether blood vessels have narrowed in the body. Depending on the type of vessel the iodine is injected into, the test may be an **arteriogram** (an image of the arteries) or a **venogram** (an image of the veins). The contrast medium is injected from a catheter into the blood vessel.

This procedure can dislodge blood clots, causing a stroke or heart attack. The process has some amount of discomfort associated with it, but given the risks, the patient must be conscious to communicate unusual levels of pain to the doctor. Discomfort is minimized with the use of pain medication and by providing a relaxing environment for the test.

Two common targets for study are the brain and the heart. The test helps to discover tumors and **aneurysms**—weak vessel walls that result in enlarged arteries.

Bone Density

As you know, osteoporosis is the demineralization of bones and is a common problem for women past the age of menopause. Special x-ray studies can detect a loss of bone density by passing low-dose beams through the body. The treatment of osteoporosis involves increasing the patient's intake of calcium to prevent further loss and weight-bearing exercise. There is no special preparation necessary for this type of diagnostic imaging.

Tomography

Tomography is a specialized radiography technique that yields multiple images in selected planes of tissue. These "cross-sections" give a complete picture of what's going on in a specific organ. This test is called **computed axial tomography (CAT)**, also known as a **CAT scan**.

The patient remains still while the table slides into the CAT scanner.

When performing a CAT scan, the x-ray tube and film is moved slightly, over and over, providing a series of precise images of a small area. Contrast media may be used to improve the view. The contrast media can cause a metallic taste in the patient's mouth. The patient must be NPO for four hours before the process and remain still during the process to help the doctor obtain the clearest possible images.

Step 9 Nuclear Medicine

- ❑ The second specialty of radiological imaging is nuclear medicine. **Nuclear medicine** uses radioactive materials other than x-rays for diagnosing and treating illnesses. Small amounts of radioactive materials are taken orally or injected into the patient's blood stream. The patient's body tissues absorb the active materials. Then the patient is placed under a large **gamma camera**—a device with one or more detectors connected to a computer. Radiation in the patient triggers sodium iodide crystals in the detector, causing tiny flashes of light that are collected and interpreted by the computer.

  The resulting image is called a **scan**. Doctors use scans to diagnose brain problems, as well as thyroid, liver, lung and gallbladder problems. The most common scan is the thyroid scan. The thyroid uses iodine to produce thyroid hormones. This can interfere with the image, so you must advise the patient not to take vitamins or foods containing iodine for at least two weeks before the actual procedure. In addition, the patient taking thyroid medication may be asked by the doctor to stop doing so in order to facilitate the test.

Positron emission tomography (**PET**) and **singe-photon emission computed tomography** (**SPECT**) are two specialized forms of nuclear medicine that produce color images to measure how much of an introduced radioactive material was absorbed. Bright colors show more active absorption. Dull colors show inactive cells. These tests help doctors evaluate the effectiveness of circulation in certain areas of the body.

Step 10 Radiation Therapy

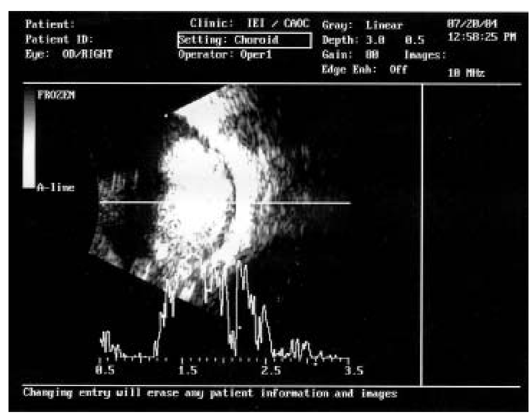
- The third specialty of radiology is **radiation therapy**—the use of radiation to treat tumor tissues. Radiation therapy is called for when a tumor is hard to reach surgically or when the doctor wishes to treat the traces of a malignant tumor that were left behind after surgery. In either case, radiation shrinks the tumor tissue. The radiation can be external, directing radiation at the skin. Or, the radioactive materials can be implanted under the skin and removed later. The object of this kind of therapy is to destroy tumor cells without destroying healthy cells. The side effects of radiation therapy are very unpleasant, and can include nausea, hair loss, vomiting, anorexia and loss of bone marrow.

Step 11 Non-radioactive Imaging

- Not all diagnostic imaging requires radioactive materials. Since radiation carries an inherent risk for the patient and the medical provider, other means of internal imaging have been developed, including *diagnostic medical sonography* and *magnetic resonance imaging*.

Diagnostic Medical Sonography

Diagnostic medical sonography—commonly called ultrasound—uses high-frequency sound waves to create images of internal organs. Sound waves are emitted from a **transducer**. These waves bounce back off of the body's organs like sonar on a ship, producing an image on a computer screen. This procedure does not harm tissue cells, so it is safe for use with pregnant women. Ultrasounds have become a standard part of prenatal care.



Ultrasound

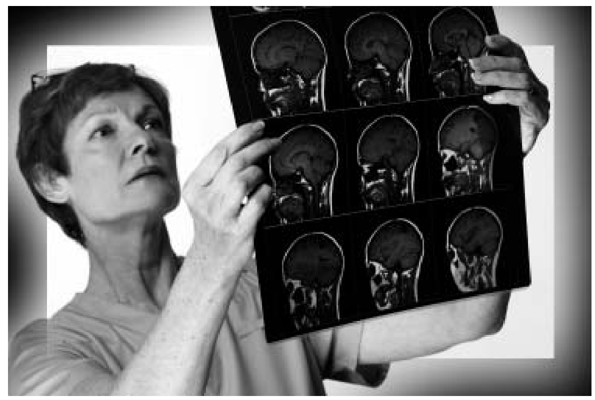
Ultrasound exams can also uncover problems with the heart, gallbladder and the abdominal and pelvic structures. **Echocardiography** uses sound to image the heart's chambers and valves to measure output and to check for inflammation or infection of the valves.

Abdominopelvic ultrasounds examine the internal structures of the abdomen, detecting fluids, cysts and tumors in the liver. Gallstones can be spotted. The liver, ureters, kidneys, spleen and pancreas can all be examined. Medical assistants cannot administer echocardiograms or abdominopelvic exams, but they are responsible for preparing and informing the patient.

One advantage to diagnostic medical sonography is that the patient usually doesn't have to make special preparations for the test. The exceptions include gallbladder examination—food makes the gallbladder contract—and prenatal ultrasounds. In order for the bladder to push the uterus up where the ultrasound can be effective, the patient is asked to drink several glasses of water about an hour before the test.

Magnetic Resonance Imaging

Magnetic resonance imaging (**MRI**) uses magnetic fields and radio waves to create a computer image. This image is extremely sharp and is helpful for looking at soft tissues like brain tissue, muscles and joints. For example, a knee full of fluid can best be explored with an MRI.



Doctor reviewing MRI

There is no physical discomfort associated with an MRI, though the machine itself can dismay the unprepared patient. The imager consists of a cylinder-shaped machine with an electromagnet. The patient lies on a table that slides inside the cylinder. Patients who are **claustrophobic**—afraid of tight places—may need medication to relieve their anxiety during the actual procedure.

MRI machines will not work for patients with pacemakers or metal pins in their joints.

To prepare the patient, ask him to wear loose, comfortable clothing without zippers or snaps. Instruct him to remove all jewelry, belts and wallets (credit cards have magnetic strips!). Advise the patient that he will be asked to lie still for 45 minutes to an hour. The MRI machine makes a tapping sound and some hospitals provide earphones to avoid the distraction.

Step 12 Documentation

- ❑ The images produced by diagnostic image testing must be preserved as a part of the patient's permanent records. Actual film is stored in special envelopes, marked with names, dates and other pertinent information. These films are usually kept at the clinic or hospital where they were taken to avoid accidental loss of the film. Both the radiologist and the patient's doctor keep written reports of imaging procedures.

Please pause to complete online Practice Exercise 25-2.

Step 13 Lesson Summary

- We've covered some interesting ground in this lesson. As you advance in your career as a professional medical assistant, you may have the opportunity to assist with special exams that go beyond the standard doctor's visit. Your primary role is to support the patient with compassion and knowledge. When you understand the procedures that a patient will undergo, as well as the reasons for those procedures, you'll be a valuable source of information and emotional support to the patient.

  You know that the Pap smear and the bimanual pelvic exam are special exams that have become an important part of the female patient's annual checkup. The Pap smear involves taking a tissue sample from the cervix to check for cervical cancer. The bimanual pelvic exam is a physical check of the female reproductive system by the doctor.

  Rectal exams and sigmoidoscopy are exams that test the health of the rectum and colon. The sigmoidoscopy uses an instrument to probe into the colon, looking for irregular growths or lesions.

  Another common specialty exam is the breast exam. You must not only know how to give a breast exam, but also be able to teach the patient how to examine herself.

  You're also well versed in the fields of radiology and other non-radioactive imaging techniques. Though many of these procedures are done in hospitals or specialty clinics, even a medical assistant working for a general practitioner needs to know these procedures in order to educate and prepare the patient.

  X-ray diagnostics take many forms, including the upper and lower GI series, the intravenous pyelogram series, mammography, angiography and the cholecystogram. When the doctor wishes to see the organ in motion, she uses a fluoroscope. If the doctor wants cross-sections of an organ, she orders a CAT scan.

  Nuclear medicine is the use of radioactivity other than x-rays to produce images. The PET and SPECT tests are specialized nuclear medicine tests.

  Sometimes the doctor uses non-radioactive imaging. Radiation can damage a fetus; so pregnant patients often use sonography. Sonic images can also be used to study the heart, abdominal cavity and pelvic structures. Magnetic resonance imaging uses a magnetic field and radio waves to obtain non-radioactive images.

  In your next lesson, you'll discover how to assist the physician during minor surgical procedures.

Please pause to complete an online Quiz.

Endnotes

1. "Health Maintenance Guidelines." *Palo Alto Medical Foundation*. Palo Alto Medical Foundation. 2006. Web. 30 Sep 2006.

2. "Early Detection is the Key to Life." *American Breast Cancer Foundation*. American Breast Cancer Foundation. n.d. Web. 30 Sep 2006.

3. Kevles, Bettyanne H. "Naked to the Bone: the Discovery of X-rays." *Health Sciences*. La Trobe University. 1997. Web. 2 Oct 2006.

Lesson 26
Minor Surgical Procedures

Step 1 Learning Objectives for Lesson 26

❑ When you have completed the instruction in this lesson, you will be trained to do the following:

- Comply with the principles of surgical asepsis to assist in minor surgery.
- Categorize and define the instruments and supplies used in minor surgery.
- Describe the proper use of each instrument and supply used in minor surgery.
- Reconstruct the procedures to prepare the patient for minor surgery, including documentation requirements, scheduling, preoperative instructions, physical preparation and post-operative care.
- Relate the importance of documentation and obtaining a signed consent form for the surgical procedure.
- Describe how to prepare skin for a surgical site and describe minor surgical procedures.
- Specify the preparation of a minor surgical tray using the virtual lab.
- Describe pre-operative setup and post-operative clean up of the operating room.
- Categorize different anesthetizing agents that are used for minor surgeries.
- Integrate the rules and guidelines for medical assistants to assist with minor surgeries.
- Construct the steps to assist with suturing a laceration.
- Organize the procedure to remove sutures using the virtual lab.

Step 2 Lesson Preview

- Cost cutting is a major medical consideration. Because of that, minor surgeries performed in a doctor's office or clinic are becoming increasingly popular. When the attending medical professionals are well trained, office surgery is a safe and economical alternative to hospitals.

  As a trained medical assistant, you may have an opportunity to assist a physician with minor surgery. This lesson will familiarize you with the minor surgical procedures and techniques that you may participate in, probably after you have gained some clinical experience in the field.

  We'll begin by discussing sterility in the operating room. You'll learn the long-established principles that keep detrimental organisms from entering the patient's body during surgery.

