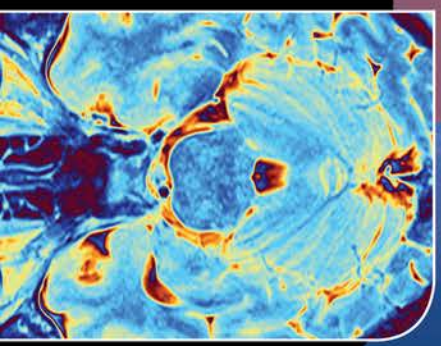
CURRENT
Medical Diagnosis & Treatment



2019

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2019

CURRENT Medical Diagnosis & Treatment

FIFTY-EIGHTH EDITION

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ISBN: 978-1-26-011744-8
MHID: 1-26-011744-8

The material in this eBook also appears in the print version of this title: ISBN: 978-1-26-011743-1, MHID: 1-26-011743-X.

eBook conversion by codeMantra
Version 1.0

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Preface

Current Medical Diagnosis & Treatment 2019 (CMDT 2019) is the 58th edition of this single-source reference for practitioners in both hospital and ambulatory settings. The book emphasizes the practical features of clinical diagnosis and patient management in all fields of internal medicine and in specialties of interest to primary care practitioners and to subspecialists who provide general care.

Our students have inspired us to look at issues of race and justice, which surely impact people's health. We have therefore reviewed the content of our work to ensure that it contains the dignity and equality that every patient deserves.

INTENDED AUDIENCE FOR *CMDT*

House officers, medical students, and all other health professions students will find the descriptions of diagnostic and therapeutic modalities, with citations to the current literature, of everyday usefulness in patient care.

Internists, family physicians, hospitalists, nurse practitioners, physician assistants, and all primary care providers will appreciate *CMDT* as a ready reference and refresher text. Physicians in other specialties, pharmacists, and dentists will find the book a useful basic medical reference text. Nurses, nurse practitioners, and physician assistants will welcome the format and scope of the book as a means of referencing medical diagnosis and treatment.

Patients and their family members who seek information about the nature of specific diseases and their diagnosis and treatment may also find this book to be a valuable resource.

NEW IN THIS EDITION OF *CMDT*

- New color figures throughout the book
- Rewritten section on pain management at the end of life
- Updated American College of Cardiology/American Heart Association (ACC/AHA) guidelines for treatment of valvular heart disease
- ACC consensus document providing decision pathway for use of transcatheter aortic valve replacement
- Extensively revised sections on long QT syndrome; AV block; and sinus arrhythmia, bradycardia, and tachycardia
- Rewritten section on atrial tachycardia
- Substantial revision of ventricular tachycardia management
- New algorithms for managing mitral regurgitation and heart failure with reduced ejection fraction
- New table outlining management strategies for women with valvular heart disease, complex congenital heart disease, pulmonary hypertension, aortopathy, and dilated cardiomyopathy
- New ACC/AHA and Hypertension Canada blood pressure guidelines
- New table outlining blood pressure values across a range of measurement methods (ie, home and ambulatory monitoring)
- New table comparing blood pressure treatment thresholds and targets in the 2017 ACC/AHA guidelines with the 2017 Hypertension Canada guidelines
- New FDA-approved medications for relapsing or refractory forms of leukemia
- Rewritten section on monoclonal gammopathy of uncertain significance
- New FDA-approved direct-acting oral anticoagulant
- Information regarding commercially available freeze-dried capsule fecal formulation for treatment of recurrent and refractory *Clostridium difficile* infection
- New FDA-approved medications for treatment of breast cancer
- Cancer Care Ontario and American Society of Clinical Oncology jointly published guidelines outlining adjuvant therapy plan for postmenopausal breast cancer patients
- Substantial revision of the targeted therapies for hormone receptor–positive metastatic breast cancer
- American College of Obstetricians and Gynecologists support for considering use of low-dose aspirin to prevent preeclampsia

- Revised recommendations for treating hepatitis C virus–associated kidney disease
- New chronic tubulointerstitial disease called Mesoamerican nephropathy
- Detailed discussion of available treatment options for refractory trigeminal neuralgia
- New classification of epilepsy
- Updated information about treating spinal muscular atrophy
- Substantial revision of Psychiatric Disorders chapter
- New section on incidentally discovered adrenal masses
- Updated treatment section for classic Turner syndrome
- New FDA-approved integrase inhibitor for treatment of HIV-1 infection
- Extensive revision of Viral & Rickettsial Infections chapter
- New FDA-approved medication for gastric adenocarcinoma
- New colon cancer screening recommendations from the US Multi-Society Task Force

OUTSTANDING FEATURES OF *CMDT*

- Medical advances up to time of annual publication
- Detailed presentation of primary care topics, including gynecology, obstetrics, dermatology, ophthalmology, otolaryngology, psychiatry, neurology, toxicology, urology, geriatrics, orthopedics, women's health, preventive medicine, and palliative care
- Concise format, facilitating efficient use in any practice setting
- More than 1000 diseases and disorders
- Annual update on HIV/AIDS and other newly emerging infections
- Specific disease prevention information
- Easy access to medication dosages, with trade names indexed and costs updated in each edition
- Recent references, with unique identifiers (PubMed, PMID numbers) for rapid downloading of article abstracts and, in some instances, full-text reference articles

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- Diagnostic Testing & Medical Decision Making
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SPECIAL RECOGNITION

After preparing his annual contribution for this 2019 edition of *CMDT*, Dr. Paul Riordan-Eva announced his retirement from the book. Dr. Riordan-Eva has contributed each year to *CMDT* for 30 years (since 1989). In addition, he has contributed to *Vaughan & Asbury's General Ophthalmology* since 1989 and has been its senior editor since 2004.

Dr. Riordan-Eva has had a distinguished career in ophthalmology. He studied at Cambridge University and St. Thomas Hospital Medical School, London. He then pursued his ophthalmology training in London, followed by a Fellowship at the Proctor Foundation in San Francisco. Dr. Riordan-Eva's first consultant appointment in 1995 was as Consultant Neuro-Ophthalmologist at Moorfields Eye Hospital and the National Hospital for Neurology and Neurosurgery. His work there was combined with Consultant Clinical Scientist at the Medical Research Council Human Movement and Balance Unit, researching brainstem control of eye movements. In 1999, Dr. Riordan-Eva moved to King's College Hospital, London, to set up the neuro-ophthalmology service in the regional neurosciences center. His publications include 46 peer-reviewed original papers and 13 reviews. Dr. Riordan-Eva retired from clinical practice in 2017. Currently, he is the Chairman of the Medical Defence Union, the leading medical indemnity provider in the United Kingdom.

On behalf of our readers and the entire staff at McGraw-Hill Education, we send our warmest congratulations to Paul for his retirement. As his editors, we offer our heartfelt gratitude for his 30 years of contribution to *CMDT*. We will sorely miss working with him each year. Felicitations, Paul!

ACKNOWLEDGMENTS

We wish to thank our associate authors for participating once again in the annual updating of this important book. We are especially grateful to Natalie J.M. Dailey Garnes, MD, MPH, C. Diana Nicoll, MD, PhD, MPA, and Suzanne Watnick, MD, who are leaving *CMDT* this year. We have all benefited from their clinical wisdom and commitment.

Many students and physicians also have contributed useful suggestions to this and previous editions, and we are grateful. We continue to welcome comments and recommendations for future editions in writing or via electronic mail. The editors' e-mail addresses are below and author e-mail addresses are included in the Authors section.

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From inability to let well alone; from too much zeal for the new and contempt for what is old; from putting knowledge before wisdom, science before art and cleverness before common sense; from treating patients as cases; and from making the cure of the disease more grievous than the endurance of the same, Good Lord, deliver us.

—Sir Robert Hutchison

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Disease Prevention & Health Promotion

1

Michael Pignone MD, MPH[1]
René Salazar, MD

GENERAL APPROACH TO THE PATIENT

The medical interview serves several functions. It is used to collect information to assist in diagnosis (the "history" of the present illness), to understand patient values, to assess and communicate prognosis, to establish a therapeutic relationship, and to reach agreement with the patient about further diagnostic procedures and therapeutic options. It also serves as an opportunity to influence patient behavior, such as in motivational discussions about smoking cessation or medication adherence. Interviewing techniques that avoid domination by the clinician increase patient involvement in care and patient satisfaction. Effective clinician-patient communication and increased patient involvement can improve health outcomes.

Patient Adherence

For many illnesses, treatment depends on difficult fundamental behavioral changes, including alterations in diet, taking up exercise, giving up smoking, cutting down drinking, and adhering to medication regimens that are often complex. Adherence is a problem in every practice; up to 50% of patients fail to achieve full adherence, and one-third never take their medicines. Many patients with medical problems, even those with access to care, do not seek appropriate care or may drop out of care prematurely. Adherence rates for short-term, self-administered therapies are higher than for long-term therapies and are inversely correlated with the number of interventions, their complexity and cost, and the patient's perception of overmedication.

As an example, in HIV-infected patients, adherence to antiretroviral therapy is a crucial determinant of treatment success. Studies have unequivocally demonstrated a close relationship between patient adherence and plasma HIV RNA levels, CD4 cell counts, and mortality. Adherence levels of more than 95% are needed to maintain virologic suppression. However, studies show that over 60% of patients are less than 90% adherent and that adherence tends to decrease over time.

[1]Dr. Pignone is a former member of the US Preventive Services Task Force (USPSTF). The views expressed in this chapter are his and Dr. Salazar's and not necessarily those of the USPSTF.

Patient reasons for nonadherence include simple forgetfulness, being away from home, being busy, and changes in daily routine. Other reasons include psychiatric disorders (depression or substance misuse), uncertainty about the effectiveness of treatment, lack of knowledge about the consequences of poor adherence, regimen complexity, and treatment side effects. The rising costs of medications, including generic drugs, and the increase in patient cost-sharing burden, has made adherence even more difficult, particularly for those with lower incomes.

Patients seem better able to take prescribed medications than to adhere to recommendations to change their diet, exercise habits, or alcohol intake or to perform various self-care activities (such as monitoring blood glucose levels at home). For short-term regimens, adherence to medications can be improved by giving clear instructions. Writing out advice to patients, including changes in medication, may be helpful. Because low functional health literacy is common (almost half of English-speaking US patients are unable to read and understand standard health education materials), other forms of communication—such as illustrated simple text, videotapes, or oral instructions—may be more effective. For non–English-speaking patients, clinicians and health care delivery systems can work to provide culturally and linguistically appropriate health services.

To help improve adherence to long-term regimens, clinicians can work with patients to reach agreement on the goals for therapy, provide information about the regimen, ensure understanding by using the "teach-back" method, counsel about the importance of adherence and how to organize medication-taking, reinforce self-monitoring, provide more convenient care, prescribe a simple dosage regimen for all medications (preferably one or two doses daily), suggest ways to help in remembering to take doses (time of day, mealtime, alarms) and to keep appointments, and provide ways to simplify dosing (medication boxes). Single-unit doses supplied in foil wrappers can increase adherence but should be avoided for patients who have difficulty opening them. Medication boxes with compartments (eg, Medisets) that are filled weekly are useful. Microelectronic devices can provide feedback to

show patients whether they have taken doses as scheduled or to notify patients within a day if doses are skipped. Reminders, including cell phone text messages, are another effective means of encouraging adherence. The clinician can also enlist social support from family and friends, recruit an adherence monitor, provide a more convenient care environment, and provide rewards and recognition for the patient's efforts to follow the regimen. Collaborative programs that utilize pharmacists to help ensure adherence are also effective.

Adherence is also improved when a trusting doctor-patient relationship has been established and when patients actively participate in their care. Clinicians can improve patient adherence by inquiring specifically about the behaviors in question. When asked, many patients admit to incomplete adherence with medication regimens, with advice about giving up cigarettes, or with engaging only in "safer sex" practices. Although difficult, sufficient time must be made available for communication of health messages.

Medication adherence can be assessed generally with a single question: "In the past month, how often did you take your medications as the doctor prescribed?" Other ways of assessing medication adherence include pill counts and refill records; monitoring serum, urine, or saliva levels of drugs or metabolites; watching for appointment nonattendance and treatment nonresponse; and assessing predictable drug effects, such as weight changes with diuretics or bradycardia from beta-blockers. In some conditions, even partial adherence, as with drug treatment of hypertension and diabetes mellitus, improves outcomes compared with nonadherence; in other cases, such as HIV antiretroviral therapy or tuberculosis treatment, partial adherence may be worse than complete nonadherence.

Guiding Principles of Care

Ethical decisions are often called for in medical practice, at both the "micro" level of the individual patient-clinician relationship and at the "macro" level of the allocation of resources. Ethical principles that guide the successful approach to diagnosis and treatment are honesty, beneficence, justice, avoidance of conflict of interest, and the pledge to do no harm. Increasingly, Western medicine involves patients in important decisions about medical care, eg, which colorectal screening test to obtain or which modality of therapy for breast cancer or how far to proceed with treatment of patients who have terminal illnesses (see Chapter 5).

The clinician's role does not end with diagnosis and treatment. The importance of the empathic clinician in helping patients and their families bear the burden of serious illness and death cannot be overemphasized. "To cure sometimes, to relieve often, and to comfort always" is a French saying as apt today as it was five centuries ago—as is Francis Peabody's admonition: "The secret of the care of the patient is in caring for the patient." Training to improve mindfulness and enhance patient-centered communication increases patient satisfaction and may also improve clinician satisfaction.

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HEALTH MAINTENANCE & DISEASE PREVENTION

Preventive medicine can be categorized as primary, secondary, or tertiary. Primary prevention aims to remove or reduce disease risk factors (eg, immunization, giving up or not starting smoking). Secondary prevention techniques promote early detection of disease or precursor states (eg, routine cervical Papanicolaou screening to detect carcinoma or dysplasia of the cervix). Tertiary prevention measures are aimed at limiting the impact of established disease (eg, partial mastectomy and radiation therapy to remove and control localized breast cancer).

Tables 1–1 and 1–2 give leading causes of death in the United States and estimates of deaths from preventable causes. Recent data suggest increased rates of death, mainly from suicide and substance misuse, particularly among less well-educated middle-aged white adults.

Many effective preventive services are underutilized, and few adults receive all of the most strongly recommended services. Several methods, including the use of provider or patient reminder systems (including interactive patient health records), reorganization of care environments, and possibly provision of financial incentives to clinicians (though this remains controversial), can increase utilization of preventive services, but such methods have not been widely adopted.

Table 1–1. Leading causes of death in the United States, 2015.

Category	Estimate
All causes	**2,712,630**
1. Diseases of the heart	633,842
2. Malignant neoplasms	595,930
3. Chronic lower respiratory diseases	155,041
4. Unintentional injuries	146,571
5. Cerebrovascular diseases	140,323
6. Alzheimer disease	110,561
7. Diabetes mellitus	79,535
8. Influenza and pneumonia	57,062
9. Nephritis, nephrotic syndrome, and nephrosis	49,959
10. Intentional self-harm (suicide)	44,193

Data from National Center for Health Statistics 2016.

Table 1–2. Deaths from all causes attributable to common preventable risk factors. (Numbers given in the thousands.)

Risk Factor	Male (95% CI)	Female (95% CI)	Both Sexes (95% CI)
Tobacco smoking	248 (226–269)	219 (196–244)	467 (436–500)
High blood pressure	164 (153–175)	231 (213–249)	395 (372–414)
Overweight–obesity (high BMI)	114 (95–128)	102 (80–119)	216 (188–237)
Physical inactivity	88 (72–105)	103 (80–128)	191 (164–222)
High blood glucose	102 (80–122)	89 (69–108)	190 (163–217)
High LDL cholesterol	60 (42–70)	53 (44–59)	113 (94–124)
High dietary salt (sodium)	49 (46–51)	54 (50–57)	102 (97–107)
Low dietary omega-3 fatty acids (seafood)	45 (37–52)	39 (31–47)	84 (72–96)
High dietary trans fatty acids	46 (33–58)	35 (23–46)	82 (63–97)
Alcohol use	45 (32–49)	20 (17–22)	64 (51–69)
Low intake of fruits and vegetables	33 (23–45)	24 (15–36)	58 (44–74)
Low dietary polyunsaturated fatty acids (in place of saturated fatty acids)	9 (6–12)	6 (3–9)	15 (11–20)

BMI, body mass index; CI, confidence interval; LDL, low-density lipoprotein.
Note: Numbers of deaths cannot be summed across categories.
Used, with permission, from Danaei G et al. The preventable causes of death in the United States: comparative risk assessment of dietary, lifestyle, and metabolic risk factors. PLoS Med. 2009 Apr 28;6(4):e1000058.

