

Regional Examinations

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Beginning the Physical Examination: General Survey and Vital Signs

Once you understand the patient's concerns and have elicited a careful history, you are ready to begin the physical examination. At first you may feel unsure of how the patient will relate to you. With practice, your skills in physical examination will grow, and you will gain confidence. Through study and repetition, the examination will flow more smoothly, and you will soon shift your attention from technique and how to handle instruments to what you hear, see, and feel. Touching the patient's body will seem more natural, and you will learn to minimize any discomfort to the patient. You will become more responsive to the patient's reactions and provide reassurance when needed. Before long, as you gain proficiency, what once took between 1 and 2 hours will take considerably less time.

This chapter addresses skills and techniques needed for initial assessment as you begin the physical examination. Under Anatomy and Physiology, you will find information on how to measure height, weight, and Body Mass Index (BMI) and guidelines for nutritional assessment. There is clinical information on the relevant health history and on health promotion and counseling. The section on Techniques of Examination describes the initial steps of the physical examination: preparing for the examination, conducting the general survey, and taking the vital signs. Then follows an example of the written record relevant to the general survey and vital signs.

ANATOMY AND PHYSIOLOGY

As you begin the physical examination, you will survey the patient's general appearance and measure the patient's height and weight. These data provide information about the patient's nutritional status and amount of body fat. Body fat consists primarily of adipose in the form of triglyceride and is stored in subcutaneous, intra-abdominal, and intramuscular fat deposits. These

stores are inaccessible and difficult to measure, so it will be important to compare your measurements of height and weight with standardized ranges of normal.

In the past, tables of desirable weight-for-height have been based on life insurance data, which often did not adjust for the effects of smoking and selected weight-inducing medical conditions such as diabetes and which tended to overstate desirable weight. Current practice, however, is to use the *Body Mass Index*, which incorporates estimated but more accurate measures of body fat than weight alone. BMI standards are derived from two surveys: the National Health Examination Survey, consisting of three survey cycles between 1960 and 1970, and the National Health and Nutrition Examination Survey, with three cycles from the 1970s to the 1990s.

More than half of U.S. adults are overweight (BMI >25), and nearly one fourth are obese (BMI >30), so assessing and educating patients about their BMI are vital for promoting health. These conditions are proven risk factors for diabetes, heart disease, stroke, hypertension, osteoarthritis, sleep apnea syndrome, and some forms of cancer. Remember that these BMI criteria are not rigid cutpoints but guidelines for increasing risks for health and well-being. Note that people older than age 65 have a disproportionate risk for undernutrition when compared with younger adults.

Height and weight in childhood and adolescence reflect the many behavioral, cognitive, and physiologic changes of growth and development. Developmental milestones, markers for growth spurts, and sexual maturity ratings can be found in Chapter 18, *Assessing Children: Infancy Through Adolescence*. With aging, some of these changes reverse, as described in Chapter 20, *The Older Adult*. Height may decrease, posture may become more stooping from kyphosis of the thoracic spine, and extension of the knees and hips may diminish. The abdominal muscles may relax, changing the abdominal contour, and fat may accumulate at the hips and lower abdomen. Be alert to these changes as you assess older patients.

Calculating the BMI. There are several ways to calculate the BMI, as shown in the accompanying table. Choose the method most suited to your practice. The National Institutes of Health and the National Heart, Lung, and Blood Institute caution that people who are very muscular may have a high BMI but still be healthy.¹ Likewise, the BMI for people with low muscle mass and reduced nutrition may appear inappropriately “normal.”

If the BMI is 35 or higher, measure the patient’s *waist circumference*. With the patient standing, measure the waist just above the hip bones. The patient may have excess body fat if the waist measures:

- ≥35 inches for women
- ≥40 inches for men

■ Methods to Calculate Body Mass Index (BMI)

Unit of Measure	Method of Calculation
Weight <i>in pounds</i> , height <i>in inches</i>	(1) Body Mass Index Chart (see table on p. XX)
	(2) $\frac{\left(\frac{\text{Weight (lbs)} \times 700^*}{\text{Height (inches)}} \right)}{\text{Height (inches)}}$
Weight <i>in kilograms</i> , height <i>in meters squared</i>	(3) $\frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$
Either	(4) “BMI Calculator” at website

*Several organizations use 704.5, but the variation in BMI is negligible. Conversion formulas: 2.2 lbs = 1 kg; 1.0 inch = 2.54 cm; 100 cm = 1 meter.

Source: National Institutes of Health and National Heart, Lung, and Blood Institute: Body Mass Index Calculator. Available at: <http://www.nhlbisupport.com/bmi/bmicalc.htm>. Accessed December 12, 2004.

■ Body Mass Index Table

	Normal						Overweight					Obese									
BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Height (inches)							Body Weight (pounds)														
58	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167	172	177	181	186
59	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173	178	183	188	193
60	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179	184	189	194	199
61	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185	190	195	201	206
62	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191	196	202	207	213
63	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197	203	208	214	220
64	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204	209	215	221	227
65	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210	216	222	228	234
66	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216	223	229	235	241
67	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223	230	236	242	249
68	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230	236	243	249	256
69	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236	243	250	257	263
70	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243	250	257	264	271
71	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250	257	265	272	279
72	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258	265	272	279	287
73	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265	272	280	288	295
74	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272	280	287	295	303
75	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279	287	295	303	311
76	156	164	172	180	189	197	205	213	221	230	238	246	254	263	271	279	287	295	304	312	320

Source: Adapted from National Institutes of Health and National Heart, Lung, and Blood Institute: Clinical Guidelines on the Identification, Evaluation and Treatment of Overweight and Obesity in Adults: The Evidence Report. June 1998. Available at: www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf. Accessed December 12, 2004.

Interpreting and Acting on the BMI. Classify the BMI according to the national guidelines in the table below. If the BMI is *above* 25, assess the patient for *additional risk factors* for heart disease and other obesity-related diseases: hypertension, high LDL cholesterol, low HDL cholesterol, high triglycerides, high blood glucose, family history of premature heart disease, physical inactivity, and cigarette smoking. Patients with a BMI over 25 and two or more risk factors should pursue weight loss, especially if the waist circumference is elevated.

■ Classification of Overweight and Obesity by BMI		
	Obesity Class	BMI (kg/m²)
Underweight		<18.5
Normal		18.5–24.9
Overweight		25.0–29.9
Obesity	I	30.0–34.9
	II	35.0–39.9
Extreme obesity	III	≥40

Source: National Institutes of Health and National Heart, Lung, and Blood Institute: Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report. NIH Publication 98-4083. June 1998.

Assessing Dietary Intake. Advising patients about diet and weight loss is important, especially in light of the many, often contradictory dieting options in the popular press. Review three excellent guidelines for counseling your patients:

See Table 4-1, *Healthy Eating: Food Groups and Servings per Day*, p. XX. For screening tools, see Table 4-2, *Rapid Screen for Dietary Intake*, p. XX, and Table 4-4, *Nutrition Screening Checklist*, p. XX.

- National Institutes of Health and National Heart, Lung, and Blood Institute: Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report. September 1998. Available at: www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf.¹
- U.S. Preventive Services Task Force: Screening for Obesity in Adults: Recommendations and Rationale. November 2003. Available at: www.ahrq.gov/clinic/3rduspstf/obesity/obesrr.htm.²
- Department of Health and Human Services and the U.S. Department of Agriculture: Nutrition and Your Health. January 2005. Available at: www.health.gov/dietaryguidelines/dga2005/report/.³

Diet recommendations hinge on assessment of the patient's motivation and readiness to lose weight and individual risk factors. The *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*¹ recommend the following general guidelines:

- A 10% weight reduction over 6 months, or a decrease of 300 to 500 kcal/day, for people with BMIs between 27 and 35

- A weight loss goal of $\frac{1}{2}$ to 1 pound per week because more rapid weight loss does not lead to better results at 1 year.¹

These guidelines recommend low-calorie diets of 800 to 1500 kcal per day. Interventions that combine nutrition education, diet, and moderate exercise with behavioral strategies are most likely to succeed (see pp. XX–XX). The *Clinical Guidelines* cite evidence supporting the role of moderate physical activity in weight loss and weight loss maintenance programs: it enhances and may assist with maintenance of weight; it increases cardiorespiratory fitness; and it may decrease abdominal fat.

If the BMI falls *below* 18.5, be concerned about possible anorexia nervosa, bulimia, or other medical conditions. These conditions are summarized in Table 4-4, Eating Disorders and Excessively Low BMI, p. XX. (See also pp. XX–XX for health promotion and counseling for overweight or underweight patients.)

THE HEALTH HISTORY

Common or Concerning Symptoms

- Changes in weight
- Fatigue and weakness
- Fever, chills, night sweats

Changes in Weight. Changes in weight result from changes in body tissues or body fluid. Good opening questions include “How often do you check your weight?” “How is it compared to a year ago?” For changes, ask, “Why do you think it has changed?” “What would you like to weigh?” If weight gain or loss appears to be a problem, ask about the amount of change, its timing, the setting in which it occurred, and any associated symptoms.

Rapid changes in weight (over a few days) suggest changes in body fluids, not tissues.

Weight gain occurs when caloric intake exceeds caloric expenditure over time and typically appears as increased body fat. Weight gain may also reflect abnormal accumulation of body fluids. When the retention of fluid is relatively mild, it may not be visible, but several pounds of fluid usually appear as *edema*.

In the overweight patient, for example, when did the weight gain begin? Was the patient heavy as an infant or a child? Using milestones appropriate to the patient’s age, inquire about weight at the following times: birth, kindergarten, high school or college graduation, discharge from military service, marriage, after each pregnancy, menopause, and retirement. What were the patient’s life circumstances during the periods of weight gain? Has the patient tried to lose weight? How? With what results?