  You'll examine the equipment and supplies used in minor surgery. Then we'll discuss the medical assistant's role in preparing the patient for surgery, including obtaining the patient's consent. We'll also discuss preparing the operating room.

  Lastly, you'll explore the different kinds of surgery in which an MA is likely to assist, from wound cleaning and suturing to cryosurgery! As you know, maintaining asepsis after the procedure is just as important as the prep work, so you'll learn post-op procedures, including cleanup, post-op patient care and documentation of the surgery. By the end of the lesson, you'll have a working knowledge of minor surgery and the role of the medical assistant in providing safe, efficient office and clinic surgical procedures.

Since 2000, more than 20 percent of all elective surgeries take place in a physician's office. Another 45 percent of those surgeries take place in clinics and other outpatient surgery centers.[1]

Step 3 Surgical Asepsis

- You know from previous lessons that asepsis means sterility. So you can probably imagine that *surgical asepsis* is sterility in the surgical setting. Specifically, **surgical asepsis** is a series of principles designed to keep detrimental microorganisms from entering the body during surgery. This means that surgery must be performed with sterilized equipment in a sterilized environment. **Aseptic** techniques are procedures used to achieve asepsis.

Surgical aseptic techniques are stringent, but there is something in the operating room that can never be sterilized. Do you know what that is?

The one major component of surgery that can't be sterilized is skin. The patient's own body, as well as the hands of the surgeon, can't be sterilized. Microorganisms live on the skin. Surgery involving any incision provides an opening to those organisms. The patient's skin must be washed and treated with an antiseptic across the area of the incision.

To further minimize the risk, the surgeon and medical assistant must wash and glove their hands using the surgical techniques you learned in Steps to Take 7-1 and 7-2 in the Procedure Guide. Take a moment to review these now before we move on. Also review Steps to Take 7-3, Remove Gloves, as this is an important part of maintaining an aseptic environment as well.

Surgical equipment and the surgery room itself must be sterilized to achieve surgical asepsis. Since microorganisms can't be seen, you should assume that they're present—and that they're a danger. The critical concerns of any surgery are the sterility of the instruments, the patient's skin and the surgical team. To maintain sterility, the following basic rules must be followed.

- If you touch a sterile object with a nonsterile object, the sterile object is no longer sterile. Only use sterile objects to touch sterile objects.
- If you can't see it, it isn't sterile. Keep the sterile field—the area where sterile instruments and supplies are staged—in plain sight. If you must turn away, cover the field with a sterile towel.
- Only the area above the waist is sterile. If you drop your hands below waist level, they are no longer sterile. Anything that falls on the floor is nonsterile.
- Sterile equipment and supplies should be kept in the middle of the sterile field. Anything outside the sterile field should be considered nonsterile.
- Don't pass nonsterile items over a sterile field.
- When handling liquids, don't pour directly onto the sterile field. Spills pick up microorganisms. Pour liquid into a bowl or onto a dressing with a waterproof wrapper. Do not let the bottle that holds the liquid touch either the bowl or the dressing.
- Don't sneeze, talk or cough when facing the sterile field.
- If you are wearing a sterile gown, everything behind your field of vision or below the waist of the gown is considered nonsterile.

Remember that maintaining surgical asepsis will ensure a safe environment for your patients.

Please pause to complete online Practice Exercise 26-1.

Step 4 Instruments Used in Minor Surgery

- In this segment, we'll discuss the different instruments and their purpose. Surgical instruments can be made of metal, plastic or rubber. These instruments are used to cut, scrape, stitch or hold skin in place. In Lesson 8, you were introduced to all of the medical equipment used in the office setting. You'll recognize those here as we review only the instruments you will use in minor surgery.

Forceps

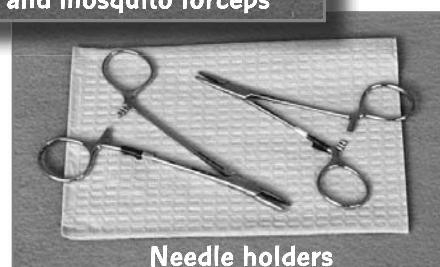
Forceps are used to grab, pull or pinch tissue or other instruments during surgery. Some are shaped like scissors and held by the ring-handles. Others are shaped like tweezers and held by the thumb and forefinger. Some have ratchet-stops in the handles so they can be locked into position.

Baby Alligator ear forceps

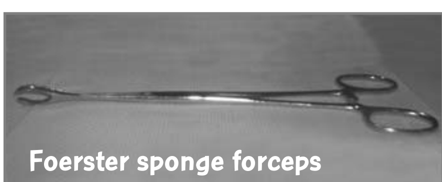
Hemostatic forceps have narrow, slender jaws so they can clamp blood vessels. **Hemostasis** means "control of bleeding." Hemostatic forceps achieve hemostasis. Two examples of hemostatic forceps are **Kelly forceps** and **mosquito forceps**. The latter are for smaller blood vessels.

Kelly and mosquito forceps

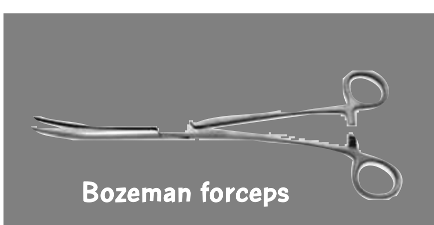
Foerster forceps are designed to hold the suturing needle used to stitch wounds. This kind of forceps has strong jaws to grip the needle. The jaws may have a groove in the middle to keep the needle in place. Needle holders come in varying lengths.



Needle holders

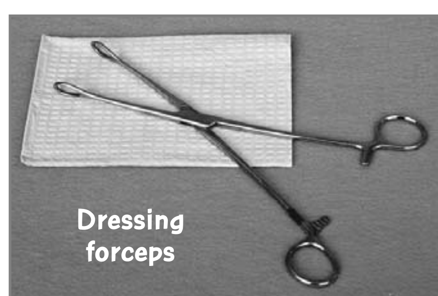


Foerster sponge forceps



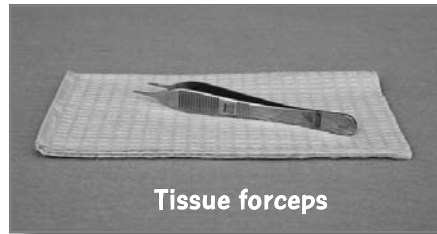
Bozeman forceps

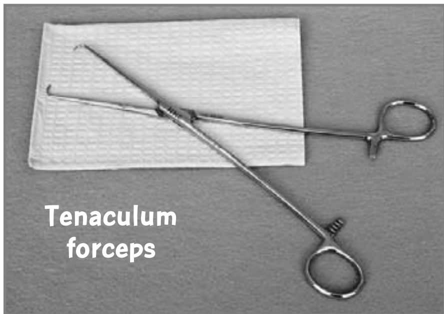
Foerster sponge forceps and **Bozeman forceps** are used to hold sterile squares of gauze called sponges. During surgery, these sponges are used to clean up excess blood. These forceps can also be used to transfer other sterile items on the operating tray. **Dressing forceps** are used to pick up gauze squares or dressings for transfer or for disposal. The names of these forceps illustrate a point: surgical instruments are often named after the function they perform or the person who invented them.



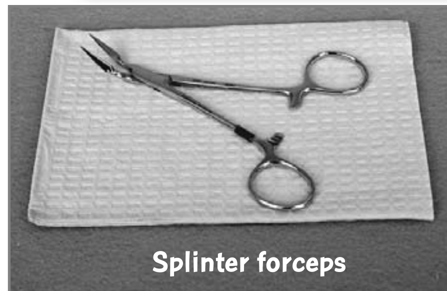
Dressing forceps

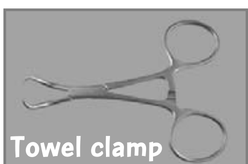
Tissue forceps are used to grasp tissue after an incision has been made. These forceps don't have ring-handles so they're sometimes called *thumb forceps*. Tissue forceps may have teeth that can grasp skin with a pincer grip without damaging the tissue.


Tissue forceps

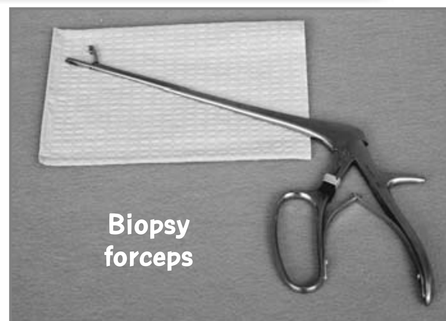

Tenaculum forceps

Splinter forceps are used to remove foreign materials from wounds. They are also used to put gauze into wounds. Splinter forceps are usually thumb forceps in varying shapes. The sharp tip helps remove even the tiniest foreign objects.


Splinter forceps


Towel clamp

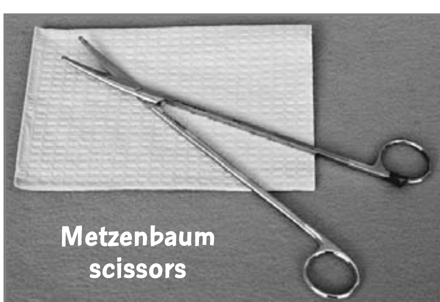
Some forceps have curved tips. **Tenaculum forceps** have long handles made to grasp tissue during surgery. Towel clamps are used to hold drapes in place during the operation.


Biopsy forceps

Biopsy forceps have a long, narrow stem with a cutting instrument at the end. Biopsy forceps can pass through an endoscope and take a tiny sample of tissue for testing.

Scissors

Scissors are ring-handled tools with two flat blades pivoting on an axis pin. In surgery, they're used to cut skin and muscle tissue, as well as bandages and other dressings. Some scissors have a sharp upper blade and a blunt lower blade. The lower blade can slide under a bandage, next to the skin, without injuring the patient.


Metzenbaum scissors


Surgical scissors

Scalpels

A scalpel is a surgical knife. A scalpel has a straight handle with various removable blades. Some scalpels come in a single disposable unit. Different shaped blades are available for various procedures. An **incision** is a cut made with a scalpel. Incisions may be the initial cut in a surgery or they may lance the skin to ensure drainage.

Scalpels and blades

Retractors

Some of the instruments we've discussed so far are used to hold tissues together. Sometimes, though, tissues need to be held open. A retractor is an instrument used to hold a flap of tissue or an incision open so that the doctor can see beneath. Some retractors have smooth tips and some are toothed. Some are self-locking. Others need a medical assistant to hold them in place.


ALM retractor

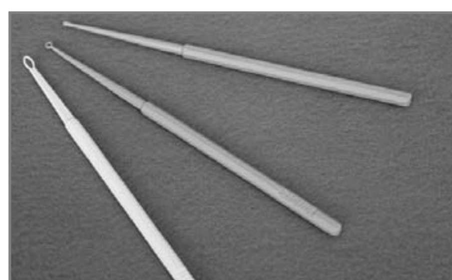
Probes

A probe is an instrument used to palpate inside an incision. Probes can also be used to test the depth of a cavity during surgery. They can also help locate foreign objects in a wound.


Probe

Curettes

A **curette** is a scraping instrument. A curette has a handle, stem and a looped end that does the actual scraping. For example, ear curettes remove earwax. Uterine curettes scrape fetal tissue from the uterus.


Ear curettes

Care of Surgical Instruments

Some surgical instruments are disposable. These instruments come sterilized. After surgery, they are simply thrown away. As you are well aware, scalpels and needles are disposed of in a sharps container to avoid injuring anyone. Suture material is also disposed of in the sharps container, since the needle is often still attached. By contrast, reusable instruments are durable, but they have to be cleaned and sterilized.

Turn now to your Procedure Guide, Steps to Take 8-1, to review the steps to care for surgical instruments. You may also want to review Virtual Lab 8-1, Use an Autoclave and Steps to Take 8-2, Ultrasonic Cleaning.