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PREVENTION OF INFECTIOUS DISEASES

Much of the decline in the incidence and fatality rates of infectious diseases is attributable to public health measures—especially immunization, improved sanitation, and better nutrition.

Immunization remains the best means of preventing many infectious diseases. Recommended immunization schedules for children and adolescents can be found online at http://www.cdc.gov/vaccines/schedules/hcp/child-adolescent.html, and the schedule for adults is at http://www.cdc.gov/vaccines/schedules/hcp/adult.html (see also Chapter 30). Substantial morbidity and mortality from vaccine-preventable diseases, such as hepatitis A, hepatitis B, influenza, and pneumococcal infections, continue to occur among adults. Increases in the number of vaccine-preventable diseases in the United States highlight the need to understand the association of vaccine refusal and the epidemiology of these diseases.

Evidence suggests annual **influenza vaccination** is safe and effective with potential benefit in all age groups, and the Advisory Committee on Immunization Practices (ACIP) recommends routine influenza vaccination for all persons aged 6 months and older, including all adults. When vaccine supply is limited, certain groups should be given priority, such as adults 50 years and older, individuals with chronic illness or immunosuppression, and pregnant women. An alternative high-dose inactivated vaccine is available for adults 65 years and older. Adults 65 years and older can receive either the standard-dose or high-dose vaccine, whereas those younger than 65 years should receive a standard-dose preparation.

The ACIP recommends two doses of measles, mumps, and rubella (MMR) vaccine in adults at high risk for exposure and transmission (eg, college students, health care workers). Otherwise, one dose is recommended for adults aged 18 years and older. Physician documentation of disease is not acceptable for evidence of MMR immunity.

Routine use of 13-valent pneumococcal conjugate vaccine (PCV13) is recommended among adults aged 65 and older. Individuals 65 years of age or older who have never received a pneumococcal vaccine should first receive PCV13 followed by a dose of 23-valent pneumococcal polysaccharide vaccine (PPSV23) 6–12 months later. Individuals who have received more than one dose of PPSV23 should receive a dose of PCV13 more than 1 year after the last dose of PPSV23 was administered.

The ACIP recommends routine use of a single dose of tetanus, diphtheria, and 5-component acellular pertussis vaccine (Tdap) for adults aged 19–64 years to replace the next booster dose of tetanus and diphtheria toxoids vaccine (Td). Due to increasing reports of pertussis in the United States, clinicians may choose to give Tdap to persons aged 65 years and older (particularly to those who might risk transmission to at-risk infants who are most susceptible to complications, including death), despite limited published data on the safety and efficacy of the vaccine in this age group.

Both **hepatitis A vaccine** and **immune globulin** provide protection against hepatitis A; however, administration of immune globulin may provide a modest benefit over vaccination in some settings. Hepatitis B vaccine administered as a three-dose series is recommended for all children aged 0–18 years and high-risk individuals (ie, health care workers, injection drug users, people with end-stage renal disease). Adults with diabetes are also at increased risk for hepatitis B infection. The ACIP recommends **vaccination for hepatitis B** in diabetic patients aged 19–59 years. The hepatitis B vaccine should also be considered in diabetic persons age 60 and older.

Human papillomavirus (HPV) virus-like particle (VLP) vaccines have demonstrated effectiveness in preventing persistent HPV infections and thus may impact the rate of cervical intraepithelial neoplasia (CIN) II–III. The ACIP recommends routine HPV vaccination (with three doses of the 9-valent [9vHPV], 4-valent [4vHPV], or 2-valent [2vHPV] vaccine) for girls aged 11–12 years. The ACIP also recommends that all unvaccinated girls and women through age 26 years receive the three-dose HPV vaccination. Studies suggest that one dose of vaccine may be as effective as three. The ACIP also recommends the routine vaccination with three doses of the 4vHPV or 9vHPV vaccine for boys aged 11 or 12 years, males through age 21 years, and men who have sex with men and immunocompromised men (including those with HIV infection) through age 26 years. Vaccination of males with HPV may lead to indirect protection of women by reducing transmission of HPV and may prevent anal intraepithelial neoplasia and squamous cell carcinoma in men who have sex with men.

Persons traveling to countries where infections are endemic should take the precautions described in Chapter 30 and at http://wwwnc.cdc.gov/travel/destinations/list. Immunization registries—confidential, population-based, computerized information systems that collect vaccination data about all residents of a geographic area—can be used to increase and sustain high vaccination coverage.

Until recently, the rate of tuberculosis in the United States had been declining. The Centers for Disease Control and Prevention (CDC) reports that after 2 decades of progress toward tuberculosis elimination—with annual decreases of greater than or equal to 0.2 case per 100,000 persons—its incidence in the United States plateaued at approximately 3.0 cases per 100,000 persons during 2013–2015. Two blood tests, which are not confounded by prior bacillus Calmette-Guérin (BCG) vaccination, have been developed to detect tuberculosis infection by measuring in vitro T-cell interferon-gamma release in response to two antigens (one, the enzyme-linked immunospot [ELISpot], [T-SPOT.TB], and the other, a quantitative ELISA [QuantiFERON-TBGold] test). These T-cell–based assays have an excellent specificity that is higher than tuberculin skin testing in BCG-vaccinated populations.

The US Preventive Services Task Force (USPSTF) recommends behavioral counseling for adolescents and adults who are sexually active and at increased risk for sexually transmitted infections. Sexually active women aged 24 years or younger and older women who are at increased risk for infection should be screened for chlamydia. Screening HIV-positive men or men who have sex with men for syphilis every 3 months is associated with improved syphilis detection.

HIV infection remains a major infectious disease problem in the world. The CDC recommends universal HIV screening of all patients aged 13–64, and the USPSTF recommends that clinicians screen adolescents and adults aged 15 to 65 years. Clinicians should integrate biomedical and behavioral approaches for HIV prevention. In addition to reducing sexual transmission of HIV, initiation of antiretroviral therapy reduces the risk for AIDS-defining events and death among patients with less immunologically advanced disease.

Daily preexposure prophylaxis (PrEP) with the fixed-dose combination of tenofovir disoproxil 300 mg and emtricitabine 200 mg (Truvada) should be considered for people who are HIV-negative but at substantial of risk for HIV infection. Studies of men who have sex with men suggest that PrEP is very effective in reducing the risk of contracting HIV. Patients taking PrEP should be encouraged to use other prevention strategies, such as consistent condom use and choosing less risky sexual behaviors (eg, oral sex), to maximally reduce their risk. Postexposure prophylaxis (PEP) with combinations of antiretroviral drugs is widely used after occupational and nonoccupational contact, and may reduce the risk of transmission by approximately 80%. PEP should be initiated within 72 hours of exposure.

In immunocompromised patients, live vaccines are contraindicated, but many killed or component vaccines are safe and recommended. *Asymptomatic* HIV-infected patients have not shown adverse consequences when given live MMR and influenza vaccinations as well as tetanus, hepatitis B, *H influenza* type b, and pneumococcal vaccinations—all should be given. However, if poliomyelitis immunization is required, the inactivated poliomyelitis vaccine is indicated. In *symptomatic* HIV-infected patients, live-virus vaccines, such as MMR, should generally be avoided, but annual influenza vaccination is safe.

Herpes zoster, caused by reactivation from previous varicella zoster virus infection, affects many older adults and people with immune system dysfunction. It can cause postherpetic neuralgia, a potentially debilitating chronic pain syndrome. Two vaccines are available for the prevention of herpes zoster, a live virus vaccine (Zostavax) and a herpes zoster subunit vaccine (HZ/su; Shingrix) (approved by the US Food and Drug Administration [FDA] in October 2017). The ACIP recommends the HZ/su vaccine

be used for the prevention of herpes zoster and related complications in immunocompetent adults age 50 and older and in individuals who previously received Zostavax. The ACIP prefers the use of the new HZ/su vaccine over the older live virus vaccine.

In May 2015, the World Health Organization reported the first local transmission of Zika virus in the Western Hemisphere. Zika virus spreads to people primarily through mosquito bites but can also spread during sex by a person infected with Zika to his or her partner. Although clinical disease is usually mild, Zika virus infections in women infected during pregnancy have been linked to fetal microcephaly and loss, and newborn and infant blindness and other neurologic problems (see Chapter 32). Pregnant women should consider postponing travel to areas where Zika virus transmission is ongoing.

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PREVENTION OF CARDIOVASCULAR DISEASE

Cardiovascular diseases, including coronary heart disease (CHD) and stroke, represent two of the most important causes of morbidity and mortality in developed countries. Several risk factors increase the risk for coronary disease and stroke. These risk factors can be divided into those that are modifiable (eg, lipid disorders, hypertension, cigarette smoking) and those that are not (eg, age, sex, family history of early coronary disease). Impressive declines in age-specific mortality rates from heart disease and stroke have been achieved in all age groups in North America during the past two decades, in large part through improvement of modifiable risk factors: reductions in cigarette smoking, improvements in lipid levels, and more aggressive detection and treatment of hypertension. This section considers the role of screening for cardiovascular risk and the use of effective therapies to reduce such risk. Key recommendations for cardiovascular prevention are shown in Table 1–3. Guidelines encourage regular assessment of global cardiovascular risk in adults 40–79 years of age without known cardiovascular disease.

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Abdominal Aortic Aneurysm

One-time screening for abdominal aortic aneurysm (AAA) by ultrasonography in men aged 65–75 years is associated with a relative reduction in odds of AAA-related mortality of almost 50% and possibly a small reduction in all-cause mortality. Women do not appear to benefit from screening, and most of the benefit in men appears to accrue among current or former smokers. Screening men aged 65 years and older is highly cost effective.

Canadian Task Force on Preventive Health Care. Recommendations on screening for abdominal aortic aneurysm in primary care. CMAJ. 2017 Sep 11;189(36):E1137–45. [PMID: 28893876]

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Table 1–3. Expert recommendations for cardiovascular risk prevention methods: US Preventive Services Task Force (USPSTF).[1]

Prevention Method	Recommendation/[Year Issued]
Screening for abdominal aortic aneurysm (AAA)	Recommends one-time screening for AAA by ultrasonography in men aged 65–75 years who have ever smoked. (B) Selectively offer screening for AAA in men aged 65–75 years who have never smoked. (C) Current evidence is insufficient to assess the balance of benefits and harms of screening for AAA in women aged 65–75 years who have ever smoked. (I) Recommends against routine screening for AAA in women who have never smoked. (D) [2014]
Aspirin use	Recommends initiating low-dose aspirin use for the primary prevention of cardiovascular disease (CVD) and colorectal cancer (CRC) in adults aged 50–59 years who have a 10% or greater 10-year CVD risk, are not at increased risk for bleeding, have a life expectancy of at least 10 years, and are willing to take low-dose aspirin daily for at least 10 years. (B) The decision to initiate low-dose aspirin use for the primary prevention of CVD and CRC in adults aged 60–69 years who have a 10% or greater 10-year CVD risk should be an individual one. Persons who are not at increased risk for bleeding, have a life expectancy of at least 10 years, and are willing to take low-dose aspirin daily for at least 10 years are more likely to benefit. Persons who place a higher value on the potential benefits than the potential harms may choose to initiate low-dose aspirin. (C) The current evidence is insufficient to assess the balance of benefits and harms of initiating aspirin use for the primary prevention of CVD and CRC in adults younger than 50 years or older than age 70. (I) [2016]
Blood pressure screening	The USPSTF recommends screening for high blood pressure in adults aged 18 years or older. The USPSTF recommends obtaining measurements outside of the clinical setting for diagnostic confirmation before starting treatment. (A) [2015]
Serum lipid screening and use of statins for prevention	The USPSTF recommends that adults without a history of CVD use a low- to moderate-dose statin for the prevention of CVD events and mortality when all of the following criteria are met: (1) they are aged 40–75 years; (2) they have one or more CVD risk factors (ie, dyslipidemia, diabetes mellitus, hypertension, or smoking); and (3) they have a calculated 10-year risk of a cardiovascular event of 10% or greater. Identification of dyslipidemia and calculation of 10-year CVD event risk requires universal lipids screening in adults aged 40–75 years. See the "Clinical Considerations" section of the USPSTF recommendations[2] for more information on lipids screening and the assessment of cardiovascular risk. (B) The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of initiating statin use for the primary prevention of CVD events and mortality in adults aged 76 years and older without a history of heart attack or stroke. (I) [2016]
Counseling about healthful diet and physical activity for CVD prevention	Recommends offering or referring adults who are overweight or obese and have additional CVD risk factors to intensive behavioral counseling interventions to promote a healthful diet and physical activity for CVD prevention. (B) [2014] Recommends that primary care professionals individualize the decision to offer or refer adults without obesity who do not have hypertension, dyslipidemia, abnormal blood glucose levels, or diabetes to behavioral counseling to promote a healthful diet and physical activity. (C) [2017]
Screening for diabetes mellitus	Recommends screening for abnormal blood glucose as part of cardiovascular risk assessment in adults aged 40–70 years who are overweight or obese. Clinicians should offer or refer patients with abnormal blood glucose to intensive behavioral counseling interventions to promote a healthful diet and physical activity. (B) [2015]
Screening for smoking and counseling to promote cessation	Recommends that clinicians ask all adults about tobacco use, advise them to stop using tobacco, and provide behavioral interventions and US Food and Drug Administration (FDA)–approved pharmacotherapy for cessation to adults who use tobacco. (A) [2015]

[1]**Recommendation A:** The USPSTF strongly recommends that clinicians routinely provide the service to eligible patients. (The USPSTF found good evidence that the service improves important health outcomes and concludes that benefits substantially outweigh harms.)
Recommendation B: The USPSTF recommends that clinicians routinely provide the service to eligible patients. (The USPSTF found at least fair evidence that the service improves important health outcomes and concludes that benefits substantially outweigh harms.)
Recommendation C: The USPSTF makes no recommendation for or against routine provision of the service.
Recommendation D: The USPSTF recommends against routinely providing the service to asymptomatic patients. (The USPSTF found at least fair evidence that the service is ineffective or that harms outweigh benefits.)
Recommendation I: The USPSTF concludes that the evidence is insufficient to recommend for or against routinely providing the service.
[2]http://www.uspreventiveservicestaskforce.org/BrowseRec/Index/browse-recommendations

Cigarette Smoking

Cigarette smoking remains the most important cause of preventable morbidity and early mortality. In 2015, there were an estimated 6.4 million premature deaths in the world attributable to smoking and tobacco use; smoking is the second leading cause of disability adjusted life years lost. Cigarettes are responsible for one in every five deaths in the United States. From 2005 to 2009, more than 480,000 deaths per year (more than 278,000 in men and more than 201,000 in women) were attributable to smoking. Annual cost of smoking-related health care is approximately $130 billion in the United States, with another $150 billion in productivity losses. Fortunately, US smoking rates are declining; in 2015, 15.1% of US adults were smokers. Global direct health care costs from smoking in 2012 were estimated at $422 billion, with total costs of over $1.4 trillion.

Nicotine is highly addictive, raises brain levels of dopamine, and produces withdrawal symptoms on discontinuation. Smokers die 5–8 years earlier than never-smokers. They have twice the risk of fatal heart disease; 10 times the risk of lung cancer; and several times the risk of cancers of the mouth, throat, esophagus, pancreas, kidney, bladder, and cervix; a twofold to threefold higher incidence of stroke and peptic ulcers (which heal less well than in nonsmokers); a two- to fourfold greater risk of fractures of the hip, wrist, and vertebrae; four times the risk of invasive pneumococcal disease; and a twofold increase in cataracts. In the United States, over 90% of cases of chronic obstructive pulmonary disease (COPD) occur among current or former smokers.

