Annals of Internal Medicine | Ideas and Opinions

Appropriate Use of Screening and Diagnostic Tests to Foster High-Value, Cost-Conscious Care

Amir Qaseem, MD, PhD, MHA; Patrick Alguire, MD; Paul Dallas, MD; Lawrence E. Feinberg, MD; Faith T. Fitzgerald, MD; Carrie Horwitch, MD, MPH; Linda Humphrey, MD, MPH; Richard LeBlond, MD; Darilyn Moyer, MD; Jeffrey G. Wiese, MD; and Steven Weinberger, MD

Unsustainable rising health care costs in the United States have made reducing costs while maintaining high-quality health care a national priority. The overuse of some screening and diagnostic tests is an important component of unnecessary health care costs. More judicious use of such tests will improve quality and reflect responsible awareness of costs. Efforts to control expenditures should focus not only on benefits, harms, and costs but on the value of diagnostic tests—meaning an assessment of whether a test provides health benefits that are worth its costs or harms. To begin to identify ways that practicing clinicians can contribute to the delivery of high-value, cost-conscious health care, the American College of Physicians convened a workgroup of physicians to identify, using a consensus-based process, common clinical situations in which screening and diagnostic tests are used in ways that do not reflect high-value care. The intent of this exercise is to promote thoughtful discussions about these tests and other health care interventions to promote high-value, cost-conscious care.

Ann Intern Med. 2012;156:147-149. www.annals.org
For author affiliations, see end of text.

Health care costs in the United States are increasing unsustainably: from $253 billion in 1980, to $714 billion in 1990, to more than $2.2 trillion in 2008 (1). In 2008, U.S. health care spending accounted for 16.2% of the nation's gross domestic product (GDP) and was approximately $7681 per person (1). Employee contributions to health care premiums have increased by nearly 150% in the past 10 years (2). The increase in costs has placed great strain on family, employer, and government budgets.

Although many factors have contributed to the increase in health care costs (3), new drugs, devices, procedures, and tests are the primary drivers of increased health care spending. However, because biomedical innovations are also often key factors in improved patient outcomes (4), it is critical that we use testing and medical technology judiciously and assess whether potential benefits justify the costs.

What Is High-Value, Cost-Conscious Care?

The distinction between cost and value is essential (5). A high-cost intervention may provide good value if its net benefits (the extent to which benefit outweighs harms) is large enough to justify the costs. Examples of expensive but high-value interventions include antiretroviral therapy for HIV infection and implantable cardioverter-defibrillators in patients who meet the clinical criteria for the therapy and have a reasonable expectation of survival with good functional status for more than 1 year (5). Conversely, low-cost interventions may provide low value if they have little or no net benefit. Examples of a low-cost, low-value tests include annual Papanicolaou smears (compared with Papanicolaou smears every 3 years) for low-risk women and preoperative chest radiography in asymptomatic, healthy persons. Because high-cost interventions may provide good value and low-cost interventions may not, efforts to control costs should focus on value rather than cost alone. The American College of Physicians' definition for high-value care stipulates that the health benefits of an intervention justify its harms and costs (5).

Methods for Identifying Tests That Clinicians Should Carefully Consider in Light of High-Value, Cost-Conscious Care

In light of increasing health care costs as well as overuse and misuse of tests and treatments, some have called for organized medicine to identify a list of "top 5" tests or treatments that are commonly overused (6). The American College of Physicians convened an ad hoc workgroup of experienced internal medicine physicians with the goal of identifying common screening and diagnostic tests relevant to internal medicine that they believe are commonly overused. Workgroup members represented a variety of internal medicine specialties, an array of practice environments, and diverse geographic locations in the United States. All members of the workgroup disclosed potential conflicts of interest.

Each member of the workgroup was asked to identify screening or diagnostic tests that he or she believed are commonly used in clinical situations where they are unlikely to be of high value. Workgroup members' initial suggestions were collated into a single document, and each

See also:

Print
Editorial comment. 162

Web-Only
Survey
Conversion of graphics into slides

member then provided an opinion about whether the candidate test represented a real-world example of a clinical situation where the target screening or diagnostic test was frequently used in a manner that resulted in low-value care. If the candidate test received unanimous support from the workgroup (all "yes" votes), the group retained the test in the list. If at least two thirds of, but not all, work group members supported a candidate test, the group discussed the test. If the group achieved unanimous consensus about the discussed test, was retained. If not, it was removed from the list. This process resulted in a list of 37 tests that the workgroup believes clinicians often use in a manner that does not reflect high-value, cost-conscious care and does not adhere to currently available clinical guidelines (**Table**).