Step 5 Surgical Supplies

- In the previous segment, we discussed surgical instruments. Next we'll review the supplies used in minor surgical procedures, including surgical draping, gauzes, cleaning solutions, suture materials, dressings and bandages.

Surgical Draping

Surgical draping is the placement of sterile materials on and around the patient to bracket the sterile field. Some physicians now use disposable draping made of paper. After the paper draping frames the site, a clear **incisional drape** is placed over the site. The incisional drape may have an adhesive back that keeps it in place.

Some surgical drapes are **fenestrated**—they have a custom opening that fits exactly over where an incision is to be made. Fenestrated drapes may be made of cloth or paper.

Fenestrated surgical drape

Gauze

Gauze squares—also known as sponges—come in a variety of sizes, from 2” × 2” to 4” × 4”. They come in sterile packs of two. They may be made of plain gauze or they may have a cotton pad backing for extra absorbency. They are used to clean and prepare skin for surgery, for padding and for cleaning and covering wounds.

As you have learned, one type of gauze, called a wick, comes in narrow lengths stored in bottles and is used to pack an open wound. Because the wick is sterile, it must be removed from the bottle with sterile forceps and cut to length with sterile scissors.

Solutions

Medical assistants use a number of different solutions in the operating room. Sterile water is used to dilute medication. Sterile saline solutions are used to clean wounds. Liquid soaps are used to scrub up before operations and to clean and prep the patient's skin at the operation site. **Betadine** (providone-iodine) is an antiseptic frequently painted on the skin prior to surgery. If Betadine is to be used, make sure the patient is not allergic to iodine.

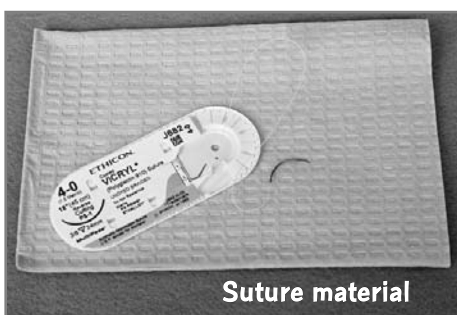
Betadine is painted over the surgical site to minimize the danger of pathogens entering the incision.

Suturing Materials

Stitches used to close an incision or wound are called **sutures**. During surgery, the medical assistant tears open the suture material package and empties the suture material onto the sterile field, avoiding contamination. Suture materials come in varying sizes. The finest (narrowest) suture material, called 6-0, is the kind most often used in office-based surgeries.

Suture materials are usually non-absorbable. **Absorbable sutures** are made of organic materials so they can decompose naturally and don't have to be removed. They are generally used for deep tissue layers. **Non-absorbable suture** materials are made from silk, rayon and other materials. These sutures must be removed after the wound is healed, usually in 6 to 10 days.

Sometimes, only a small amount of tension is necessary to keep the edges of a wound sealed. In these cases, adhesive strips can be used instead of traditional sutures.



Suture material

Needles

Suture needles often come **swaged**—fused to the suture material. The needles are often curved to assist in suturing while causing the least amount of damage to the skin. Needles are held with a needle holder, rather than with the gloved hand. This keeps the needle rigid, avoiding accidental injury. After use, the needle and unused attached materials should be disposed of in a sharps container.

Suture removal kit

Dressings

After a wound is closed, dressings are sometimes applied to the wound. Dressings are gauze patches that may be covered with medication. For example, gauze may be smeared with an ointment to help prevent infection. Some types of dressings have a special surface to prevent them from sticking to the wound when the dressing is changed.

Gauze dressing

Bandages

A bandage is a nonsterile material that is applied over a dressing and wound in order to keep the dressing in place. Some bandages are gauze. Custom shaped or tubular bandages are designed to fit in hard to cover places like elbows or over appendages. Elastic bandages are also used to provide pressure.

Now that you've been introduced to the equipment and supplies that medical assistants need in the operating room, we'll turn our attention to preparing for surgery.

Step 6 Preparing for Surgery—Prepping the Patient

- ❑ If the patient is having a planned procedure, she will have time to make necessary preparations, such as making any special dietary changes ordered by the doctor, scheduling time off from work and purchasing special supplies she'll need post-op. Prior planning can also include contacting the insurance company for authorization and to arrange payment.

Not every minor surgery can be planned. For example, a patient might suffer a laceration that needs immediate attention. Either way, the medical assistant must follow protocol to inform and prepare the patient for what is to come.

If the patient is receiving treatment for an accident, the MA must determine how the wound occurred, in case special medication such as a tetanus shot is necessary. The MA must also determine the patient's allergies and find out what OTC and prescribed drugs the patient is currently taking.

If the minor surgery is planned, the MA should instruct the patient on dietary considerations. For example, the procedure might require that the patient not eat or drink for several hours before the surgery. In addition, the MA can prepare the patient for any medication needed for post-operative care. For example, some procedures require the patient to take antibiotics afterward to prevent infections. Special supplies, such as crutches or a brace, might be necessary. These considerations often fall under the medical assistant's job description, depending on the office or clinic.

Informed Consent

In addition to planning for the surgery, the MA must get the patient's consent. For all surgical procedures, the patient must sign a written, informed consent form. As you know, an informed consent form specifies the procedure and explains in straightforward terms what will occur. The form also lists alternatives and possible adverse outcomes. This form is not just a "rubber stamp." Knowing the alternatives and consequences constitutes an informed consent. Before the patient signs the form, the MA or the physician can also answer the patient's questions about the procedure.

The informed consent form also covers the costs of the procedures. The MA will occasionally bring the office bookkeeper in to discuss payment options during the consent discussion, though financing itself is not part of the consent form.

Before the Operation

It may be your duty to prepare the area of the body where the operation will be performed. As mentioned earlier in the lesson, skin cannot be sterilized. It is possible to minimize micro-organisms at the surgery site, however. This is accomplished by washing the site, shaving the area (if necessary), rinsing and drying. Then, you will paint antiseptic on the skin. You should always wear sterile gloves while preparing the patient's skin.

A framed surgical site

For each subsequent step, from washing to shaving to rinsing and drying, you should start where the incision will be made and work outward. Apply the antiseptic with 4" × 4" gauze or sterile swabs. Allow the skin prep solution to air dry—do not blot dry with gauze.

Then, you'll "frame" the surgical site using the draping materials we discussed earlier. If the draping is not fenestrated, the doctor will make a cut in the incision draping at the site of the actual surgery. Drapes may bracket the incision site, held in place by towel clamps or adhesive tape.

Step 7 Preparing for Surgery—Prepping the Room

- To prepare the room for surgery, you'll gather the instruments and supplies and prepare the surgery tray. Planning for the surgery begins with **surgery cards**—3 × 5 cards that list the equipment, supplies and instruments necessary. Some physicians store this information in computer files to be printed out in advance of the procedure. The computer will have a separate printout for each procedure, discussing the needs of the procedure in great detail, including the physician's glove size, preoperative procedures, postoperative procedures and special requirements for both the surgeon and the patient. Both printouts and surgery cards are wonderful resources for medical assistants preparing for a surgery.

  You've explored some aspects of pre-op room preparation. Now it's time to actually do it! Walk through the steps to prepare the treatment room using your Procedure Guide.

Steps to Take 26-1 Prepare Treatment Room

1. Turn to Steps to Take 26-1 in your Procedure Guide.
2. Read the Steps to Take to prepare a treatment room for a minor surgical procedure.
3. Review this procedure until you can describe the procedure without reading the steps.

Now access the Virtual Lab to examine the surgical tray setup in detail.

Virtual Lab 26-1 Set up Minor Surgical Tray

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 26-1 Set up Minor Surgical Tray. This will bring up the instructional video about setting up the surgical tray.
3. Follow along with Virtual Lab 26-1 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. Review this procedure and watch the virtual lab until you can outline the procedure without reading the steps or watching the lab.

In the next segment, we'll discuss anesthetics, the various minor surgeries an MA might assist with and postoperative procedures.

Please pause to complete online Practice Exercise 26-2.

Step 8 Anesthetics

❑ As you know from your pharmacology lesson, an anesthetic is any substance that causes a loss of feeling. When a doctor performs minor surgery, the patient needs protection from the pain involved in the procedure. Anesthetics can be inhaled, injected or applied topically.

The most common anesthetics used in minor office surgery are injected into the subcutaneous tissues. Nerves are temporarily prevented from sending sensations to the brain, preventing pain due to the surgery. These anesthetics include Xylocaine, Novocain and Carbocaine. In addition, the anesthetic may also include epinephrine, a vasoconstrictor that acts locally to control bleeding. Anesthetics with epinephrine should not be used on extremities (fingers, toes, nose) because the constricting action can damage the tissues. When preparing an anesthetic injection, the MA should always bring the vial of requested medication to the operating room so that the physician can triple-check the medication before the injection.

Some anesthetics are topical—applied directly to the site, either by spray or liquid. For example, physicians use ethyl chloride to freeze the skin for a few seconds to allow the doctor to pierce or lance the skin. If the doctor is giving a patient a deep injection, he may use the spray to take the sting out of the shot!

Step 9 Minor Surgical Procedures

❑ So far, we've talked about equipment and supplies, preparation and patient education. Now let's talk about the operations themselves! Medical assistants can participate in each of the following minor surgical procedures. In fact, the MA will have a series of specific responsibilities. Depending on the doctor's preference, the medical assistant may work sterile or nonsterile.

When working nonsterile, the MA may not touch anything within the sterile field. The medical assistant will have plenty to do, however! Some of your tasks might include the following:

- Tie the back of the surgeon's gown. Remember—the back of the gown is nonsterile.
- Obtain additional supplies if they are needed.
- Speak to the patient, offering support and reassurance.
- Adjust the lighting.
- Adjust the doctor's mask and glasses.
- Wipe sweat from the doctor's face.
- Hold the container to receive a biopsy sample.

When working sterile, the MA may be sterile and gloved for simple procedures. Or the medical assistant may be in gown and gloves. An MA working sterile may:

- Hand instruments to the doctor.
- Hold a retractor.
- Use a sterile suction catheter or sterile gauze sponges to clear blood from the surgical site.
- Prepare the suture material for the doctor.

Let's look at each of the minor surgical procedures an MA can assist in.

Excision of Lesions

A **lesion** is a skin irregularity. Irregularities like moles or skin tags are "dry." That is, they don't contain fluid. To remove a lesion, the doctor performs an excision. Remember that excision means "cutting out."

It's standard procedure to send a sample of the skin irregularity for testing to ensure that the irregularity doesn't signal a bigger problem. The physician will take a small biopsy sample and store it in a bottle containing **formalin**, a tissue preservative. The MA holds the bottle, cap removed and the doctor places the sample in the bottle. After surgery, the labeled bottle is sent to a cytology lab for analysis.

Incision

An **abscess** is a localized, self-contained collection of pus, usually the result of the body's own immune system responding to a foreign body. Because the pus creates pressure on the surrounding tissues, the abscess may be painful.

Sometimes if an oil duct becomes clogged it may cause a **cyst**. The cyst may become infected. Cysts are surrounded by a membrane and must be completely removed. Prior to removal, the cyst sac may have to be lanced and drained of sebum—the oily secretion of the sebaceous gland—so that it doesn't spatter the sterile field during removal.

Incision and drainage (I&D) involves cutting into an infected area and allowing the pus or sebum to drain out under controlled conditions. Sometimes the liquid is collected and sent for examination. The patient's wound may be treated with oral antibiotics or antibiotic cream. After the abscess or cyst is cut into, the wound is not sutured. A small, lanced abscess will heal by itself. Larger abscesses may need to continue to drain, which allows healing from the inside out. If the skin closes too soon, the fluids will collect and cause pressure again and the abscess will reform.

If a cyst needs to be lanced and drained, it will be removed entirely after the lancing. Again, no suturing is necessary. The skin will close and heal on its own.

Suturing

Not every wound closes on its own, however. A **laceration** is a medical term for a "cut." Some lacerations need to be sutured. There are four general signs that indicate suturing may be necessary.

