

Patient Safety Tip of the Week

September 27, 2016 Lab Errors Costly

In our multiple columns on errors related to lab testing we've usually focused on the cost in human terms. But there is also a cost in financial terms. With results similar to prior studies, an ECRI Institute "Deep Dive" in 2014 ([ECRI Institute 2014](#)) showed 74% of lab errors occurred in the pre-analytic phase and 22% in the post-analytic phase. Only 4% occurred during the analytic phase.

A prior study ([Green 2013](#)) estimated that errors related to poor blood specimen quality and pre-analytical errors could represent as much as 0.23% to 1.2% of total hospital operating expenses. Extrapolated to an average 650-bed hospital the unnecessary expenditure could be \$1.2 million per year. Costs include those related to patient management, redraws, lab investigations, collection consumables, and instrument downtime.

A new study ([Atwaru 2016](#)) has also quantified some of the costs related to lab errors, particularly those related to the pre-analytical phase where most lab errors occur. Atwaru and colleagues noted the most common errors in the pre-analytical phase were specimen labeling errors, improperly collected samples, wrong blood in tube, and missing specimens and subsequent redraws so they focused their cost analyses on these categories of pre-analytic errors.

Factoring in the time spent by various personnel when a specimen is missing, they found the average cost of a missing specimen that is found is \$401.25 and that of a missing specimen not found \$583.72. But when calculating the average costs times the frequency of such events they found the average cumulative costs over 3 months were \$14,826.45 and \$20,430.20 for those two categories respectively.

For an improperly collected specimen with request for stat retesting the average cost was \$158.30 (cumulatively \$2374.50 over 3 months). And for wrong blood in a tube the average cost was \$562.65 (cumulatively \$11,815.65 over 3 months).

These cost estimates do not even take into account the indirect costs that might be associated with unhappy customers impacted by the lab errors.

The authors note that addressing such errors involves a broad range of personnel (client services, clerical staff, sales staff, technical staff, quality improvement staff, and executive staff).

A study on pre-analytic errors ([Kaushik 2014](#)) categorized such errors in 3 phases:

1. **Before specimen collection** (these included inappropriate test ordered or correct test not ordered, patient identification errors, inadequate patient preparation, and inadequate collection of patient information)
2. **During specimen collection** (these included inadequate specimen volume, wrong blood to anticoagulant ratio, clotting or hemolysis of specimens due to inappropriate tube mixing, use of inappropriate specimen containers, contamination from infusion routes, and incorrect order of draws)
3. **After specimen collection** (these included specimen labeling errors, improper specimen transport or storage, and improper centrifugation time or speed)

We addressed **specimen labeling errors** in several previous columns (see our Patient Safety Tips of the Week for October 9, 2007 “[Errors in the Laboratory](#)“ and November 16, 2010 “[Lost Lab Specimens](#)”). Another recent study looked at specimen labeling errors in specimens drawn by nurses in two adult ICU’s ([Martin 2015](#)). The error rate prior to interventions was 1.31 errors per 1000 specimens. The intervention was two-fold: (1) one-on-one education for the nurses and (2) removal of an electronic option that allowed bypassing of the barcode safety function. After the intervention the error rate was reduced to 0.139 errors per 1000 specimens. Though the actual total numbers of errors were small (10 errors before and 1 error after the intervention) the reduction was statistically significant.

Note that workarounds that bypass barcoding are not uncommon. In our June 17, 2008 Patient Safety Tip of the Week “Technology Workarounds Defeat Safety Intent” we highlighted a study by Koppel and colleagues that found 15 types of workarounds and 31 types of causes for the workarounds in barcoding medication administration systems ([Koppel 2008](#)).

In our March 6, 2012 Patient Safety Tip of the Week ““[Lab](#)” Error” we suggested each hospital (or other healthcare facility) use a tracer methodology to determine which steps in their facility might be vulnerable to errors in the pre- and post-analytic steps. It’s worth repeating here the steps we’d recommend in doing a tracer on laboratory testing:

Step 1 Choose a Test to Trace

Where would you start? Which tests should you look at? One option would be to take a look at your highest volume tests, since statistically most errors in the loop would occur for these tests. However, you might also consider looking at tests you already know may be “abused” or of controversial value. Or you might look at tests for which errors would be likely to have the most serious patient consequences.

Step 2 Ordering the Test

After you choose a test on which to run a tracer, let’s start at the beginning: the ordering of the test by a clinician. Is the rationale for ordering the test clear from the medical record? Is it for diagnosis related to current patient symptoms? Is it for screening or risk factor management? Is it a necessary follow up to a prior abnormal test result? Is it for monitoring treatment (eg. serum drug levels) or assessing for treatment efficacy or side effects?

But there are other questions you should ask. Was there a prior result of that test that might have sufficed? Was that result known? Could it have been known? Was that result available on the hospital IT system or the regional RHIO? Did the provider attempt to see if a prior result was available?