Weight loss is an important symptom with many causes. Mechanisms include one or more of the following: decreased intake of food for reasons such as anorexia, dysphagia, vomiting, and insufficient supplies of food; defective absorption of nutrients through the gastrointestinal tract; increased metabolic requirements; and loss of nutrients through the urine, feces, or injured skin. A person may also lose weight when a fluid-retaining state improves or responds to treatment.

Try to determine whether the drop in weight is proportional to any change in food intake, or whether it has remained normal or even increased.

Symptoms associated with weight loss often suggest a cause, as does a good psychosocial history. Who cooks and shops for the patient? Where does the patient eat? With whom? Are there any problems with obtaining, storing, preparing, or chewing food? Does the patient avoid or restrict certain foods for medical, religious, or other reasons?

Throughout the history, be alert for signs of malnutrition. Symptoms may be subtle and nonspecific, such as weakness, easy fatigability, cold intolerance, flaky dermatitis, and ankle swelling. Securing a good history of eating patterns and quantities is mandatory. It is important to ask general questions about intake at different times throughout the day, such as “Tell me what you typically eat for lunch.” “What do you eat for a snack?” “When?”

Fatigue and Weakness. Like weight loss, *fatigue* is a nonspecific symptom with many causes. It refers to a sense of weariness or loss of energy that patients describe in various ways. “I don’t feel like getting up in the morning” . . . “I don’t have any energy” . . . “I just feel blah” . . . “I’m all done in” . . . “I can hardly get through the day” . . . “By the time I get to the office I feel as if I’ve done a day’s work.” Because fatigue is a normal response to hard work, sustained stress, or grief, try to elicit the life circumstances in which it occurs. Fatigue unrelated to such situations requires further investigation.

Use open-ended questions to explore the attributes of the patient’s fatigue, and encourage the patient to fully describe what he or she is experiencing. Important clues about etiology often emerge from a good psychosocial history, exploration of sleep patterns, and a thorough review of systems.

Causes of weight loss include gastrointestinal diseases; endocrine disorders (diabetes mellitus, hyperthyroidism, adrenal insufficiency); chronic infections; malignancy; chronic cardiac, pulmonary, or renal failure; depression; and anorexia nervosa or bulimia (see Table 4-3, Eating Disorders and Excessively Low BMI, p. XX).

Weight loss with relatively high food intake suggests diabetes mellitus, hyperthyroidism, or malabsorption. Consider also binge eating (bulimia) with clandestine vomiting.

Poverty, old age, social isolation, physical disability, emotional or mental impairment, lack of teeth, ill-fitting dentures, alcoholism, and drug abuse increase the likelihood of malnutrition.

See Table 4-4, Nutrition Screening Checklist, p. XX.

Fatigue is a common symptom of depression and anxiety states, but also consider infections (such as hepatitis, infectious mononucleosis, and tuberculosis); endocrine disorders (hypothyroidism, adrenal insufficiency, diabetes mellitus, panhypopituitarism); heart failure; chronic disease of the lungs, kidneys, or liver; electrolyte imbalance; moderate to severe anemia; malignancies; nutritional deficits; and medications.

Weakness is different from fatigue. It denotes a demonstrable loss of muscle power and will be discussed later with other neurologic symptoms (see pp. XXX–XXX).

Weakness, especially if localized in a neuroanatomic pattern, suggests possible neuropathy or myopathy.

Fever, Chills and Night Sweats. *Fever* refers to an abnormal elevation in body temperature (see p. XX for definitions of normal). Ask about fever if patients have an acute or chronic illness. Find out whether the patient has used a thermometer to measure the temperature. Bear in mind that errors in technique can lead to unreliable information. Has the patient felt feverish or unusually hot, noted excessive sweating, or felt chilly and cold? Try to distinguish between subjective *chilliness*, and a *shaking chill* with shivering throughout the body and chattering of teeth.

Recurrent shaking chills suggest more extreme swings in temperature and systemic bacteremia.

Feeling cold, goosebumps, and shivering accompany a rising temperature, while feeling hot and sweating accompany a falling temperature. Normally the body temperature rises during the day and falls during the night. When fever exaggerates this swing, *night sweats* occur. Malaise, headache, and pain in the muscles and joints often accompany fever.

Feelings of heat and sweating also accompany menopause. Night sweats occur in tuberculosis and malignancy.

Fever has many causes. Focus your questions on the timing of the illness and its associated symptoms. Become familiar with patterns of infectious diseases that may affect your patient. Inquire about travel, contact with sick people, or other unusual exposures. Be sure to inquire about medications because they may cause fever. In contrast, recent ingestion of aspirin, acetaminophen, corticosteroids, and nonsteroidal anti-inflammatory drugs may mask fever and affect the temperature recorded at the time of the physical examination.

HEALTH PROMOTION AND COUNSELING

Important Topics for Health Promotion and Counseling

- Optimal weight and nutrition
- Exercise
- Blood pressure and diet

Optimal Weight and Nutrition. Less than half of U.S. adults maintain a healthy weight (BMI ≥ 19 but ≤ 25). Obesity has increased in every segment of the population, regardless of age, gender, ethnicity, or socioeconomic group. More than half of people with non-insulin-dependent diabetes and roughly 20% of those with hypertension or elevated cholesterol are overweight or obese. Increasing obesity in children has been linked to rising rates of childhood diabetes. Once you detect excess weight or unhealthy nutritional patterns, take advantage of the excellent materials available to promote weight loss and good nutrition. Even reducing weight by

5% to 10% can improve blood pressure, lipid levels, and glucose tolerance and reduce the risk for developing diabetes or hypertension.

Once you have assessed food intake, nutritional status, and motivation to adopt healthy eating behaviors or lose weight, give patients the “nine major messages” of the 2005 Dietary Guidelines Advisory Committee to the Secretaries of HHS and USDA, as summarized and adapted below³:

- Consume a variety of foods within and among the basic food groups while staying within energy needs.
- Control calorie intake and portion size to manage body weight.
- Maintain moderate physical activity for at least 30 minutes each day, for example, walking 3 to 4 miles per hour.
- Increase daily intake of fruits and vegetables, whole grains, and nonfat or low-fat milk and milk products.
- Choose fats wisely, keeping intake of saturated fat, *trans* fat found in partially hydrogenated vegetable oils, and cholesterol low.
- Choose carbohydrates—sugars, starches, and fibers—wisely for good health.
- Choose and prepare foods with little salt.
- If you drink alcoholic beverages, do so in moderation.
- Keep food safe to eat.

Be prepared to help adolescent females and women of childbearing age increase intake of iron and folic acid. Assist adults older than age 50 to identify foods rich in vitamin B12 and calcium. Advise older adults and those with dark skin or low exposure to sunlight to increase intake of vitamin D.

Exercise. Fitness is a key component of both weight control and weight loss. Currently, 30 minutes of moderate activity, defined as walking 2 miles in 30 minutes on most days of the week or its equivalent, is recommended. Patients can increase exercise by such simple measures as parking further away from their place of work or using stairs instead of elevators. A safe goal for weight loss is $\frac{1}{2}$ to 2 pounds per week.

Blood Pressure and Diet. With respect to blood pressure, there is reliable evidence that regular and frequent exercise, decreased sodium intake and increased potassium intake, and maintenance of a healthy weight will reduce the risk for developing hypertension as well as lower blood pressure in adults who are already hypertensive. Explain to patients that most of the sodium in our diet comes from salt (sodium chloride). The recommended daily allowance (RDA) of sodium is <2400 mg, or 1 teaspoon, per day. Patients need to read food labels closely, especially the Nutrition Facts panel. Low-sodium foods are those with sodium listed at less than 5% of the RDA of <2400 mg. For nutritional interventions to reduce the risk for cardiac disease, turn to p. XX.

See Table 4-1, Healthy Eating: Food Groups and Servings per Day

See Table 4-5, Nutrition Counseling: Sources of Nutrients, p. XX.

See Table 4-6, Patients With Hypertension: Recommended Changes in Diet, p. XX.

TECHNIQUES OF EXAMINATION

BEGINNING THE EXAMINATION: SETTING THE STAGE

Preparing for the Physical Examination

- Reflect on your approach to the patient.
- Adjust the lighting and the environment.
- Determine the scope of the examination.
- Choose the sequence of the examination.
- Observe the correct examining position and handedness.
- Make the patient comfortable.

Before you begin the physical examination, take time to prepare for the tasks ahead. Think through your approach to the patient, your professional demeanor, and how to make the patient feel comfortable and relaxed. Review the measures that promote the patient's physical comfort and make any adjustments needed in the lighting and the surrounding environment. *Make sure that you wash your hands in the presence of the patient before beginning the examination. This is a subtle yet much appreciated gesture of concern for the patient's welfare.*

Reflect on Your Approach to the Patient. When first examining patients, feelings of insecurity are inevitable, but these will soon diminish with experience. Be straightforward. Identify yourself as a student. Try to appear calm, organized, and competent, even when you feel differently. If you forget to do part of the examination, this is not uncommon, especially at first! Simply examine that area out of sequence, but smoothly. It is not unusual to go back to the bedside and ask to check one or two items that you might have overlooked.

As a beginner, you will need to spend more time than experienced clinicians on selected portions of the examination, such as the ophthalmoscopic examination or cardiac auscultation. To avoid alarming the patient, warn the patient ahead of time by saying, for example, "I would like to spend extra time listening to your heart and the heart sounds, but this doesn't mean I hear anything wrong."

Most patients view the physical examination with at least some anxiety. They feel vulnerable, physically exposed, apprehensive about possible pain, and uneasy about what the clinician may find. At the same time, they appreciate the clinician's concern about their problems and respond to your attentiveness. With these considerations in mind, the skillful clinician is thorough without wasting time, systematic without being rigid, gentle yet not afraid to cause discomfort should this be required. In applying the techniques of inspection, palpation, auscultation, and percussion, the skillful clinician examines each region

of the body, and at the same time senses the whole patient, notes the wince or worried glance, and shares information that calms, explains, and reassures.