1. If the edges of the wound are far apart rather than close together, the wound may need sutures.
2. If the wound is bleeding and the bleeding can't be controlled, sutures may stop the flow.
3. If the laceration is located on a part of the body that moves, risking reopening of the wound, sutures will protect the treated laceration.
4. If the laceration is deep, extending into underlying muscle tissues, it may require sutures.

Let's turn to the Procedure Guide to explore how suturing is accomplished.

Steps to Take 26-2 Assist with Suturing a Laceration

1. Turn to Steps to Take 26-2 in your Procedure Guide.
2. Read the Steps to Take to assist the physician in suturing a laceration.
3. Review the procedure until you can describe the procedure without reading the steps.

Electrocautery

Electrocautery—also called **electrosurgery**—involves cutting or destroying tissue with a concentrated electric current. Electrocautery is used to remove skin tags and warts that don't require a living tissue sample for biopsy. Electrocautery has an advantage over excision—bleeding is controlled because blood vessels are sealed by the current.

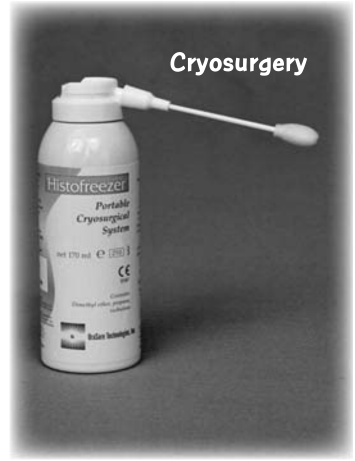
Electrocautery is accomplished with a handheld device with a tip that applies the current to the patient's skin tissue. The device might run on batteries or be connected to a wall power-source. Since the device uses electric current, it should be inspected for frayed wires before use. Any electrical equipment is a potential fire hazard, so flammable solutions such as alcohol and ethyl chloride should not be used in the area while the electrocautery is being performed.

After the procedure, the treated tissues will **slough**—die and separate from the healthy tissue. The patient should be warned that for the first week or so, the sloughing tissue will have an unpleasant odor. The patient may need dressing on the affected area, depending on the location. Electrocautery is becoming rare as the use of cryosurgery increases.

Chemical Tissue Destruction

Chemical tissue destruction is similar to electrocautery in that tissues are destroyed and blood vessels cauterized. Instead of electrical current, however, chemical tissue destruction utilizes silver nitrate on the end of an applicator stick to seal **friable** (easily broken) blood vessels. For example, the doctor may treat frequent nosebleeds by using silver nitrate inside the nostrils.

Cryosurgery



Cryosurgery refers to the destruction of tissues by freezing. The most common way to conduct cryosurgery is to apply liquid nitrogen to tissues. Some areas of the body heal faster when the tissue is destroyed by freezing rather than by burning (cautery).

Liquid nitrogen is created by compressing nitrogen gas under cold temperatures. The liquid is **volatile** (unstable) and must be handled very carefully. Liquid nitrogen is usually kept in a canister in the doctor's office and transferred to the operating room in a thermos.

Some cryosurgery is performed using nitrous oxide, which is less volatile than liquid nitrogen. Nitrous oxide is not as cold as liquid nitrogen, so patients experience less pain. However, because nitrous oxide isn't as cold, it's less effective in tissue destruction.

Though cryosurgery is used to extract cataracts, remove anal lesions and treat throat lesions, it is most commonly used to remove warts. The procedure consists of applying the liquid nitrogen directly to the skin with a probe. Nitrous oxide is applied from a tank through a **cryogun** that uses a disposable tip to administer the treatment. As with electrocautery, the treated tissues slough. An unpleasant odor and local discomfort may result. The doctor may suggest a dressing and antibiotic ointment while the treated area heals.

Laser Surgery

Laser is actually an acronym: *light amplification by stimulated emission of radiation.* In the doctor's office, a laser creates a concentrated light that can destroy tissue. Lasers are used in surgery to burn or remove tissues or to cauterize blood vessels. The first medical uses of lasers focused on the eyes, but they are now used for many procedures throughout the entire body.

Lasers are potentially hazardous light. The physician, patient and MA must wear protective goggles to prevent retina damage. A warning sign should be posted on the operating room door when the laser is in use.

Other laser-related hazards include the following:

- Lasers can "vaporize" tissues. Those in the operating room should avoid inhaling those vapors.
- As with electrocautery, a fire hazard exists. Equipment should be inspected in advance. Flammable liquids should be removed from the operating field.
- If the patient has been prepped with a flammable product, the patient's skin should be dry before the laser is used.
- Sterile water should be available in the event of an accidental fire.

Because of the variety of hazards, medical assistants are limited in their ability to assist in laser surgery. Your state may require that medical assistants undergo specific training on the type of laser the physician uses.

Step 10 Postoperative Procedures

- ❑ The operation is successful. The procedures are complete. What's next for the medical assistant? From cleaning the operating room to postoperative care of the patient, the medical assistant has important responsibilities. In this segment, we'll discuss those responsibilities, beginning with the care of the operating room.

Care of the Operating Room

After minor surgery is performed, the medical assistant may be required to care for the room and equipment. Surgical instruments are delicate and must be handled by a professional. Needles and other biohazards must be disposed of in a safe manner. After donning gloves, gown and goggles, the medical assistant may perform some or all of the following tasks:

One task MAs perform is offering support to patients.

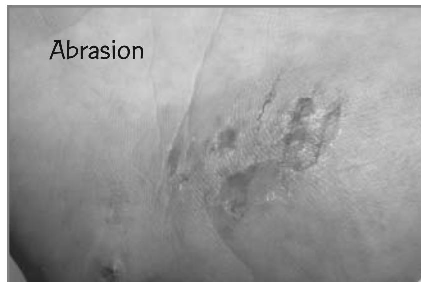
- Dispose of all drapes and covers. When appropriate, use a biohazard waste receptacle.
- Remove all needles and blades from the operating field using forceps. Dispose of used instruments in a sharps container.
- Place instruments in a plastic soak bin.
- Dispose of all used gloves and gauze in a biohazard waste receptacle.
- Sanitize Mayo equipment tray and all other operating surfaces, including the operating table, doctor's stool, countertops, sink and stationary equipment.
- Disinfect all surfaces and allow to air dry.

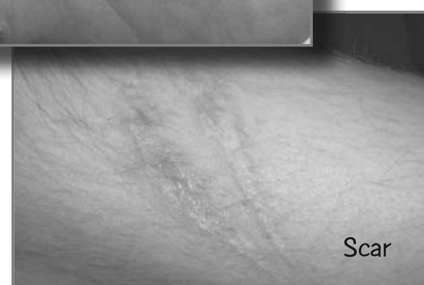
Wound Healing

Like the old saying says, time heals all wounds. But all wounds aren't the same. Wounds vary by type. Wounds also vary by how far along in the healing process they are. And finally, wounds vary by how well the healing process succeeds. Understanding each of these three variables will help you to fully understand the healing process.

Let's begin by reviewing wounds by type. As you learned in Lesson 7, there are five basic types of wounds. One of them does not involve penetration of the skin. This type of wound is called a closed wound, or contusion. A contusion is the result of trauma that damages the underlying tissues, but leaves the skin intact. If you've ever had a bruise, you know what a contusion is!

Open wounds are those that involve tearing of the skin. Lacerations are deep, uneven tears. This type of wound is often more difficult to suture. Incisions are deep, even tears. This kind of wound is often intentional—the physician may make an incision during a procedure, for example. Punctures are deep cuts with a small entry point. Because of that small entry point, punctures may bleed less than other open wounds. Finally, abrasions are accidental wounds that tear back the skin's surface without damaging the subcutaneous layer.





All wounds need to heal. Suturing a wound holds the wound in place, but there is a biological process that must follow. This process happens in three phases. The first phase, called the **inflammatory response**, lasts for three to four days. Blood vessels contract, slowing the bleeding. Blood platelets begin to bind the wound by forming a natural glue. Fibrin is released, collecting red blood cells into a clot that will become a scab. Under the scab, the edges of the wound will begin to pull together.

The second phase of wound healing is called **proliferation**. This phase lasts from 5 to 20 days. Tissue continues to contract under the scab. Clean, shallow cuts usually heal completely by the end of this phase.

The third phase of wound healing is called **remodeling**. If the wound is serious enough, a thick protein material called **collagen** forms into scar tissue. Scar tissue is stronger than skin, but it has no blood supply and it's not as elastic as skin.

A final way to regard the process of wound healing is to examine the results of the healing process. Wounds that heal by **primary intention** see very little scarring. The edges of the wound seal evenly and eventually disappear. Wounds that heal by **secondary intention** heal by **granulation**—the filling up of the wound with granulated tissue from the bottom up. This kind of healing can leave a large, obvious scar. Wounds that heal by **tertiary intention** are kept open for a while to avoid infection. Once cleaned or drained, the wound is sutured. Like secondary intention wounds, tertiary intention wounds have a greater chance of scarring.

Dressing the Wound

Dressing a wound has two purposes. First, the dressing provides a direct application of medicine to the affected area. Second, the dressing absorbs drainage. When placing a dressing on a wound, the MA should be certain to choose a dressing large enough to completely cover the wound. The dressing should be placed directly on the wound, rather than placed off-center and slid into place. And, the dressing and wound should be treated as a sterile field to avoid infections. Finally, the MA may wish to tape the dressing in place. This last step does not require gloves, as the dressing already covers the wound when the tape is applied.

Bandaging

After placing dressing over a wound, the wound should be bandaged. Follow these basic guidelines to cover the dressing with a protective bandage:

- Bandages should be snug but comfortable. If they are too tight, they will restrict circulation and inhibit wound healing.
- The bandage should be secure enough to endure normal activity.
- The bandaged area should be in its normal position before being bandaged. Skin surfaces shouldn't touch under the bandage to avoid scarring that keeps skin surfaces connected.
- Bandages should be wrapped from the distal point of the dressing to the proximal point. This means beginning the wrap from the furthest part from the body's center, toward the body. For example, from the ankle to the knee or the wrist to the elbow. This promotes circulation and results in a more secure wrap.

As you learned in Lesson 7, there are several methods of bandage wrapping. They include the circular turn, the spiral turn, the spiral reverse, the figure-8 and the recurrent turn. We will briefly review those here.

The circular turn wraps the bandage several times around a fixed position, like a wrist, anchoring the bandage.

A spiral turn is used to wrap the straight part of an appendage, moving from the distal to the proximal point in a spiral.

A similar wrap is the reverse spiral, which starts like a spiral turn, but then comes back down the other way to provide a more secure wrap. This sort of wrap provides more padding and protection, since it uses more bandaging.

The figure-8 turn works best on joints, like ankles or knees. The bandage starts with a circular turn then proceeds in a figure-8 to brace and cover the bending joint.

Finally, the recurrent turn is used for appendages or extremities like an amputation. The bandage is folded back and forth across the dressing and anchored with circular turns.

Finally, you'll use clips to hold the end of the bandage in place.

Changing a Sterile Dressing

Some wounds require that the dressing be changed and fresh medication applied as healing progresses. Use the principles of surgical asepsis when you change sterile dressings and always wear gloves.

The first step in changing a sterile dressing is to remove the old one. Tape may be pulled off, but it should be pulled in the direction of the incision, so as not to reopen the wound. Cut bandages free using scissors, but be careful not to go near the incision to prevent the wound from accidentally reopening. If the dressing sticks because of dried blood or fluids, soak the dressing with sterile water or saline solution to work the dressing free. After the wound is uncovered, the physician will inspect the wound. At this time, change gloves to avoid contaminating the wound with bacteria from the old bandage.

Finally, redress and bandage the wound as directed by the doctor.

