

ANDREI BRATEANU, MD

Department of Internal Medicine, Medicine Institute, Cleveland Clinic; Assistant Professor, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland, OH

MICHAEL B. ROTHBERG, MD, MPH

Vice Chair for Research, Medicine Institute, Cleveland Clinic, Cleveland Clinic; Professor, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland, OH

Why do clinicians continue to order ‘routine preoperative tests’ despite the evidence?

GUIDELINES AND PRACTICE ADVISORIES issued by several medical societies, including the American Society of Anesthesiologists,¹ American Heart Association (AHA) and American College of Cardiology (ACC),² and Society of General Internal Medicine,³ advise against routine preoperative testing for patients undergoing low-risk surgical procedures. Such testing often includes routine blood chemistry, complete blood cell counts, measures of the clotting system, and cardiac stress testing.

See related article, page 664

In this issue of the *Cleveland Clinic Journal of Medicine*, Dr. Nathan Houchens reviews the evidence against these measures.⁴

Despite a substantial body of evidence going back more than 2 decades that includes prospective randomized controlled trials,^{5–10} physicians continue to order unnecessary, ineffective, and costly tests in the perioperative period.¹¹ The process of abandoning current medical practice—a phenomenon known as *medical reversal*¹²—often takes years,¹³ because it is more difficult to convince physicians to discontinue a current behavior than to implement a new one.¹⁴ The study of what makes physicians accept new therapies and abandon old ones began more than half a century ago.¹⁵

More recently, Cabana et al¹⁶ created a framework to understand why physicians do not follow clinical practice guidelines. Among the reasons are lack of familiarity or agreement with the contents of the guideline, lack of out-

doi:10.3949/ccjm.82a.15118

come expectancy, inertia of previous practice, and external barriers to implementation.

The rapid proliferation of guidelines in the past 20 years has led to numerous conflicting recommendations, many of which are based primarily on expert opinion.¹⁷ Guidelines based solely on randomized trials have also come under fire.^{18,19}

In the case of preoperative testing, the recommendations are generally evidence-based and consistent. Why then do physicians appear to disregard the evidence? We propose several reasons why they might do so.

■ SOME PHYSICIANS ARE UNFAMILIAR WITH THE EVIDENCE

The complexity of the evidence summarized in guidelines has increased exponentially in the last decade, but physician time to assess the evidence has not increased. For example, the number of references in the executive summary of the ACC/AHA perioperative guidelines increased from 96 in 2002 to 252 in 2014. Most of the recommendations are backed by substantial amounts of high-quality evidence. For example, there are 17 prospective and 13 retrospective studies demonstrating that routine testing with the prothrombin time and the partial thromboplastin time is not helpful in asymptomatic patients.²⁰

Although compliance with medical evidence varies among specialties,²¹ most physicians do not have time to keep up with the ever-increasing amount of information. Specifically in the area of cardiac risk assessment, there has been a rapid proliferation of tests

It is harder to convince physicians to discontinue a current behavior than to implement a new one

that can be used to assess cardiac risk.^{22–28} In a Harris Interactive survey from 2008, physicians reported not applying medical evidence routinely. One-third believed they would do it more if they had the time.²⁹ Without information technology support to provide medical information at the point of care,³⁰ especially in small practices, using evidence may not be practical. Simply making the information available online and not promoting it actively does not improve utilization.³¹

As a consequence, physicians continue to order unnecessary tests, even though they may not feel confident interpreting the results.³²

■ PHYSICIANS MAY NOT BELIEVE THE EVIDENCE

A lack of transparency in evidence-based guidelines and, sometimes, a lack of flexibility and relevance to clinical practice are important barriers to physicians' acceptance of and adherence to evidence-based clinical practice guidelines.³⁰