Over time, you will begin sharing your findings with the patient. As a beginner, avoid interpreting your findings. You are not the patient's primary caretaker, and your views may be conflicting or wrong. As you grow in experience and responsibility, sharing findings will become more appropriate. If the patient has specific concerns, you may even provide reassurance as you finish examining the relevant area. Be selective, however—if you find an unexpected abnormality, you may wish you had kept a judicious silence. At times, you may discover abnormalities such as an ominous mass or a deep oozing ulcer. Always avoid showing distaste, alarm, or other negative reactions.

Adjust the Lighting and the Environment. Surprisingly, several environmental factors affect the calibre and reliability of your physical findings. To achieve superior techniques of examination, it is important to “set the stage” so that both you and the patient are comfortable. As the examiner, you will find that awkward positions impair the quality of your observations. Take the time to adjust the bed to a convenient height (but be sure to lower it when finished!), and ask the patient to move toward you if this makes it easier to examine a region of the body more carefully.

Good lighting and a quiet environment make important contributions to what you see and hear but may be hard to arrange. Do the best you can. If a television interferes with listening to heart sounds, politely ask the nearby patient to lower the volume. Most people cooperate readily. Be courteous and remember to thank the patient as you leave.

Tangential lighting is optimal for inspecting structures such as the jugular venous pulse, the thyroid gland, and the apical impulse of the heart. It casts light across body surfaces that throws contours, elevations, and depressions, whether moving or stationary, into sharper relief.

When light is perpendicular to the surface or diffuse, shadows are reduced and subtle undulations across the surface are lost. Experiment with focused,



TANGENTIAL LIGHTING



PERPENDICULAR LIGHTING

tangential lighting across the tendons on the back of your hand; try to see the pulsations of the radial artery at your wrist.

Determine the Scope of the Examination: Comprehensive or Focused? With each patient visit, you will ponder “How complete should I make the physical examination?” There is no simple answer to this common question. Chapter 1 provides initial guidelines for selecting a comprehensive examination or a focused examination (see p. XX). Review the table below to clarify your thinking as you enter the realm of patient assessment.

■ The Physical Examination: Comprehensive or Focused? General Guidelines	
The Comprehensive Examination	The Focused Examination
<ul style="list-style-type: none">■ Is appropriate for new patients in the office or hospital■ Provides fundamental and personalized knowledge about the patient■ Strengthens the clinician-patient relationship■ Helps identify or rule out physical causes related to patient concerns■ Provides baselines for future assessments■ Creates platform for health promotion through education and counseling■ Develops proficiency in the essential skills of physical examination	<ul style="list-style-type: none">■ Is appropriate for established patients, especially during routine or urgent care visits■ Addresses focused concerns or symptoms■ Assesses symptoms restricted to a specific body system■ Applies examination methods relevant to assessing the concern or problem as precisely and carefully as possible

As you can see, the *comprehensive examination* does more than assess body systems. It is a source of fundamental and personalized knowledge about the patient that strengthens the clinician-patient relationship. Most people seeking your care have specific worries or symptoms. The comprehensive examination provides a more complete basis for assessing patient concerns and answering patient questions.

For the focused examination, you will select the methods relevant to thorough assessment of the targeted problem. The patient’s symptoms, age, and health history help determine the scope of your examination, as does your knowledge of disease patterns. Of all the patients with sore throat, for example, you will need to decide who may have infectious mononucleosis and warrants careful palpation of the liver and spleen and who, in contrast, has a common cold and does not need this examination. The clinical thinking that underlies and guides such decisions is discussed in Chapter 3.

What about the *routine clinical check-up*, or *periodic physical examination*? The usefulness of the comprehensive physical examination for the purposes

of screening and prevention of illness, in contrast to evaluation of symptoms, has been scrutinized in several studies.⁴⁻⁶ Findings have validated the importance of physical examination techniques: blood pressure measurement, assessment of central venous pressure from the jugular venous pulse, listening to the heart for evidence of valvular disease, the clinical breast examination, detection of hepatic and splenic enlargement, and the pelvic examination with Papanicolaou smears. Recommendations for examination and screening have been further expanded by various consensus panels and expert advisory groups. Bear in mind, however, that when used for screening (rather than assessment of complaints), not all components of the examination have been validated as ways to reduce future morbidity and mortality.

Choose the Sequence of the Examination. It is important to recognize that *the key to a thorough and accurate physical examination is developing a systematic sequence of examination*. Organize your comprehensive or focused examination around three general goals:

- Maximize the patient's comfort.
- Avoid unnecessary changes in position.
- Enhance clinical efficiency.


In general, move from “head to toe.” Avoid examining the patient's feet, for example, before checking the face or mouth. You will quickly see that some segments of the examination are best obtained while the patient is sitting, such as examination of the head and neck and of the thorax and lungs, whereas others are best obtained with the patient supine, such as the cardiovascular and abdominal examinations.

Often you will need to examine a patient *at bed rest*, as often occurs in the hospital, where patients frequently cannot sit up in bed or stand. This often dictates changes in your sequence of examination. You can examine the head, neck, and anterior chest with the patient lying supine. Then roll the patient onto each side to listen to the lungs, examine the back, and inspect the skin. Roll the patient back and finish the rest of the examination with the patient again supine.









With practice, you will develop your own sequence of examination, keeping the need for thoroughness and patient comfort in mind. At first, you may need notes to remind you what to look for as you examine each region of the body, but with a few months of practice, you will acquire a routine sequence of your own. This sequence will become habit and often prompt you to return to a segment of the examination you may have inadvertently skipped, helping you to become thorough.

Turn to Chapter 1, pp. XX–XX, to review the examination sequence suggested there, and study the outline of this sequence summarized below. After you study and practice the techniques described in the regional examination chapters, reread these overviews to see how each segment of the examination fits into an integrated whole.

THE PHYSICAL EXAMINATION: SUMMARY OF SUGGESTED SEQUENCE

- | | |
|--|--|
|  <ul style="list-style-type: none"> ■ General survey ■ Vital signs ■ Skin: upper torso, anterior and posterior ■ Head and neck, including thyroid and lymph nodes ■ <i>Optional</i>: nervous system (mental status, cranial nerves, upper extremity motor strength, bulk, tone; cerebellar function) ■ Thorax and lungs ■ Breasts ■ Musculoskeletal as indicated: upper extremities |  <ul style="list-style-type: none"> ■ Nervous system: lower extremity motor strength, bulk, tone: sensation; reflexes; Babinskis ■ Musculoskeletal, as indicated ■ <i>Optional</i>: skin, anterior and posterior ■ <i>Optional</i>: nervous system, including gait ■ <i>Optional</i>: musculoskeletal, comprehensive |
|  <ul style="list-style-type: none"> ■ Cardiovascular, including JVP, carotid upstrokes and bruits, PMI, etc. |  <ul style="list-style-type: none"> ■ <i>Women</i>: pelvic and rectal examination |
|  <ul style="list-style-type: none"> ■ Cardiovascular, for S₃ and murmur of mitral stenosis |  <ul style="list-style-type: none"> ■ <i>Men</i>: prostate and rectal examination |
|  <ul style="list-style-type: none"> ■ Cardiovascular, for murmur of aortic insufficiency | |
|  <ul style="list-style-type: none"> ■ <i>Optional</i>: thorax and lungs — anterior ■ Breasts and axillae ■ Abdomen ■ Peripheral vascular; <i>Optional</i>: skin—lower torso and extremities | |

Key to the Symbols for the Patient's Position

- | | |
|--|---|
|  Sitting |  Lying supine |
|  Lying supine, with head of bed raised 30 degrees |  Standing |
|  Same, turned partly to left side |  Lying supine, with hips flexed, abducted, and externally rotated, and knees flexed (lithotomy position) |
|  Sitting, leaning forward |  Lying on the left side (left lateral decubitus) |

Each symbol pertains until a new one appears. Two symbols separated by a slash indicate either or both positions.

Observe the Correct Examining Position and Handedness. *This book recommends examining the patient from the patient's right side, moving to the opposite side or foot of the bed or examining table as necessary. This is the standard position for the physical examination and has several advantages compared with the left side: it is more reliable to estimate jugular venous pressure from the right, the palpating hand rests more comfortably on the apical impulse, the right kidney is more frequently palpable than the left,*

and examining tables are frequently positioned to accommodate a right-handed approach.

Left-handed students are encouraged to adopt right-sided positioning, even though at first it may seem awkward. It still may be easier to use the left hand for percussing or for holding instruments such as the otoscope or reflex hammer.

Make the Patient Comfortable. Your access to the patient's body is a unique and time-honored privilege of your role as a clinician. Showing concern for privacy and patient modesty must be ingrained in your professional behavior. These attributes help the patient feel respected and at ease. Be sure to close nearby doors and draw the curtains in the hospital or examining room before the examination begins.

You will acquire the art of *draping the patient* with the gown or draw sheet as you learn each segment of the examination in the chapters ahead. *Your goal is to visualize one area of the body at a time.* This preserves the patient's modesty but also helps you to focus on the area being examined. With the patient sitting, for example, untie the gown in back to better listen to the lungs. For the breast examination, uncover the right breast but keep the left chest draped. Redrape the right chest, then uncover the left chest and proceed to examine the left breast and heart. For the abdominal examination, only the abdomen should be exposed. Adjust the gown to cover the chest and place the sheet or drape at the inguinal area.

To help the patient prepare for segments that might be awkward, it is considerate to briefly describe your plans before starting the examination. As you proceed with the examination, keep the patient informed, especially when you anticipate embarrassment or discomfort, as when checking for the femoral pulse. Also try to gauge how much the patient wants to know. Is the patient curious about the lung findings or your method for assessing the liver or spleen?

Make sure your instructions to the patient at each step in the examination are courteous and clear. For example, "I would like to examine your heart now, so please lie down."