Removing Sutures

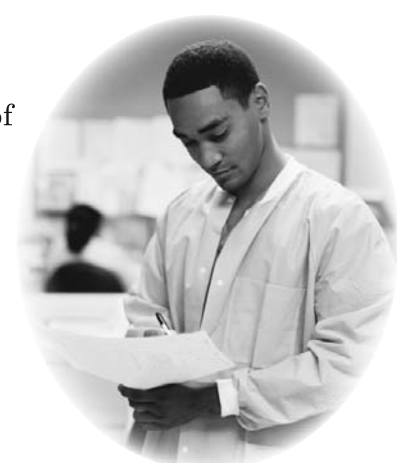
Eventually, non-absorbable sutures used to hold the edges of a wound together must be removed. The wound is not completely healed when this occurs. If sutures are left too long, they are more difficult to remove and can cause unnecessary skin marks and even scarring. The MA often performs the removal of sutures. To learn the basics, we will turn to another virtual lab!

Virtual Lab 26-2 Remove Sutures

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 26-2 Remove Sutures. This will bring up the instructional video about removing sutures.
3. Follow along with Virtual Lab 26-2 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. Review this procedure and watch the virtual lab until you can explain the procedure without reading the steps or watching the lab.

Outpatient Documentation

It's almost impossible to overemphasize the importance of documentation. Every procedure must be logged, annotated and initialed. This includes minor surgery, dressing changes, wound cleaning and any instructions given to the patient. It also includes progress notes on the wound healing process. This duty is usually the responsibility of the medical assistant.



Please pause to complete online Practice Exercise 26-3.

Step 11 Lesson Summary

- This lesson focused on minor surgery that occurs in doctors' offices and clinics. Many patients opt to have their surgery done outside of a hospital setting. The medical assistant has an important role in this kind of surgery.

  The principles of surgical asepsis help keep minor surgery safe by providing a sterile environment for surgical procedures. There are various instruments that a medical assistant is likely to encounter, including those that clamp tissues (forceps), those that pull tissues back (retractors), those that cut (scalpels and scissors) and those that explore (probes). Along with sterile instruments, a wide array of supplies are used in surgery.

  Preoperative preparation includes patient education and consent, as well as the physical preparation of the patient. Your duties will also include preparing the operating room and surgical instrument tray.

  You can assist in many common minor surgical procedures, including excisions, incisions, suturing, cryosurgery, laser surgery and chemical tissue destruction.

  One of your postoperative responsibilities is to clean the operating room. More importantly, you will attend to patient postoperative concerns such as wound healing, dressings, bandages and the removal of sutures.

  And, as always, you must remember to document all of the procedures just mentioned in the patient's records. This lesson covered some advanced procedures that you may not be involved in right away as you begin your new career. But because of the foundation you are building now through this course, when you are ready to train and assist in clinical procedures, you'll already be halfway there!

Please pause to complete an online Quiz.

Endnotes

1. "Problems of Office Surgery." *nysenate.gov*. NY State Senate. n.d. Web. 25 Sept. 2006

Lesson 27
Preparing and Administering Medications

Step 1 Learning Objectives for Lesson 27

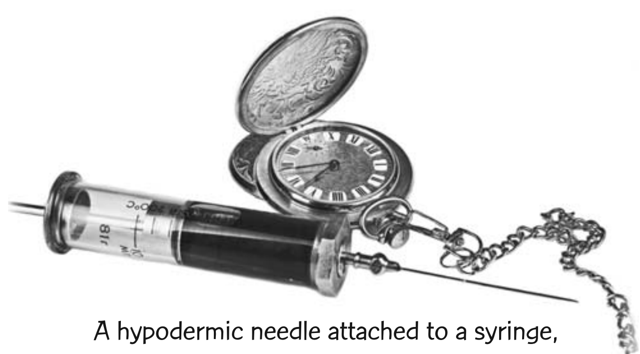
- When you have completed the instruction in this lesson, you will be trained to do the following:
  - Identify the various routes of drug administration.
  - Calculate medication dosages using the ratio and proportion methods.
  - Discuss the factors involved when calculating children's dosages.
  - Explain the proper procedure to carry out verbal orders.
  - Summarize the 14 guidelines to follow when administering a medication.
  - Defend the procedure of triple checking medications prior to administration by using the *"Six Rights."*
  - Discuss the documentation requirements when medications are administered and when errors occur.
  - Illustrate how to apply a transdermal patch medication properly and identify the precautions when applying this type of patch medication.
  - Relate the steps to properly apply topical medication and administer oral medication.
  - Explain the proper procedures to instill eye drops and ear drops.
  - Specify the types of rectal and vaginal medications and clarify the proper positioning of rectal medications.
  - Identify the parts of a syringe and the different kinds and sizes of syringes.
  - Describe how to withdraw medication from an ampule and a vial.
  - Identify the tissue layers and sites of injection for intradermal, intramuscular and subcutaneous injections.
  - Defend the use of different length and gauge needles and different angles of needle entry to administer various medications in specific injection sites.
  - Explain how to administer intradermal, subcutaneous and intramuscular injections using the virtual lab.

- Identify the various sites for administering insulin injections and instruct patients to self-administer insulin injections.
- Explain the steps to administer an intramuscular injection by Z-track method using the virtual lab.
- Relate how to properly discard a used syringe and needle.
- Describe administration and educational concerns related to immunizations.
- Explain how and why the medical assistant informs patients, or the responsible party for a minor, in writing and verbally, of the risks and benefits of immunizations before they are administered.
- Discuss the importance of patient education regarding medications.

Step 2 Lesson Preview

❑ It's hard to imagine a time when we didn't know the basics of human anatomy. Believe it or not, it was only 400 years ago that Dr. William Harvey published his ground-breaking research proving that the heart pumps blood through a circulatory system. From there, it wasn't long until Robert Boyle and Sir Christopher Wren were experimenting with a syringe-like device made of a quill attached to a bladder. They used this "clyster" to inject opium and other substances into a dog.[1] The modern-day pump syringe was invented in the early 1700s by Dominique Anel. He used the syringe to suction and clean the battle wounds of French soldiers. Since then, physicians and researchers refined the syringe until it looked more like a sleek medical tool and less like an instrument of torture.

In your pharmacology lesson you learned that the mission of drug therapy is to deliver the right drug in the right amount at the right time to the right place in the body to have a positive effect. In this lesson we'll answer the question, "What is the right amount?" Drugs must be taken in the proper amount to be effective and safe. How are those amounts calculated? What are the standard measurements used? You'll be able to answer these questions when you examine dosages.



A hypodermic needle attached to a syringe, made of silver and glass.

In addition to the right dosage, you must consider the delivery method. There are many ways to administer medications to your patients. What are the different ways patients take drugs? What are the pros and cons of each method? What is the medical assistant's role in applying prescribed medications? We'll explore these questions throughout the lesson.

By the end of this lesson, you'll understand the hows and whys of medication preparation and administration. This knowledge will be an important part of your training to become a medical assistant! Let's begin by looking at delivery methods.

Step 3 How Do Drugs Get Delivered?

- [ ] There are three ways that drugs are handled in the doctor's office. They are prescribed, *dispensed* or *administered*. You know that a prescribed drug is purchased by the patient at a pharmacy after the doctor has given him a prescription. When a drug is **dispensed**, it's given to the patient in the office to be taken later. When the patient takes a drug in the office or clinic, the drug is **administered**.

In the following lesson segments, we'll talk about how drugs are administered and how a doctor calculates the proper amount of a drug to administer. These two topics are interrelated, because the **dosage**—the amount of a drug given to a patient—will depend on the way the drug is administered.

This material is important to you as a medical assistant. Most states allow an MA to prepare and administer medications under the supervision of a doctor. What are the ways drugs are administered?

In this segment, we'll look at **drug routes**—the different ways drugs are administered to patients. There are a variety of reasons for choosing one drug route over another. Different drug routes provide different rates of absorption. For example, oral medications take longer to absorb than inhaled medications. Also, the patient's physical and mental state must be considered. Obviously, a patient under sedation can't take an oral medication. And some patients don't like needles. A third factor governing administration is the characteristics of the drug itself. For example, digestive enzymes destroy insulin, so it can't be taken orally. Let's look at the common drug routes, and learn about the pros and cons of each method.

Oral Medication

Oral medication is taken through the mouth and distributed through the gastrointestinal system. There are several forms of oral medications to choose from. **Tablets** are solid discs of medication. **Capsules** are oblong-shaped, gelatin tubes filled with powdered medication. **Caplets** are capsule-shaped tablets. A **solution** is a powdered medication that is dissolved in water and swallowed. **Syrup** is a concentrated solution mixed with sugar or a sugar substitute. A **suspension** is an insoluble medication contained in a liquid—milk of magnesia for example. **Elixirs** were originally medicines dissolved in alcohol. Since many elixirs are prepared for children, they are now made with and without alcohol.

Sometimes, oral medications are coated to allow for specialized distribution. They may be **enteric coated** with a material that won't break down until it reaches the intestine, avoiding an upset stomach. Some capsules have tiny, coated doses inside that enter the bloodstream at different rates, allowing for **time-release**.

Buccal and Sublingual Medications

Some medications taken by mouth can bypass the gastrointestinal system. **Buccal** administration means placing the medication between the cheek and gum until it's absorbed through the vascular oral mucosa. **Sublingual** administration means placing the medication under the tongue until it dissolves and is absorbed through the oral mucosa membrane. This is how nitroglycerin tablets—used for the treatment of angina—are administered. These methods allow for quick absorption. In addition, some topical medications, used in the treatment of sore throats, are held in the mouth and then spit out, rather than swallowed.

Transdermal Medication

A **transdermal** medication is put in a patch that is placed on the skin. The medication is absorbed slowly over a period of time—usually three days. A common example of a transdermal is the nicotine patch. Patients trying to quit smoking receive nicotine to help with withdrawal symptoms. Each successive patch contains less nicotine until the body is finally able to do without. Patches are also used to administer birth control.

Topical Medication

A **topical** medication is designed to be applied to the surface of the body. This can include the skin, eyes, ears, nails or mucous membranes. Topical medications can have a local or systemic effect. Many of the drug routes described here are considered topical, as opposed to **enteral**—through the GI system—and **parenteral**—through the circulatory system.

Rectal and Vaginal Medications

Medications can be administered either rectally or vaginally either by ointment or by **suppository**—a medicine with a glycerin or cocoa butter base that is dissolved by body heat and absorbed. A suppository is useful when the patient's symptoms include vomiting, making oral medications impractical, or if the infection or condition is in the area where the suppository is inserted.

Inhalers

An **inhaler** uses an aerosol vapor, gas or spray to shoot medication directly into the respiratory system. This can be accomplished either through the nose or mouth, using a mask or nebulizer. One common example is medication used for asthma. Inhaled medication is absorbed quickly, but it is most often used as a local medication, rather than a systemic one.

The inhaled medicine expands the breathing passages, making respiration easier.

Parenteral Medication

Parenteral medications are given by injection, either into body tissue or directly into a vein. The word parenteral means "beyond the intestine." We will cover parenteral delivery techniques later in the lesson. The chief advantage of parenteral medication is quick absorption.

Implants

Implant medications are inserted beneath the skin surgically. Once there, they release a steady dose of medication over a long period of time. One common example is Norplant, a contraceptive. The advantage of the implant is that, unlike oral birth control, you can't forget to take it.

Pumps

One last drug route to discuss is the **pump**, a miniature device that administers a continuous flow of medication. For example, diabetics who don't want to constantly monitor their blood sugar use the pump to provide a steady supply of insulin. Pumps can be attached to an intravenous drip. New technology even allows miniature pumps to be implanted surgically.

Now that we've discussed delivery methods, let's learn how to calculate the right amount—the dosage.

Step 4 Calculating Dosage

❑ Many modern medicines come in what's known as **unit dose medication**—pre-measured doses of a drug. A **USP unit** is the standard unit of dosage for a medication according to the United States Pharmacopeia. Today's drugs are more powerful than ever and mistakes in medication are all too common. (See boxed information.) So it's important for you to understand how dosage is determined so you can protect your patients from accidental overdose.