Even experts who write guidelines may not be swayed by the evidence. For example, a randomized prospective trial of almost 6,000 patients reported that coronary artery revascularization before elective major vascular surgery does not affect long-term mortality rates.³³ Based on this study, the 2014 ACC/AHA guidelines² advised against revascularization before noncardiac surgery exclusively to reduce perioperative cardiac events. Yet the same guidelines do recommend assessing for myocardial ischemia in patients with elevated risk and poor or unknown functional capacity, using a pharmacologic stress test. Based on the extent of the stress test abnormalities, coronary angiography and revascularization are then suggested for patients willing to undergo coronary artery bypass grafting (CABG) or percutaneous coronary intervention.²

The 2014 European Society of Cardiology and European Society of Anaesthesiology guidelines directly recommend revascularization before high-risk surgery, depending on the extent of a stress-induced perfusion defect.³⁴ This recommendation relies on data from the Coronary Artery Surgery Study registry, which included almost 25,000 patients who underwent coronary angiography from

1975 through 1979. At a mean follow-up of 4.1 years, 1,961 patients underwent high-risk surgery. In this observational cohort, patients who underwent CABG had a lower risk of death and myocardial infarction after surgery.³⁵ The reliance of medical societies³⁴ on data that are more than 30 years old—when operative mortality rates and the treatment of coronary artery disease have changed substantially in the interim and despite the fact that this study did not test whether preoperative revascularization can reduce postoperative mortality—reflects a certain resistance to accept the results of the more recent and relevant randomized trial.³³

Other physicians may also prefer to rely on selective data or to simply defer to guidelines that support their beliefs. Some physicians find that evidence-based guidelines are impractical and rigid and reduce their autonomy.³⁶ For many physicians, trials that use surrogate end points and short-term outcomes are not sufficiently compelling to make them abandon current practice.³⁷ Finally, when members of the guideline committees have financial associations with the pharmaceutical industry, or when corporations interested in the outcomes provide financial support for a trial's development, the likelihood of a recommendation being trusted and used by physicians is drastically reduced.³⁸

■ PRACTICING DEFENSIVELY

Even if physicians are familiar with the evidence and believe it, they may choose not to act on it. One reason is fear of litigation.

In court, attorneys can use guidelines as well as articles from medical journals as both exculpatory and inculpatory evidence. But they more frequently rely on the standard of care, or what most physicians would do under similar circumstances. If a patient has a bad outcome, such as a perioperative myocardial infarction or life-threatening bleeding, the defendant may assert that testing was unwarranted because guidelines do not recommend it or because the probability of such an outcome was low. However, because the outcome occurred, the jury may not believe that the probability was low enough not to consider, especially if expert witnesses testify that the

Most physicians do not have time to keep up with the ever-increasing amount of information

standard of care would be to order the test.

In areas of controversy, physicians generally believe that erring on the side of more testing is more defensible in court.³⁹ Indeed, following established practice traditions, learned during residency,^{11,40} may absolve physicians in negligence claims if the way medical care was delivered is supported by recognized and respected physicians.⁴¹

As a consequence, physicians prefer to practice the same way their peers do rather than follow the evidence. Unfortunately, the more procedures physicians perform for low-risk patients, the more likely these tests will become accepted as the legal standard of care.⁴² In this vicious circle, the new standard of care can increase the risk of litigation for others.⁴³ Although unnecessary testing that leads to harmful invasive tests or procedures can also result in malpractice litigation, physicians may not consider this possibility.

■ FINANCIAL INCENTIVES

The threat of malpractice litigation provides a negative financial incentive to keep performing unnecessary tests, but there are a number of positive incentives as well.

First, physicians often feel compelled to order tests when they believe that physicians referring the patients want the tests done, or when they fear that not completing the tests could delay or cancel the scheduled surgery.⁴⁰ Refusing to order the test could result in a loss of future referrals. In contrast, ordering tests allows them to meet expectations, preserve trust, and appear more valuable to referring physicians and their patients.