As in the interview, be sensitive to the patient's feelings and physical comfort. Watching the patient's facial expressions and even asking "Is it okay?" as you move through the examination often reveals unexpressed worries or sources of pain. To ease discomfort, it may help to adjust the slant of the patient's bed or examining table. Rearranging the pillows or adding blankets for warmth shows your attentiveness to the patient's well-being.

When you have completed the examination, tell the patient your general impressions and what to expect next. For hospitalized patients, make sure the patient is comfortable and rearrange the immediate environment to his or her satisfaction. Be sure to lower the bed to avoid risk for falls and raise the bedrails if needed. As you leave, wash your hands, clean your equipment, and dispose of any waste materials.

THE GENERAL SURVEY

The *General Survey* of the patient's build, height, and weight begins with the opening moments of the patient encounter, but you will find that your observations of the patient's appearance crystallize as you start the physical examination. The best clinicians continually sharpen their powers of observation and description, like naturalists identifying birds from silhouettes backlit against the sky. It is important to heighten the acuity of your clinical perceptions of the patient's mood, build, and behavior. These details enrich and deepen your emerging clinical impression. A skilled observer can depict distinguishing features of the patient's general appearance so well in words that a colleague could spot the patient in a crowd of strangers.

Many factors contribute to the patient's body habitus—socioeconomic status, nutrition, genetic makeup, degree of fitness, mood state, early illnesses, gender, geographic location, and age cohort. Recall that the patient's nutritional status affects many of the characteristics you scrutinize during the *General Survey*: height and weight, blood pressure, posture, mood and alertness, facial coloration, dentition and condition of the tongue and gingiva, color of the nail beds, and muscle bulk, to name a few. Be sure to make the assessment of height, weight, BMI, and risk for obesity a routine part of your clinical practice.

You should now recapture the observations you have been making since the first moments of your interaction and sharpen them throughout your assessment. Does the patient hear you when greeted in the waiting room or examination room? Rise with ease? Walk easily or stiffly? If hospitalized when you first meet, what is the patient doing—sitting up and enjoying television? . . . or lying in bed? . . . What occupies the bedside table—a magazine? . . . a flock of “get well” cards? . . . a Bible or a rosary? . . . an emesis basin? . . . or nothing at all? Each of these observations should raise one or more tentative hypotheses about the patient for you to consider during future assessments.

Apparent State of Health. Try to make a general judgment based on observations throughout the encounter. Support it with the significant details.

Acutely or chronically ill, frail, feeble

Level of Consciousness. Is the patient awake, alert, and responsive to you and others in the environment? If not, promptly assess the level of consciousness (see p. XXX).

Signs of Distress. For example, does the patient show evidence of these problems?

■ Cardiac or respiratory distress

Clutching the chest, pallor, diaphoresis; labored breathing, wheezing, cough

■ Pain

Wincing, sweating, protectiveness of painful area

■ Anxiety or depression

Height and Build. If possible, measure the patient's height in stocking feet. Is the patient unusually short or tall? Is the build slender and lanky, muscular, or stocky? Is the body symmetric? Note the general body proportions and look for any deformities.

Weight. Is the patient emaciated, slender, plump, obese, or somewhere in between? If the patient is obese, is the fat distributed evenly or concentrated over the trunk, the upper torso, or around the hips?

Whenever possible, weigh the patient with shoes off. Weight provides one index of caloric intake, and changes over time yield other valuable diagnostic data. Remember that changes in weight can occur with changes in body fluid status, as well as in fat or muscle mass.

Use weight and height measurements to calculate the BMI (see pp. XX–XX).

Skin Color and Obvious Lesions. See Chapter 5, The Skin, Hair, and Nails, for details.

Dress, Grooming, and Personal Hygiene. How is the patient dressed? Is clothing appropriate to the temperature and weather? Is it clean, properly buttoned, and zipped? How does it compare with clothing worn by people of comparable age and social group?

Glance at the patient's shoes. Have holes been cut in them? Are the laces tied? Or is the patient wearing slippers?

Is the patient wearing any unusual jewelry? Where? Is there any body piercing?

Note the patient's hair, fingernails, and use of cosmetics. They may be clues to the patient's personality, mood, or lifestyle. Nail polish and hair coloring that have "grown out" may signify decreased interest in personal appearance.

Anxious face, fidgety movements, cold and moist palms; inexpressive or flat affect, poor eye contact, psychomotor slowing

Very short stature is seen in Turner's syndrome, childhood renal failure, and achondroplastic and hypopituitary dwarfism. Long limbs in proportion to the trunk are seen in hypogonadism and Marfan's syndrome. Height loss occurs with osteoporosis and vertebral compression fractures.

Generalized fat in simple obesity; truncal fat with relatively thin limbs in Cushing's syndrome and metabolic, or insulin resistance, syndrome

Causes of weight loss include malignancy, diabetes mellitus, hyperthyroidism, chronic infection, depression, diuresis, and successful dieting.

Pallor, cyanosis, jaundice, rashes, bruises

Excess clothing may reflect the cold intolerance of hypothyroidism, hide skin rash or needle marks, or signal personal lifestyle preferences.

Cut-out holes or slippers may indicate gout, bunions, or other painful foot conditions. Untied laces or slippers also suggest edema.

Copper bracelets are sometimes worn for arthritis. Piercing may appear on any part of the body.

"Grown-out" hair and nail polish can help you estimate the length of an illness if the patient cannot give a history. Fingernails chewed to the quick may reflect stress.

Do personal hygiene and grooming seem appropriate to the patient's age, lifestyle, occupation, and socioeconomic group? These are norms that vary widely, of course.

Facial Expression. Observe the facial expression at rest, during conversation about specific topics, during the physical examination, and in interaction with others. Watch for eye contact. Is it natural? Sustained and unblinking? Averted quickly? Absent?

Odors of the Body and Breath. Odors can be important diagnostic clues, such as the fruity odor of diabetes or the scent of alcohol. (For the scent of alcohol, the CAGE questions, p. XX, will help you determine possible misuse.)

Never assume that alcohol on a patient's breath explains changes in mental status or neurologic findings.

Posture, Gait, and Motor Activity. What is the patient's preferred posture?

Is the patient restless or quiet? How often does the patient change position? How fast are the movements?

Is there any apparent involuntary motor activity? Are some body parts immobile? Which ones?

Does the patient walk smoothly, with comfort, self-confidence, and balance, or is there a limp or discomfort, fear of falling, loss of balance, or any movement disorder?

Unkempt appearance may be seen in depression and dementia, but this appearance must be compared with the patient's probable norm.

The stare of hyperthyroidism; the immobile face of parkinsonism; the flat or sad affect of depression. Decreased eye contact may be cultural, or may suggest anxiety, fear, or sadness.

Breath odors of alcohol, acetone (diabetes), pulmonary infections, uremia, or liver failure

People with alcoholism may have other serious and potentially correctable problems such as hypoglycemia, subdural hematoma, or post-ictal state

Preference for sitting up in left-sided heart failure, and for leaning forward with arms braced in chronic obstructive pulmonary disease

Fast, frequent movements of hyperthyroidism; slowed activity of hypothyroidism

Tremors or other involuntary movements; paralyses. See Table X-X, Involuntary Movements (pp. XX-XX).

See Table X-X, Abnormalities of Gait and Posture (pp. XX-XX).

THE VITAL SIGNS

Now you are ready to measure the *Vital Signs*—the blood pressure, heart rate, respiratory rate, and temperature. You may find that the vital signs are already taken and recorded in the chart; if abnormal, you may wish to repeat them yourself. You can also make these important measurements later as you start

the cardiovascular and thorax and lung examinations, but often they provide important initial information that influences the direction of your evaluation.

Check either the blood pressure or the pulse first. If the blood pressure is high, measure it again later in the examination. Count the radial pulse with your fingers, or the apical pulse with your stethoscope at the cardiac apex. Continue either of these techniques and count the respiratory rate without alerting the patient; because breathing patterns may change if the patient becomes aware that someone is watching. The temperature is taken with glass thermometers, tympanic thermometers, or digital electronic probes. Further details on techniques for ensuring accuracy of the vital signs are provided in the following pages.



BLOOD PRESSURE

Choice of Blood Pressure Cuff (Sphygmomanometer). As many as 50 million Americans have elevated blood pressure.⁷ To measure blood pressure accurately, you must carefully choose a cuff of appropriate size. The blood pressure gauge may be either the aneroid or the mercury type. Because an aneroid instrument can become inaccurate with repeated use, it should be recalibrated regularly.

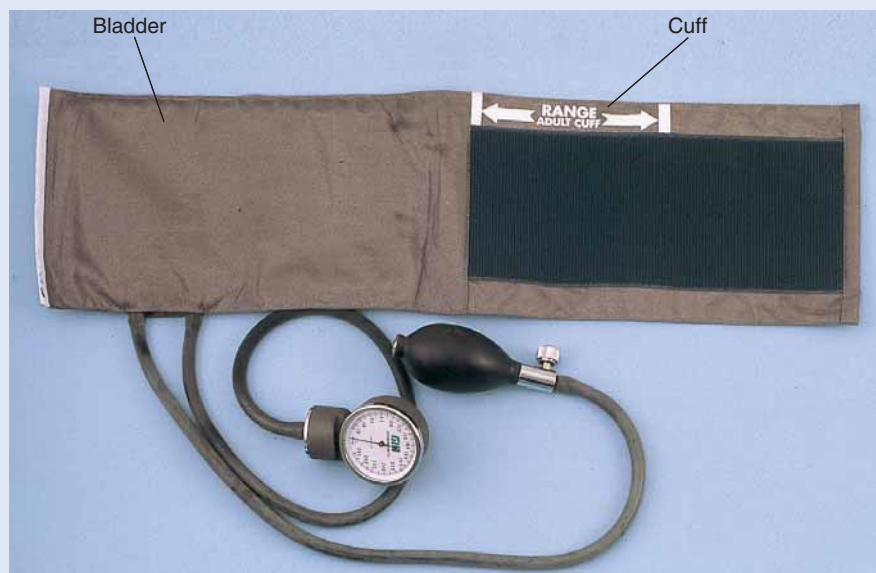
The guidelines below will help you to select the best size blood pressure cuff and also to advise patients wishing to purchase home measurement devices. Urge patients to have such devices checked routinely for accuracy.