Dosage Errors

A recent report estimated that more than 1.5 million Americans are affected each year by errors, either in the prescription, dosage or the administration of drugs. Of these errors, more that 58 percent are dosage errors![2] Errors are so common that hospital patients suffer a mistake per day on average. The cost of treating these mistakes comes to more than 3.5 billion dollars a year.[3]

Albert Wu, a drug safety expert at Johns Hopkins University notes, "Everyone in the health care system has to wake up and take this more seriously."

Systems for Dosage Measurement

When talking about dosages, you need to know what measurement system is being used. There are two basic systems for measuring the amount of a drug being administered—the *metric* system and the *household* system.

The Metric System

The **metric system** is used worldwide, particularly in the scientific field. It is based on the decimal system, with units based on multiples of 10. To understand the system, it will be helpful to review the common prefixes. Units feature a prefix, followed by a measurement. For example, the prefix **milli** means one thousandth of a unit. A **meter** is a measurement of length, a little over a yard long. Thus, a **millimeter** is a thousandth of a meter.

The chart below lists common metric prefixes and measurements:

Prefix	Meaning
milli	one thousandth
centi	one hundredth
deci	one tenth
deka	ten
hecto	one hundred
kilo	one thousand
Unit	**Type of Measurement**
Meter	length
Liter	volume
Gram	mass/weight

A liter is about 1.05 quarts. A hectoliter would be a hundred liters, or about 105 quarts. A kilogram is 1,000 grams. A centimeter is one hundredth of a meter (less than an inch).

Household Measurements

Household measurements are less precise than metric measurements—they get their name because they are used in the home, not the doctor's office. Because some patients are unfamiliar with the metric system, the medical assistant should be familiar with both measurement systems and be prepared to use either one. The chart below lists some common household measurements:

Common Measurement	Equivalent
3 teaspoons	1 tablespoon
2 tablespoons	1 ounce
8 ounces	1 cup
2 cups	1 pint
2 pints	1 quart
4 cups	1 quart
4 quarts	1 gallon

Doing the Math

In order to understand how doses are calculated, it will first be necessary to understand some mathematical concepts. The first concept is **ratio**—defining the relationship between two components. To illustrate a ratio, let's look at a common one that might have helped make your breakfast—cinnamon sugar. Cinnamon sugar is made with granulated sugar and cinnamon spice. But that information won't be enough to make a tasty batch. You need to know how much cinnamon to mix in with the sugar. The relationship of cinnamon to sugar is called the ratio. For every one part of cinnamon, there must be 12 parts of granulated sugar. This ratio can be expressed as a quotient (1 to 12) or a fraction (1/12th) or as a decimal (.08333, which is 1 divided by 12).

But knowing the ingredients and the ratio still isn't enough information. Do you want a cup of cinnamon sugar or ten gallons? Our second important concept is **proportion**—the relation between a part with regard to size or number. The proportion will help you convert a ratio into a recipe (or, in the case of medicines, a dosage). To understand this, let's look at the way a proportion equation compares ratios.

$$3:8 = 6:16$$

This equation claims that 3 relates to 8 like 6 relates to 16. Is that true? One way to check is to multiply the *means* and the *extremes*. The *means* are the two inner numbers in the proportion equation—in this case, 8 and 6. The *extremes* are the two outer numbers—3 and 16. If the proportion is true, then the product of the means will equal the product of the extremes. In this case:

$$8 \times 6 = 48 \text{ and } 3 \times 16 = 48$$

The product of the means and the product of the extremes are equal, so the proportion is true.

Now, let's continue our cinnamon sugar example. Suppose we have six cups of granulated sugar, and we want to know how much cinnamon sugar to add. The equation will look like this:

1:12 = x: 6 cups

In this case, x stands for cinnamon. We're asking the question, if the ratio is 1 to 12, and we have six cups of sugar, how much cinnamon will we need to maintain the proper proportion? Let's multiply the products of the means and the extremes:

$12x$ = 6 cups

We did this by multiplying the means (the two inner numbers) 12 and x to get $12x$. Then we multiplied the extremes (the two outer numbers) 1 and 6. Now we have changed our proportion into a simple algebra formula. Dividing both sides of the equation by 12, we find that:

$$x = \frac{6 \text{ cups}}{12}$$

x = .5 cup

We have to add a half-cup of cinnamon to our 6 cups of granulated sugar to maintain our 1 to 12 ratio.

The Proportional Method for Calculating Dosages

Now let's get out of the kitchen and into the doctor's office. Suppose your doctor has ordered 2000 USP units of a medication to be given by syringe. On hand, you have a solution of the drug with 3000 USP units per milliliter. How much should you give the patient? Let's start by setting up a proportion equation.

On Hand Medication: Unit	=	Dose Ordered: Amount to be Given
3000 units: milliliter (mL)	=	2000 units: x

By multiplying the means and the extremes, we can convert this proportion into an algebraic equation:

$3000x$ = 2000 mL

or, x = .667 mL

So you will give the patient .667 mL of the medication.

Let's look at another example. The doctor has prescribed 400 mg of a medicine. On hand, you have tabs that are 200 mg each. How many tabs should you give the patient?

On Hand Medication: Unit = Dose Ordered: Amount to be Given

200:1 = 400: x

Now multiply the means and the extremes to find that:

$$200x = 400$$

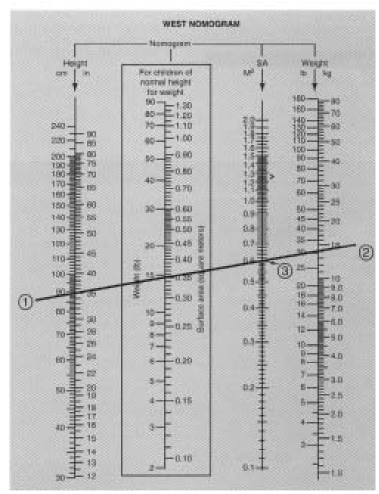
$$x = 2$$

Using the supply of the drug on hand, you will give two tabs to the patient. Notice that the first example involved a liquid and the second example involved a solid. This method of calculation works, no matter what drug route the doctor selects.

Doses for Children

Children do not develop at the same rate, so dosages must vary according to the individual. In the past, doctors used a guide called the **Young's, Clark's and Fried's rules** to calculate dosages as a percentage of adult dosages, but it's inaccurate to simply estimate dosages based on age—children are not just "little adults." They have different physiologies and different weight to body surface area ratios—both important factors in dosage calculations.

Today, doctors may prescribe according to a formula and **nomogram** (a graph) to calculate the precise dosage based on the **body surface area** (**BSA**). Using the nomogram, a straight line is drawn from the child's height to the child's weight. The nomogram, which looks a little like a slide ruler, will give a corresponding body surface area.



A nomogram is used to calculate pediatric dosages.

For example, if a normal adult should get 100 mL of a pain reliever, how much should a 35-inch, 30 lb child get? The child has a BSA of .6. The average adult has a BSA of 1.7. Our proportion equation looks like this:

$$.6 : 1.7 \quad = \quad x : 100 \text{ mL}$$

By multiplying the means and the extremes, we find that:

$$1.7\,x = .6 \times 100 \text{ mL}$$

$$1.7\,x = 60 \text{ mL}$$

$$x = 35.29 \text{ mL}$$

Our toddler should get 35.29 mL of the pain reliever, using the BSA method.

A more common method of calculating children's dosages is to use the child's body-weight in kilograms. Although not as accurate as a nomogram, it is less cumbersome to use and only requires one measurement (weight) to calculate the dosage.

Here's how this method works. A kilogram is 2.2 pounds. Let's suppose that the doctor prescribes a pain reliever at 11 mg/kg/day in three equal doses. That means that for every kilogram of weight, our patient gets 11 mg per day, divided into three doses. Our patient weighs 55 pounds. First, you must convert pounds to kilograms:

Pounds : Kilograms		Pounds/Kilograms
$2.2 : 1$	=	$55 : x$
$2.2\,x$	=	55
x	=	25 kilograms

Our toddler weighs 25 kilograms. Now, we want to convert the doctor's orders into a daily dosage.

mg medicine : Kilogram		Patient Dose : Patient's Weight
$11 : 1$	=	$x : 25$
x	=	275 mg

Now let's divide that into three equal doses:

$$275/3 = 91.67$$

Our toddler gets three doses per day of 91.67 mg per dose.

You can see how complicated calculating dosages can become! It's important that you familiarize yourself with metric prefixes and units of measurement. And, you must understand ratios and proportions in order to convert a doctor's prescription into a safe and effective dose of medicine.

In the next segment, we'll take a look at the actual administration of drugs using different drug routes. We will practice these techniques using a series of virtual labs.

Please pause to complete online Practice Exercise 27-1.

Step 5 Administering Medicines

- So far, we've examined the common drug routes and looked at dosage calculation. In the next two segments, we'll look at the actual administration of drugs. We'll look at safe, effective practices. We'll discuss how to document what you do. And you will get a chance to use virtual labs to watch the procedures discussed in this lesson.

Doctor's Orders

The administration of medicine begins with the doctor. The doctor decides the medication and the drug route. If the doctor writes a prescription, the patient will go to a pharmacy to have it filled. In some cases, the doctor will dispense medication in the office or clinic. This order may be a **single order**, the administration of a single dose of medicine. Or the doctor may ask for a **stat order**, the immediate administration of a medicine.

THEODORA WAGNER, M.D.
WAGNER CLINIC
ROSSTOWN, IL 66618

For F. Karkonen Date 1/11/08

Rx: Lexxel® 5 mg
30
PO QD

May substitute? Refills:

Physician Name: T.A. Wagner, M.D. DEA #: (on file)

The doctor's orders might be written on the patient's records, or they might be a **verbal order**—a **VO**. If you, as a medical assistant are given a verbal order, you should repeat the order back to be certain that you correctly understood the order. Then, write the order down on the patient's records for the provider to countersign later.

A **routine** or **standing order** refers to a medication administered on a regular basis to patients who come to the office or clinic to receive that medication. For example, a patient may require monthly vitamin injections. Standing orders are good for as long as twelve months.

Administration Guidelines

The following guidelines should always be followed when preparing and administering medicines, regardless of the drug route or medium. You should be familiar with all of these guidelines, and put these principles into practice at all times.

1. Always practice medical asepsis.
2. Work in a clean, well-lit environment with sufficient work space.
3. Always check for allergies on the patient's chart before administering medication.
4. Practice the "Six Rights" of drug administration. (See boxed material.)
5. Only administer drugs that are ordered by a medical professional who is licensed to do so.
6. Never administer medications if questions remain about the order.
7. Be familiar with any drug you administer. If necessary, research the drug in the PDR.
8. If the drug's color, consistency or odor make it suspect, do NOT administer the drug.
9. If the physician gives a VO, write down the information. Do NOT trust the administration of a drug to memory.
10. Check any drug for an expiration date before administering it.
11. If you prepare a drug for administration, you should administer it yourself. Do not leave the medicine unattended. Dividing the task creates an opportunity for error.
12. When pouring a liquid medicine, set the measuring device on a flat surface and observe the scale at eye level to ensure correct measurement. Measure at the **meniscus**—the outer surface of the liquid, which will have a concave shape due to surface tension. There should be no bubbles in liquid medication.
13. If dispensing the medication requires removing a cap, place the cap rim-up on a clean surface. Do not contaminate the cap by placing it rim-down.
14. Carefully follow all procedural steps for whatever type of medicine you are preparing.

The "Six Rights" of Medicine Administration

The "Six Rights" are a list of actions developed for a medical assistant who is about to administer medication. This list will allow the MA to "triple check" her work and avoid the kind of errors that harm patients with incorrect medications or dosages.