Both active smoking and passive smoking are associated with deterioration of the elastic properties of the aorta (increasing the risk of aortic aneurysm) and with progression of carotid artery atherosclerosis. Smoking has also been associated with increased risks of leukemia, of colon and prostate cancers, of breast cancer among postmenopausal women who are slow acetylators of N-acetyltransferase-2 enzymes, of osteoporosis, and of Alzheimer disease. In cancers of the head and neck, lung, esophagus, and bladder, smoking is linked to mutations of the *P53* gene, the most common genetic change in human cancer. Patients with head and neck cancer who continue to smoke during radiation therapy have lower rates of response than those who do not smoke. Olfaction and taste are impaired in smokers, and facial wrinkles are increased. Heavy smokers have a 2.5 greater risk of age-related macular degeneration.

The children of smokers have lower birth weights, are more likely to be mentally retarded, have more frequent respiratory infections and less efficient pulmonary function, have a higher incidence of chronic ear infections than children of nonsmokers, and are more likely to become smokers themselves. In addition, exposure to environmental tobacco smoke has been shown to increase the risk of cervical cancer, lung cancer, invasive pneumococcal disease, and heart disease; to promote endothelial damage and platelet aggregation; and to increase urinary excretion of tobacco-specific lung carcinogens. The incidence of breast cancer may be increased as well. Over 41,000 deaths per year in the United States are attributable to environmental tobacco smoke.

Smoking cessation reduces the risks of death and of myocardial infarction in people with coronary artery disease; reduces the rate of death and acute myocardial infarction in patients who have undergone percutaneous coronary revascularization; lessens the risk of stroke; and is associated with improvement of COPD symptoms. On average, women smokers who quit smoking by age 35 add about 3 years to their life expectancy, and men add more than 2 years to theirs. Smoking cessation can increase life expectancy even for those who stop after the age of 65.

Although tobacco use constitutes the most serious common medical problem, it is undertreated. Almost 40% of smokers attempt to quit each year, but only 4% are successful. Persons whose clinicians advise them to quit are 1.6 times as likely to attempt quitting. Over 70% of smokers see a physician each year, but only 20% of them receive any medical quitting advice or assistance.

Factors associated with successful cessation include having a rule against smoking in the home, being older, and having greater education. Several effective interventions are available to promote smoking cessation, including counseling, pharmacotherapy, and combinations of the two. The five steps for helping smokers quit are summarized in Table 1–4.

Common elements of supportive smoking cessation treatments are reviewed in Table 1–5. A system should be implemented to identify smokers, and advice to quit should be tailored to the patient's level of readiness to change. All patients trying to quit should be offered pharmacotherapy except those with medical contraindications, women who are pregnant or breast-feeding, and adolescents. Weight gain occurs in most patients (80%) following smoking cessation. Average weight gain is 2 kg, but for some (10–15%), major weight gain—over 13 kg—may occur. Planning for the possibility of weight gain, and means of mitigating it, may help with maintenance of cessation.

Several pharmacologic therapies have been shown to be effective in promoting cessation. Nicotine replacement therapy doubles the chance of successful quitting. The nicotine patch, gum, and lozenges are available over the counter and nicotine nasal spray and inhalers by prescription. The sustained-release antidepressant drug bupropion (150–300 mg/day orally) is an effective smoking cessation agent and is associated with minimal weight gain, although seizures are a contraindication. It acts by boosting brain levels of dopamine and norepinephrine, mimicking the effect of nicotine. More recently, varenicline, a partial nicotinic acetylcholine-receptor agonist, has been shown to improve cessation rates; however, its adverse effects, particularly its effects on mood, are not completely understood and warrant careful consideration. No single pharmacotherapy is clearly more effective than others, so patient preferences and data on adverse effects should be taken into account in selecting a treatment. Combination therapy is more effective than a single pharmacologic modality. The efficacy of e-cigarettes in smoking cessation has not been well evaluated, and some users may find them addictive.

Table 1–4. Actions and strategies for the primary care clinician to help patients quit smoking.

Action	Strategies for Implementation
	Step 1. Ask—Systematically Identify All Tobacco Users at Every Visit
Implement an officewide system that ensures that for *every* patient at *every* clinic visit, tobacco-use status is queried and documented[1]	Expand the vital signs to include tobacco use. Data should be collected by the health care team. The action should be implemented using preprinted progress note paper that includes the expanded vital signs, a vital signs stamp or, for computerized records, an item assessing tobacco-use status. Alternatives to the vital signs stamp are to place tobacco-use status stickers on all patients' charts or to indicate smoking status using computerized reminder systems.
	Step 2. Advise—Strongly Urge All Smokers to Quit
In a clear, strong, and personalized manner, urge every smoker to quit	Advice should be **Clear:** "I think it is important for you to quit smoking now, and I will help you. Cutting down while you are ill is not enough." **Strong:** "As your clinician, I need you to know that quitting smoking is the most important thing you can do to protect your current and future health." **Personalized:** Tie smoking to current health or illness and/or the social and economic costs of tobacco use, motivational level/readiness to quit, and the impact of smoking on children and others in the household. Encourage clinic staff to reinforce the cessation message and support the patient's quit attempt.
	Step 3. Attempt—Identify Smokers Willing to Make a Quit Attempt
Ask every smoker if he or she is willing to make a quit attempt at this time	If the patient is willing to make a quit attempt at this time, provide assistance (see step 4). If the patient prefers a more intensive treatment or the clinician believes more intensive treatment is appropriate, refer the patient to interventions administered by a smoking cessation specialist and follow up with him or her regarding quitting (see step 5). If the patient clearly states he or she is not willing to make a quit attempt at this time, provide a motivational intervention.
	Step 4. Assist—Aid the Patient in Quitting
A. Help the patient with a quit plan	**Set a quit date.** Ideally, the quit date should be within 2 weeks, taking patient preference into account. **Help the patient prepare for quitting.** The patient must: **Inform** family, friends, and coworkers of quitting and request understanding and support. **Prepare the environment** by removing cigarettes from it. Prior to quitting, the patient should avoid smoking in places where he or she spends a lot of time (eg, home, car). **Review** previous quit attempts. What helped? What led to relapse? **Anticipate** challenges to the planned quit attempt, particularly during the critical first few weeks.
B. Encourage nicotine replacement therapy except in special circumstances	Encourage the use of the nicotine patch or nicotine gum therapy for smoking cessation.
C. Give key advice on successful quitting	**Abstinence:** Total abstinence is essential. Not even a single puff after the quit date. **Alcohol:** Drinking alcohol is highly associated with relapse. Those who stop smoking should review their alcohol use and consider limiting or abstaining from alcohol use during the quit process. **Other smokers in the household:** The presence of other smokers in the household, particularly a spouse, is associated with lower success rates. Patients should consider quitting with their significant others and/or developing specific plans to maintain abstinence in a household where others still smoke.
D. Provide supplementary materials	**Source:** Federal agencies, including the National Cancer Institute and the Agency for Health Care Policy and Research; nonprofit agencies (American Cancer Society, American Lung Association, American Heart Association); or local or state health departments. **Selection concerns:** The material must be culturally, racially, educationally, and age appropriate for the patient. **Location:** Readily available in every clinic office.

(*continued*)

Table 1–4. Actions and strategies for the primary care clinician to help patients quit smoking. (continued)

Action	Strategies for Implementation
	Step 5. Arrange—Schedule Follow-Up Contact
Schedule follow-up contact, either in person or via telephone	**Timing:** Follow-up contact should occur soon after the quit date, preferably during the first week. A second follow-up contact is recommended within the first month. Schedule further follow-up contacts as indicated. **Actions during follow-up:** Congratulate success. If smoking occurred, review the circumstances and elicit recommitment to total abstinence. Remind the patient that a lapse can be used as a learning experience and is not a sign of failure. Identify the problems already encountered and anticipate challenges in the immediate future. Assess nicotine replacement therapy use and problems. Consider referral to a more intense or specialized program.

[1]Repeated assessment is not necessary in the case of the adult who has never smoked or not smoked for many years and for whom the information is clearly documented in the medical record.

Clinicians should not show disapproval of patients who failed to stop smoking or who are not ready to make a quit attempt. Thoughtful advice that emphasizes the benefits of cessation and recognizes common barriers to success can increase motivation to quit and quit rates. An intercurrent illness or hospitalization may motivate even the most addicted smoker to quit.

Table 1–5. Common elements of supportive smoking treatments.

Component	Examples
Encouragement of the patient in the quit attempt	Note that effective cessation treatments are now available. Note that half the people who have *ever* smoked have now quit. Communicate belief in the patient's ability to quit.
Communication of caring and concern	Ask how the patient feels about quitting. Directly express concern and a willingness to help. Be open to the patient's expression of fears of quitting, difficulties experienced, and ambivalent feelings.
Encouragement of the patient to talk about the quitting process	Ask about: Reasons that the patient wants to quit. Difficulties encountered while quitting. Success the patient has achieved. Concerns or worries about quitting.
Provision of basic information about smoking and successful quitting	Inform the patient about: The nature and time course of withdrawal. The addictive nature of smoking. The fact that any smoking (even a single puff) increases the likelihood of full relapse.

Individualized or group counseling is very cost effective, even more so than in treating hypertension. Smoking cessation counseling by telephone ("quitlines") and text messaging–based interventions have both proved effective. An additional strategy is to recommend that any smoking take place outdoors to limit the effects of passive smoke on housemates and coworkers. This can lead to smoking reduction and quitting.

The clinician's role in smoking cessation is summarized in Tables 1–4 and 1–5. Public policies, including higher cigarette taxes and more restrictive public smoking laws, have also been shown to encourage cessation, as have financial incentives directed to patients.

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Lipid Disorders (see Chapter 28)

Higher low-density lipoprotein (LDL) cholesterol concentrations and lower high-density lipoprotein (HDL) levels are associated with an increased risk of CHD. Measurement of total and high-density lipoprotein cholesterol levels can help assess the degree of CHD risk. The best age to start screening is controversial, as is its frequency. Cholesterol-lowering therapy reduces the relative risk of CHD events, with the degree of reduction proportional to the reduction in LDL cholesterol achieved. The absolute benefits of screening for—and treating—abnormal lipid levels depend on the presence and level of other cardiovascular risk factors, including hypertension, diabetes mellitus, smoking, age, and sex. If other risk factors are present, atherosclerotic cardiovascular disease risk is higher and the potential benefits of therapy are greater. Patients with known cardiovascular disease are at higher risk and have larger benefits from reduction in LDL cholesterol. The optimal risk threshold for initiating statins for primary prevention remains somewhat controversial, although most guidelines now suggest statin therapy when the 10-year atherosclerotic cardiovascular risk is greater than 10%.

Evidence for the effectiveness of statin-type drugs is better than for the other classes of lipid-lowering agents or dietary changes specifically for improving lipid levels. Multiple large, randomized, placebo-controlled trials have demonstrated important reductions in total mortality, major coronary events, and strokes with lowering levels of LDL cholesterol by statin therapy for patients with known cardiovascular disease. Statins also reduce cardiovascular events for patients with diabetes mellitus. For patients with no previous history of cardiovascular events or diabetes, meta-analyses have shown important reductions of cardiovascular events.

New antilipidemic monoclonal antibody agents (eg, evolocumab and alirocumab) lower LDL cholesterol by 50–60% by binding proprotein convertase subtilisin kexin type 9 (PCSK9), which decreases the degradation of LDL receptors. PCSK9 inhibitors also decrease Lp(a) levels. These new agents are very expensive so are often used mainly when statin therapy does not reduce the LDL cholesterol sufficiently at maximally tolerated doses or when patients are intolerant of statins. So far, few side effects have been reported with PCSK9 inhibitor use. To date, there has been only one large placebo-controlled trial of alirocumab as add-on therapy to maximal statin doses.

Guidelines for statin and PCSK9 therapy are discussed in Chapter 28.

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Hypertension (see Chapter 11)

Over 67 million adults in the United States have hypertension, representing 29% of the adult US population. Hypertension in nearly half of these adults is not controlled (ie, less than 140/90 mm Hg). Among those whose hypertension is not well controlled, nearly 40% are not aware of their elevated blood pressure; almost 16% are aware but not being treated; and 45% are being treated but the hypertension is not controlled. In every adult age group, higher values of systolic and diastolic blood pressure carry greater risks of stroke and heart failure. Systolic blood pressure is a better predictor of morbid events than diastolic blood pressure. Home monitoring is better correlated with target organ damage than clinic-based values. Clinicians can apply specific blood pressure criteria, such as those of the Joint National Committee or American Heart Association guidelines, along with consideration of the patient's cardiovascular risk and personal values, to decide at what levels treatment should be considered in individual cases. One trial suggests additional benefit from more intensive blood pressure control (goal systolic blood pressure of 120 mm Hg) in patients at higher risk; however, another found no benefit from more aggressive treatment in patients at intermediate risk.

Primary prevention of hypertension can be accomplished by strategies aimed at both the general population and special high-risk populations. The latter include persons with high-normal blood pressure or a family history of hypertension, blacks, and individuals with various behavioral risk factors, such as physical inactivity; excessive consumption of salt, alcohol, or calories; and deficient intake of potassium. Effective interventions for primary prevention of hypertension include reduced sodium and alcohol consumption, weight loss, and regular exercise. Potassium supplementation lowers blood pressure modestly, and a diet high in fresh fruits and vegetables and low in fat, red meats, and sugar-containing beverages also reduces blood pressure. Interventions of unproven efficacy include pill supplementation of potassium, calcium, magnesium, fish oil, or fiber; macronutrient alteration; and stress management.

Improved identification and treatment of hypertension is a major cause of the recent decline in stroke deaths as well as the reduction in incidence of heart failure–related hospitalizations. Because hypertension is usually asymptomatic, screening is strongly recommended to identify patients for treatment. Elevated office readings should be confirmed with repeated measurements, ideally from ambulatory monitoring or home measurements. Despite strong recommendations in favor of screening and treatment, hypertension control remains suboptimal. An intervention that included both patient and provider education was more effective than provider education alone in achieving control of hypertension, suggesting the benefits of patient participation; another trial found that home

monitoring combined with telephone-based nurse support was more effective than home monitoring alone for blood pressure control. Pharmacologic management of hypertension is discussed in Chapter 11.

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Lonn EM et al; HOPE-3 Investigators. Blood-pressure lowering in intermediate-risk persons without cardiovascular disease. N Engl J Med. 2016 May 26;374(21):2009–20. [PMID: 27041480]
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Chemoprevention

Regular use of low-dose aspirin (81–325 mg) can reduce cardiovascular events but increases gastrointestinal bleeding. Aspirin may also reduce the risk of death from several common types of cancer (colorectal, esophageal, gastric, breast, prostate, and possibly lung). The potential benefits of aspirin appear to exceed the harms for those at increased cardiovascular risk, which can be defined as a 10-year risk of greater than 10%.

Results from a meta-analysis suggest that aspirin could also reduce the risk of death from several common types of cancer (colorectal, esophageal, gastric, breast, prostate, and possibly lung). Nonsteroidal anti-inflammatory drugs may reduce the incidence of colorectal adenomas and polyps but may also increase heart disease and gastrointestinal bleeding, and thus are not recommended for colon cancer prevention in average-risk patients.

Antioxidant vitamin (vitamin E, vitamin C, and beta-carotene) supplementation produced no significant reductions in the 5-year incidence of—or mortality from—vascular disease, cancer, or other major outcomes in high-risk individuals with coronary artery disease, other occlusive arterial disease, or diabetes mellitus.

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PREVENTION OF OSTEOPOROSIS

See Chapter 26.

Osteoporosis, characterized by low bone mineral density, is common and associated with an increased risk of fracture. The lifetime risk of an osteoporotic fracture is approximately 50% for women and 30% for men. Osteoporotic fractures can cause significant pain and disability. As such, research has focused on means of preventing osteoporosis and related fractures. Primary prevention strategies include calcium supplementation, vitamin D supplementation, and exercise programs. The effectiveness of calcium and vitamin D for fracture prevention remain controversial, particularly in noninstitutionalized individuals.

Screening for osteoporosis on the basis of low bone mineral density is recommended for women over age 65, based on indirect evidence that screening can identify women with low bone mineral density and that treatment of women with low bone density with bisphosphonates is effective in reducing fractures. However, real-world adherence to pharmacologic therapy for osteoporosis is low: one-third to one-half of patients do not take their medication as directed. The effectiveness of screening for osteoporosis in younger women and in men has not been established. Concern has been raised that bisphosphonates may increase the risk of certain uncommon atypical types of femoral fractures and rare osteonecrosis of the jaw, making consideration of the benefits and risks of therapy important when considering osteoporosis screening.

