

Are lab tests overused: Large-scale analysis finds inappropriate lab testing throughout medicine

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Laboratory testing is health care's single highest volume activity, with over 5 billion tests performed each year in the U.S.

Now a new study examining 15 years' worth of published research reveals some surprising findings about the humble blood [test](#). Led by investigators at Beth Israel Deaconess Medical Center (BIDMC) and reported on-line today in the journal *PLOS ONE*, the large-scale analysis of 1.6 million results from 46 of medicine's 50 most commonly ordered lab tests finds that, on average, 30 percent of all tests are probably unnecessary. Even more surprising, the results suggest that equally as many necessary tests may be going unordered.

"Lab tests are used in all medical specialties, affecting virtually all patients," explains senior author Ramy Arnaout, MD, DPhil, Associate Director of the Clinical Microbiology Laboratories in the Department of Pathology at BIDMC and Assistant Professor of Pathology at Harvard Medical School (HMS). "While working with my clinical colleagues around the hospital, I often found myself wondering about the appropriateness or inappropriateness of all of these tests. In developing this study, my coauthors and I wanted to learn more about overall lab test utilization so that we could better understand how and where errors were occurring in this extremely high-volume activity."

Their findings revealed a stark problem: Not only was there a 30 percent

overall rate of test overuse— there was a similar rate of underuse.

While the authors found both overuse and underuse to be prevalent problems throughout laboratory testing, the overall findings point to a bigger issue, says Arnaout. "It's not ordering more tests or fewer tests that we should be aiming for, it's ordering the right tests, however few or many that is," he notes. "Remember, lab tests are inexpensive. Ordering one more test or one less test isn't going to 'bend the curve,' even if we do it across the board. It's everything that happens next – the downstream visits, the surgeries, the hospital stays – that matters to patients and to the economy and should matter to us."

"This paper explores many of the nuances surrounding exactly how, when and why lab tests are ordered and misordered," says Jeffrey Saffitz, MD, PhD, BIDMC Chairman of Pathology. "Many times, the reasons for ordering tests seems to be based on dogma, the way it's always been done. This comprehensive and meticulous analysis shows that there are patterns in laboratory test utilization that can reveal when we do a good job at ordering tests and where we need to do better."

To conduct the study, the authors undertook a thorough review of the medical literature. Going back to 1997 – the year that the last previous review of lab tests had been conducted – Arnaout, together with first author Ming Zhi, MD, then a student at Harvard Medical School and currently an intern at Kaiser Permanente Santa Clara Medical Center, began by scouring a host of databases matching terms such as "laboratory," "blood test," "utilization," "overuse," and "underuse." They came up with approximately 34,000 papers.

"We cast a wide net, then filtered things out and eventually got down to a couple of hundred papers on laboratory utilization," says Arnaout. Further refinement led to an examination of 42 papers covering 1.6 million orders of 46 of the 50 most commonly ordered lab tests. These

ranged from common tests such as the complete blood count and basic metabolic panel to less common tests like D-dimer (for pulmonary embolism) and HIV-1 tests.

From these measurements, they set about estimating the overall prevalence of inappropriate testing, including overuse (tests that are ordered but not indicated) and underuse (tests that are indicated but not ordered.) They also distinguished between inappropriate initial testing – during a clinician's first evaluation of a patient or in response to new signs or symptoms – and inappropriate repeat testing, which occurs when the same tests are repeated – often multiple times – during a patient's hospitalization.

"Most of the time when doctors talk about inappropriate lab testing, there's a generally accepted notion that it's too many 'repeat' tests being ordered," says Arnaout. "But, unexpectedly, on a per-test basis, we actually found that the main problem was tests being over-ordered during a patient's initial examination, rather than during repeat tests. This indicates to us that ordering the right test during the initial evaluation may lead to fewer errors and better patient care."

The authors also established a number of criteria that influence how doctors order [lab tests](#) and examined their final outcomes in the context of these criteria, for example, what they call restrictive vs. permissive criteria.

"In medicine, as a rule, we only do things if there is a reason," says Arnaout. "You'd never have a situation where you drop a loved one off at the doctor and when you pick them up at the end of a day, they're missing a foot because the doctor went down a checklist and couldn't see any reason not to remove the foot. That doesn't happen because medicine adheres to 'restrictive' policies. However, as our findings showed, laboratory medicine is the exception to this rule. In ordering

blood tests, we too often tend to be permissive, asking 'why not?' instead of 'why?'"

In fact, first author Ming Zhi notes that as a medical resident, he now finds himself in this very position as he decides which tests to order on a day-to-day basis. "I think there's often a mindset of 'just go ahead and order the tests,'" he explains. "But I've now discovered that it's a lot more nuanced in the clinical setting. Working on this project has had a direct impact on my own behavior. I find myself asking, 'Do my patients really need another set of tests? Do they really need another needle stick? Is there a test they may need that I left out?'"

"Because laboratory tests play such a crucial and ubiquitous role in medicine, efforts to identify opportunities for improvement in the selection of tests have the potential to contribute greatly to the care patients receive," adds William Taylor, MD, a clinician in BIDMC's Division of General Medicine and Primary Care. "By drawing attention to this important topic, Dr. Arnaout and his colleagues are setting the stage for further work to help more patients benefit from proper test selection, while protecting patients from the potential harm and wasted resources induced by unnecessary tests."

"These findings offer the field of pathology both an opportunity and challenge for the future," adds Saffitz. "When it comes to appropriate lab testing I think the pathologist has as much responsibility to get it right as the doctor who is ordering the test. This paper focuses attention on this important issue."

Provided by Beth Israel Deaconess Medical Center

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