See Table 4-7, *Abnormalities of the Arterial Pulse and Pressure Waves* (p. XX). See Table 4-8, *Abnormalities in Rate and Rhythm of Breathing* (p. XX).

Cuffs that are too short or too narrow may give falsely high readings. Using a regular-size cuff on an obese arm may lead to a false diagnosis of hypertension.

SELECTING THE CORRECT BLOOD PRESSURE CUFF

- Width of the inflatable bladder of the cuff should be about 40% of upper arm circumference (about 12–14 cm in the average adult).
- Length of the inflatable bladder should be about 80% of upper arm circumference (almost long enough to encircle the arm).



Technique for Measuring Blood Pressure. Before assessing the blood pressure, you should take several steps to make sure your measurement will be accurate. Once these steps are taken, you are ready to measure the blood pressure. Proper technique is important and reduces the inherent variability arising from the patient or examiner, the equipment, and the procedure itself.

GETTING READY TO MEASURE BLOOD PRESSURE

- Ideally, instruct the patient to avoid smoking or drinking caffeinated beverages for 30 minutes before the blood pressure is measured.
- Check to make sure the examining room is quiet and comfortably warm.
- Ask the patient to sit quietly for at least 5 minutes in a chair, rather than on the examining table, with feet on the floor. The arm should be supported at heart level.
- Make sure the arm selected is *free of clothing*. There should be no arteriovenous fistulas for dialysis, scarring from prior brachial artery cutdowns, or signs of lymphedema (seen after axillary node dissection or radiation therapy).
- Palpate the brachial artery to confirm that it has a viable pulse.
- Position the arm so that the brachial artery, at the antecubital crease, is *at heart level*—roughly level with the 4th interspace at its junction with the sternum.
- If the patient is seated, rest the arm on a table a little above the patient's waist; if standing, try to support the patient's arm at the midchest level.

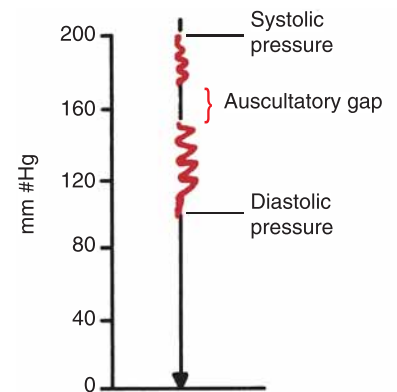
If the brachial artery is much below heart level, blood pressure appears falsely high. The patient's own effort to support the arm may raise the blood pressure.

Now you are ready to measure the blood pressure.

- Center the inflatable bladder over the brachial artery. The lower border of the cuff should be about 2.5 cm above the antecubital crease. Secure the cuff snugly. Position the patient's arm so that it is slightly flexed at the elbow.
- To determine how high to raise the cuff pressure, first estimate the systolic pressure by palpation. As you feel the radial artery with the fingers of one hand, rapidly inflate the cuff until the radial pulse disappears. Read this pressure on the manometer and add 30 mm Hg to it. Use of this sum as the target for subsequent inflations prevents discomfort from unnecessarily high cuff pressures. It also avoids the occasional error caused by an *auscultatory gap*—a silent interval that may be present between the systolic and the diastolic pressures.
- Deflate the cuff promptly and completely and wait 15 to 30 seconds.
- Now place the bell of a stethoscope lightly over the brachial artery, taking care to make an air seal with its full rim. Because the sounds to be heard, the *Korotkoff sounds*, are relatively low in pitch, they are heard better with the bell.

A loose cuff or a bladder that balloons outside the cuff leads to falsely high readings.

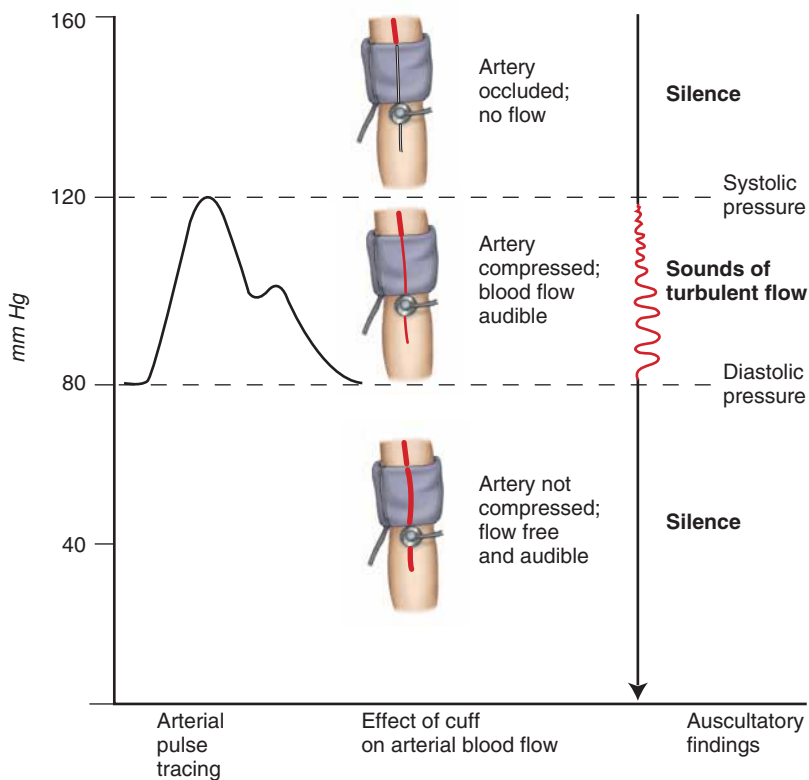
An unrecognized auscultatory gap may lead to serious underestimation of systolic pressure (e.g., 150/98 in the example on the next page) or overestimation of diastolic pressure.



If you find an auscultatory gap, record your findings completely (e.g., 200/98 with an auscultatory gap from 170–150).

An auscultatory gap is associated with arterial stiffness and atherosclerotic disease.⁸

- Inflate the cuff rapidly again to the level just determined, and then deflate it slowly at a rate of about 2 to 3 mm Hg per second. Note the level at which you hear the sounds of at least two consecutive beats. This is the systolic pressure.



- Continue to lower the pressure slowly until the sounds become muffled and then disappear. To confirm the disappearance of sounds, listen as the pressure falls another 10 to 20 mm Hg. Then deflate the cuff rapidly to zero. The disappearance point, which is usually only a few mm Hg below the muffling point, provides the best estimate of true diastolic pressure in adults.
- Read both the systolic and the diastolic levels to the nearest 2 mm Hg. Wait 2 or more minutes and repeat. Average your readings. If the first two readings differ by more than 5 mm Hg, take additional readings.
- When using a mercury sphygmomanometer, keep the manometer vertical (unless you are using a tilted floor model) and make all readings at eye level with the meniscus. When using an aneroid instrument, hold the dial so that it faces you directly. Avoid slow or repetitive inflations of the cuff, because the resulting venous congestion can cause false readings.
- Blood pressure should be taken in both arms at least once. Normally, there may be a difference in pressure of 5 mm Hg and sometimes up to 10 mm Hg. Subsequent readings should be made on the arm with the higher pressure.

Classification of Normal and Abnormal Blood Pressure. In its seventh report in 2003, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recommended using the mean of two or more properly measured seated blood pressure readings, taken on two or more office visits, for diagnosis of hypertension.⁷ Blood pressure measurement should be verified in the contralateral arm.

The Joint National Committee has identified four levels of systolic and diastolic hypertension. Note that either component may be high.

■ Blood Pressure Classification (Adults Older Than 18 Years)		
Category	Systolic (mm Hg)	Diastolic (mm Hg)
Normal	<120	<80
Prehypertension	120–139	80–89
Hypertension		
Stage 1	140–159	90–99
Stage 2	≥160	≥100

When the systolic and diastolic levels fall in different categories, use the higher category. For example, 170/92 mm Hg is Stage 2 hypertension; 135/100 mm Hg is Stage 1 hypertension. In *isolated systolic hypertension*, systolic blood pressure is ≥140 mm Hg, and diastolic blood pressure is <90 mm Hg.⁹

In some people, the muffling point and the disappearance point are farther apart. Occasionally, as in aortic regurgitation, the sounds never disappear. If there is more than 10 mm Hg difference, record both figures (e.g., 154/80/68).

By making the sounds less audible, venous congestion may produce artificially low systolic and high diastolic pressures.

Pressure difference of more than 10–15 mm Hg suggests arterial compression or obstruction on the side with the lower pressure.

Assessment of hypertension also includes its effects on target organs—the eyes, the heart, the brain, and the kidneys. Look for evidence of hypertensive retinopathy, left ventricular hypertrophy, and neurologic deficits suggesting a stroke. Renal assessment requires urinalysis and blood tests.

Relatively low levels of blood pressure should always be interpreted in the light of past readings and the patient's present clinical state.

If indicated, assess *orthostatic*, or *postural*, *blood pressure* (see Chapter 20, the Older Adult, pp. XX–XX). Measure blood pressure and heart rate in two positions—supine after the patient is resting up to 10 minutes, then within 3 minutes after the patient stands up. Normally, as the patient rises from the horizontal to the standing position, systolic pressure drops slightly or remains unchanged, while diastolic pressure rises slightly. Orthostatic hypotension is a drop in systolic blood pressure of ≥ 20 mm Hg or in diastolic blood pressure of ≥ 10 mm Hg within 3 minutes of standing.^{10,11}

Special Situations

Weak or Inaudible Korotkoff Sounds. Consider technical problems such as erroneous placement of your stethoscope, failure to make full skin contact with the bell, and venous engorgement of the patient's arm from repeated inflations of the cuff. Consider also the possibility of shock.