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PREVENTION OF PHYSICAL INACTIVITY

Lack of sufficient physical activity is the second most important contributor to preventable deaths, trailing only tobacco use. A sedentary lifestyle has been linked to 28% of deaths from leading chronic diseases. Sedentary behavior and physical inactivity have also been linked to decreases in midlife cognition. Worldwide, approximately 30% of adults are physically inactive. Inactivity rates are higher in women, in those from high-income countries (such as the Americas), and in aged individuals. Alarmingly, among

teens aged 13–15, 80% report doing fewer than 60 minutes of physical activity of moderate to vigorous intensity per day; boys are more active than girls.

The US Department of Health and Human Services and the CDC recommend that adults (including older adults) engage in 150 minutes of moderate-intensity (such as brisk walking) or 75 minutes of vigorous-intensity (such as jogging or running) aerobic activity or an equivalent mix of moderate- and vigorous-intensity aerobic activity each week. In addition to activity recommendations, the CDC recommends activities to strengthen all major muscle groups (abdomen, arms, back, chest, hips, legs, and shoulders) at least twice a week.

Patients who engage in regular moderate to vigorous exercise have a lower risk of myocardial infarction, stroke, hypertension, hyperlipidemia, type 2 diabetes mellitus, diverticular disease, and osteoporosis. Evidence supports the recommended guidelines of 30 minutes of moderate physical activity on most days of the week in both the primary and secondary prevention of CHD.

In longitudinal cohort studies, individuals who report higher levels of leisure-time physical activity are less likely to gain weight. Conversely, individuals who are overweight are less likely to stay active. However, at least 60 minutes of daily moderate-intensity physical activity may be necessary to maximize weight loss and prevent significant weight regain. Moreover, adequate levels of physical activity appear to be important for the prevention of weight gain and the development of obesity. Physical activity also appears to have an independent effect on health-related outcomes, such as development of type 2 diabetes mellitus in patients with impaired glucose tolerance when compared with body weight, suggesting that adequate levels of activity may counteract the negative influence of body weight on health outcomes.

Physical activity can be incorporated into any person's daily routine. For example, the clinician can advise a patient to take the stairs instead of the elevator, to walk or bike instead of driving, to do housework or yard work, to get off the bus one or two stops earlier and walk the rest of the way, to park at the far end of the parking lot, or to walk during the lunch hour. The basic message should be the more the better, and anything is better than nothing.

To be more effective in counseling about exercise, clinicians can also incorporate motivational interviewing techniques, adopt a whole-practice approach (eg, use practice nurses to assist), and establish linkages with community agencies. Clinicians can incorporate the "5 As" approach:

1. Ask (identify those who can benefit).
2. Assess (current activity level).
3. Advise (individualize plan).
4. Assist (provide a written exercise prescription and support material).
5. Arrange (appropriate referral and follow-up).

Such interventions have a moderate effect on self-reported physical activity and cardiorespiratory fitness, even if they do not always help patients achieve a predetermined level of physical activity. In their counseling, clinicians should advise patients about both the benefits and risks of exercise, prescribe an exercise program appropriate for each patient, and provide advice to help prevent injuries and cardiovascular complications.

Although primary care providers regularly ask patients about physical activity and advise them with verbal counseling, few providers provide written prescriptions or perform fitness assessments. Tailored interventions may potentially help increase physical activity in individuals. Exercise counseling with a prescription, eg, for walking at either a hard intensity or a moderate intensity with a high frequency, can produce significant long-term improvements in cardiorespiratory fitness. To be effective, exercise prescriptions must include recommendations on type, frequency, intensity, time, and progression of exercise and must follow disease-specific guidelines. Several factors influence physical activity behavior, including personal, social (eg, family and work), and environmental (eg, access to exercise facilities and well-lit parks). Walkable neighborhoods around workplaces support physical activity such as walking and bicycling. A community-based volunteer intervention resulted in increased walking activity among older women, who were at elevated risk for both inactivity and adverse health outcomes.

Broad-based interventions targeting various factors are often the most successful, and interventions to promote physical activity are more effective when health agencies work with community partners, such as schools, businesses, and health care organizations. Enhanced community awareness through mass media campaigns, school-based strategies, and policy approaches are proven strategies to increase physical activity.

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PREVENTION OF OVERWEIGHT & OBESITY

Obesity is now a true epidemic and public health crisis that both clinicians and patients must face. Normal body weight is defined as a body mass index (BMI), calculated as the weight in kilograms divided by the height in meters squared, of less than 25; overweight is defined as a BMI = 25.0–29.9, and obesity as a BMI greater than 30. Between 1980 and 2013, there was an 8% increase worldwide in the proportion of men and women with a BMI greater than 25. The most recent national data reveal that one-third of adults in the United States are obese, and prevalence rates are higher in blacks and Hispanics compared to

non-Hispanic whites. This trend has been linked both to declines in physical activity and to increased caloric intake.

Risk assessment of the overweight and obese patient begins with determination of BMI, waist circumference for those with a BMI of 35 or less, presence of comorbid conditions, and a fasting blood glucose and lipid panel. Obesity is clearly associated with type 2 diabetes mellitus, hypertension, hyperlipidemia, cancer, osteoarthritis, cardiovascular disease, obstructive sleep apnea, and asthma. In addition, almost one-quarter of the US population currently has the metabolic syndrome.

Metabolic syndrome is defined as the presence of any three of the following: waist measurement of 40 inches or more for men and 35 inches or more for women, triglyceride levels of 150 mg/dL (1.70 mmol/L) or above, HDL cholesterol level less than 40 mg/dL (less than 1.44 mmol/L) for men and less than 50 mg/dL (less than 1.80 mmol/L) for women, blood pressure of 130/85 mm Hg or above, and fasting blood glucose levels of 100 mg/dL (5.55 mmol/L) or above. The relationship between overweight and obesity and diabetes, hypertension, and coronary artery disease is thought to be due to insulin resistance and compensatory hyperinsulinemia.

Obesity is associated with a higher all-cause mortality rate. Data suggest an increase among those with grades 2 and 3 obesity (BMI more than 35); however, the impact on all-cause mortality among overweight (BMI 25–30) and grade 1 obesity (BMI 30–35) is questionable. Persons with a BMI 40 or higher have death rates from cancers that are 52% higher for men and 62% higher for women than the rates in men and women of normal weight. Significant trends of increasing risk of death with higher BMIs are observed for cancers of the stomach and prostate in men and for cancers of the breast, uterus, cervix, and ovary in women, and for cancers of the esophagus, colon and rectum, liver, gallbladder, pancreas, and kidney, non-Hodgkin lymphoma, and plasma cell myeloma (previously called multiple myeloma) in both men and women.

In the Framingham Heart Study, overweight and obesity were associated with large decreases in life expectancy. For example, 40-year-old female nonsmokers lost 3.3 years and 40-year-old male nonsmokers lost 3.1 years of life expectancy because of overweight, and 7.1 years and 5.8 years of life expectancy, respectively, because of obesity. Obese female smokers lost 7.2 years and obese male smokers lost 6.7 years of life expectancy compared with normal-weight smokers, and 13.3 years and 13.7 years, respectively, compared with normal-weight nonsmokers.

Prevention of overweight and obesity involves both increasing physical activity and dietary modification to reduce caloric intake. Adequate levels of physical activity appear to be important for the prevention of weight gain and the development of obesity. Physical activity programs consistent with public health recommendations may promote modest weight loss (~2 kg); however, the amount of weight loss for any one individual is highly variable. Only 49% of Americans are physically active at a moderate level and 20% at a more vigorous level. In addition, only 3% of Americans meet four of the five USDA recommendations for the intake of grains, fruits, vegetables, dairy products, and meat. Only one of four Americans eats the recommended five or more fruits and vegetables per day.

Clinicians can help guide patients to develop personalized eating plans to reduce energy intake, particularly by recognizing the contributions of fat, concentrated carbohydrates, and large portion sizes (see Chapter 29). Patients typically underestimate caloric content, especially when consuming food away from home. Providing patients with caloric and nutritional information may help address the current obesity epidemic. To prevent the long-term chronic disease sequelae of overweight and obesity, clinicians must work with patients to modify other risk factors, eg, by smoking cessation (see above) and strict blood pressure and glycemic control (see Chapters 11 and 27).

Lifestyle modification, including diet, physical activity, and behavior therapy, has been shown to induce clinically significant weight loss. Other treatment options for obesity include pharmacotherapy and surgery (see Chapter 29). In overweight and obese persons, at least 60 minutes of moderate- to high-intensity physical activity per day may be necessary to maximize weight loss and prevent significant weight regain. Counseling interventions or pharmacotherapy can produce modest (3–5 kg) sustained weight loss over 6–12 months. Counseling appears to be most effective when intensive and combined with behavioral therapy. Pharmacotherapy appears safe in the short term; long-term safety is still not established. Lorcaserin, a selective 5-hydroxytryptamine 2C (5-HT_{2C}) agonist, has been shown to reduce body weight through a reduction of energy intake without influencing energy expenditure. It was approved by the FDA for adults with a BMI 30 or higher or adults with a BMI 27 or higher who have at least one obesity-related condition, such as hypertension, type 2 diabetes mellitus, or hypercholesterolemia.

Commercial weight loss programs are effective in promoting weight loss and weight loss management. A randomized controlled trial of over 400 overweight or obese women demonstrated the effectiveness of a free prepared meal and incentivized structured weight loss program compared with usual care.

Weight loss strategies using dietary, physical activity, or behavioral interventions can produce significant improvements in weight among persons with prediabetes and a significant decrease in diabetes incidence. Lifestyle interventions including diet combined with physical activity are effective in achieving weight loss and reducing cardiometabolic risk factors among patients with severe obesity.

Bariatric surgical procedures, eg, adjustable gastric band, sleeve gastrectomy, and Roux-en-Y gastric bypass, are reserved for patients with morbid obesity whose BMI exceeds 40, or for less severely obese patients (with BMIs between 35 and 40) with high-risk comorbid conditions such as life-threatening cardiopulmonary problems (eg, severe sleep apnea, Pickwickian syndrome, and obesity-related cardiomyopathy) or severe diabetes mellitus. In selected patients, surgery can produce substantial weight loss (10 to 159 kg) over 1 to 5 years, with rare but sometimes severe complications. Nutritional deficiencies are one complication of bariatric surgical procedures and close monitoring of a patient's metabolic and nutritional status is essential.

Finally, clinicians seem to share a general perception that almost no one succeeds in long-term maintenance of weight loss. However, research demonstrates that approximately 20% of overweight individuals are successful at long-term weight loss (defined as losing 10% or more of initial body weight and maintaining the loss for 1 year or longer). National Weight Control Registry members who lost an average of 33 kg and maintained the loss for more than 5 years have provided useful information about how to maintain weight loss. Members report engaging in high levels of physical activity (approximately 60 min/day), eating a low-calorie, low-fat diet, eating breakfast regularly, self-monitoring weight, and maintaining a consistent eating pattern from weekdays to weekends.

Clinicians must work to identify and provide the best prevention and treatment strategies for patients who are overweight and obese. Clinician advice on weight loss can have a significant impact on patient attempts to adjust weight-related behaviors. Unfortunately, many clinicians are poorly prepared to address obesity. Clinician bias and lack of training in behavior-change strategies impair the care of obese patients. Strategies to address these issues should be incorporated into innovative treatment and care-delivery strategies.

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CANCER PREVENTION

Primary Prevention

Cancer mortality rates continue to decrease in the United States; part of this decrease results from reductions in tobacco use, since cigarette smoking is the most important preventable cause of cancer. Primary prevention of skin cancer consists of restricting exposure to ultraviolet light by wearing appropriate clothing and use of sunscreens. Persons who engage in regular physical exercise and avoid obesity have lower rates of breast and colon cancer. Prevention of occupationally induced cancers involves minimizing exposure to carcinogenic substances, such as asbestos, ionizing radiation, and benzene compounds. Chemoprevention has been widely studied for primary cancer prevention (see above Chemoprevention section and Chapter 39). Use of tamoxifen, raloxifene, and aromatase inhibitors for breast cancer prevention is discussed in Chapters 17 and 39. Hepatitis B vaccination can prevent hepatocellular carcinoma (HCC), and screening and vaccination programs may be cost effective and useful in preventing HCC in high-risk groups, such as Asians and Pacific Islanders. The use of HPV vaccine to prevent cervical and possibly anal cancer is discussed above. In addition to preventing anogenital cancers, HPV vaccines may have a role in the prevention of HPV-related head and neck cancers. Guidelines for optimal cancer screening in adults over the age of 75 are unsettled; thus, an individualized approach that considers differences in disease risk rather than chronological age is recommended.

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Screening & Early Detection

Screening prevents death from cancers of the breast, colon, and cervix. Current cancer screening recommendations from the USPSTF are shown in Table 1–6. Despite an increase in rates of screening for breast, cervical, and colon cancer over the last decade, overall screening for these cancers is suboptimal. Interventions effective in promoting recommended cancer screening include group education, one-on-one education, patient reminders, reduction of structural barriers, reduction of out-of-pocket costs, and provider assessment and feedback.

Evidence from randomized trials suggests that screening mammography has both benefits and downsides. A 2011 Cochrane review estimated that screening with mammography led to a reduction in breast cancer mortality of 15% but resulted in 30% overdiagnosis and overtreatment. Currently, the appropriate form and frequency of screening for breast cancer remains controversial, and screening guidelines vary. Clinicians should discuss the risks and benefits with each patient and consider individual patient preferences when deciding when to begin screening (see Chapters 17 and e6).

Table 1–6. Cancer screening recommendations for average-risk adults: US Preventive Services Task Force (USPSTF).[1]

Test	USPSTF Recommendation/[Year Issued]
Breast self-examination	Recommends against teaching breast self-examination. (D) [2009]
Clinical breast examination	Insufficient evidence to recommend for or against clinical breast examination. (I) [2009]
Mammography	Recommends biennial screening mammography for women aged 50–74 years. (B) The decision to start screening mammography in women prior to age 50 years should be an individual one. Women who place a higher value on the potential benefit than the potential harms may choose to begin biennial screening between the ages of 40 and 49 years. (C) [2016]
Cervical cancer screening	Recommends screening for cervical cancer in women aged 21–65 years with cytology (Pap smear) every 3 years or, for women aged 30–65 years who want to lengthen the screening interval, screening with a combination of cytology and human papillomavirus (HPV) testing every 5 years. (A) Recommends against screening for cervical cancer in women younger than 21 years. (D) Recommends against screening for cervical cancer in women older than 65 years who have had adequate prior screening and are not otherwise at high risk for cervical cancer. (D) Recommends against screening for cervical cancer in women who have had a hysterectomy with removal of the cervix and who do not have a history of a high-grade precancerous lesion (ie, cervical intraepithelial neoplasia [CIN] grade 2 or 3) or cervical cancer. (D) [2017]
Colorectal cancer (CRC) screening	Recommends screening for CRC starting at age 50 years and continuing until age 75 years. (A) The decision to screen for CRC in adults aged 76–85 years should be an individual one, taking into account the patient's overall health and prior screening history. (C) [2016]
Characteristics of colorectal cancer screening strategies	Reviews the following tests: fecal occult blood tests (gFOBT, FIT) every year; FIT-DNA every 1 or 3 years; colonoscopy every 10 years; CT colonography every 5 years; flexible sigmoidoscopy every 5 years; flexible sigmoidoscopy every 10 years plus FIT every 1 year.
Lung cancer screening	Recommends annual lung cancer screening using low-dose CT in current smokers aged 55–80 years with a 30-pack-year smoking history, or in smokers who quit within the past 15 years. (B) Recommends stopping screening once a person has not smoked for 15 years or a health problem that significantly limits life expectancy has developed. [2013]
Prostate cancer screening	Recommends that clinicians inform men ages 55–69 years about the potential benefits and harms of prostate-specific antigen (PSA)–based screening for prostate cancer. (C) Recommends against prostate specific antigen PSA–based screening for prostate cancer in men age 70 years and older. (D) [2017]
Testicular cancer screening	Recommends against screening for testicular cancer in adolescent or adult males. [2011]

[1]United States Preventive Services Task Force recommendations available at http://www.uspreventiveservicestaskforce.org/BrowseRec/Index/browse-recommendations.

Recommendation A: The USPSTF strongly recommends that clinicians routinely provide the service to eligible patients. (The USPSTF found good evidence that the service improves important health outcomes and concludes that benefits substantially outweigh harms.)

