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## Decreasing unnecessary laboratory testing in medical critical care

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### Abstract

The overuse of laboratory testing is common in the intensive care unit (ICU) which leads to an increased cost of care and an increased potential for harm to the patient. There is no evidence that obtaining daily laboratory tests helps to reduce mortality or morbidity in critical care patients. We conducted a retrospective study where chart review was performed to assess the frequency of unnecessary laboratory testing followed by a quality improvement initiative. With our study we were successful at reducing the inappropriate laboratory testing and improving the appropriate laboratory testing through our study.

### Conflict of Interest Statement

none

## ARTICLE

# Decreasing Unnecessary Laboratory Testing in Medical Critical Care

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## Abstract

The overuse of laboratory testing is common in the intensive care unit (ICU) which leads to an increased cost of care and an increased potential for harm to the patient. There is no evidence that obtaining daily laboratory tests helps to reduce mortality or morbidity in critical care patients. We conducted a retrospective study where chart review was performed to assess the frequency of unnecessary laboratory testing followed by a quality improvement initiative. With our study we were successful at reducing the inappropriate laboratory testing and improving the appropriate laboratory testing through our study.

## 1. Introduction

The overuse of laboratory testing is common in the intensive care unit (ICU). Daily laboratory testing is obtained for diagnosis, monitoring of disease, and assessing the response to treatment in critically ill patients. Overuse of testing leads to an increased cost of care and an increased potential for harm to the patient.

There has been no supporting data in the literature that obtaining laboratory tests daily helps to reduce mortality or morbidity in critical care patients. Many times, the patient gets several blood draws for testing because of lack of awareness, providers' fears of missing a diagnosis, or as a part of an order set. A study by Smoller and colleagues has shown that an average of 3.4 blood draws per day and a total of 762.2 ml of blood is drawn during the entire hospitalization for ICU patients. Increased laboratory testing occurs more frequently in patients with an arterial line, which may subsequently lead to a need for a blood transfusion.<sup>1</sup>

The purpose of this retrospective study was to assess the frequency of unnecessary laboratory testing at baseline followed by a quality

improvement initiative to reduce this testing. Appropriate laboratory testing was defined as having supporting documentation in the electronic medical record (EMR) that the lab studies were clinically indicated, and the results were used for decision making, monitoring of disease condition, or to see the response to treatment. The study hypothesizes that routine morning laboratory studies are often not utilized for patient management, contributing to unnecessary blood draws, and that an educational intervention will decrease the unnecessary laboratory studies.

## 2. Methods

This was an observational study conducted pre- and post-an educational intervention. The primary objective was to observe the frequency of laboratory studies in patients admitted to the medical ICU before and after the intervention, and to assess whether appropriateness of testing is documented in the EMR. The study included patients greater than 18 years of age admitted to the medical ICU of Robert Packer Hospital for >24 h. The study excluded patients admitted for <24 h or those who were in comfort care. The Institutional Review

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Board of The Guthrie Clinic approved the study and included a waiver of informed consent.

2.1. Pre-intervention

During a 2-month pre-intervention period, researchers used an Apache Outcomes (Cerner, Inc) ICU report and retrospectively reviewed patient charts to assess laboratory testing appropriateness. Each patient chart review looked at morning complete blood count (CBC) and basic metabolic panel (BMP). Researchers reviewed provider notes to calculate the percentage of laboratory tests that had documentation in the EMR for utilization of the lab results for decision making, monitoring of disease condition, or to see the response to treatment.

2.2. Intervention

Our intervention was aimed at resident physicians, critical care attendings and nursing staff of our medical ICU. Preintervention data was used to enlighten the ICU team on percentage of inappropriate laboratory studies. Guidelines were developed to define criteria for obtaining a CBC or BMP and to ensure that documentation demonstrated use of these studies for decision making, monitoring of disease condition, or to see the response to treatment. Education focused on indications for requesting laboratory studies, utilization of results, and documentation of the review of the studies. Researchers developed educational training with input from the internal medicine faculty according to the standard educational requirements of the internal medicine residency program. Researchers placed educational materials including pamphlets and flyers at the ICU workstations. Following the intervention, researchers analyzed data for the percentage of studies with documented utilization.

2.3. Post-intervention

Data for 2 months after the intervention assessed if there was improvement in appropriateness of the laboratory testing with documentation that the results were utilized for decision making, monitoring of disease condition, or to see the response to treatment.

3. Results

A total of 153 morning CBC and BMP studies were analyzed pre and post intervention. Appropriateness of laboratory test ordering was defined as either:

- 1) clinically indicated (CI) if the order contains supporting documentation in the EMR that the lab results were utilized for decision making, monitoring of disease condition, or to see the response to treatment.
- 2) non-clinically indicated (NCI) if the order does not contain supporting documentation in the EMR that the lab results were utilized for decision making, monitoring of disease condition, or to see the response to treatment.