When you cannot hear Korotkoff sounds at all, you may be able to estimate the systolic pressure by palpation. Alternative methods such as Doppler techniques or direct arterial pressure tracings may be necessary.

To intensify Korotkoff sounds, one of the following methods may be helpful:

- Raise the patient's arm before and while you inflate the cuff. Then lower the arm and determine the blood pressure.
- Inflate the cuff. Ask the patient to make a fist several times, and then determine the blood pressure.

Arrhythmias. Irregular rhythms produce variations in pressure and therefore unreliable measurements. Ignore the effects of an occasional premature contraction. With frequent premature contractions or atrial fibrillation, determine the average of several observations and note that your measurements are approximate.

The Anxious Patient and Isolated Office Hypertension (or “white coat hypertension”). Anxiety is a frequent cause of diastolic blood pressure readings in the office that are higher than those at home or during normal activities, occurring in 12% to 25% of patients.^{12,13} This effect may last for several visits. Try to relax the patient and measure the blood pressure again later in the encounter.

The Obese or Very Thin Patient. For the obese arm, it is important to use a wide cuff of 15 cm. If the arm circumference exceeds 41 cm, use a thigh cuff of 18 cm. For the very thin arm, a pediatric cuff may be indicated.

A pressure of 110/70 mm Hg would usually be normal, but could also indicate significant hypotension if past pressures have been high.

A fall in systolic pressure of 20 mm Hg or more, especially when accompanied by symptoms, indicates orthostatic (postural) hypotension. Causes include drugs, loss of blood, prolonged bed rest, and diseases of the autonomic nervous system.

Isolated home or ambulatory hypertension, unlike isolated office hypertension, is associated with increased risk for cardiovascular disease.^{12–15}

Use of a cuff that is too small can lead to overestimation of systolic blood pressure in obese patients.

The Hypertensive Patient With Unequal Blood Pressures in the Arms and Legs. To detect coarctation of the aorta, make two further blood pressure measurements at least once in every hypertensive patient:

- Compare blood pressures in the arms and legs.
- Compare the volume and timing of the radial and femoral pulses. Normally, volume is equal and the pulses occur simultaneously.

To determine blood pressure in the leg, use a wide, long thigh cuff that has a bladder size of 18×42 cm, and apply it to the midthigh. Center the bladder over the posterior surface, wrap it securely, and listen over the popliteal artery. If possible, the patient should be prone. Alternatively, ask the supine patient to flex one leg slightly, with the heel resting on the bed. When cuffs of the proper size are used for both the leg and the arm, blood pressures should be equal in the two areas. (The usual arm cuff, improperly used on the leg, gives a falsely high reading.)

Coarctation of the aorta arises from narrowing of the thoracic aorta, usually proximal but sometimes distal to the left subclavian artery.

Coarctation of the aorta and occlusive aortic disease are distinguished by hypertension in the upper extremities and low blood pressure in the legs and by diminished or delayed femoral pulses.¹⁶

HEART RATE AND RHYTHM

Examine the arterial pulses, the heart rate and rhythm, and the amplitude and contour of the pulse wave.

Heart Rate. The radial pulse is commonly used to assess the heart rate. With the pads of your index and middle fingers, compress the radial artery until a maximal pulsation is detected. If the rhythm is regular and the rate seems normal, count the rate for 15 seconds and multiply by 4. If the rate is unusually fast or slow, however, count it for 60 seconds.



When the rhythm is irregular, evaluate the heart rate by cardiac auscultation. Beats that occur earlier than others may not be detected peripherally, and the heart rate can thus be seriously underestimated.

Rhythm. To begin your assessment of rhythm, feel the radial pulse. If there are any irregularities, check the rhythm again by listening with your stethoscope at the cardiac apex. Is the rhythm regular or irregular? If irregular, try to identify a pattern: (1) Do early beats appear in a basically regular rhythm? (2) Does the irregularity vary consistently with respiration? (3) Is the rhythm totally irregular?

Irregular rhythms include atrial fibrillation and atrial or ventricular premature contractions.

See Table 8-XX, Selected Heart Rates and Rhythms (p. XX) and Table 8-XX, Selected Irregular Rhythms (p. XX).

RESPIRATORY RATE AND RHYTHM

Observe the *rate, rhythm, depth, and effort of breathing*. Count the number of respirations in 1 minute either by visual inspection or by subtly listening over the patient's trachea with your stethoscope during your examination of the head and neck or chest. Normally, adults take 14 to 20 breaths per minute in a quiet, regular pattern. An occasional sigh is normal. Check to see if expiration is prolonged.

Palpation of an irregularly irregular rhythm reliably indicates atrial fibrillation. For all other irregular patterns, an ECG is needed to identify the arrhythmia.

See Table 4-8, Abnormalities in Rate and Rhythm of Breathing (p. XX).

Prolonged expiration suggests narrowing in the bronchioles.

TEMPERATURE

Although you may choose to omit measuring the temperature in ambulatory patients, it should be checked whenever you suspect an abnormality. The average *oral temperature*, usually quoted at 37°C (98.6°F), fluctuates considerably. In the early morning hours, it may fall as low as 35.8°C (96.4°F), and in the late afternoon or evening, it may rise as high as 37.3°C (99.1°F). *Rectal temperatures* are *higher* than oral temperatures by an average of 0.4 to 0.5°C (0.7 to 0.9°F), but this difference is also quite variable. In contrast, *axillary temperatures* are *lower* than oral temperatures by approximately 1°, but take 5 to 10 minutes to register and are generally considered less accurate than other measurements.

Fever or pyrexia refers to an elevated body temperature. *Hyperpyrexia* refers to extreme elevation in temperature, above 41.1°C (106°F), while *hypothermia* refers to an abnormally low temperature, below 35°C (95°F) rectally.

Most patients prefer oral to rectal temperatures. However, taking oral temperatures is not recommended when patients are unconscious, restless, or unable to close their mouths. Temperature readings may be inaccurate and thermometers may be broken by unexpected movements of the patient's jaws.

Rapid respiratory rates tend to increase the discrepancy between oral and rectal temperatures. In this situation, rectal temperatures are more reliable.

For *oral temperatures*, you may choose either a glass or electronic thermometer. When using a glass thermometer, shake the thermometer down to 35°C (96°F) or below, insert it under the tongue, instruct the patient to close both lips, and wait 3 to 5 minutes. Then read the thermometer, reinsert it for a minute, and read it again. If the temperature is still rising, repeat this procedure until the reading remains stable. Note that hot or cold liquids, and even smoking, can alter the temperature reading. In these situations, it is best to delay measuring the temperature for 10 to 15 minutes.

Causes of fever include infection, trauma such as surgery or crush injuries, malignancy, blood disorders such as acute hemolytic anemia, drug reactions, and immune disorders such as collagen vascular disease.

If using an electronic thermometer, carefully place the disposable cover over the probe and insert the thermometer under the tongue. Ask the patient to close both lips, and then watch closely for the digital readout. An accurate temperature recording usually takes about 10 seconds.

The chief cause of *hypothermia* is exposure to cold. Other predisposing causes include reduced movement as in paralysis, interference

For a *rectal temperature*, ask the patient to lie on one side with the hip flexed. Select a rectal thermometer with a stubby tip, lubricate it, and insert it about 3 cm to 4 cm (1½ inches) into the anal canal, in a direction pointing to the umbilicus. Remove it after 3 minutes, then read. Alternatively, use an electronic thermometer after lubricating the probe cover. Wait about 10 seconds for the digital temperature recording to appear.

Taking the *tympanic membrane temperature* is an increasingly common practice and is quick, safe, and reliable if performed properly. Make sure the external auditory canal is free of cerumen. Position the probe in the canal so that the infrared beam is aimed at the tympanic membrane (otherwise the measurement will be invalid). Wait 2 to 3 seconds until the digital temperature reading appears. This method measures core body temperature, which is higher than the normal oral temperature by approximately 0.8°C (1.4°F).

with vasoconstriction as from sepsis or excess alcohol, starvation, hypothyroidism, and hypoglycemia. Elderly people are especially susceptible to hypothermia and also less likely to develop fever.

RECORDING YOUR FINDINGS

Your write-up of the physical examination begins with a general description of the patient's appearance, based on the General Survey. Note that initially you may use sentences to describe your findings; later you will use phrases. The style below contains phrases appropriate for most write-ups.

Recording the Physical Examination— The General Survey and Vital Signs

Choose vivid and graphic adjectives, as if you are painting a picture in words. Avoid clichés such as “well-developed” or “well-nourished” or “in no acute distress,” because they could apply to any patient and do not convey the special features of the patient before you.

Record the vital signs taken at the time of your examination. They are preferable to those taken earlier in the day by other providers. (Common abbreviations for blood pressure, heart rate, and respiratory rate are self-explanatory.)

“Mrs. Scott is a young, healthy-appearing woman, well-groomed, fit, and in good spirits. Height is 5’4”, weight 135 lbs, BMI 24, BP 120/80, HR 72 and regular, RR 16, temperature 37.5°C.”

OR

“Mr. Jones is an elderly male who looks pale and chronically ill. He is alert, with good eye contact but unable to speak more than two or three words at a time due to shortness of breath. He has intercostal muscle retraction when breathing and sits upright in bed. He is thin, with diffuse muscle wasting. Height is 6’2”, weight 175 lbs, BP 160/95, HR 108 and irregular, RR 32 and labored, temperature 101.2°F.”