The Right Patient	Before administering any medication be certain that you have the right patient. In a hospital, the patient will have an identification bracelet. In the office or clinic, call the patient by name to ensure the patient's identity.
The Right Drug	To ensure that you are administering the correct drug, compare the written medical order or your notes for a VO to the label on the medicine. Triple check the drug—once when you select the drug from the storage area, once when you remove it from its container, and once more when you return the medication or dispose of the empty container.
The Right Route	The medication must use the correct drug route to have the desired action. If parenteral injection is used, this means selecting the proper needle length to reach the desired tissue. We will discuss this in depth later in the lesson.
The Right Dose	Safe, effective medication demands the correct dose to achieve the desired action. Too little of a medication can be ineffective. Too much can be harmful. If the dose on hand is not the dose ordered by the doctor, use the proportion method explained earlier in the lesson to determine the amount of medication needed. Have at least one other person verify your calculations to eliminate mistakes.
The Right Time	The right time refers to the interval between doses. Failure to maintain the proper interval will result in an improper level of medication in the blood.
The Right Documentation	Documentation is a vital communication between the medical assistant and the doctor. It's a permanent written record of medication given to any patient.

Documentation Guidelines

Once a medication has been administered, the medical assistant must document the information on the patient's records. The record must include the date and time of the administration, the name of the drug, the dosage and the drug route, as well as patient data such as blood pressure, respiration and pulse. If there were any unusual reactions or complications arising from the administration of the drug, they should be recorded as well. Finally, the person administering the medication must sign the notes.

This information can be recorded in progress notes or on a medications flowchart. Either way, the information should not be recorded until *after* the medication has been administered. A patient may refuse medication, in which case the doctor must be notified and the reason for refusal must be recorded.

Adverse Reactions and Errors—When Something Goes Wrong

Any patient can have an adverse reaction to a medication. Patients are not always aware of their allergies, and might have no reason to expect a negative reaction. If the reaction is mild, it often occurs after leaving the office or clinic.

Severe reactions usually happen immediately. Most adverse reactions occur from parenteral injections, not oral medication. The medical assistant must observe the patient and be prepared to respond to adverse reactions, including informing the doctor of any possible concerns. To ensure that this happens, the patient should be instructed to stay in the doctor's office for at least 15 minutes after a shot is administered.

The warning signs of an adverse reaction include hives, redness or itching at the site of the injection. These symptoms can progress to more dangerous symptoms like anaphylaxis. If a reaction occurs, ask the patient to lie down, which improves blood circulation. Take the patient's pulse and blood pressure. Monitor the patient's breathing. If the reaction is severe, the pulse will be rapid, the blood pressure will drop and the patient may have trouble breathing. Don't leave the patient alone. Call for help and ask for the prescribing doctor.

The procedures listed in this lesson, along with the principles established in the "Six Rights" of medication administration, are designed to minimize errors. However, people are human, and human beings make mistakes. The most important thing to remember about errors is to *report them as soon as they occur*. Then monitor the patient to ensure that there is no adverse reaction to the error. Thankfully, most errors do *not* result in long-lasting harm to the patient.

Errors must be documented in the patient's records, and the person who made the error must sign them. This information must include the date and time of the error, the nature of the error and a thorough account of the symptoms suffered by the patient. In addition, an incident report must be filled out and reviewed by the risk management specialist in the office or clinic. This will allow management to review procedures and recommend changes to prevent further errors.

Step 6 Administration Routes without Injection

- In this segment, we'll look at each of the drug routes, and note the important techniques associated with each type of medication. We'll also use virtual labs and your Procedure Guide Supplement to learn and observe these same techniques. This section will focus on administration that a trained medical assistant is allowed to do. Implants, for example, are a minor surgical procedure, and would not be part of the MA's duties.

Oral Medication

We'll begin our look at the actual administration of medication with the most common drug route—oral medication. Because tablets, capsules and liquids are so easy to use, most doctors prescribe rather than administer these medications. Still, you should know how to prepare the various kinds of oral medication.

Oral medication is absorbed in the gastrointestinal system. Most oral medication comes in the form of a tablet or capsule, though liquids are available for children and adults who have trouble swallowing pills.

The most common drug route is through the mouth.

Preparing oral medication differs, depending on whether the medication is solid or liquid. To prepare solid medications pour the medication from the container into the container cap until you have the correct dosage. Then, pour the medication from the cap into a plastic or paper medication cup for the patient. Replace the cap on the container and return the medication to the storage cabinet.

Let's practice this concept by viewing a virtual lab.

Virtual Lab 27-1 Obtain and Administer Oral Medication

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 27-1 Obtain and Administer Oral Medication. This will bring up the instructional video about dispensing oral medications.
3. Follow along with Virtual Lab 27-1 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. If possible, practice this procedure and watch the virtual lab until you can perform the procedure without reading the steps or watching the lab.

The preparation of liquid medication requires a few additional steps. You may recall that some liquid medicines are a **suspension**—solid medication suspended in a liquid. It is especially important to shake suspensions before dispensing them in order to ensure a uniform dose.

Another consideration in the administration of liquid medicines is measuring the dose. The medical assistant should pour the correct dosage into a plastic measuring cup or draw it with an eyedropper. If the liquid is poured into a measuring cup, be certain to set the cup on a flat surface. Pour the correct dosage, careful to look at eye level. Remember, the liquid's surface will be curved. The lowest point of that surface, the meniscus, is the proper place to read the level.

Take a moment to read Steps to Take 27-1 and compare it with the virtual lab you just completed. Note any differences between administering solid and liquid oral medicines.

Steps to Take 27-1 Obtain and Administer Liquid Oral Medication

1. Turn to Steps to Take 27-1 in your Procedure Guide.
2. Read the Steps to Take to obtain and administer a liquid oral medication.
3. Review the procedure until you can describe the procedure without reading the steps.

Transdermal medication, topical medication and rectal/vaginal medications are rarely administered in the office or clinic. Still, the medical assistant should know the proper techniques for administering each.

Transdermal Medications

Before applying a transdermal patch, you must always remove any old patch. Be careful not to touch the inside of the old patch to avoid inadvertently absorbing any remaining medication. Fold the sticky sides of the patch together, and discard.

To prepare an area for the patch, clip any hair, but do not shave. Try to place the new patch in a different area than the previous patch. Patches can be applied to the upper arms, chest or back. Gently wash and dry the target area. Then apply the new patch.

Patches can be applied to the upper arm, chest or back.

Topical Medication

Topical medications such as ointments and creams are occasionally administered in the office or clinic. Always begin administration by washing your hands. Then gently wash the patient's affected area. If the skin area is broken, use proper aseptic techniques, including gloves. If the target area is to be bandaged, apply the medication to the bandage, not the skin. If applying the medication directly to the skin, apply it with a clean tongue blade or a fresh cotton swab.

Other topical medications include eye and ear drops. These are often administered in the office or clinic, and as a medical assistant, you will surely have opportunities to perform these topical applications. Let's look at two virtual labs that will prepare you for this task.

Virtual Lab 27-2 Demonstrate Eye Drop Instillation

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 27-2 Demonstrate Eye Drop Instillation. This will bring up the instructional video about instilling eye drops.
3. Follow along with Virtual Lab 27-2 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. If possible, practice this procedure and watch the virtual lab until you can perform the procedure without reading the steps or watching the lab.

Virtual Lab 27-3 Demonstrate Ear Drop Instillation

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 27-3 Demonstrate Ear Drop Instillation. This will bring up the instructional video about instilling ear drops.
3. Follow along with Virtual Lab 27-3 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. If possible, practice this procedure and watch the virtual lab until you can perform the procedure without reading the steps or watching the lab.

Rectal and Vaginal Medications

A patient who is vomiting might not be able to keep down oral medication. In such a case, the doctor may recommend rectal medication, which can be in the form of a liquid, cream or suppository. Suppositories are usually refrigerated. When administering a rectal suppository, either the MA or the patient must insert the suppository past the sphincter so that it isn't eliminated immediately. A lubricant can be used to assist the process, though the lubricant must be water-based, not petroleum-based.

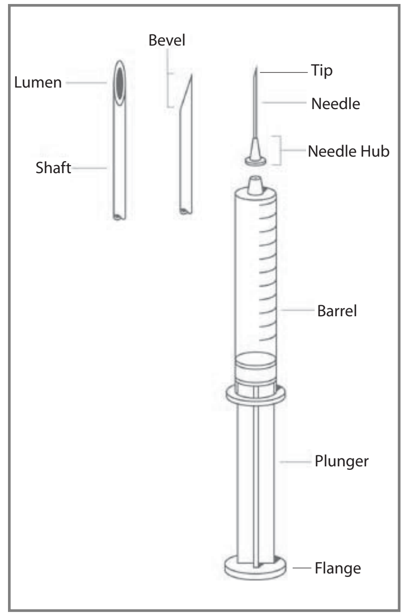
Vaginal medications are also available as suppositories or as ointments. Vaginal suppositories are much easier to administer and will probably not require a lubricant. Some birth control medications, such as spermicide, are also administered vaginally.

Please pause to complete online Practice Exercise 27-2.

Step 7 The Injection Route

- Parenteral injections are a common office or clinic procedure. There are advantages to injections, including the ability to bypass the gastrointestinal system, the speed of absorption and the accuracy and consistency of medication levels available because of that speed. Medications like insulin can't be delivered orally, because insulin is made inactive by gastrointestinal enzymes.

Because giving an injection is a learned skill, injections are often given at the doctor's office or at the clinic by an experienced professional. Before we view the virtual labs associated with parenteral medication, let's review the equipment that makes this kind of medication possible.



The parts of a syringe

Equipment

The most important piece of equipment in administering injections is the *syringe*. The **syringe** is the needle and plunger assembly that delivers the medicine. There are many types of syringes, but they share certain parts. The **tip** is the small hole where the *needle* is inserted, and through which the medicine will flow. The **needle** is a hollow metal tube of varying length, sharp enough to pierce the skin. The **barrel** of the syringe is the tube the MA holds when giving the injection. Inside the barrel is a **plunger**, which forces the medicine out through the tip and into the needle when the plunger is pushed. The MA pushes the plunger at the flat end, called the **flange**.

Medication used in injections may be stored in several ways. It may be stored in an **ampule**—a small glass flask with a fragile top that breaks free under pressure. A **vial** is a small glass bottle with a rubber stopper through which the needle draws medication. Some syringes even come prefilled with a standard dose of medication.

The needles themselves vary according to the needs of the injection. Some injections go skin deep, others go down into the muscle tissue. Needles have two variables. The **lumen** is the needle's opening. (Remember—needles are hollow.) The size of the lumen is called the needle's **gauge.** Needles also vary by length. A longer needle is necessary, for example, to get down into muscle tissue. The slanted end of the needle is called the **bevel**. The bevel allows the needle to come to a point for easier insertion into the skin.

Now that you know the parts of a syringe, let's turn to the Procedure Guide to review the procedure to withdraw medication using a syringe.

Steps to Take 27-2 Withdraw Medication from an Ampule

1. Turn to Steps to Take 27-2 in your Procedure Guide.
2. Read the Steps to Take to withdraw medication from an ampule.
3. Review the procedure until you can describe the procedure without reading the steps.

Not all injection medications come from ampules. Next, read Steps to Take 27-3 in your Procedure Guide to learn how to withdraw medication from a vial.

Steps to Take 27-3 Withdraw Medication from a Vial

1. Turn to Steps to Take 27-3 in your Procedure Guide.
2. Read the Steps to Take to withdraw medication from a vial.
3. Review the procedure until you can describe the procedure without reading the steps.

Injection Angle of Entry

Choosing the proper needle depends on the angle of entry into the skin. There are three primary angles of entry, including *intradermal*, *subcutaneous* and *intramuscular*.

Intradermal Injections

Intradermal injections are administered at a 10 degree angle to ensure that the medication stays in the dermal layer. Intradermal injections are often used for allergy tests. A small amount of a suspected allergen is injected just below the skin with the bevel of the needle facing up. The fluid forms a small bubble called a **wheal**. If the wheal swells, the patient is allergic to the suspected allergen. Common sites for intradermal injections include the upper arm, inner forearm, upper back below the shoulder blades and the pectoral area of the chest. Let's look at another virtual lab to put this information into practice!