Insurance companies are complicit in these practices. Paying for unnecessary tests can create direct financial incentives for physicians or institutions that own on-site laboratories or diagnostic imaging equipment. Evidence shows that under those circumstances physicians do order more tests. Self-referral and referral to facilities where physicians have

a financial interest is associated with increased healthcare costs.⁴⁴ In addition to direct revenues for the tests performed, physicians may also bill for test interpretation, follow-up visits, and additional procedures generated from test results.

This may be one explanation why the ordering of cardiac tests (stress testing, echocardiography, vascular ultrasonography) by US physicians varies widely from state to state.⁴⁵

■ RECOMMENDATIONS TO REDUCE INAPPROPRIATE TESTING

To counter these influences, we propose a multifaceted intervention that includes the following:

- Establish preoperative clinics staffed by experts. Despite the large volume of potentially relevant evidence, the number of articles directly supporting or refuting preoperative laboratory testing is small enough that physicians who routinely engage in preoperative assessment should easily master the evidence.
- Identify local leaders who can convince colleagues of the evidence. Distribute evidence summaries or guidelines with references to major articles that support each recommendation.
- Work with clinical practice committees to establish new standards of care within the hospital. Establish hospital care paths to dictate and support local standards of care. Measure individual physician performance and offer feedback with the goal of reducing utilization.
- National societies should recommend that insurance companies remove inappropriate financial incentives. If companies deny payment for inappropriate testing, physicians will stop ordering it. Even requirements for preauthorization of tests should reduce utilization. The Choosing Wisely campaign (www.choosingwisely.org) would be a good place to start. ■

Even physicians who write the guidelines may be unswayed by the evidence

■ REFERENCES

1. **Committee on Standards and Practice Parameters, Apfelbaum JL, Connis RT, Nickinovich DG, et al.** Practice advisory for preanesthesia evaluation. An updated report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation. *Anesthesiology* 2012; 116:522–538.
2. **Fleisher LA, Fleischmann KE, Auerbach AD, et al; American College of Cardiology and American Heart Association.** 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines. *J Am Coll Cardiol* 2014; 64:e77–e137.
3. **Society of General Internal Medicine.** Don't perform routine preoperative testing before low-risk surgical procedures. *Choosing Wisely*.