Recommendation B: The USPSTF recommends that clinicians routinely provide the service to eligible patients. (The USPSTF found at least fair evidence that the service improves important health outcomes and concludes that benefits substantially outweigh harms.)

Recommendation C: The USPSTF recommends against routinely providing the service. There may be considerations that support providing the service in an individual patient. There is at least moderate certainty that the net benefit is small.

Recommendation D: The USPSTF recommends against routinely providing the service to asymptomatic patients. (The USPSTF found at least fair evidence that the service is ineffective or that harms outweigh benefits.)

Recommendation I: The USPSTF concludes that the evidence is insufficient to recommend for or against routinely providing the service. http://www.uspreventiveservicestaskforce.org/BrowseRec/Index/browse-recommendations

Digital mammography is more sensitive in women with dense breasts and younger women; however, studies exploring outcomes are lacking. MRI is not currently recommended for general screening, and its impact on breast cancer mortality is uncertain; nevertheless, the American Cancer Society recommends it for women at high risk (20–25% or more), including those with a strong family history of breast or ovarian cancer. Screening with both MRI and mammography might be superior to mammography alone in ruling out cancerous lesions in women with an inherited predisposition to breast cancer.

All current recommendations call for cervical and colorectal cancer screening. Screening for testicular cancers among asymptomatic adolescent or adult males is not recommended by the USPSTF. Prostate cancer screening remains controversial, since no completed trials have answered the question of whether early detection and treatment after screen detection produce sufficient benefits to outweigh harms of treatment. A 2013 Cochrane systematic review revealed that prostate cancer screening with PSA testing did not decrease all-cause mortality and may not decrease prostate cancer–specific mortality. Any benefits in terms of reduction in prostate cancer–related mortality would take more than 10 years to become evident. Men with less than 10–15 years' life expectancy should be informed that screening for prostate cancer is unlikely to be beneficial. In 2017, the USPSTF recommended against PSA-based prostate cancer screening for men older than age 70 years (grade D recommendation).

Annual or biennial fecal occult blood testing reduces mortality from colorectal cancer by 16–33%. Fecal immunochemical tests (FIT) are superior to guaiac-based fecal occult blood tests (gFOBT) in detecting advanced adenomatous polyps and colorectal cancer, and patients are more likely to favor FIT over gFOBT. Randomized trials using sigmoidoscopy as the screening method found 20–30% reductions in mortality from colorectal cancer. Colonoscopy has also been advocated as a screening examination. It is more accurate than flexible sigmoidoscopy for detecting cancer and polyps, but its value in reducing colon cancer mortality has not been studied directly. CT colonography (virtual colonoscopy) is a noninvasive option in screening for colorectal cancer. It has been shown to have a high safety profile and performance similar to colonoscopy. The American College of Physicians (ACP) recommends clinicians stop screening for colorectal cancer in individuals over the age of 75 years or with a life expectancy of less than 10 years. The USPSTF recommends screening for colorectal cancer starting at age 50 years and continuing until age 75 years (grade A recommendation) but says that the decision to screen for colorectal cancer in adults aged 76–85 years should be an individual one, taking into account the patient's overall health and prior screening history (grade C recommendation).

The USPSTF recommends screening for cervical cancer in women aged 21–65 years with a Papanicolaou smear (cytology) every 3 years or, for women aged 30–65 years who desire longer intervals, screening with cytology and HPV testing every 5 years. The USPSTF recommends against screening in women younger than 21 years of age and average-risk women over 65 with adequate negative prior screenings. Receipt of HPV vaccination has no impact on screening intervals.

In 2012, the American Cancer Society, the American Society for Colposcopy and Cervical Pathology, and the American Society for Clinical Pathology published updated guidelines for management of abnormal results. Women whose cervical specimen HPV tests are positive but cytology results are otherwise negative should repeat co-testing in 12 months (option 1) or undergo HPV-genotype–specific testing for types 16 or 16/18 (option 2). Colposcopy is recommended in women who test positive for types 16 or 16/18. Women with atypical squamous cells of undetermined significance (ASCUS) on cytology and a negative HPV test result should continue routine screening as per age-specific guidelines.

In a randomized, controlled trial, transvaginal ultrasound combined with serum cancer antigen 125 (CA-125) as screening tools to detect ovarian cancer did not reduce mortality. Furthermore, complications were associated with diagnostic evaluations to follow up false-positive screening test results. Thus, screening for ovarian cancer with transvaginal ultrasound and CA-125 is not recommended.

Evidence suggests that chest CT is significantly more sensitive than chest radiography in identifying small asymptomatic lung cancers; however, controversy exists regarding the efficacy and cost-effectiveness of low-dose CT screening in high-risk individuals. In the United States, the National Lung Screening Trial (NLST), a randomized clinical trial of over 53,000 individuals at high risk for lung cancer, revealed a 20% relative reduction and 6.7% absolute reduction in lung cancer mortality in those who were screened with annual low-dose CTs for 3 years compared with those who had chest radiographs. There were a greater number of false-positive results in the low-dose CT group compared with those in the radiography group (23.3% vs 6.5%) (see Chapter 39). In Italy, the Multicentric Italian Lung Detection (MILD) study, a randomized trial of over 4000 participants comparing annual or biennial low-dose CT with observation revealed no evidence of a protective effect with annual or biennial low-dose CT screening.

The USPSTF recommends annual lung cancer screening with low-dose CT in current smokers aged 55 to 80 years with a 30-pack-year smoking history or smokers who quit within the past 15 years. Screening should stop once a person has not smoked for 15 years or a health problem that significantly limits life expectancy has developed. Screening should not be viewed as an alternative to smoking cessation.

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PREVENTION OF INJURIES & VIOLENCE

Injuries remain the most important cause of loss of potential years of life before age 65. Homicide and motor vehicle accidents are a major cause of injury-related deaths among young adults, and accidental falls are the most common cause of injury-related death in older adults. Approximately one-third of all injury deaths include a diagnosis of traumatic brain injury. Other causes of injury-related deaths include suicide and accidental exposure to smoke, fire, and flames.

Although motor vehicle accident deaths per miles driven have declined in the United States, there has been an increase in motor vehicle accidents related to distracted driving (using a cell phone, texting, eating). Evidence also suggests that motorists' use of sleeping medications (such as zolpidem) almost doubles the risk of motor vehicle accidents. Clinicians should discuss this risk when selecting a sleeping medication. For 16- and 17-year-old drivers, the risk of fatal crashes increases with the number of passengers.

Each year in the United States, more than 500,000 people are nonfatally injured while riding bicycles. The rate of helmet use by bicyclists and motorcyclists is significantly increased in states with helmet laws. Young men appear most likely to resist wearing helmets.

Males aged 16–35 are at especially high risk for serious injury and death from accidents and violence, with blacks and Latinos at greatest risk. Deaths from firearms have reached epidemic levels in the United States. In 2015, a total of 13,286 people were killed in the United States in a gun homicide, unintentional shooting, or murder/suicide. Having a gun in the home increases the likelihood of homicide nearly threefold and of suicide fivefold. Educating clinicians to recognize and treat depression as well as restricting access to lethal methods have been found to reduce suicide rates.

In addition, clinicians should try to educate their patients about always wearing seat belts and safety helmets, about the risks of using cellular telephones or texting while driving, of drinking and driving—or of using other intoxicants (including marijuana) or long-acting benzodiazepines and then driving—and about the risks of having guns in the home.

Clinicians have a critical role in the detection, prevention, and management of intimate partner violence (see Chapter e6.). The USPSTF recommends screening women of childbearing age for intimate partner violence and providing or referring women to intervention services when needed. Inclusion of a single question in the medical history—"At any time, has a partner ever hit you, kicked you, or otherwise physically hurt you?"—can increase identification of this common problem. Assessment for abuse and offering of referrals to community resources create the potential to interrupt and prevent recurrence of domestic violence and associated trauma. Clinicians should take an active role in following up with patients whenever possible, since intimate partner violence screening with passive referrals to services may not be adequate. Evaluation of services available to patients after identification of intimate partner violence should be a priority.

Physical and psychological abuse, exploitation, and neglect of older adults are serious, underrecognized problems; they may occur in up to 10% of elders. Risk factors for elder abuse include a culture of violence in the family; a demented, debilitated, or depressed and socially isolated victim; and a perpetrator profile of mental illness, alcohol or drug abuse, or emotional and/or financial dependence on the victim. Clues to elder mistreatment include the patient's ill-kempt appearance, recurrent urgent-care visits, missed appointments, suspicious physical findings, and implausible explanations for injuries.

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PREVENTION OF SUBSTANCE ABUSE: ALCOHOL & ILLICIT DRUGS

Substance abuse is a major public health problem in the United States, where approximately 51% of adults 18 years and older are current regular drinkers (at least 12 drinks in the past year). Maximum recommended consumption for adult women and those older than 65 years is three or fewer drinks per day (seven per week), and for adult men, four or fewer drinks per day (14 per week). The spectrum of alcohol misuse includes risky drinking (alcohol consumption above the recommended daily, weekly, or per-occasion amounts), harmful use (a pattern causing damage to health), alcohol abuse (a pattern leading to clinically significant impairment or distress), and alcohol dependence (defined as three or more of the following: tolerance, withdrawal, increased consumption, desire to cut down use, giving up social activities, increased time using alcohol or recovering from use, continued use despite known adverse effects). Underdiagnosis and under-treatment of alcohol misuse is substantial, both because of patient denial and lack of detection of clinical clues. Treatment rates for alcohol dependence have slightly declined over the last several years. Only a quarter of alcohol-dependent patients have ever been treated.

As with cigarette use, clinician identification and counseling about alcohol misuse is essential. An estimated 15–30% of hospitalized patients have problems with alcohol abuse or dependence, but the connection between patients' presenting complaints and their alcohol use is often missed. The USPSTF recommends screening adults aged 18 years and older for alcohol misuse.

The Alcohol Use Disorder Identification Test (AUDIT) consists of questions on the quantity and frequency of alcohol consumption, on alcohol dependence symptoms, and on alcohol-related problems (Table 1–7). The AUDIT questionnaire is a cost-effective and efficient diagnostic tool for routine screening of alcohol use disorders in primary care settings. Brief advice and counseling without regular follow-up and reinforcement cannot sustain significant long-term reductions in unhealthy drinking behaviors.

Time restraints may prevent clinicians from using the AUDIT to screen patients, but single-question screening tests for unhealthy alcohol use may help increase the frequency of subsequent AUDIT screening in primary care settings. The National Institute on Alcohol Abuse and Alcoholism recommends the following single-question screening test (validated in primary care settings): "How many times in the past year have you had X or more drinks

Table 1–7. Screening for alcohol abuse using the Alcohol Use Disorder Identification Test (AUDIT).

(Scores for response categories are given in parentheses. Scores range from 0 to 40, with a cutoff score of 5 or more indicating hazardous drinking, harmful drinking, or alcohol dependence.)				
1. How often do you have a drink containing alcohol?				
(0) Never	(1) Monthly or less	(2) Two to four times a month	(3) Two or three times a week	(4) Four or more times a week
2. How many drinks containing alcohol do you have on a typical day when you are drinking?				
(0) 1 or 2	(1) 3 or 4	(2) 5 or 6	(3) 7 to 9	(4) 10 or more
3. How often do you have six or more drinks on one occasion?				
(0) Never	(1) Less than monthly	(2) Monthly	(3) Weekly	(4) Daily or almost daily
4. How often during the past year have you found that you were not able to stop drinking once you had started?				
(0) Never	(1) Less than monthly	(2) Monthly	(3) Weekly	(4) Daily or almost daily
5. How often during the past year have you failed to do what was normally expected of you because of drinking?				
(0) Never	(1) Less than monthly	(2) Monthly	(3) Weekly	(4) Daily or almost daily
6. How often during the past year have you needed a first drink in the morning to get yourself going after a heavy drinking session?				
(0) Never	(1) Less than monthly	(2) Monthly	(3) Weekly	(4) Daily or almost daily
7. How often during the past year have you had a feeling of guilt or remorse after drinking?				
(0) Never	(1) Less than monthly	(2) Monthly	(3) Weekly	(4) Daily or almost daily
8. How often during the past year have you been unable to remember what happened the night before because you had been drinking?				
(0) Never	(1) Less than monthly	(2) Monthly	(3) Weekly	(4) Daily or almost daily
9. Have you or has someone else been injured as a result of your drinking?				
(0) No		(2) Yes, but not in the past year		(4) Yes, during the past year
10. Has a relative or friend or a doctor or other health worker been concerned about your drinking or suggested you cut down?				
(0) No		(2) Yes, but not in the past year		(4) Yes, during the past year

Adapted, with permission, from BMJ Publishing Group Ltd. and Piccinelli M et al. Efficacy of the alcohol use disorders identification test as a screening tool for hazardous alcohol intake and related disorders in primary care: a validity study. BMJ. 1997 Feb 8;314(7078):420–4.

in a day?" (X is 5 for men and 4 for women, and a response of more than 1 time is considered positive.)

Clinicians should provide those who screen positive for hazardous or risky drinking with brief behavioral counseling interventions to reduce alcohol misuse. Use of screening procedures and brief intervention methods (see Chapter 25) can produce a 10–30% reduction in long-term alcohol use and alcohol-related problems.

Several pharmacologic agents are effective in reducing alcohol consumption. In acute alcohol detoxification, long-acting benzodiazepines are preferred because they can be given on a fixed schedule or through "front-loading" or "symptom-triggered" regimens. Adjuvant sympatholytic medications can be used to treat hyperadrenergic symptoms that persist despite adequate sedation. Three drugs are FDA approved for treatment of alcohol dependence: disulfiram, naltrexone, and acamprosate. Disulfiram, an aversive agent, has significant adverse effects and consequently, compliance difficulties have resulted in no clear evidence that it increases abstinence rates, decreases relapse rates, or reduces cravings. Compared with placebo, naltrexone can lower the risk of treatment withdrawal in alcohol-dependent patients, and the long-acting intramuscular formulation of naltrexone has been found to be well tolerated and to reduce drinking significantly among treatment-seeking alcoholics over a 6-month period. In a randomized, controlled trial, patients receiving medical management with naltrexone, a combined behavioral intervention, or both, fared better on drinking outcomes, whereas acamprosate showed no evidence of efficacy with or without combined behavioral intervention. Persons who receive short-term treatment with naltrexone have a lower chance of alcoholism relapse. Topiramate is a promising treatment for alcohol dependence. A 6-month randomized trial of topiramate versus naltrexone revealed a greater reduction of alcohol intake and cravings in participants receiving topiramate. Topiramate's side effect profile is favorable, and its benefits appear to increase over time. Clinicians should be aware that although topiramate appears to be an effective treatment for alcohol dependence, the manufacturer has not pursued FDA approval for this indication.

Over the last decade, the rate of prescription drug abuse has increased dramatically, particularly at both ends of the age spectrum. The most commonly abused classes of medications are pain relievers, tranquilizers, stimulants, and sedatives. Opioid-based prescription drug abuse, misuse, and overdose has reached epidemic proportions in the United States. Deaths due to prescription opioid overdose have dramatically increased. Opioid risk mitigation strategies include use of risk assessment tools, treatment agreements (contracts), and urine drug testing. Additional strategies include establishing and strengthening prescription drug monitoring programs, regulating pain management facilities, and establishing dosage thresholds requiring consultation with pain specialists. The FDA supports greater access to naloxone and is currently exploring options to make naloxone more available to treat opioid overdose. (See Chapter 5.)

Use of illegal drugs—including cocaine, methamphetamine, and so-called designer drugs—either sporadically or episodically remains an important problem. Lifetime prevalence of drug abuse is approximately 8% and is generally greater among men, young and unmarried individuals, Native Americans, and those of lower socioeconomic status. As with alcohol, drug abuse disorders often coexist with personality, anxiety, and other substance abuse disorders. Abuse of anabolic-androgenic steroids has been associated with use of other illicit drugs, alcohol, and cigarettes and with violence and criminal behavior.

As with alcohol abuse, the lifetime treatment rate for drug abuse is low (8%). The recognition of drug abuse presents special problems and requires that the clinician actively consider the diagnosis. Clinical aspects of substance abuse are discussed in Chapter 25.