Suggested Principles for Providing High-Value, Cost-Conscious Care

A careful assessment of benefits, harms, and costs of a diagnostic test to determine its value is critical to preserving quality of care while reducing costs. Appropriate use of screening and diagnostic tests is an important component of providing high-value health care because these tests are an important driver of costs. The high-value care suggestions (**Table**) are informed by systematic reviews and guidelines about the use of specific tests, and in part by general principles for appropriate use of diagnostic tests (7, 8). The first such principle is that diagnostic tests usually should not be performed if the results will not change management. For example, chest radiography 4 weeks after

Table. **Clinical Situations in Which a Test Does Not Reflect High-Value Care***

1. Repeating screening ultrasonography for abdominal aortic aneurysm following a negative study
2. Performing coronary angiography in patients with chronic stable angina with well-controlled symptoms on medical therapy or who lack specific high-risk criteria on exercise testing
3. Performing echocardiography in asymptomatic patients with innocent-sounding heart murmurs, most typically grade I–II/VI short systolic, midpeaking murmurs that are audible along the left sternal border
4. Performing routine periodic echocardiography in asymptomatic patients with mild aortic stenosis more frequently than every 3–5 y
5. Routinely repeating echocardiography in asymptomatic patients with mild mitral regurgitation and normal left ventricular size and function
6. Obtaining electrocardiograms to screen for cardiac disease in patients at low to average risk for coronary artery disease
7. Obtaining exercise electrocardiogram for screening in low-risk asymptomatic adults
8. Performing an imaging stress test (echocardiographic or nuclear) as the initial diagnostic test in patients with known or suspected coronary artery disease who are able to exercise and have no resting electrocardiographic abnormalities that may interfere with interpretation of test results
9. Measuring brain natriuretic peptide in the initial evaluation of patients with typical findings of heart failure
10. Annual lipid screening for patients not receiving lipid-lowering drug or diet therapy in the absence of reasons for changing lipid profiles
11. Using MRI rather than mammography as the breast cancer screening test of choice for average-risk women
12. In asymptomatic women with previously treated breast cancer, performing follow-up complete blood counts, blood chemistry studies, tumor marker studies, chest radiography, or imaging studies other than appropriate breast imaging
13. Performing dual-energy x-ray absorptiometry screening for osteoporosis in women younger than 65 y in the absence of risk factors
14. Screening low-risk individuals for hepatitis B virus infection
15. Screening for cervical cancer in low-risk women aged 65 y or older and in women who have had a total hysterectomy (uterus and cervix) for benign disease
16. Screening for colorectal cancer in adults older than 75 y or in adults with a life expectancy of less than 10 y
17. Repeating colonoscopy within 5 y of an index colonoscopy in asymptomatic patients found to have low-risk adenomas
18. Screening for prostate cancer in men older than 75 y or with a life expectancy of less than 10 y
19. Using CA-125 antigen levels to screen women for ovarian cancer in the absence of increased risk
20. Performing imaging studies in patients with nonspecific low back pain
21. Performing preoperative chest radiography in the absence of a clinical suspicion for intrathoracic pathology
22. Ordering routine preoperative laboratory tests, including complete blood count, liver chemistry tests, and metabolic profiles, in otherwise healthy patients undergoing elective surgery
23. Performing preoperative coagulation studies in patients without risk factors or predisposing conditions for bleeding and with a negative history of abnormal bleeding
24. Performing serologic testing for suspected early Lyme disease
25. Performing serologic testing for Lyme disease in patients with chronic nonspecific symptoms and no clinical evidence of disseminated Lyme disease
26. Performing sinus imaging studies for patients with acute rhinosinusitis in the absence of predisposing factors for atypical microbial causes
27. Performing imaging studies in patients with recurrent, classic migraine headache and normal findings on neurologic examination
28. Performing brain imaging studies (CT or MRI) to evaluate simple syncope in patients with normal findings on neurologic examination
29. Routinely performing echocardiography in the evaluation of syncope, unless the history, physical examination, and electrocardiogram do not provide a diagnosis or underlying heart disease is suspected
30. Performing predischarge chest radiography for hospitalized patients with community-acquired pneumonia who are making a satisfactory clinical recovery
31. Obtaining CT scans in a patient with pneumonia that is confirmed by chest radiography in the absence of complicating clinical or radiographic features
32. Performing imaging studies, rather than a high-sensitivity D-dimer measurement, as the initial diagnostic test in patients with low pretest probability of venous thromboembolism
33. Measuring D-dimer rather than performing appropriate diagnostic imaging (extremity ultrasonography, CT angiography, or ventilation–perfusion scintigraphy), in patients with intermediate or high probability of venous thromboembolism
34. Performing follow-up imaging studies for incidentally discovered pulmonary nodules ≤4 mm in low-risk individuals
35. Monitoring patients with asthma or chronic obstructive pulmonary disease by using full pulmonary function testing that includes lung volumes and diffusing capacity, rather than spirometry alone (or peak expiratory flow rate monitoring in asthma)
36. Performing an antinuclear antibody test in patients with nonspecific symptoms, such as fatigue and myalgia, or in patients with fibromyalgia
37. Screening for chronic obstructive pulmonary disease with spirometry in individuals without respiratory symptoms