- An initiative of the ABIM Foundation. September 12, 2013. www.choosingwisely.org/clinician-lists/society-general-internal-medicine-routine-preoperative-testing-before-low-risk-surgery/. Accessed August 31, 2015.
4. Houchens N. Should healthy patients undergoing low-risk, elective, noncardiac surgery undergo routine preoperative laboratory testing? *Cleve Clin J Med* 2015; 82:664–666.
 5. Rohrer MJ, Michelotti MC, Nahrwold DL. A prospective evaluation of the efficacy of preoperative coagulation testing. *Ann Surg* 1988; 208:554–557.
 6. Eagle KA, Coley CM, Newell JB, et al. Combining clinical and thallium data optimizes preoperative assessment of cardiac risk before major vascular surgery. *Ann Intern Med* 1989; 110:859–866.
 7. Mangano DT, London MJ, Tubau JF, et al. Dipyridamole thallium-201 scintigraphy as a preoperative screening test. A reexamination of its predictive potential. Study of Perioperative Ischemia Research Group. *Circulation* 1991; 84:493–502.
 8. Stratmann HG, Younis LT, Wittry MD, Amato M, Mark AL, Miller DD. Dipyridamole technetium 99m sestamibi myocardial tomography for preoperative cardiac risk stratification before major or minor nonvascular surgery. *Am Heart J* 1996; 132:536–541.
 9. Schein OD, Katz J, Bass EB, et al. The value of routine preoperative medical testing before cataract surgery. Study of Medical Testing for Cataract Surgery. *N Engl J Med* 2000; 342:168–175.
 10. Hashimoto J, Nakahara T, Bai J, Kitamura N, Kasamatsu T, Kubo A. Preoperative risk stratification with myocardial perfusion imaging in intermediate and low-risk non-cardiac surgery. *Circ J* 2007; 71:1395–1400.
 11. Smetana GW. The conundrum of unnecessary preoperative testing. *JAMA Intern Med* 2015; 175:1359–1361.
 12. Prasad V, Cifu A. Medical reversal: why we must raise the bar before adopting new technologies. *Yale J Biol Med* 2011; 84:471–478.
 13. Tatsioni A, Bonitsis NG, Ioannidis JP. Persistence of contradicted claims in the literature. *JAMA* 2007; 298:2517–2526.
 14. Moscucci M. Medical reversal, clinical trials, and the “late” open artery hypothesis in acute myocardial infarction. *Arch Intern Med* 2011; 171:1643–1644.
 15. Coleman J, Menzel H, Katz E. Social processes in physicians’ adoption of a new drug. *J Chronic Dis* 1959; 9:1–19.
 16. Cabana MD, Rand CS, Powe NR, et al. Why don’t physicians follow clinical practice guidelines? A framework for improvement. *JAMA* 1999; 282:1458–1465.
 17. Tricoci P, Allen JM, Kramer JM, Califf RM, Smith SC Jr. Scientific evidence underlying the ACC/AHA clinical practice guidelines. *JAMA* 2009; 301:831–841.
 18. Moher D, Hopewell S, Schulz KF, et al; CONSORT. CONSORT 2010 explanation and elaboration: updated guidelines for reporting parallel group randomised trials. *Int J Surg* 2012; 10:28–55.
 19. Gattinoni L, Gjomarelli P. Acquiring knowledge in intensive care: merits and pitfalls of randomized controlled trials. *Intensive Care Med* 2015; 41:1460–1464.
 20. Levy JH, Szlam F, Wolberg AS, Winkler A. Clinical use of the activated partial thromboplastin time and prothrombin time for screening: a review of the literature and current guidelines for testing. *Clin Lab Med* 2014; 34:453–477.
 21. Dale W, Hemmerich J, Moliski E, Schwarze ML, Tung A. Effect of specialty and recent experience on perioperative decision-making for abdominal aortic aneurysm repair. *J Am Geriatr Soc* 2012; 60:1889–1894.
 22. Underwood SR, Anagnostopoulos C, Cerqueira M, et al; British Cardiac Society, British Nuclear Cardiology Society, British Nuclear Medicine Society, Royal College of Physicians of London, Royal College of Physicians of London. Myocardial perfusion scintigraphy: the evidence. *Eur J Nucl Med Mol Imaging* 2004; 31:261–291.
 23. Das MK, Pellikka PA, Mahoney DW, et al. Assessment of cardiac risk before nonvascular surgery: dobutamine stress echocardiography in 530 patients. *J Am Coll Cardiol* 2000; 35:1647–1653.
 24. Meijboom WB, Mollet NR, Van Mieghem CA, et al. Pre-operative computed tomography coronary angiography to detect significant coronary artery disease in patients referred for cardiac valve surgery. *J Am Coll Cardiol* 2006; 48:1658–1665.