Buprenorphine has potential as a medication to ameliorate the symptoms and signs of withdrawal from opioids and has been shown to be effective in reducing concomitant cocaine and opioid abuse. The risk of overdose is lower with buprenorphine than methadone and it is preferred for patients at high risk for methadone toxicity (see Chapter 5). Rapid opioid detoxification with opioid antagonist induction using general anesthesia has emerged as an approach to treat opioid dependence. However, a randomized comparison of buprenorphine-assisted rapid opioid detoxification with naltrexone induction and clonidine-assisted opioid detoxification with delayed naltrexone induction found no significant differences in rates of completion of inpatient detoxification, treatment retention, or proportions of opioid-positive urine specimens, and the anesthesia procedure was associated with more potentially life-threatening adverse events. Finally, cognitive-behavior therapy, contingency management, couples, and family therapy, and other types of behavioral treatment have been shown to be effective interventions for drug addiction.

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2 Common Symptoms

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COUGH

ESSENTIAL INQUIRIES

- Age, tobacco or cannabis use, occupational history, environmental exposures, and duration of cough.
- Dyspnea (at rest or with exertion).
- Vital signs (heart rate, respiratory rate, body temperature).
- Chest examination.
- Chest radiography when unexplained cough lasts more than 3–6 weeks.

General Considerations

Cough is the most common symptom for which patients seek medical attention. Cough adversely affects personal and work-related interactions, disrupts sleep, and often causes discomfort of the throat and chest wall. Most people seeking medical attention for acute cough desire symptom relief; few are worried about serious illness. Cough results from stimulation of mechanical or chemical afferent nerve receptors in the bronchial tree. Effective cough depends on an intact afferent–efferent reflex arc, adequate expiratory and chest wall muscle strength, and normal mucociliary production and clearance.

Clinical Findings

A. Symptoms

Distinguishing **acute** (less than 3 weeks), **persistent** (3–8 weeks), and **chronic** (more than 8 weeks) cough illness syndromes is a useful first step in evaluation. Postinfectious cough lasting 3–8 weeks has also been referred to as **subacute** cough to distinguish this common, distinct clinical entity from acute and chronic cough.

1. Acute cough—In healthy adults, most acute cough syndromes are due to viral respiratory tract infections. Additional features of infection such as fever, nasal congestion, and sore throat help confirm this diagnosis. Dyspnea (at rest or with exertion) may reflect a more serious condition, and further evaluation should include assessment of oxygenation (pulse oximetry or arterial blood gas measurement), airflow (peak flow or spirometry), and pulmonary parenchymal disease (chest radiography). The timing and character of the cough are not very useful in establishing the cause of acute cough syndromes, although cough-variant asthma should be considered in adults with prominent nocturnal cough, and persistent cough with phlegm increases the likelihood of chronic obstructive pulmonary disease (COPD). The presence of posttussive emesis or inspiratory whoop in adults modestly increases the likelihood of pertussis, and the absence of paroxysmal cough and the presence of fever decreases its likelihood. Uncommon causes of acute cough should be suspected in those with heart disease (heart failure) or hay fever (allergic rhinitis) and those with occupational risk factors (such as farmworkers).

2. Persistent and chronic cough—Cough due to acute respiratory tract infection resolves within 3 weeks in the vast majority (more than 90%) of patients. Pertussis should be considered in adolescents and adults with persistent or severe cough lasting more than 3 weeks, and in selected geographic areas where its prevalence approaches 20% (although its exact prevalence is difficult to ascertain due to the limited sensitivity of diagnostic tests).

When angiotensin-converting enzyme (ACE) inhibitor therapy, acute respiratory tract infection, and chest radiograph abnormalities are absent, most cases of persistent and chronic cough are due to (or exacerbated by) postnasal drip (upper airway cough syndrome), asthma, or gastroesophageal reflux disease (GERD), or some combination of these three entities. Approximately 10% of cases are caused by nonasthmatic eosinophilic bronchitis. A history of nasal or sinus congestion, wheezing, or heartburn should direct subsequent evaluation and treatment, though these conditions frequently cause persistent cough in the absence of typical symptoms. Dyspnea at rest or with exertion is not commonly reported among patients with persistent cough; dyspnea requires assessment for chronic lung disease, HF, anemia, pulmonary embolism, or pulmonary hypertension.

Bronchogenic carcinoma is suspected when cough is accompanied by unexplained weight loss, hemoptysis, and fevers with night sweats, particularly in persons with significant tobacco or occupational exposures (asbestos, radon, diesel exhaust, and metals). Persistent and chronic cough accompanied by excessive mucus secretions increases the likelihood of COPD, particularly among smokers, or of bronchiectasis if accompanied by a history of recurrent or complicated pneumonia; chest radiographs are helpful in diagnosis.

B. Physical Examination

Examination can direct subsequent diagnostic testing for acute cough. Pneumonia is suspected when acute cough is accompanied by vital sign abnormalities (tachycardia, tachypnea, fever). Findings suggestive of airspace consolidation (rales, decreased breath sounds, fremitus, egophony) are significant predictors of community-acquired pneumonia but are present in the minority of cases. Purulent sputum is associated with bacterial infections in patients with structural lung disease (eg, COPD, cystic fibrosis), but it is a poor predictor of pneumonia in the otherwise healthy adult. Wheezing and rhonchi are frequent findings in adults with acute bronchitis and do not indicate consolidation or adult-onset asthma in most cases.

Examination of patients with persistent cough should look for evidence of chronic sinusitis, contributing to postnasal drip syndrome or asthma. Chest and cardiac signs may help distinguish COPD from HF. In patients with cough and dyspnea, a normal match test (ability to blow out a match from 25 cm away) and maximum laryngeal height greater than 4 cm (measured from the sternal notch to the cricoid cartilage at end expiration) substantially decrease the likelihood of COPD. Similarly, normal jugular venous pressure and no hepatojugular reflux decrease the likelihood of biventricular HF.

C. Diagnostic Studies

1. Acute cough—Chest radiography should be considered for any adult with acute cough whose vital signs are abnormal or whose chest examination suggests pneumonia. The relationship between specific clinical findings and the probability of pneumonia is shown in Table 2–1. A large, multicenter randomized clinical trial found that elevated serum C-reactive protein (levels greater than 30 mg/dL) improves diagnostic accuracy of clinical prediction rules for pneumonia in adults with acute cough; procalcitonin added no clinically relevant information. A meta-analysis found that lung ultrasonography had better accuracy than chest radiography for the diagnosis of adult community-acquired pneumonia. Lung ultrasonography had a pooled sensitivity of 0.95 (95% confidence interval [CI], 0.93–0.97) and a specificity of 0.90 (95% CI, 0.86–0.94). Chest radiography had a pooled sensitivity of 0.77 (95% CI, 0.73–0.80) and a specificity of 0.91 (95% CI, 0.87–0.94). In patients with dyspnea, pulse oximetry and peak flow help exclude hypoxemia or obstructive airway disease. However, a normal pulse oximetry value (eg, greater than 93%) does not rule out a significant alveolar–arterial (A–a) gradient when patients have effective respiratory compensation. During documented outbreaks, clinical diagnosis of influenza has a positive predictive value of ~70%; this usually obviates the need for rapid diagnostic tests.

Table 2–1. Positive and negative likelihood ratios for history, physical examination, and laboratory findings in the diagnosis of pneumonia.

Finding	Positive Likelihood Ratio	Negative Likelihood Ratio
Medical history		
Fever	1.7–2.1	0.6–0.7
Chills	1.3–1.7	0.7–0.9
Physical examination		
Tachypnea (RR > 25 breaths/min)	1.5–3.4	0.8
Tachycardia (> 100 beats/min in two studies or > 120 beats/min in one study)	1.6–2.3	0.5–0.7
Hyperthermia (> 37.8°C)	1.4–4.4	0.6–0.8
Chest examination		
Dullness to percussion	2.2–4.3	0.8–0.9
Decreased breath sounds	2.3–2.5	0.6–0.8
Crackles	1.6–2.7	0.6–0.9
Rhonchi	1.4–1.5	0.8–0.9
Egophony	2.0–8.6	0.8–1.0
Laboratory findings		
Leukocytosis (> 11×10^9/L in one study or ≥ 10.4×10^9/L in another study)	1.9–3.7	0.3–0.6

RR, respiratory rate.

2. Persistent and chronic cough—Chest radiography is indicated when ACE inhibitor therapy–related and postinfectious cough are excluded. If pertussis is suspected, polymerase chain reaction testing should be performed on a nasopharyngeal swab or nasal wash specimen—although the ability to detect pertussis decreases as the duration of cough increases. When the chest film is normal, postnasal drip, asthma, or GERD are the most likely causes. The presence of typical symptoms of these conditions directs further evaluation or empiric therapy, though typical symptoms are often absent. Definitive tests for determining the presence of each are available (Table 2–2). However, empiric treatment with a maximum-strength regimen for postnasal drip, asthma, or GERD for 2–4 weeks is one recommended approach since documenting the presence of postnasal drip, asthma, or GERD does not mean they are the cause of the cough. Alternative approaches to identifying patients who have asthma with its corticosteroid-responsive cough include examining induced sputum for increased eosinophil counts (greater than 3%) or providing an empiric trial of prednisone, 30 mg daily orally for 2 weeks. Spirometry may help identify large airway obstruction in

Table 2–2. Empiric treatments or tests for persistent cough.

Suspected Condition	Step 1 (Empiric Therapy)	Step 2 (Definitive Testing)
Postnasal drip	Therapy for allergy or chronic sinusitis	Sinus CT scan; ENT referral
Asthma	Beta-2-agonist	Spirometry; consider methacholine challenge if normal
GERD	Lifestyle and diet modifications with or without proton pump inhibitors	Esophageal pH monitoring

ENT, ear, nose, and throat; GERD, gastroesophageal reflux disease.

patients who have persistent cough and wheezing and who are not responding to asthma treatment. When empiric treatment trials are not successful, additional evaluation with pH manometry, endoscopy, barium swallow, sinus CT, or high-resolution chest CT may identify the cause.

Differential Diagnosis

A. Acute Cough

Acute cough may be a symptom of acute respiratory tract infection, asthma, allergic rhinitis, and HF, as well as many less common causes.

B. Persistent and Chronic Cough

Causes of persistent cough include environmental exposures (cigarette smoke, air pollution), occupational exposures, pertussis, postnasal drip, asthma (including cough-variant asthma), GERD, COPD, bronchiectasis, eosinophilic bronchitis, tuberculosis or other chronic infection, interstitial lung disease, and bronchogenic carcinoma. COPD is a common cause of persistent cough among patients older than 50 years. Persistent cough may also be due to somatic cough syndrome (previously called "psychogenic cough") or tic cough (previously called "habit cough").

Treatment

A. Acute Cough

Treatment of acute cough should target the underlying etiology of the illness, the cough reflex itself, and any additional factors that exacerbate the cough. Cough duration is typically 1–3 weeks, yet patients frequently expect cough to last fewer than 10 days. Limited studies on the use of dextromethorphan suggest a minor or modest benefit; dextromethorphan should be avoided in children and adolescents because of concerns about misuse.

When influenza is diagnosed (including H1N1 influenza), oral oseltamivir or zanamivir or intravenous peramivir are equally effective (1 less day of illness) when initiated within 30–48 hours of illness onset; treatment is recommended regardless of illness duration when patients have severe influenza requiring hospitalization. In *Chlamydophila*- or *Mycoplasma*-documented infection or outbreaks, first-line antibiotics include erythromycin or doxycycline. However, antibiotics do not improve cough severity or duration in patients with uncomplicated acute bronchitis. In patients with bronchitis and wheezing, inhaled beta-2-agonist therapy reduces severity and duration of cough. In patients with acute cough, treating the accompanying postnasal drip (with antihistamines, decongestants, or nasal corticosteroids) can be helpful. A Cochrane review (n = 163) found codeine to be no more effective than placebo in reducing cough symptoms.

B. Persistent and Chronic Cough

Evaluation and management of persistent cough often require multiple visits and therapeutic trials, which frequently lead to frustration, anger, and anxiety. When pertussis infection is suspected early in its course, treatment with a macrolide antibiotic (see Chapter 33) is appropriate to reduce organism shedding and transmission. When pertussis has lasted more than 7–10 days, antibiotic treatment does not affect the duration of cough, which can last up to 6 months. Early identification, revaccination with Tdap, and treatment of adult patients who work or live with persons at high risk for complications from pertussis (pregnant women, infants [particularly younger than 1 year], and immunosuppressed individuals) are encouraged.

Table 2–2 outlines empiric treatments for persistent cough. There is no evidence to guide how long to continue treatment for persistent cough due to postnasal drip, asthma, or GERD. Studies have not found a consistent benefit of inhaled corticosteroid therapy in adults with persistent cough. Eight weeks of thrice-weekly azithromycin did not improve cough in patients without asthma.

When empiric treatment trials fail, consider other causes of chronic cough such as obstructive sleep apnea, tonsillar or uvular enlargement, and environmental fungi. The small percentage of patients with idiopathic chronic cough should be managed in consultation with an otolaryngologist or a pulmonologist; consider a high-resolution CT scan of the lungs. Treatment options include nebulized lidocaine therapy and morphine sulfate, 5–10 mg orally twice daily. Sensory dysfunction of the laryngeal branches of the vagus nerve may contribute to persistent cough syndromes and may help explain the effectiveness of gabapentin in patients with chronic cough. Speech pathology therapy combined with pregabalin has some benefit in chronic refractory cough. In patients with reflex cough syndrome, therapy aimed at shifting the patient's attentional focus from internal stimuli to external focal points can be helpful. Proton pump inhibitors are not effective on their own; most benefit appears to come from lifestyle modifications and weight reduction.

When to Refer

- Failure to control persistent or chronic cough following empiric treatment trials.
- Patients with recurrent symptoms should be referred to an otolaryngologist, pulmonologist, or gastroenterologist.

When to Admit

- Patient at high risk for tuberculosis for whom compliance with respiratory precautions is uncertain.
- Need for urgent bronchoscopy, such as suspected foreign body.
- Smoke or toxic fume inhalational injury.
- Gas exchanged is impaired by cough.
- Patients at high risk for barotrauma (eg, recent pneumothorax).

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DYSPNEA

ESSENTIAL INQUIRIES

- Fever, cough, and chest pain.
- Vital sign measurements; pulse oximetry.
- Cardiac and chest examination.
- Chest radiography and arterial blood gas measurement in selected patients.

General Considerations

Dyspnea is a subjective experience or perception of uncomfortable breathing. There is a lack of empiric evidence on the prevalence, etiology, and prognosis of dyspnea in general practice. The relationship between level of dyspnea and the severity of underlying disease varies widely among individuals. Dyspnea can result from conditions that increase the mechanical effort of breathing (eg, COPD, restrictive lung disease, respiratory muscle weakness), conditions that produce compensatory tachypnea (eg, hypoxemia, acidosis), primary pulmonary vasculopathy (pulmonary hypertension), or psychogenic conditions. The following factors play a role in how and when dyspnea presents in patients: rate of onset, previous dyspnea, medications, comorbidities, psychological profile, and severity of underlying disorder.

Clinical Findings

A. Symptoms

The duration, severity, and periodicity of dyspnea influence the tempo of the clinical evaluation. Rapid onset or severe dyspnea in the absence of other clinical features should raise concern for pneumothorax, pulmonary embolism, or increased left ventricular end-diastolic pressure (LVEDP). Spontaneous pneumothorax is usually accompanied by chest pain and occurs most often in thin, young males and in those with underlying lung disease. Pulmonary embolism should always be suspected when a patient with new dyspnea reports a recent history (previous 4 weeks) of prolonged immobilization or surgery, estrogen therapy, or other risk factors for deep venous thrombosis (DVT) (eg, previous history of thromboembolism, cancer, obesity, lower extremity trauma) and when the cause of dyspnea is not apparent. Silent myocardial infarction, which occurs more frequently in diabetic persons and women, can result in increased LVEDP, acute HF, and dyspnea.