Suggests exacerbation of chronic obstructive pulmonary disease

Bibliography

CITATIONS

1. National Institutes of Health and National Heart, Lung, and Blood Institute. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report. NIH Publication 98-4083. June 1998. Available at: www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf. Accessed December 12, 2004.
2. U.S. Preventive Services Task Force. Screening for Obesity in Adults: Recommendations and Rationale. Rockville, MD. Agency for Healthcare Research and Quality, November 2003. Available at: www.ahrq.gov/clinic/3rduspstf/obesity/obesrr.htm. Accessed December 12, 2004.
3. 2005 Dietary Guidelines Advisory Committee to the Secretaries of Health and Human Services and the U.S. Department of Agriculture. Nutrition and Your Health. January 2005. Available at: www.health.gov/dietaryguidelines/dga2005/report/. Accessed December 13, 2004.
4. U.S. Preventive Services Task Force. Clinician's Handbook of Preventive Services: Put Prevention Into Practice, 2nd ed. Washington, DC, Office of Public Health and Science, Office of Disease Prevention and Health Promotion, 1998.
5. Hensrud DD. Clinical preventive medicine in primary care: background and practice. *Rational and current preventive practices*. Mayo Clin Proc 75:165–172, 2000.
6. Culica D, Rohrer J, Ward M, et al. Medical check-ups: who does not get them? *Am J Public Health* 92(1):8890, 2002.
7. Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure—The JNC 7 Report. *JAMA* 289(19):2560–2572, 2003. Available at: www.nhlbi.nih.gov/guidelines/hypertension/jncintro.htm.
8. Cavallini MC, Roman MJ, Blank SG, et al. Association of the auscultatory gap with vascular disease in hypertensive patients. *Ann Intern Med* 124(10):877–883, 1996.
9. Chaudhry SI, Krumholz HM, Foody JM. Systolic hypertension in older persons. *JAMA* 292(9):1074–1080, 2004.
10. Carlson JE. Assessment of orthostatic blood pressure: measurement technique and clinical applications. *South Med J* 92(2):167–173, 1999.
11. Consensus Committee of the American Autonomic Society and the American Academy of Neurology. Consensus statement on the definition of orthostatic hypotension, pure autonomic failure, and multiple system atrophy. *Neurology* 46:1470, 1996.
12. Kaplan NM, Rose BD. Ambulatory blood pressure monitoring and white coat hypertension in adults. Available at: www.utdol.com. Accessed December 11, 2004.
13. Bobrie G, Genes N, Vaur L, et al. Is “isolated home” hypertension as opposed to “isolated office” hypertension a sign of greater cardiovascular risk? *Arch Intern Med* 161(18):2205–2211, 2001.
14. Clement DL, De Buyzere ML, De Bacquer DA, et al. Prognostic value of ambulatory blood-pressure recordings in patients with treated hypertension. *N Engl J Med* 348(24):2407–2415, 2003.
15. Rickerby J. The role of home blood pressure measurement in managing hypertension: an evidence-based review. *J Hum Hypertens* 16(7):469–472, 2002.
16. Brickner ME, Hillis LD, Lange RA. Congenital heart disease in adults. First of two parts. *N Engl J Med* 342(4):256–263, 2000.

ADDITIONAL REFERENCES

Weight and Nutrition

- American Academy of Family Physicians. Nutrition Screening Initiative. Available at: http://www.aafp.org/preBuilt/NSI_DETERMINE.pdf. Accessed December 12, 2004.
- Beevers G, Lip GY, O'Brien E. ABC of hypertension. Blood pressure measurement. Part I. Sphygmomanometry: factors common in all techniques. *BMJ* 322(7292):981–985, 2001.
- Beevers G, Lip GY, O'Brien E. ABC of hypertension. Blood pressure measurement. Part II. Conventional sphygmomanometry: technique of auscultatory blood pressure measurement. *BMJ* 322(7293):1043–1047, 2001.
- Ford ES, Wayne G, Dietz WH, Ford ES, Giles WH, Dietz WH. Prevalence of the metabolic syndrome among U.S. adults: findings from the Third National Health and Nutrition Examination Survey. *JAMA* 287(3):356–359, 2002.
- Gail SM, Castracane VD, Mantazoros. Energy homeostasis, obesity and eating disorders: recent advances in endocrinology. *J. Nutr* 134:295–298, 2004.
- Mehler PS. Bulimia nervosa. *N Engl J Med* 349(9):875–880, 2003.
- Sacks FM, Svetkey LP, Vollmer WM, et al. Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *N Engl J Med* 344(1):3–10, 2001.
- Samaha FF, Iqbal N, Seshadri P, et al. A low-carbohydrate as compared with a low-fat diet in severe obesity. *N Engl J Med* 34(21):2074–2081, 2003.
- McAlister FA, Straus SE. Evidence-based treatment of hypertension. Measurement of blood pressure: an evidence based review. *BMJ* 322:908–911, 2001.
- Pearson TA, Blair SN, Daniels SR, et al. AHA guidelines for primary prevention of cardiovascular disease and stroke: 2002 update. *Circulation* 106:388–391, 2002.

Blood Pressure

- Perry HM, Davis BR, Price TR, et al, for the Systolic Hypertension in the Elderly Program Cooperative Research Group. Effect of treating isolated systolic hypertension on the risk of developing various types and subtypes of stroke: the Systolic Hypertension in the Elderly Program (SHEP). *JAMA* 284(4):465–471, 2000.
- Tholl U, Forstner K, Anlauf M. Measuring blood pressure: pitfalls and recommendations. *Nephrol Dial Transplant* 19:766, 2004.
- U.S. Preventive Services Task Force. Screening for High Blood Pressure: Recommendations and Rationale. Rockville, MD, Agency for Healthcare Research and Quality, July 2003. Available at: <http://www.ahrq.gov/clinic/3rduspstf/hibloodrr.htm>. Accessed December 9, 2004.
- Writing Group of the PREMIER Collaborative Research Group. Effects of comprehensive lifestyle modification on blood pressure control: main results of the PREMIER clinical trial. *JAMA* 289(16):2083–2093, 2003.

TABLE 4-1

Healthy Eating: Food Groups and Servings per Day

Food Group	Women, Some Older Adults, Children Ages 2–6 yrs (about 1,600 cal)*	Active Women, Most Men, Older Children, Teen Girls (about 2,200 cal)*	Active Men, Teen Boys (about 2,800 cal)*
Bread, rice, cereal, pasta (grains) group, especially whole grain	6	9	11
Vegetable group	3	4	5
Fruit group	2	3	4
Milk, yogurt, and cheese (dairy) group—preferably fat free or low fat	2–3**	2–3**	2–3**
Dry beans, eggs, nuts, fish, and meat and poultry group—preferably lean or low fat	2, for a total of 5 oz	2, for a total of 6 oz	3, for a total of 7 oz

Source: Adapted from U.S. Department of Agriculture, Center for Nutrition Policy and Promotion. The Food Guide Pyramid, Home and Garden Bulletin Number 252, 1996.

*These are the calorie levels if low-fat, lean foods are chosen from the 5 major food groups and foods from the fats, oil, and sweets group are used sparingly.

**Older children and teenagers (ages 9–18 yrs) and adults older than the age of 50 need 3 servings daily. During pregnancy and lactation, the recommended number of dairy group servings is the same as for nonpregnant women.

TABLE 4-2

Rapid Screen for Dietary Intake

	Portions Consumed by Patient	Recommended
Grains, cereals, bread group	_____	6–11
Fruit group	_____	2–4
Vegetable group	_____	3–5
Meat/meat substitute group	_____	2–3
Dairy group	_____	2–3
Sugars, fats, snack foods	_____	—
Soft drinks	_____	—
Alcoholic beverages	_____	<2

Instructions. Ask the patient for a 24-hour dietary recall (perhaps two of these) before completing the form.

Source: Nestle M: Nutrition. In: Woolf SH, Jonas S, Lawrence RS, eds. Health Promotion and Disease Prevention in Clinical Practice. Baltimore, Williams & Wilkins, 1996.

In the United States an estimated 5 to 10 million women and 1 million men suffer from eating disorders. These severe disturbances of eating behavior are often difficult to detect, especially in teens wearing baggy clothes or in individuals who binge then induce vomiting or evacuation. Be familiar with the two principal eating disorders, *anorexia nervosa* and *bulimia nervosa*. Both conditions are characterized by distorted perceptions of body image and weight. Early detection is important, because prognosis improves when treatment occurs in the early stages of these disorders.

Clinical Features	
<i>Anorexia Nervosa</i>	<i>Bulimia Nervosa</i>
<ul style="list-style-type: none"> ■ Refusal to maintain minimally normal body weight (or BMI above 17.5 kg/m²) ■ Afraid of appearing fat ■ Frequently starving but in denial; lacking insight ■ Often brought in by family members ■ May present as failure to make expected weight gains in childhood or adolescence, amenorrhea in women, loss of libido or potency in men ■ Associated with depressive symptoms such as depressed mood, irritability, social withdrawal, insomnia, decreased libido ■ Additional features supporting diagnosis: self-induced vomiting or purging, excessive exercise, use of appetite suppressants and/or diuretics ■ Biologic complications <ul style="list-style-type: none"> ■ <i>Neuroendocrine changes</i>: amenorrhea, increased corticotropin-releasing factor, cortisol, growth hormone, serotonin; decreased diurnal cortisol fluctuation, luteinizing hormone, follicle-stimulating hormone, thyroid-stimulating hormone ■ <i>Cardiovascular disorders</i>: bradycardia, hypotension, arrhythmias, cardiomyopathy ■ <i>Metabolic disorders</i>: hypokalemia, hypochloremic metabolic alkalosis, increased BUN, edema ■ <i>Other</i>: dry skin, dental caries, delayed gastric emptying, constipation, anemia, osteoporosis 	<ul style="list-style-type: none"> ■ Repeated binge eating followed by self-induced vomiting, misuse of laxatives, diuretics or other medications, fasting; or excessive exercise ■ Often with normal weight ■ Overeating at least twice a week during 3-month period; large amounts of food consumed in short period (~2 hrs) ■ Preoccupation with eating; craving and compulsion to eat; lack of control over eating; alternating with periods of starvation ■ Dread of fatness but may be obese ■ Subtypes of <ul style="list-style-type: none"> ■ <i>Purging</i>: bulimic episodes accompanied by self-induced vomiting or use of laxatives, diuretics, or enemas ■ <i>Nonpurging</i>: bulimic episodes accompanied by compensatory behavior such as fasting, exercise, but without purging ■ Biologic complications <p>See changes listed for anorexia nervosa, especially weakness, fatigue, mild cognitive disorder; also erosion of dental enamel, parotitis, pancreatic inflammation with elevated amylase, mild neuropathies, seizures, hypokalemia, hypochloremic metabolic acidosis, hypomagnesemia</p>