 25. Russo V, Gostoli V, Lovato L, et al. Clinical value of multidetector CT coronary angiography as a preoperative screening test before non-coronary cardiac surgery. *Heart* 2007; 93:1591–1598.
 26. Schuetz GM, Zacharopoulou NM, Schlattmann P, Dewey M. Meta-analysis: noninvasive coronary angiography using computed tomography versus magnetic resonance imaging. *Ann Intern Med* 2010; 152:167–177.
 27. Bluemke DA, Achenbach S, Budoff M, et al. Noninvasive coronary artery imaging: magnetic resonance angiography and multidetector computed tomography angiography: a scientific statement from the American Heart Association Committee on Cardiovascular Imaging and Intervention of the Council on Cardiovascular Radiology and Intervention, and the Councils on Clinical Cardiology and Cardiovascular Disease in the Young. *Circulation* 2008; 118:586–606.
 28. Nagel E, Lehmkühl HB, Bocksch W, et al. Noninvasive diagnosis of ischemia-induced wall motion abnormalities with the use of high-dose dobutamine stress MRI: comparison with dobutamine stress echocardiography. *Circulation* 1999; 99:763–770.
 29. Taylor H. Physicians’ use of clinical guidelines—and how to increase it. *Healthcare News* 2008; 8:32–55. www.harrisinteractive.com/vault/HI_HealthCareNews2008Vol8_Iss04.pdf. Accessed August 31, 2015.
 30. Kenefick H, Lee J, Fleishman V. Improving physician adherence to clinical practice guidelines. Barriers and strategies for change. New England Healthcare Institute, February 2008. www.nehi.net/writable/publication_files/file/cpg_report_final.pdf. Accessed August 31, 2015.
 31. Williams J, Cheung WY, Price DE, et al. Clinical guidelines online: do they improve compliance? *Postgrad Med J* 2004; 80:415–419.
 32. Wians F. Clinical laboratory tests: which, why, and what do the results mean? *Lab Medicine* 2009; 40:105–113.
 33. McFalls EO, Ward HB, Moritz TE, et al. Coronary-artery revascularization before elective major vascular surgery. *N Engl J Med* 2004; 351:2795–2804.
 34. Kristensen SD, Knuuti J, Saraste A, et al; Authors/Task Force Members. 2014 ESC/ESA guidelines on non-cardiac surgery: cardiovascular assessment and management: The Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA). *Eur Heart J* 2014; 35:2383–2431.
 35. Eagle KA, Rihal CS, Mickel MC, Holmes DR, Foster ED, Gersh BJ. Cardiac risk of noncardiac surgery: influence of coronary disease and type of surgery in 3368 operations. CASS Investigators and University of Michigan Heart Care Program. Coronary Artery Surgery Study. *Circulation* 1997; 96:1882–1887.
 36. Farquhar CM, Kofa EW, Slutsky JR. Clinicians’ attitudes to clinical practice guidelines: a systematic review. *Med J Aust* 2002; 177:502–506.
 37. Prasad V, Cifu A, Ioannidis JP. Reversals of established medical practices: evidence to abandon ship. *JAMA* 2012; 307:37–38.
 38. Steinbrook R. Guidance for guidelines. *N Engl J Med* 2007; 356:331–333.
 39. Sirovich BE, Woloshin S, Schwartz LM. Too little? Too much? Primary care physicians’ views on US health care: a brief report. *Arch Intern Med* 2011; 171:1582–1585.
 40. Brown SR, Brown J. Why do physicians order unnecessary preoperative tests? A qualitative study. *Fam Med* 2011; 43:338–343.
 41. LeCraw LL. Use of clinical practice guidelines in medical malpractice litigation. *J Oncol Pract* 2007; 3:254.
 42. Studdert DM, Mello MM, Sage WM, et al. Defensive medicine among high-risk specialist physicians in a volatile malpractice environment. *JAMA* 2005; 293:2609–2617.
 43. Budetti PP. Tort reform and the patient safety movement: seeking common ground. *JAMA* 2005; 293:2660–2662.
 44. Bishop TF, Federman AD, Ross JS. Laboratory test ordering at physician offices with and without on-site laboratories. *J Gen Intern Med* 2010; 25:1057–1063.
 45. Rosenthal E. Medical costs rise as retirees winter in Florida. *The New York Times*, Jan 31, 2015. <http://nyti.ms/1vmjfa5>. Accessed August 31, 2015.

ADDRESS: Andrei Brateanu, MD, Department of Medicine, NA10, Cleveland Clinic, 9500 Euclid Avenue, Cleveland, OH 44195; e-mail: abrteanu@ccf.org