At baseline, 60.1% of BMP and 54.2% of CBC studies had documentation that the laboratory test was clinically indicated. The percentage of clinically indicated BMP studies improved from 60.1% pre-intervention to 79.1% post-intervention. This was a statistically significant improvement. The percentage of clinically indicated CBCs improved from 54.2% pre-intervention to 60.8% post-intervention. This change was not statistically significant (Table 1). Statistical significance was determined by chi-square with p-values < 0.05 as statistically significant.

There was a significant increase in clinical indicated BMPs in the post intervention group compared to the pre-intervention group with a p-value of 0.001. There was no significant difference in clinical indicated studies between pre-intervention and post-intervention groups for CBCs.

4. Discussion

It is estimated that 4–5 billion laboratory tests are performed in the United States per year.

Unnecessary laboratory testing and diagnostic imaging is common. This results in increased cost of care and error leading to further testing. Excess blood testing leads to iatrogenic anemia and risks of infection. It has been associated with poor sleep quality in elderly patients contributing to hospital acquired delirium. A meta-analysis conducted by Zhi and colleagues estimated the rate of unnecessary laboratory testing to be 43.9% at the time of admission and 7.4% for subsequent testing.<sup>5</sup> A study conducted by Sedrak and colleagues assessed

Table 1. Pre and post intervention data.

Morning Laboratory Test		Pre-intervention n (%)	Post-intervention n (%)	p
BMP	CI	92 (60.1)	121 (79.1)	0.001
	NCI	61 (39.9)	32 (20.9)	
CBC	CI	83 (54.2)	93 (60.8)	0.298
	NCI	70 (45.8)	60 (39.2)	

CI = clinically indicated, NCI = not clinically indicated.

unnecessary ordering of laboratory tests by internal medicine and general surgery residents. This behavior was attributed to the health care system culture, lack of transparency of the costs associated with health care services, and lack of faculty role models that celebrate restraints.<sup>6</sup>

There are many examples of quality improvement project being done which have resulted in sustained reduction in number of unnecessary tests performed per day.<sup>4</sup>

Our findings were similar to the studies conducted by Kumwilaisak and colleaues and Dhanani and colleagues which showed that guidelines to decrease unnecessary laboratory testing reduced the frequency of tests, health care costs, and risk of complications such as anemia, without changing patient outcomes or mortality.<sup>2,3</sup>

#### 4.1. Limitations

Our study has several limitations.

1. Due to the study design as an observational study, there is no randomization to alleviate bias.
2. It is possible that the study improved documentation rather than reducing unnecessary lab testing.
3. Due to the abbreviated period of the study, it is not known if the improvement will be sustainable.

#### 5. Conclusion

Getting the right test at the right time is particularly important to achieve high value care. We were successful at reducing the inappropriate laboratory testing and improving the appropriate laboratory testing through our study. Continued

studies like ours on a larger scale can help minimize inappropriate laboratory testing and sustain it for a longer time. This will improve patient satisfaction and lower the cost without compromising care.

#### Author contribution

Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing.

#### Conflict of interest

The authors have no conflicts of interest to disclose.

#### References

1. Smoller BR, Kruskall MS. Phlebotomy for diagnostic laboratory tests in adults. Pattern of use and effect on transfusion requirements. *N Engl J Med.* 1986;314(19):1233–1235. <https://doi.org/10.1056/NEJM198605083141906>.
2. Kumwilaisak K, Noto A, Schmidt UH, et al. Effect of laboratory testing guidelines on the utilization of tests and order entries in a surgical intensive care unit. *Crit Care Med.* 2008; 36(11):2993–2999. <https://doi.org/10.1097/CCM.0b013e31818b3a9d>.
3. Dhanani JA, Barnett AG, Lipman J, et al. Strategies to reduce inappropriate laboratory blood test orders in intensive care are effective and safe: a before-and-after quality improvement study. *Anaesth Intensive Care.* 2018;46(3):313–320. <https://doi.org/10.1177/0310057X1804600309>.
4. Mehari SM, Havill JH. Written guidelines for laboratory testing in intensive care—still effective after 3 years. *Crit Care Resusc.* 2001;3(3):158–162.
5. Zhi M, Ding EL, Theisen-Toupal J, Whelan J, Arnaout R. The landscape of inappropriate laboratory testing: a 15-year meta-analysis. *PLoS One.* 2013;8(11), e78962. <https://doi.org/10.1371/journal.pone.0078962>.
6. Sedrak M, Patel M, Ziemba J, et al. Residents' self-report on why they order perceived unnecessary inpatient laboratory tests. *J Hosp Med.* 2016;11(12):869–872. <https://doi.org/10.1002/jhm.2645>.