LESS IS MORE

A Decision Support Tool to Reduce Overtesting for Ceruloplasmin and Improve Adherence With Clinical Guidelines

Nondirected testing, simultaneously assessing a multitude of diseases, is a specific form of overtesting. This pattern of testing is expensive and generates false-positive test results. It is also common, particularly for the evaluation of liver disease. For example, elevated liver enzymes affect 7.9% of the US population, whereas Wilson disease, an inborn error of copper metabolism associated with liver injury, is routinely assessed along with viral hepatitis despite affecting only 0.003% of the US population.

Guidelines suggest testing for Wilson disease with ceruloplasmin blood levels after excluding common liver diseases and, given the rarity of late-onset Wilson disease, recommends rarely testing patients older than 55 years. We conducted a prospective study to evaluate the effect of a decision support tool on ceruloplasmin use by measuring use rates 7 months before and 7 months after implementing an electronic pop-up in electronic medical record system at Beth Israel Deaconess Medical Center. The study reviewed records from October 1, 2013, through November 27, 2014.

Methods | All ceruloplasmin orders that had been placed by all physicians associated with the academic medical center were reviewed. When clinicians ordered the ceruloplasmin test after implementation, the decision support tool (Figure 1) pops up on the computer screen to confirm the physicians’ intent. The primary outcome was the number of ceruloplasmin orders made at the same time as orders for viral hepatitis. The secondary outcome was the number of orders made for patients older than 55 years. Ceruloplasmin values lower than 20 mg/dL were considered positive for Wilson disease. Diagnoses were determined from confirmatory testing of urine or hepatic copper levels. α1-Antitrypsin levels are often ordered to evaluate liver disease. As such, we were able to compare trends in ceruloplasmin use with α1-antitrypsin use. Outcomes were assessed using rate ratios (RRs) with time denominators specific to the length of observation 211 days before and 210 days after implementation. This study was approved by the medical center’s institutional review board.

Results | Ceruloplasmin was ordered 448 times (mean times per day, 2.12) before implementation and 219 times (mean times per day, 2.1) after implementation (RR, 0.49; 95% CI, 0.42-0.58; \( P < .001 \)). There was no reduction in the rate of α1-antitrypsin orders: 449 before and 418 after. Compared with α1-antitrypsin orders, the RR of ceruloplasmin orders decreased from 1.00 (95% CI, 0.88-1.14; \( P > .99 \)) before implementation to 0.53 (95% CI, 0.45-0.62; \( P < .001 \)) after implementation (Figure 2). Simultaneous tests for viral hepatitis decreased from 407 before implementation to 185 after implementation (RR, 0.46; 95% CI, 0.38-0.54; \( P < .001 \)). The number of patients older than 55 years whose blood samples were tested for ceruloplasmin decreased from 158 to 61 (RR, 0.39; 95% CI, 0.29-0.52; \( P < .001 \)). For comparison, in this subpopulation, α1-antitrypsin tests were ordered at rates of 0.88 patients per day before and 0.84 patients per day after implementation. The RR for α1-antitrypsin and ceruloplasmin orders made simultaneously decreased from 0.85 (95% CI, 0.69-1.06; \( P = .14 \)) before implementation to 0.34 (95% CI, 0.26-0.46; \( P < .001 \)) after implementation. No new diagnoses of Wilson disease were made during the study period; all results that had tested positive for ceruloplasmin (regardless of study phase) had negative confirmatory urine or hepatic test results.

Discussion | In this prospective trial, the decision support tool was associated with a reduction in ceruloplasmin overutilization. The findings from our study could inform programs to reduce the number of orders for nondirected tests in other common clinical scenarios, including antibody tests for rheumatologic or infectious diseases or routine blood tests for routine daily blood tests for inpatients.

Our results may not be generalizable to centers with other approaches to liver disease. Further study is needed to extend this intervention into systematic changes including reflex testing of rare conditions after common diseases have been excluded or restricting testing options for clinicians.

In summary, a simple decision support tool that interrupts workflow can reduce overtesting. A pop-up screen in
tervent can be used for other conditions for which nondirected testing is common.

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Editor’s Note
Maximizing the EMR’s Educational Potential

Today, a small but significant amount of our education as house officers comes from pop-up alerts in the electronic medical record (EMR). Medical school lectures shaped our understanding of venous thromboembolism prophylaxis, antibiotic stewardship, and transfusion of blood products. In residency, EMR-based clinical decision support (CDS) tools cement the Padua score, empirical antibiotic choices, and appropriate transfusion thresholds. We contend that involving medical trainees in developing CDS tools will increase their value in academic medical centers.

In this issue of JAMA Internal Medicine, Tapper et al report on a CDS intervention at a single academic center where providers frequently drew ceruloplasmin levels during initial evaluation of abnormal liver function tests. This expense practice runs contrary to American Association for the Study of Liver Disease (AASLD) guidelines. The authors created an alert that popped up when ceruloplasmin was ordered describing the rarity of Wilson disease and the situations in which the AASLD recommended testing for it. Their before-and-after analysis demonstrated that all ceruloplasmin orders decreased by half and first-pass ceruloplasmin orders—those ordered at the same time as viral hepatitis serologies—decreased even more substantially.

In a recent systematic review of health information technology (IT) implementation, the Office of the National Coordinator for Health IT highlighted well-implemented CDS tools that reduce cost, length of stay, and mortality. However, they also find health IT interventions that are ineffective or even detrimental. Too many pop-ups lead to alert fatigue, which limits CDS efficacy and resident physician sanity. Among other worries, some fear that trainees may develop so-called “automation bias” by relying on CDS tools to make decisions, rather than thinking critically and independently. It is not yet well understood what aspects of CDS tools increase high-value care, clinical efficiency, and trainee education; pinpointing them is crucial to advance the field.