Accompanying symptoms provide important clues to causes of dyspnea. When cough and fever are present, pulmonary disease (particularly infection) is the primary concern; myocarditis, pericarditis, and septic emboli can present in this manner. Chest pain should be further characterized as acute or chronic, pleuritic or exertional. Although acute pleuritic chest pain is the rule in acute pericarditis and pneumothorax, most patients with pleuritic chest pain in the outpatient clinic have pleurisy due to acute viral respiratory tract infection. Periodic chest pain that precedes the onset of dyspnea suggests myocardial ischemia or pulmonary embolism. When associated with wheezing, most cases of dyspnea are due to acute bronchitis; however, other causes include new-onset asthma, foreign body, and vocal cord dysfunction. Interstitial lung disease and pulmonary hypertension should be considered in patients with symptoms (or history) of connective tissue disease.

When a patient reports prominent dyspnea with mild or no accompanying features, consider noncardiopulmonary causes of impaired oxygen delivery (anemia, methemoglobinemia, cyanide ingestion, carbon monoxide), metabolic acidosis, panic disorder, neuromuscular disorders, and chronic pulmonary embolism.

Platypnea-orthodeoxia syndrome is characterized by dyspnea and hypoxemia on sitting or standing that improves in the recumbent position. It may be caused by an intracardiac shunt, pulmonary vascular shunt, or ventilation-perfusion mismatch.

B. Physical Examination

A focused physical examination should include evaluation of the head and neck, chest, heart, and lower extremities. Visual inspection of the patient can suggest obstructive

Table 2–3. Clinical findings suggesting obstructive airway disease.

	Adjusted Likelihood Ratios	
	Factor Present	Factor Absent
> 40 pack-years smoking	11.6	0.9
Age ≥ 45 years	1.4	0.5
Maximum laryngeal height ≤ 4 cm	3.6	0.7
All three factors	58.5	0.3

Reproduced, with permission, from Straus SE et al. The accuracy of patient history, wheezing, and laryngeal measurements in diagnosing obstructive airway disease. CARE-COAD1 Group. Clinical Assessment of the Reliability of the Examination—Chronic Obstructive Airways Disease. JAMA. 2000 Apr 12;283(14):1853–7.

airway disease (pursed-lip breathing, use of accessory respiratory muscles, barrel-shaped chest), pneumothorax (asymmetric excursion), or metabolic acidosis (Kussmaul respirations). Patients with impending upper airway obstruction (eg, epiglottitis, foreign body) or severe asthma exacerbation sometimes assume a tripod position. Focal wheezing raises the suspicion for a foreign body or other bronchial obstruction. Maximum laryngeal height (the distance between the top of the thyroid cartilage and the suprasternal notch at end expiration) is a measure of hyperinflation. Obstructive airway disease is virtually nonexistent when a nonsmoking patient younger than 45 years has a maximum laryngeal height greater than 4 cm (Table 2–3). Absent breath sounds suggest a pneumothorax. An accentuated pulmonic component of the second heart sound (loud P2) is a sign of pulmonary hypertension and pulmonary embolism.

Table 2–4 shows clinical predictors of increased LVEDP in dyspneic patients with no prior history of HF. When none is present, there is a very low probability (less than 10%) of increased LVEDP, but when two or more are present, there is a very high probability (greater than 90%) of increased LVEDP.

Table 2–4. Clinical findings suggesting increased left ventricular end-diastolic pressure.

Tachycardia
Systolic hypotension
Jugular venous distention (> 5–7 cm H_2O)[1]
Hepatojugular reflux (> 1 cm)[2]
Crackles, especially bibasilar
Third heart sound[3]
Lower extremity edema
Radiographic pulmonary vascular redistribution or cardiomegaly[1]

[1]These findings are particularly helpful.
[2]Proper abdominal compression for evaluating hepatojugular reflux requires > 30 seconds of sustained right upper quadrant abdominal compression.
[3]Auscultation of the heart at 45-degree angle in left lateral decubitus position doubles the detection rate of third heart sounds.
Data from Badgett RG et al. Can the clinical examination diagnose left-sided heart failure in adults? JAMA. 1997 Jun 4;277(21):1712–9.

C. Diagnostic Studies

Causes of dyspnea that can be managed without chest radiography are few: ingestions causing lactic acidosis, anemia, methemoglobinemia, and carbon monoxide poisoning. The diagnosis of pneumonia should be confirmed by chest radiography in most patients, and elevated blood levels of procalcitonin or C-reactive protein can support the diagnosis of pneumonia in equivocal cases or in the presence of interstitial lung disease. Conversely, a low procalcitonin can help exclude pneumonia in dyspneic patients presenting with HF. Lung ultrasonography is more accurate than chest radiography for the diagnosis of pneumonia in patients admitted to an acute geriatric ward. Chest radiography is fairly sensitive and specific for new-onset HF (represented by redistribution of pulmonary venous circulation) and can help guide treatment of patients with other cardiac diseases. NT-proBNP can assist in the diagnosis of HF; the Acute Diagnostic Cut-Offs in the Emergency Department study defines best diagnostic cutoff points. End-expiratory chest radiography enhances detection of small pneumothoraces.

A normal chest radiograph has substantial diagnostic value. When there is no physical examination evidence of COPD or HF and the chest radiograph is normal, the major remaining causes of dyspnea include pulmonary embolism, *Pneumocystis jirovecii* infection (initial radiograph may be normal in up to 25%), upper airway obstruction, foreign body, anemia, and metabolic acidosis. If a patient has tachycardia and hypoxemia but a normal chest radiograph and electrocardiogram (ECG), then tests to exclude pulmonary emboli, anemia, or metabolic acidosis are warranted. High-resolution chest CT is particularly useful in the evaluation of interstitial and alveolar lung disease. Helical ("spiral") CT is useful to diagnose pulmonary embolism since the images are high resolution and require only one breathhold by the patient, but to minimize unnecessary testing and radiation exposure, the clinician should first consider a clinical decision rule (with or without D-dimer testing) to estimate the pretest probability of a pulmonary embolism. It is appropriate to forego CT scanning in patients with very low probability of pulmonary embolus when other causes of dyspnea are more likely (see Chapter 9).

Table 2–4 shows clinical findings suggesting increased LVEDP. Elevated serum or B-type natriuretic peptide (BNP or NT-proBNP) levels are both sensitive and specific for increased LVEDP in symptomatic persons. BNP has been shown to reliably diagnose severe dyspnea caused by HF and to differentiate it from dyspnea due to other conditions. However, systematic use of BNP in evaluation of dyspnea in the emergency department does not appear to have a clinically significant impact on patient or system outcomes, and it does not conclusively affect hospital mortality rates. Newer cardiac biomarkers such as ST2 may have better prognostic value for mortality and may help titrate medical therapy.

Arterial blood gas measurement may be considered if clinical examination and routine diagnostic testing are equivocal. With two notable exceptions (carbon monoxide poisoning and cyanide toxicity), arterial blood gas measurement distinguishes increased mechanical effort causes of dyspnea (respiratory acidosis with or without hypoxemia) from compensatory tachypnea (respiratory alkalosis with or without hypoxemia or metabolic acidosis) and from psychogenic dyspnea (respiratory alkalosis). An observational study, however, found that arterial blood gas measurement had little value in determining the cause of dyspnea in patients presenting to the emergency department. Carbon monoxide and cyanide impair oxygen delivery with minimal alterations in Po_2; percent carboxyhemoglobin identifies carbon monoxide toxicity. Cyanide poisoning should be considered in a patient with profound lactic acidosis following exposure to burning vinyl (such as a theater fire or industrial accident). Suspected carbon monoxide poisoning or methemoglobinemia can also be confirmed with venous carboxyhemoglobin or methemoglobin levels. Venous blood gas testing is also an option for assessing respiratory and acid-base status by measuring venous pH and Pco_2 but is unable to provide information on oxygenation status. To correlate with arterial blood gas values, venous pH is typically 0.03–0.05 units lower, and venous Pco_2 is typically 4–5 mm Hg higher than arterial samples.

Because arterial blood gas testing is impractical in most outpatient settings, **pulse oximetry** has assumed a central role in the office evaluation of dyspnea. Oxygen saturation values above 96% almost always correspond with a Po_2 greater than 70 mm Hg, whereas values less than 94% may represent clinically significant hypoxemia. Important exceptions to this rule include carbon monoxide toxicity, which leads to a normal oxygen saturation (due to the similar wavelengths of oxyhemoglobin and carboxyhemoglobin), and methemoglobinemia, which results in an oxygen saturation of about 85% that fails to increase with supplemental oxygen. A delirious or obtunded patient with obstructive lung disease warrants immediate measurement of arterial blood gases to exclude hypercapnia and the need for intubation, regardless of the oxygen saturation. If a patient reports dyspnea with exertion, but resting oximetry is normal, assessment of desaturation with ambulation (eg, a brisk walk around the clinic) can be useful for confirming impaired gas exchange.

A study found that for adults without known cardiac or pulmonary disease reporting dyspnea on exertion, spirometry, NT-proBNP, and CT imaging were the most informative tests.

Episodic dyspnea can be challenging if an evaluation cannot be performed during symptoms. Life-threatening causes include recurrent pulmonary embolism, myocardial ischemia, and reactive airway disease. When associated with audible wheezing, vocal cord dysfunction should be considered, particularly in a young woman who does not respond to asthma therapy. Spirometry is very helpful in further classifying patients with obstructive airway disease but is rarely needed in the initial or emergent evaluation of patients with acute dyspnea.

Differential Diagnosis

Urgent and emergent conditions causing acute dyspnea include pneumonia, COPD, asthma, pneumothorax, pulmonary embolism, cardiac disease (eg, HF, acute myocardial infarction, valvular dysfunction, arrhythmia, intracardiac shunt), pleural effusion, diffuse alveolar hemorrhage, metabolic acidosis, cyanide toxicity, methemoglobinemia, and carbon monoxide poisoning. Chronic dyspnea may be caused by interstitial lung disease and pulmonary hypertension.

Treatment

The treatment of urgent or emergent causes of dyspnea should aim to relieve the underlying cause. Pending diagnosis, patients with hypoxemia should be immediately provided supplemental oxygen unless significant hypercapnia is present or strongly suspected pending arterial blood gas measurement. Dyspnea frequently occurs in patients nearing the end of life. Opioid therapy, anxiolytics, and corticosteroids can provide substantial relief independent of the severity of hypoxemia. However, inhaled opioids are not effective. Oxygen therapy is most beneficial to patients with significant hypoxemia (Pao_2 less than 55 mm Hg) (see Chapter 5). In patients with severe COPD and hypoxemia, oxygen therapy improves mortality and exercise performance. Pulmonary rehabilitation programs are another therapeutic option for patients with moderate to severe COPD or interstitial pulmonary fibrosis. A small study showed that patients with pulmonary hypertension had less dyspnea and lower plasma norepinephrine and interleukin-6 (IL-6) with slow paced respiration therapy. Noninvasive ventilation may be considered for patients with dyspnea caused by an acute COPD exacerbation, but the efficacy of this treatment is still uncertain.

When to Refer

- Following acute stabilization, patients with advanced COPD should be referred to a pulmonologist, and patients with HF or valvular heart disease should be referred to a cardiologist.
- Cyanide toxicity or carbon monoxide poisoning should be managed in conjunction with a toxicologist.
- Lung transplantation can be considered for patients with advanced interstitial lung disease.

When to Admit

- Impaired gas exchange from any cause or high risk of pulmonary embolism pending definitive diagnosis.
- Suspected cyanide toxicity or carbon monoxide poisoning.

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HEMOPTYSIS

ESSENTIAL INQUIRIES

- Fever, cough, and other symptoms of lower respiratory tract infection.
- Smoking history.
- Nasopharyngeal or gastrointestinal bleeding.
- Chest radiography and complete blood count (and, in some cases, INR).

General Considerations

Hemoptysis is the expectoration of blood that originates below the vocal cords. It is commonly classified as trivial, mild, or massive—the latter defined as more than 200–600 mL (about 1–2 cups) in 24 hours. Massive hemoptysis can be usefully defined as any amount that is hemodynamically significant or threatens ventilation. Its in-hospital mortality was 6.5% in one study. The initial goal of management of massive hemoptysis is therapeutic, not diagnostic.

The causes of hemoptysis can be classified anatomically. Blood may arise from the airways in COPD, bronchiectasis, and bronchogenic carcinoma; from the pulmonary vasculature in left ventricular failure, mitral stenosis, pulmonary embolism, pulmonary arterial hypertension, and arteriovenous malformations; or from the pulmonary parenchyma in pneumonia, fungal infections, inhalation of crack cocaine, or granulomatosis with polyangiitis (formerly Wegener granulomatosis). Diffuse alveolar hemorrhage—manifested by alveolar infiltrates on chest radiography—is due to small vessel bleeding usually caused by autoimmune or hematologic disorders, or rarely precipitated by warfarin. Most cases of hemoptysis presenting in the outpatient setting are due to infection (eg, acute or chronic bronchitis, pneumonia, tuberculosis, aspergillosis). Hemoptysis due to lung cancer increases with age, causing up to 20% of cases among older adults. Less commonly (less than 10% of cases), pulmonary venous hypertension (eg, mitral stenosis, pulmonary embolism) causes hemoptysis. Most cases of hemoptysis that have no visible cause on CT scan or bronchoscopy will resolve within 6 months without treatment, with the notable exception of patients at high risk for lung cancer (smokers older than 40 years). Iatrogenic hemorrhage may follow transbronchial lung biopsies, anticoagulation, or pulmonary artery rupture due to distal placement of a balloon-tipped catheter. Obstructive sleep apnea may be a risk factor for hemoptysis. No cause is identified in up to 15–30% of cases.

Clinical Findings

A. Symptoms

Blood-tinged sputum in the setting of an upper respiratory tract infection in an otherwise healthy, young (age under 40 years) nonsmoker does not warrant an extensive diagnostic evaluation if the hemoptysis subsides with resolution of the infection. However, hemoptysis is frequently a sign of serious disease, especially in patients with a high prior probability of underlying pulmonary pathology. Hemoptysis is the only symptom found to be a specific predictor of lung cancer. There is no value in distinguishing blood-streaked sputum and cough productive of blood during evaluation; the goal of the history is to identify patients at risk for one of the disorders listed above. Pertinent features include duration of symptoms, presence of respiratory infection, and past or current tobacco use. Nonpulmonary sources of hemorrhage—from the sinuses or the gastrointestinal tract—must be excluded.

B. Physical Examination

Elevated pulse, hypotension, and decreased oxygen saturation suggest large-volume hemorrhage that warrants emergent evaluation and stabilization. The nares and oropharynx should be carefully inspected to identify a potential upper airway source of bleeding. Chest and cardiac examination may reveal evidence of HF or mitral stenosis.

C. Diagnostic Studies

Diagnostic evaluation should include a chest radiograph and complete blood count. Kidney function tests, urinalysis, and coagulation studies are appropriate in specific circumstances. Hematuria that accompanies hemoptysis may be a clue to Goodpasture syndrome or vasculitis. Flexible bronchoscopy reveals endobronchial cancer in 3–6% of patients with hemoptysis who have a normal (non-lateralizing) chest radiograph. Nearly all of these patients are smokers over the age of 40, and most will have had symptoms for more than 1 week. High-resolution chest CT scan complements bronchoscopy; it can visualize unsuspected bronchiectasis and arteriovenous malformations and will show central endobronchial cancers in many cases. It is the test of choice for suspected small peripheral malignancies. Helical CT pulmonary angiography is the initial test of choice for evaluating patients with suspected pulmonary embolism, although caution should be taken to avoid large contrast

loads in patients with even mild chronic kidney disease (serum creatinine greater than 2.0 g/dL or rapidly rising creatinine in normal range). Helical CT scanning can be avoided in patients who are at "unlikely" risk for pulmonary embolism using the Wells score for pulmonary embolism and the sensitive D-dimer test. Echocardiography may reveal evidence of HF or mitral stenosis.

Treatment

Management of mild hemoptysis consists of identifying and treating the specific cause. Massive hemoptysis is life-threatening. The airway should be protected with endotracheal intubation, ventilation ensured, and effective circulation maintained. If the location of the bleeding site is known, the patient should be placed in the decubitus position with the involved lung dependent. Uncontrollable hemorrhage warrants rigid bronchoscopy and surgical consultation. In stable patients, flexible bronchoscopy may localize the site of bleeding, and angiography can embolize the involved bronchial arteries. Embolization is effective initially in 85% of cases, although rebleeding may occur in up to 20% of patients during the following year. The anterior spinal artery arises from the bronchial artery in up to 5% of people, and paraplegia may result if it is inadvertently cannulated and embolized. There is some evidence that antifibrinolytics may reduce the duration of bleeding.