CT = computed tomography; MRI = magnetic resonance imaging.
* Tests are listed in no particular order.

diagnosis of pneumonia in a patient who has responded clinically to treatment will not affect management because resolution of radiographic abnormalities may take as long as 6 to 8 weeks. In this situation, the test incurs costs but provides no benefit to the patient. We should discontinue the use of diagnostic tests that provide little or no benefit and can be classified as low value.

The second general principle is that when the pretest probability of disease is low, the likelihood of a false-positive test result is higher than the likelihood of a true-positive result. For example, a positive exercise stress test result in an asymptomatic 45-year-old man is more likely to be a false-positive result than is a positive result in a 55-year-old man with chest pain on exertion that resolves with rest. False-positive results are of concern because they often lead to further testing, which may be expensive and potentially harmful. They may also create anxiety for the patient and may lead to inappropriate treatment.

Finally, it is important to note that the true cost of a test includes not only the cost of the test itself but also the downstream costs incurred because the test was performed (5). For example, an exercise stress test in an asymptomatic patient may result in a false-positive finding that leads to cardiac catheterization, with its attendant costs and risks, but with no proven benefit. Thus, a seemingly inexpensive test can result in substantial costs because of subsequent testing, treatment, or follow-up. In assessing the costs of a diagnostic test, we must consider these downstream costs and savings.

Conclusion

The goal of this consensus-based exercise was to identify common clinical situations in which there are opportunities to both improve care and decrease expenditures by reducing the use of diagnostic tests that are unnecessary and do not improve patient care. The workgroup believes that in these 37 identified situations, more testing is not better but rather may provide no benefit or may be harmful. We hope that this list will promote thoughtful discussions among physicians, patients, and other stakeholders about how to apply medical technology in a manner that promotes high-value, cost-conscious care. We welcome comments on this list to refine and possibly expand it. The Clinical Guidelines Committee of the American College of Physicians has begun to address some of these situations in more detailed articles that fully analyze the evidence for the misuse, benefits, and harms of the individual interventions (5, 9).

From the American College of Physicians and Temple University School of Medicine, Philadelphia, Pennsylvania; Virginia Tech Carilion School of Medicine and Research Institute, Roanoke, Virginia; University of Colorado Health Sciences Center, Aurora, Colorado; University of California, Davis, Health System, Sacramento, California; Virginia Mason Medical Center, University of Washington, Seattle, Washington; Oregon Health & Science University, Portland, Oregon; University of Iowa Carver College of Medicine, Iowa City, Iowa; and Tulane University Health Sciences Center, New Orleans, Louisiana.

Disclaimer: This high-value care advice is a guide only and may not apply to all patients and all clinical situations. Thus, this advice is not intended to override clinicians' judgment.

Acknowledgment: The authors thank Dr. Douglas K. Owens for his critical review and comments.

Financial Support: Financial support for the development of this paper comes exclusively from the American College of Physicians operating budget.

Potential Conflicts of Interest: Disclosures can be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M11-2550.

Requests for Single Reprints: Amir Qaseem, MD, PhD, MHA, American College of Physicians, 190 N. Independence Mall West, Philadelphia, PA 19106; e-mail, aqaseem@acponline.org.

Current author addresses and author contributions are available at www.annals.org.