Sources: World Health Organization: The ICD-10 Classification of Mental and Behavioral Disorders: Diagnostic Criteria for Research. Geneva, World Health Organization, 1993. American Psychiatric Association: DSM-IV-TR: Diagnostic and Statistical Manual of Mental Disorders, 4th ed. Washington, DC, American Psychiatric Association, 1994. Halmi KA: Eating Disorders. In: Kaplan HI, Sadock BJ, eds. Comprehensive Textbook of Psychiatry, 7th ed. Philadelphia, Lippincott Williams & Wilkins, 1663–1676, 2000. Mehler PS. Bulimia nervosa. N Engl J Med 349(9):875–880, 2003.

TABLE 4-4

Nutrition Screening Checklist

I have an illness or condition that made me change the kind and/or amount of food I eat.	Yes (2 pts) _____
I eat fewer than 2 meals per day.	Yes (3 pts) _____
I eat few fruits or vegetables, or milk products.	Yes (2 pts) _____
I have 3 or more drinks of beer, liquor, or wine almost every day.	Yes (2 pts) _____
I have tooth or mouth problems that make it hard for me to eat.	Yes (2 pts) _____
I don't always have enough money to buy the food I need.	Yes (4 pts) _____
I eat alone most of the time.	Yes (1 pt) _____
I take 3 or more different prescribed or over-the-counter drugs each day.	Yes (1 pt) _____
Without wanting to, I have lost or gained 10 pounds in the last 6 months.	Yes (2 pts) _____
I am not always physically able to shop, cook, and/or feed myself.	Yes (2 pts) _____
	TOTAL _____

Instructions. Check “yes” for each condition that applies, then total the nutritional score. For total scores between 3–5 points (moderate risk) or ≥ 6 points (high risk), further evaluation is needed (especially for the elderly).

Source: American Academy of Family Physicians: The Nutrition Screening Initiative. Available at: www.aafp.org/PreBuilt/NSI_DETERMINE.pdf. Accessed December 12, 2004.

TABLE 4-5

Nutrition Counseling: Sources of Nutrients

Nutrient	Food Source
Calcium	Dairy foods such as yogurt, milk, and natural cheeses Breakfast cereal, fruit juice with calcium supplements Dark green leafy vegetables such as collards, turnip greens
Iron	Shellfish Lean meat, dark turkey meat Cereals with iron supplements Spinach, peas, lentils Enriched and whole-grain bread
Folate	Cooked dried beans and peas Oranges, orange juice Dark-green leafy vegetables
Vitamin D	Milk (fortified) Eggs, butter, margarine Cereals (fortified)

Source: Adapted from Dietary Guidelines Committee, 2000 Report. Nutrition and Your Health: Dietary Guidelines for Americans. Washington, DC, Agricultural Research Service, U.S. Department of Agriculture, 2000.

TABLE 4-6

Patients With Hypertension: Recommended Changes in Diet

Dietary Change	Food Source
Increase foods high in potassium	Baked white or sweet potatoes, cooked greens such as spinach Bananas, plantains, many dried fruits, orange juice
Decrease foods high in sodium	Canned foods (soups, tuna fish) Pretzels, potato chips, pickles, olives Many processed foods (frozen dinners, ketchup, mustard) Batter-fried foods Table salt, including for cooking

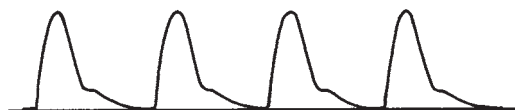
Source: Adapted from Dietary Guidelines Committee, 2000 Report. Nutrition and Your Health: Dietary Guidelines for Americans. Washington, DC, Agricultural Research Service, U.S. Department of Agriculture, 2000.

Normal

The pulse pressure is about 30–40 mm Hg. The pulse contour is smooth and rounded. (The notch on the descending slope of the pulse wave is not palpable.)

Small, Weak Pulses

The pulse pressure is diminished, and the pulse feels weak and small. The upstroke may feel slowed, the peak prolonged. Causes include (1) decreased stroke volume, as in heart failure, hypovolemia, and severe aortic stenosis, and (2) increased peripheral resistance, as in exposure to cold and severe congestive heart failure.

Large, Bounding Pulses

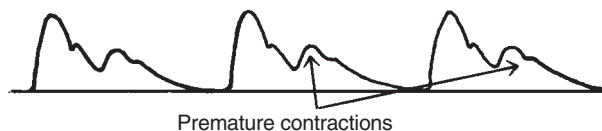
The pulse pressure is increased, and the pulse feels strong and bounding. The rise and fall may feel rapid, the peak brief. Causes include (1) an increased stroke volume, a decreased peripheral resistance, or both, as in fever, anemia, hyperthyroidism, aortic regurgitation, arteriovenous fistulas, and patent ductus arteriosus; (2) an increased stroke volume due to slow heart rates, as in bradycardia and complete heart block; and (3) decreased compliance (increased stiffness) of the aortic walls, as in aging or atherosclerosis.

Bisferiens Pulse

A bisferiens pulse is an increased arterial pulse with a double systolic peak. Causes include pure aortic regurgitation, combined aortic stenosis and regurgitation, and, though less commonly palpable, hypertrophic cardiomyopathy.

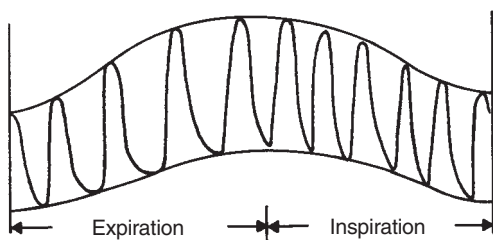
Pulsus Alternans

The pulse alternates in amplitude from beat to beat even though the rhythm is basically regular (and must be for you to make this judgment). When the difference between stronger and weaker beats is slight, it can be detected only by sphygmomanometry. Pulsus alternans indicates left ventricular failure and is usually accompanied by a left-sided S_3 .

Bigeminal Pulse

Premature contractions

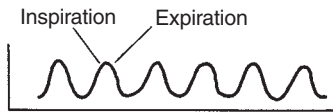
This is a disorder of rhythm that may masquerade as pulsus alternans. A bigeminal pulse is caused by a normal beat alternating with a premature contraction. The stroke volume of the premature beat is diminished in relation to that of the normal beats, and the pulse varies in amplitude accordingly.

Paradoxical Pulse

A paradoxical pulse may be detected by a palpable decrease in the pulse's amplitude on quiet inspiration. If the sign is less pronounced, a blood pressure cuff is needed. Systolic pressure decreases by more than 10 mm Hg during inspiration. A paradoxical pulse is found in pericardial tamponade, constrictive pericarditis (though less commonly), and obstructive lung disease.

TABLE 4-8**Abnormalities in Rate and Rhythm of Breathing**

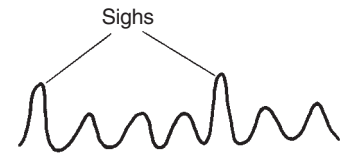
When observing respiratory patterns, think in terms of *rate*, *depth*, and *regularity* of the patient's breathing. Describe what you see in these terms. Traditional terms, such as tachypnea, are given below so that you will understand them, but simple descriptions are recommended for use.

**Normal**

The respiratory rate is about 14–20 per min in normal adults and up to 44 per min in infants.

**Slow Breathing (*Bradypnea*)**

Slow breathing may be secondary to such causes as diabetic coma, drug-induced respiratory depression, and increased intracranial pressure.

**Sighing Respiration**

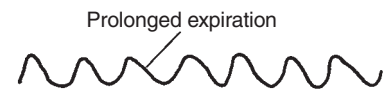
Breathing punctuated by frequent sighs should alert you to the possibility of hyperventilation syndrome—a common cause of dyspnea and dizziness. Occasional sighs are normal.

**Rapid Shallow Breathing (*Tachypnea*)**

Rapid shallow breathing has a number of causes, including restrictive lung disease, pleuritic chest pain, and an elevated diaphragm.

**Cheyne-Stokes Breathing**

Periods of deep breathing alternate with periods of apnea (no breathing). Children and aging people normally may show this pattern in sleep. Other causes include heart failure, uremia, drug-induced respiratory depression, and brain damage (typically on both sides of the cerebral hemispheres or diencephalon).

**Obstructive Breathing**

In obstructive lung disease, expiration is prolonged because narrowed airways increase the resistance to air flow. Causes include asthma, chronic bronchitis, and COPD.

**Rapid Deep Breathing (*Hyperpnea, Hyperventilation*)**

Rapid deep breathing has several causes, including exercise, anxiety, and metabolic acidosis. In the comatose patient, consider infarction, hypoxia, or hypoglycemia affecting the midbrain or pons. *Kussmaul breathing* is deep breathing due to metabolic acidosis. It may be fast, normal in rate, or slow.

**Ataxic Breathing (*Biot's Breathing*)**

Ataxic breathing is characterized by unpredictable irregularity. Breaths may be shallow or deep, and stop for short periods. Causes include respiratory depression and brain damage, typically at the medullary level.