When to Refer

- Patients should be referred to a pulmonologist when bronchoscopy of the lower respiratory tract is needed.
- Patients should be referred to an otolaryngologist when an upper respiratory tract bleeding source is identified.
- Patients with severe coagulopathy complicating management should be referred to a hematologist.

When to Admit

- To stabilize bleeding process in patients at risk for or experiencing massive hemoptysis.
- To correct disordered coagulation (using clotting factors or platelets, or both).
- To stabilize gas exchange.

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CHEST PAIN

ESSENTIAL INQUIRIES

- Pain onset, character, location/size, duration, periodicity, and exacerbators; shortness of breath.
- Vital signs; chest and cardiac examination.
- Electrocardiography and biomarkers of myocardial necrosis in selected patients.

General Considerations

Chest pain (or chest discomfort) is a common symptom that can occur as a result of cardiovascular, pulmonary, pleural, or musculoskeletal disease, esophageal or other gastrointestinal disorders, herpes zoster, cocaine use, or anxiety states. The frequency and distribution of life-threatening causes of chest pain, such as acute coronary syndrome (ACS), pericarditis, aortic dissection, vasospastic angina, pulmonary embolism, pneumonia, and esophageal perforation, vary substantially between clinical settings. Systemic lupus erythematosus, rheumatoid arthritis, reduced estimated glomerular filtration rate, and HIV infection are conditions that confer a strong risk of coronary artery disease. Precocious ACS may represent acute thrombosis independent of underlying atherosclerotic disease. In patients aged 35 years or younger, risk factors for ACS are obesity, hyperlipidemia, and smoking.

Chest pain characteristics that can lead to early diagnosis of acute myocardial infarction do not differ in frequency or strength of association between men and women. Because pulmonary embolism can present with a wide variety of symptoms, consideration of the diagnosis and rigorous risk factor assessment for venous thromboembolism (VTE) is critical. Classic VTE risk factors include cancer, trauma, recent surgery, prolonged immobilization, pregnancy, oral contraceptives, and family history and prior history of VTE. Other conditions associated with increased risk of pulmonary embolism include HF and COPD. Sickle cell anemia can cause acute chest syndrome. Patients with this syndrome often have chest pain, fever, and cough.

Clinical Findings

A. Symptoms

Myocardial ischemia is usually described as a dull, aching sensation of "pressure," "tightness," "squeezing," or "gas," rather than as sharp or spasmodic. Ischemic symptoms usually subside within 5–20 minutes but may last longer. Progressive symptoms or symptoms at rest may represent unstable angina. Prolonged chest pain episodes might represent myocardial infarction, although up to one-third of patients with acute myocardial infarction do not report chest pain. When present, pain due to myocardial ischemia is commonly accompanied by a sense of anxiety or uneasiness. The location is usually retrosternal or left precordial.

Because the heart lacks somatic innervation, precise localization of pain due to cardiac ischemia is difficult; the pain is commonly referred to the throat, lower jaw, shoulders, inner arms, upper abdomen, or back. Ischemic pain may be precipitated or exacerbated by exertion, cold temperature, meals, stress, or combinations of these factors and is usually relieved by rest. However, many episodes do not conform to these patterns, and atypical presentations of ACS are more common in older adults, women, and persons with diabetes mellitus. Other symptoms that are associated with ACS include shortness of breath; dizziness; a feeling of impending doom; and vagal symptoms, such as nausea and diaphoresis. In older persons, fatigue is a common presenting complaint of ACS. Likelihood ratios (LRs) for cardinal symptoms considered in the evaluation of acute myocardial infarction are summarized in Table 2–5.

A meta-analysis found the clinical findings and risk factors most suggestive of ACS were prior abnormal stress test (specificity, 96%; LR, 3.1 [95% CI, 2.0–4.7]), peripheral arterial disease (specificity, 97%; LR, 2.7 [95% CI, 1.5–4.8]), and pain radiation to both arms (specificity, 96%; LR, 2.6 [95% CI, 1.8–3.7]). The ECG findings associated with ACS were ST-segment depression (specificity, 95%; LR, 5.3 [95% CI, 2.1–8.6]) and any evidence of ischemia (specificity, 91%; LR, 3.6 [95% CI, 1.6–5.7]). Risk scores derived from both the History, Electrocardiogram, Age, Risk Factors, Troponin (HEART) and Thrombolysis in Myocardial Infarction (TIMI) trials performed well in detecting ACS (LR, 13 [95% CI, 7.0–24] for HEART score of 7–10, and LR, 6.8 [95% CI, 5.2–8.9] for TIMI score of 5–7).

Table 2–5. Likelihood ratios (LRs) for clinical features associated with acute myocardial infarction.

Clinical Feature	LR+ (95% CI)
History	
Chest pain that radiates to the left arm	2.3 (1.7–3.1)
Chest pain that radiates to the right shoulder	2.9 (1.4–3.0)
Chest pain that radiates to both arms	7.1 (3.6–14.2)
Pleuritic chest pain	0.2 (0.2–0.3)
Sharp or stabbing chest pain	0.3 (0.2–0.5)
Positional chest pain	0.3 (0.2–0.4)
Nausea or vomiting	1.9 (1.7–2.3)
Diaphoresis	2.0 (1.9–2.2)
Physical examination	
Systolic blood pressure ≤ 80 mm Hg	3.1 (1.8–5.2)
Chest pain reproduced by palpation	0.2–0.41
Pulmonary crackles	2.1 (1.4–3.1)
Third heart sound	3.2 (1.6–6.5)
Electrocardiogram	
Any ST-segment elevation (≥ 1 mm)	11.2 (7.1–17.8)
Any ST-segment depression	3.2 (2.5–4.1)
Any Q wave	3.9 (2.7–7.7)
Any conduction defect	2.7 (1.4–5.4)
New ST-segment elevation (≥ 1 mm)	(5.7–53.9)[1]
New ST-segment depression	(3.0–5.2)[1]
New Q wave	(5.3–24.8)[1]
New conduction defect	6.3 (2.5–15.7)

[1]Heterogeneous studies do not allow for calculation of a point estimate.

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Hypertrophy of either ventricle or aortic stenosis may also give rise to chest pain with less typical features. Pericarditis produces pain that may be greater when supine than upright and increases with respiration, coughing, or swallowing. Pleuritic chest pain is usually not ischemic, and pain on palpation may indicate a musculoskeletal cause. Aortic dissection classically produces an abrupt onset of tearing pain of great intensity that often radiates to the back; however, this classic presentation occurs in a small proportion of cases. Anterior aortic dissection can also lead to myocardial or cerebrovascular ischemia.

Pulmonary embolism has a wide range of clinical presentations, with chest pain present in about 75% of cases. The chief objective in evaluating patients with suspected pulmonary embolism is to assess the patient's clinical risk for VTE based on medical history and associated signs and symptoms (see above and Chapter 9). Rupture of the thoracic esophagus iatrogenically or secondary to vomiting is another cause of chest pain.

B. Physical Examination

Findings on physical examination can occasionally yield important clues to the underlying cause of chest pain; however, a normal physical examination should never be used as the sole basis for ruling out most diagnoses, particularly ACS and aortic dissection. Vital signs (including pulse oximetry) and cardiopulmonary examination are always the first steps for assessing the urgency and tempo of the subsequent examination and diagnostic workup.

Findings that increase the likelihood of ACS include diaphoresis, hypotension, S_3 or S_4 gallop, pulmonary crackles, or elevated jugular venous pressure (see Table 2–5). Although chest pain that is reproducible or worsened with palpation strongly suggests a musculoskeletal cause, up to 15% of patients with ACS will have reproducible chest wall tenderness. Pointing to the location of the pain with one finger has been shown to be highly correlated with nonischemic chest pain. Aortic dissection can result in differential blood pressures (greater than 20 mm Hg), pulse amplitude deficits, and new diastolic murmurs. Although hypertension is considered the rule in patients with aortic dissection, systolic blood pressure less than 100 mm Hg is present in up to 25% of patients.

A cardiac friction rub represents pericarditis until proven otherwise. It can best be heard with the patient sitting forward at end-expiration. Tamponade should be excluded in all patients with a clinical diagnosis of pericarditis by assessing pulsus paradoxus (a decrease in systolic

blood pressure during inspiration greater than 10 mm Hg) and inspection of jugular venous pulsations. Subcutaneous emphysema is common following cervical esophageal perforation but present in only about one-third of thoracic perforations (ie, those most commonly presenting with chest pain).

The absence of abnormal physical examination findings in patients with suspected pulmonary embolism usually serves to *increase* the likelihood of pulmonary embolism, although a normal physical examination is also compatible with the much more common conditions of panic/anxiety disorder and musculoskeletal disease.

C. Diagnostic Studies

Unless a competing diagnosis can be confirmed, an ECG is warranted in the initial evaluation of most patients with acute chest pain to help exclude ACS. ST-segment elevation is the ECG finding that is the strongest predictor of acute myocardial infarction (see Table 2–5); however, up to 20% of patients with ACS can have a normal ECG. In the emergency department, patients with suspected ACS can be safely removed from cardiac monitoring if they are pain-free at initial physician assessment and have a normal or nonspecific ECG. This decision rule had 100% sensitivity for serious arrhythmia (95% CI, 80–100%). Clinically stable patients with cardiovascular disease risk factors, normal ECG, normal cardiac biomarkers, and no alternative diagnoses (such as typical GERD or costochondritis) should be followed up with a timely exercise stress test that includes perfusion imaging. However, more than 25% of patients with stable chest pain referred for noninvasive testing will have normal coronary arteries and no long-term clinical events. The ECG can also provide evidence for alternative diagnoses, such as pericarditis and pulmonary embolism. Chest radiography is often useful in the evaluation of chest pain, and is always indicated when cough or shortness of breath accompanies chest pain. Findings of pneumomediastinum or new pleural effusion are consistent with esophageal perforation. Stress echocardiography is useful in risk stratifying patients with chest pain, even among those with significant obesity.

Diagnostic protocols using a single high-sensitivity troponin assay combined with a standardized clinical assessment are an efficient strategy to rapidly determine whether patients with chest pain are at low risk and may be discharged from the emergency department. Five established risk scores are (1) the modified Goldman Risk Score, (2) Thrombolysis in Myocardial Infarction (TIMI) Risk Score, (3) Global Registry of Acute Cardiac Events (GRACE) Risk Score, (4) HEART Risk Score, and (5) Vancouver Chest Pain Rule. A study compared these risk scores for predicting acute myocardial infarction within 30 days and reported a sensitivity of 98% (which correlates with a negative predictive value of greater than or equal to 99.5%). Patients eligible for discharge (about 30%) were those with a TIMI score of less than or equal to 1, modified Goldman score of less than or equal to 1 with normal high-sensitivity (hs-) troponin T, TIMI score of 0, or HEART score of less than or equal to 3 with normal high-sensitivity hs-troponin I.

While some studies of high-sensitivity cardiac troponin suggest that it may be the best cardiac biomarker, it may not outperform conventional troponin assays if an appropriate cutoff is used. Copeptin, beta$_2$-microglobulin, and heart-type fatty-acid–binding protein may also have a role in increasing diagnostic sensitivity.

Patients who arrive at the emergency department with chest pain of intermediate or high probability for ACS without electrocardiographic or biomarker evidence of a myocardial infarction can be safely discharged from an observation unit after stress cardiac MRI. Sixty-four–slice CT coronary angiography (CTA) is an alternative to stress testing in the emergency department for detecting ACS among patients with normal or nonspecific ECG and normal biomarkers. A meta-analysis of nine studies found ACS in 10% of patients, and an estimated sensitivity of CTA for ACS of 95%, specificity of 87%, yielding a negative LR of 0.06 and a positive LR of 7.4. Coronary CTA applied early in the evaluation of suspected ACS does not identify more patients with significant CAD requiring coronary revascularization, shorten hospital stay, or allow for more direct discharge from the emergency department compared to hs-troponins. Thus, functional testing appears to be the best initial noninvasive test in symptomatic patients with suspected coronary artery disease. CTA is an option for patients who do not have access to functional testing.

A minimal-risk model developed by the PROMISE investigators includes 10 clinical variables that correlate with normal coronary CTA results and no clinical events (C statistic = 0.725 for the derivation and validation subsets; 95% CI, 0.705–0.746). These variables include (1) younger age; (2) female sex; (3) racial or ethnic minority; (4–6) no history of hypertension, diabetes, or dyslipidemia; (7) no family history of premature coronary artery disease; (8) never smoking; (9) symptoms unrelated to physical or mental stress; and (10) higher high-density lipoprotein cholesterol level.

In the evaluation of pulmonary embolism, diagnostic test decisions and results must be interpreted in the context of the clinical likelihood of VTE. A negative D-dimer test is helpful for excluding pulmonary embolism in patients with low clinical probability of VTE (3-month incidence = 0.5%); however, the 3-month risk of VTE among patients with intermediate and high risk of VTE is sufficiently high in the setting of a negative D-dimer test (3.5% and 21.4%, respectively) to warrant further imaging given the life-threatening nature of this condition if left untreated. CT angiography (with helical or multidetector CT imaging) has replaced ventilation-perfusion scanning as the preferred initial diagnostic test, having approximately 90–95% sensitivity and 95% specificity for detecting pulmonary embolism (compared with pulmonary angiography). However, for patients with high clinical probability of VTE, lower extremity ultrasound or pulmonary angiogram may be indicated even with a normal helical CT.

Panic disorder is a common cause of chest pain, accounting for up to 25% of cases that present to emergency departments and a higher proportion of cases presenting in primary care office practices. Features that correlate with an increased likelihood of panic disorder

include absence of coronary artery disease, atypical quality of chest pain, female sex, younger age, and a high level of self-reported anxiety. Depression is associated with recurrent chest pain with or without coronary artery disease (odds ratio [OR] = 2.11, 95% CI 1.18–3.79).

Treatment

Treatment of chest pain should be guided by the underlying etiology. The term "noncardiac chest pain" is used when a diagnosis remains elusive after patients have undergone an extensive workup. Almost half reported symptom improvement with high-dose proton-pump inhibitor therapy. A meta-analysis of 15 trials suggested modest to moderate benefit for psychological (especially cognitive-behavioral) interventions. It is unclear whether tricyclic or selective serotonin reuptake inhibitor antidepressants have benefit in noncardiac chest pain. Hypnotherapy may offer some benefit.

When to Refer

- Refer patients with poorly controlled, noncardiac chest pain to a pain specialist.
- Refer patients with sickle cell anemia to a hematologist.

When to Admit

- Failure to adequately exclude life-threatening causes of chest pain, particularly myocardial infarction, dissecting aortic aneurysm, pulmonary embolism, and esophageal rupture.
- High risk of pulmonary embolism and a positive sensitive D-dimer test.
- TIMI score of 1 or more, abnormal electrocardiogram, and abnormal 0- and 2-hour troponin tests.
- Pain control for rib fracture that impairs gas exchange.

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PALPITATIONS

ESSENTIAL INQUIRIES

- Forceful, rapid, or irregular beating of the heart.
- Rate, duration, and degree of regularity of heartbeat; age at first episode.
- Factors that precipitate or terminate episodes.
- Light-headedness or syncope; neck pounding.
- Chest pain; history of myocardial infarction or structural heart disease.

General Considerations

Palpitations are defined as an unpleasant awareness of the forceful, rapid, or irregular beating of the heart. They are the primary symptom for approximately 16% of patients presenting to an outpatient clinic with a cardiac complaint. Palpitations represent 5.8 of every 1000 emergency department visits, with an admission rate of 24.6%. While palpitations are usually benign, they are occasionally the symptom of a life-threatening arrhythmia. To avoid missing a dangerous cause of the patient's symptom, clinicians sometimes pursue expensive and invasive testing when a conservative diagnostic evaluation is sufficient. The converse is also true; in one study, 54% of patients with supraventricular tachycardia were initially wrongly diagnosed with panic, stress, or anxiety disorder. A disproportionate number of these misdiagnosed patients are women. Table 2–6 lists history, physical examination, and ECG findings suggesting a cardiovascular cause for the palpitations.

Clinical Findings

A. Symptoms

Although described by patients in a myriad of ways, guiding the patient through a careful description of their palpitations may indicate a mechanism and narrow the differential diagnosis. Pertinent questions include the age at first episode; precipitants; and rate, duration, and degree