Many allergies can be diagnosed by using an intradermal injection.

Virtual Lab 27-4 Administer an Intradermal Injection

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 27-4 Administer Intradermal Injection. This will bring up the instructional video about performing an intradermal injection.
3. Follow along with Virtual Lab 27-4 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. Review this procedure and watch the virtual lab until you can explain the procedure without reading the steps or watching the lab.

Subcutaneous Injections

Subcutaneous injections are given at a 45 degree angle, into the layer of fatty tissue just below the skin. This kind of injection is given when the medication might irritate muscle tissue or a slower rate of absorption is desired. Some vaccinations and insulin injections are administered using this method of injection. Common injection sites have plenty of fatty tissue, including the abdomen, the top of the legs and the back just below the shoulder blades.

Subcutaneous injection sites must have a layer of fatty tissue.

Subcutaneous injections are administered into fatty tissue, not into blood vessels. To avoid blood vessels, the injection should be **aspirated**: Before injecting, the plunger should be pulled back a little to ensure the needle hasn't found a vessel. If the needle is in a vessel, blood will enter the syringe. Intradermal injections do not need to be aspirated, since large blood vessels at the skin's surface are visible and can be avoided. Let's watch another virtual lab to put these concepts into practice.

Virtual Lab 27-5 Administer a Subcutaneous Injection

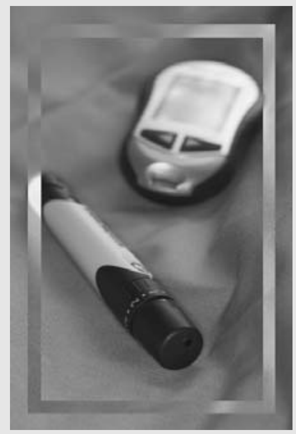
1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 27-5 Administer a Subcutaneous Injection. This will bring up the instructional video about performing a subcutaneous injection.
3. Follow along with Virtual Lab 27-5 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. Review this procedure and watch the virtual lab until you can explain the procedure without reading the steps or watching the lab.

Insulin: A Special Kind of Injection

Patients with Type I diabetes must take insulin two or three times a day by injection. That is too many injections to give in the office or clinic. A diabetic with Type I must learn to test his glucose levels and self-administer injections without the assistance of a doctor or MA.

The doctor will prescribe the proper dosage; an amount arrived at with considerable effort and observation. Thereafter, the patient is responsible for making injections. Insulin is administered subcutaneously, usually in the upper arms or legs, abdomen or buttocks. Patients must rotate injection sites often.

The medical assistant may be called upon to instruct the patient in insulin injection procedures. Most diabetics use two types of insulin. **Regular insulin** is clear and works within one half to one hour after injection. The effects of **long-acting insulin**, a cloudy substance, can last all day. Both insulins are administered in one dose. Regular insulin should be drawn up in the syringe first, followed by the long-acting insulin so there is no chance that any of the long-acting insulin can contaminate the vial of regular insulin. More serious problems can occur if the regular insulin is contaminated than the long-lasting insulin.



Glucose test kit

Occasionally, there can be too much insulin in the blood stream. This is called **insulin reaction**. Patients must be taught the symptoms of insulin reaction, which include rapid breathing, cold skin, sweating, dizziness, headaches and extreme hunger, and take prompt action by ingesting sugar or glucose.

While instructing a patient on the proper technique for insulin injection, the MA must also instruct the patient on the dangers of insulin reaction and the proper response.

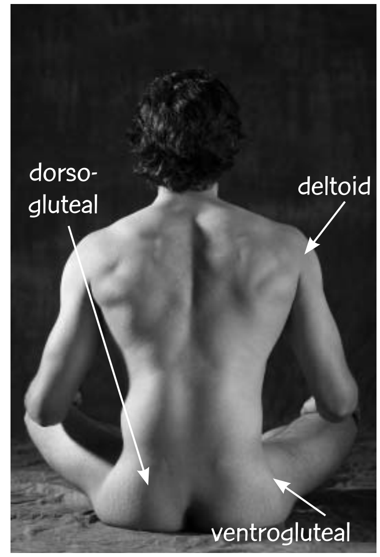
Intramuscular Injections

Intramuscular injections are given straight down into the muscle tissue, requiring a long, fairly wide needle to reach and penetrate the muscle. This sort of injection has a quick absorption. The intramuscular site should be chosen according to the amount of medication being delivered. A small muscle can't absorb a large volume of medication. After the injection has been made, gently massaging the area helps the muscle absorb the medication.

Intramuscular injections require skill to avoid damaging nerves, blood vessels and tissue.

Like the subcutaneous injection, the intramuscular injection must be aspirated to be certain that the injection is not going directly into a blood vessel.

One common site for intramuscular injections is the deltoid muscle of the upper arm. The site provides comfort and modesty for the patient. Because the deltoid is small, it should be chosen for injections of 1 mL or less. It does not require as long or thick a needle as other sites. However, children should not be given injections in this site. The deltoid of a child is too small.



The three main places where insulin injections are given

A second common site is the **dorsogluteal** site. This is a deep injection site requiring a long, thick needle. Injections in the gluteus maximus must be made in the upper portion of the buttock to avoid striking the sciatic nerve or blood vessels. This site can absorb up to 3 mL of fluid.

A third common site is the **ventrogluteal** site. This site, on the side of the hip, has few nerves or large blood vessels. This is the least used of the intramuscular sites.

Let’s take a closer look at intramuscular injections.

Virtual Lab 27-6 Administer an Intramuscular Injection

1. Go to to the Internet and access the online portion of your course.
2. Click on Virtual Lab 27-6 Administer an Intramuscular Injection. This will bring up the instructional video about administering an injection to a muscle.
3. Follow along with Virtual Lab 27-6 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. Review this procedure and watch the virtual lab until you can explain it without reading the steps or watching the lab.

Some medications can be irritating to the skin. An MA may use either the *air-lock* or the *Z-track* method of preventing medication from leaking back into the subcutaneous tissue. The **air-lock** method involves taking in a small amount of air with the medication. When the injection is made, the air will rise above the liquid and go in last, creating an air-lock that keeps the medication from leaking.

To accomplish the **Z-track** method, the medical assistant slides the skin of the target site to the side and holds it in place while the injection is made. After the medication is administered, the MA waits ten seconds and then removes the needle followed by immediately releasing the skin. The skin slides back laterally, blocking the needle path and preventing leakage.

Learning to stop the leakage associated with intramuscular injections is an important skill. Let’s take a closer look at the Z-track method of injection.

Virtual Lab 27-7 Administer an Intramuscular Injection by Z-track Method

1. Go to the Internet and access the online portion of your course.
2. Click on Virtual Lab 27-7 Administer an Intramuscular Injection by Z-track Method. This will bring up the instructional video about administering an injection to a muscle using the Z-track method.
3. Follow along with Virtual Lab 27-7 in your Procedure Guide Supplement as you watch the video. Note that the text in the Procedure Guide often provides additional information than is shown in the virtual lab.
4. Review this procedure and watch the virtual lab until you can explain it without reading the steps or watching the lab.

Immunizations

One special kind of injection is the immunization, also called vaccination. Experienced clinical medical assistants can administer immunizations in doctors' offices and clinics. You learned about immunizations in a previous lesson, so we'll discuss only administration of vaccines here.

Immunizations, or vaccinations, are doses of vaccines that stimulate the body to add antibodies to the immune system to help fight diseases. They can be either *live attenuated vaccines* or *inactivated vaccines*. **Live attenuated vaccines**, which scientists create in a laboratory using live viruses or bacteria, are more effective than inactivated vaccines and usually work with only one dose. **Inactivated vaccines** are made from viruses or bacteria that are no longer alive. The closer in nature an inactivated vaccine is to its harmful origins, the more effective it will be.[4]

Children, teens and even adults are immunized according to the vaccination schedules shown in the Patient Exam lesson. The child and adolescent charts of most vaccines list a number, or footnote, after the vaccine name. These numbers refer you to the footnotes at the bottom of the page that provide additional, important details about the timing of vaccines.

Vaccines can be given via oral, intranasal, transdermal, puncture or injection routes. As with any medications, there is some risk involved with vaccinations. Common negative reactions include tenderness and swelling at the injection site, a rash or fever. Yet myths about immunizations persist. Some believe that the vaccines cause SIDS (Sudden Infant Death Syndrome) or autism, though no link between immunization and these conditions can be shown scientifically by U.S. researchers. Some believe that the diseases that vaccines are meant to cure have been eradicated, but the fact is, these diseases still exist. Though in rare cases, vaccines can cause severe allergic reactions, even seizures, the risk associated with these adverse reactions is less than the risk associated with the disease the vaccines are meant to prevent.

Because of these myths and the recent rise in lawsuits based on vaccine administration, parents must be educated about each vaccine and its possible side effects before their children receive the immunization. It's important to have the parent acknowledge in writing that he has read the information and gives permission for the child to have the vaccine. This protects you, the doctor and the facility should any legal issues arise. Also, the child's vaccination record should be maintained meticulously and retained throughout the child's life.

Syringe Disposal

There is a health risk associated with the handling of used syringes. Anyone who is exposed to the used syringe will be in danger of contamination. Special steps are required when disposing of used syringes to ensure that others aren't infected with diseases ranging from hepatitis B and syphilis to Rocky Mountain spotted fever and HIV.

As you know, used syringes must be disposed of in rigid, puncture-resistant sharps containers, manufactured for that purpose. Do not recap a needle before disposing of it—most contaminations happen when recapping is attempted! If the sharps container is used and disposed of safely, the risk of syringe contamination is greatly reduced.

As you've seen, injections can be an excellent method of drug delivery, but only when they're done correctly.

Patient Education: The Responsibility of the Medical Assistant

Of all the medical assistant's responsibilities regarding the preparation and administration of drugs, the most important may be educating the patient. For a drug to be used safely and effectively, the recommended dosage must be followed. Unfortunately, many patients follow the "more is better" notion. Others have fast-paced lifestyles that make it difficult to maintain the intervals between doses.

But maintaining a consistent and proper level of medication in the bloodstream is critical to the success of any drug treatment. Educating patients is the key to enlisting their enthusiastic cooperation in their own therapy.

Please pause to complete online Practice Exercise 27-3.

Step 8 Lesson Summary

- In this lesson, you were introduced to drug dosages, drug routes and methods of administering drugs. Dosages are measured using the mathematic principles of ratio and proportion. The dosage size depends, in part, on the method of delivery—the drug route. Drug routes include transdermal, topical, buccal, sublingual, rectal, vaginal, inhaler, oral, implant, pumps and parenteral medications.

  Parenteral medication is delivered through a syringe. Shots are classified by their angle of entry and by the location of administration, including intradermal, subcutaneous and intramuscular. You watched demonstrations of parenteral delivery, and are well versed on the procedure for each. You're ready to begin your hands-on training in your new career!

  You've made it! You've stayed the course, and you have reached your goal! You're on your way to a profitable, enjoyable and important new career. And as you enter the working world of a medical assistant, keep in touch and let us know how you're doing.

Please pause to complete an online Quiz.
Then, please move on to the online Final Practicum.

Endnotes

1. Derricott, Jon. "Section 1: history of injecting and needle exchange." *drugtext.org*. Mario Lap Drugtext Foundation. 1999. Web. 12 Mar. 2010.

2. "Commonly Studied Medication Errors as Causes of Adverse Drug Events (ADEs): Percent of ADEs for Each Cause." *ahrg.gov*. Agency for Healthcare Research and Quality. n.d. Web. 19 Sept. 2006.

3. Kaufman, Marc. "Medication Errors Harming Millions, Report Says." *washingtonpost.com*. Wash. Post Co. 21 July 2006. Web. 19 Sept. 2006.

4. Moini, Jahangir. *The Pharmacy Technician: A Comprehensive Approach*. New York: Thomson Delmar, 2005. Print. 383.