References

1. **Centers for Medicare & Medicaid Services.** National Health Care Expenditures Data. 2010. Accessed at https://www.cms.gov/nationalhealthexpenddata on 28 November 2011.
2. **Kaiser Family Foundation and Health Research & Educational Trust.** Employer Health Benefits: 2010 Summary of Findings. Accessed at http://ehbs.kff.org/pdf/2010/8086.pdf on 20 April 2011.
3. **Smith S, Newhouse JP, Freeland MS.** Income, insurance, and technology: why does health spending outpace economic growth? Health Aff (Millwood). 2009;28:1276-84. [PMID: 19738242]
4. **Fuchs VR.** How to think about future health care spending. N Engl J Med. 2010;362:965-7. [PMID: 20220179]
5. **Owens DK, Qaseem A, Chou R, Shekelle P; Clinical Guidelines Committee of the American College of Physicians.** High-value, cost-conscious health care: concepts for clinicians to evaluate the benefits, harms, and costs of medical interventions. Ann Intern Med. 2011;154:174-80. [PMID: 21282697]
6. **Brody H.** Medicine's ethical responsibility for health care reform—the top five list. N Engl J Med. 2010;362:283-5. [PMID: 20032315]
7. **Sox HC Jr.** Probability theory in the use of diagnostic tests. An introduction to critical study of the literature. Ann Intern Med. 1986;104:60-6. [PMID: 3079637]
8. **Owens DK, Sox HC.** Biomedical decision making: probabilistic clinical reasoning. In: Shortliffe EH, Cimino JJ, eds. Biomedical Informatics: Computer Applications in Health Care and Biomedicine, 3rd ed. New York: Springer Science+Business Media; 2006:80-132.
9. **Chou R, Qaseem A, Owens DK, Shekelle P; Clinical Guidelines Committee of the American College of Physicians.** Diagnostic imaging for low back pain: advice for high-value health care from the American College of Physicians. Ann Intern Med. 2011;154:181-9. [PMID: 21282698]

Current Author Addresses: Drs. Qaseem, Alguire, and Weinberger: American College of Physicians, 190 N. Independence Mall West, Philadelphia, PA 19106.
Dr. Dallas: Virginia Tech Carilion School of Medicine and Research Institute, 1906 Belleview Avenue, Roanoke, VA 24014.
Dr. Feinberg: University of Colorado Health Sciences Center, 1635 Aurora Court, 13001 East 17th Place, Aurora, CO 80013.
Dr. Fitzgerald: University of California, Davis, Health System, 4150 V Street, Suite 2400, Sacramento, CA 95817.
Dr. Horwitch: Virginia Mason Medical Center, University of Washington, 1100 Ninth Avenue, Seattle, WA 98111.
Dr. Humphrey: Oregon Health & Science University, 3710 SW U.S. Veterans Hospital Road, Portland, OR 97201.
Dr. LeBlond: University of Iowa Carver College of Medicine, 200 Hawkins Drive, Iowa City, IA 52242.
Dr. Moyer: Temple University School of Medicine, 3401 North Broad Street, Philadelphia, PA 19140.
Dr. Wiese: Tulane University Health Sciences Center, 1430 Tulane Avenue, New Orleans, LA 70112.

Author Contributions: Conception and design: A. Qaseem, P. Alguire, P. Dallas, F.T. Fitzgerald, D. Moyer, R. LeBlond, S. Weinberger.
Analysis and interpretation of the data: A. Qaseem, P. Dallas, L.E. Feinberg, F.T. Fitzgerald, C. Horwitch, L. Humphrey, D. Moyer, J.G. Wiese, S. Weinberger.
Drafting of the article: A. Qaseem, P. Alguire, P. Dallas, D. Moyer, S. Weinberger.
Critical revision of the article for important intellectual content: A. Qaseem, P. Alguire, P. Dallas, L.E. Feinberg, F.T. Fitzgerald, L. Humphrey, R. LeBlond, D. Moyer, J.G. Wiese, S. Weinberger.
Final approval of the article: A. Qaseem, P. Alguire, L.E. Feinberg, F.T. Fitzgerald, C. Horwitch, L. Humphrey, R. LeBlond, D. Moyer, J.G. Wiese, S. Weinberger.
Provision of study materials or patients: A. Qaseem.
Statistical expertise: A. Qaseem.
Administrative, technical, or logistic support: A. Qaseem, P. Alguire.
Collection and assembly of data: A. Qaseem, P. Alguire, P. Dallas, L.E. Feinberg, F.T. Fitzgerald, C. Horwitch, D. Moyer, J.G. Wiese, S. Weinberger.