

Reducing Unnecessary Phlebotomy Testing Using a Clinical Decision Support System

Valerie L. Strockbine, MSN, RN, CPHQ, Cathie E. Guzzetta, PhD, RN, FAAN, Eric Gehrie, MD, SM, Qiuping (Pearl) Zhou, PhD, RN

Background/Evidence

Overuse of phlebotomy testing offers little to improve patient outcomes but may subject patients to additional morbidity. As a value-based system in healthcare continues to evolve, providers and healthcare organizations need to reduce non-value-added care without compromising quality. Low-cost, high-frequency tests are often ordered recurrently, unnecessarily, and contribute to the high cost of health care. Reducing unnecessary phlebotomy tests can cut costs without compromising quality.

Clinical decision support systems (CDSSs) are applications embedded in the electronic health record with specific patient information that appear at the time of ordering to assist health care professionals in decision-making to improve care.

Adoption of CDSSs have been successful in reducing unnecessary radiologic imaging, overuse of antibiotics, and *Clostridium difficile* testing.

Problem & Purpose

Type and screen testing is used to determine blood compatibility and identify clinically significant antibodies affecting blood transfusion compatibility.

Type and screen testing was suspected to be unnecessarily ordered in our organization. Type and screen tests are active for three days from the date the specimen is collected, yet many patients receive orders for repeat testing well in advance of the sample's expiration. Effects of CDSS have not been assessed when applied specifically to type and screen tests.

The specific aims of our study were to:

- Determine the number of unnecessarily ordered type and screen tests prior to and after implementation of a CDSS.
- Determine the difference in estimated costs of unnecessary type and screen testing based on testing materials and labor expenses before versus after implementation of a CDSS.
- Describe the unnecessary type and screen test ordering practices of different provider type(s) (i.e., physician, advanced practice nurse [APRN], and physician assistant [PA]) before and after implementation of a CDSS.

Methods

Design: Our value improvement initiative used a retrospective separate-sample pretest posttest design.

Sample: The total number of appropriate and unnecessarily ordered type and screen tests from the three-month pre-intervention and three-month post-intervention period was used to determine effectiveness of the CDSS. All unnecessarily ordered tests from the pre- and post- intervention periods were used for cost estimation. Random selections of 801 tests before and 801 tests after the intervention were used to describe ordering practices by provider type.

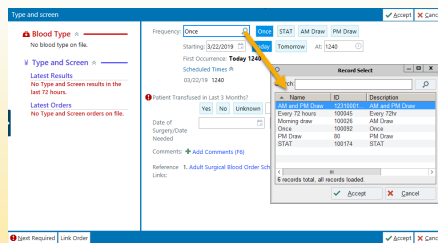
Setting: Large Mid-Atlantic urban academic medical center.

Intervention: A CDSS to promote appropriate test ordering was embedded in our computerized order entry (CPOE) system. The CDSS appears when a type and screen test is ordered informing the provider of the date and time the current test expires (Figure 1).

Measurement: The total number of type and screen tests was captured in a monthly aggregate report. Unnecessary tests are those ordered and preformed prior to the previous test's expiration. Using data from the CPOE, laboratory information, and transfusion software systems, a customized report identified the unnecessary tests. Estimated cost of unnecessary tests used a combination of direct costs and labor costs. Our office of credentialing provided the total number of each provider type employed at our medical center.

Analysis: Pre-intervention and post-intervention data were compared using chi-square, time-drive activity-based costing estimate, and descriptive statistics. Level of significance was set at 0.05.

Figure 1 CDSS for Type and Screen Test



Results

There were a total of 26,206 pre- and 25,053 post-intervention specimens. Significantly fewer unnecessary type and screen tests were ordered after the intervention (12.3%, n=3,073) than before (14.1%, n=3,691; $p < 0.001$; Table 1), representing a reduction of 16.7%

The results demonstrated an estimated yearly savings of \$142,612 (Table 2). The majority of the tests were ordered by physicians (85.3% before and 83.1% after the intervention) compared to APRNs and PAs (Table 3).

Table 1 Unnecessary Type and Screen Tests Ordered Before Versus After Implementation of a CDSS

	Total n (%)	Appropriate order n (%)	Unnecessary order n (%)	Statistic χ^2	p-value
Pre-CDSS tool	26206 (100)	225151 (85.9)	3691 (14.1)	36.98	<0.001
Post-CDSS tool	25053 (100)	21980 (87.7)	3073 (12.3)		

Table 2 Estimated Cost of Unnecessary Type and Screen Tests Ordered Before Versus After CDSS

	Pre-CDSS	Post-CDSS
Estimated cost of unnecessary tests during 3 month data collection period	\$212,936.00	\$177,283.00
Estimated annual cost of unnecessary tests	\$851,744.00	\$709,132.00
Estimated yearly savings		\$142,612

Table 3 Unnecessary Type and Screen Tests Ordered by Provider Type Before Versus After Implementation of a CDSS

	Total n (%)	Physician n (%)	APRN n (%)	PA n (%)
Pre-CDSS	801 (50)	683 (85.3)	51 (6.4)	67 (8.4)
Post-CDSS	801 (50)	666 (83.1)	80 (10)	55 (6.9)
Total	1602 (100)	1349 (84.2)	131 (8.2)	122 (7.6)

Conclusions

Our study demonstrated that a CDSS impacted a variety of provider types, reduced unnecessary phlebotomy tests, and achieved yearly cost savings. To further improve test ordering practices of all provider types, we recommend additional interventions such as organizational support, education, audits, and feedback.

Unnecessary laboratory testing continues in health care and contributes to excessive health spending without adding value. Phlebotomy testing is one example of how providers can reduce waste and control healthcare costs for low-cost, high-frequency tests.

In this era of precision healthcare, the upshot of ordering the right test, at the right time, for the right reason can reduce cost, reduce waste, improve quality and satisfaction for patients.

Implications

Our study illustrates the effectiveness of CDSS as a means of reducing unnecessary health care services. CPOE is widely used in a variety of health care settings and can incorporate CDSS to guide all provider types to make judicious decisions at the time of care.

Until the establishment of national quality measures aimed to control the number of low-cost, high-frequency tests, health systems must find a way to reduce unnecessary health services.