If the rationale for the test is not obvious, also look to see if there were circumstances that “nudged” the provider to order the test. Was the test part of a “panel” or was ordering the test influenced by its appearance on a standardized order set or clinical protocol or the way the lab requisition was formatted (some commercial labs use the requisition form in a manner that tends to “market” certain tests).

Was the timing of the ordered test appropriate? For example, if the test was for a serum anticonvulsant level was the test likely ordered before a steady state level would have been achieved? Or if it is an HbA1C level has enough time elapsed since the change in management that the HbA1C level would reflect the overall glycemic status resulting from that change?

The patient interaction must be considered as well. Was the reason for the test discussed with the patient? Was special preparation for the test (eg. fasting) discussed with the patient? Most importantly, did the provider discuss with the patient how long it would be before the test results come back and how the result will be communicated with him/her (more on that on the post-analytic phase)?

Lastly, and most importantly, before ordering a test the clinician should ask him/herself, and discuss with the patient (1) what will we do if the test result is normal? (2) what will we do if it is abnormal as we expect it to be? (3) what will we do if it shows us something unexpected? For example, do you really need to order that C-reactive protein (CRP) in your patient who has multiple CAD risk factors and a high LDL who you are going to treat with statins regardless of the CRP result?

Keep in mind that some lab results may be “abnormal” by chance. If you have a 5% chance that a test result will fall outside the “normal range” statistically and you order a comprehensive metabolic profile of 18-20 tests you are very likely to have one test result that is “abnormal”. Interestingly, when we talk to lab directors we often get responses like “it is less expensive and more efficient for me to run the panel than the individual test”. That, however, fails to take into account the expense and inconveniences that will be generated following up on such an “abnormal” result.

Step 3 How was the test ordered?

Was it written out on a prescription form? Was a lab requisition used? Was CPOE used? Regardless of the method used, was the intent of the order clear? Were there handwriting issues? Inappropriate abbreviations used? Was it clear who was ordering the test? (Ever get a test report for a patient who was not your patient because the lab could not read the name of the actual ordering physician?)

Note that some errors in Steps 2 and 3 may be reduced by use of electronic laboratory utilization management systems. A recent study ([Konger 2016](#)) found that such a system effectively reduced unnecessary lab testing. Laboratory cost savings were estimated on the order of \$150,000 annually for one hospital and no adverse effects on patient care were reported.

Step 4 Specimen Collection

Where, when and how was the specimen obtained? Were the appropriate patient identification procedures used prior to obtaining the specimen? Were the correct tubes or other containers used for collecting the specimen? Were they correctly labeled? Are all specimens labeled immediately and individually? How did they get to the lab (collected at the lab, sent by courier to the lab, transported from a hospital unit to the lab, etc.)? Do you have a system that actually tracks the specimen on its way to the lab? How do you know if a specimen never reached the lab? If the specimen and test were time-sensitive, did the specimen get to the lab within the appropriate time frame?

Again, see our Patient Safety Tips of the Week for October 9, 2007 “[Errors in the Laboratory](#)“ and November 16, 2010 “[Lost Lab Specimens](#)” for discussions on specimen identification, labeling, etc. Some best practices to help avoid patient misidentification and specimen labeling errors are use of barcoding, use of at least 2 patient identifiers, use of biometrics, and labeling the specimen containers immediately after specimen collection (for example, printing labels and affixing them right at the bedside when the specimen is obtained).

We also recommend you pay particular attention to sites doing point of care (POC) testing, whether in the office or at the bedside in the hospital. Our experience is that procedures for identification and labeling of specimens in those settings are more prone to “workarounds” and thus more errors.

Our March 6, 2012 Patient Safety Tip of the Week “[“Lab” Error](#)” also addressed the need to analyze your **post-analytic steps**. See that column and our numerous columns on communicating significant test results (listed below).

Some of our other columns on errors related to laboratory studies:

- October 9, 2007 “[Errors in the Laboratory](#)“
- November 16, 2010 “[Lost Lab Specimens](#)”
- October 11, 2011 “[LEAN in the Lab](#)”
- March 6, 2012 “[“Lab” Error](#)”
- April 2012 “[Specimen Labeling Errors](#)”
- January 22, 2013 “[You Don’t Know What You Don’t Know](#)”
- April 15, 2014 “[Specimen Identification Mixups](#)”
- November 25, 2014 “[Misdiagnosis Due to Lab Error](#)”
- March 24, 2015 “[Specimen Issues in Prostate Cancer](#)”

- May 26, 2015 [“How Safe is the Lab You Use?”](#)
- March 29, 2016 [“Inappropriate Lab Testing”](#)

See also our other columns on communicating significant results:

- May 1, 2007 [“The Missed Cancer”](#)
- February 12, 2008 [“More on Tracking Test Results”](#)
- October 13, 2009 [“Slipping Through the Cracks”](#)
- July 2009 [“Failure to Inform Patients of Clinically Significant Outpatient Test Results”](#)
- March 9, 2010 [“Communication of Urgent or Unexpected Radiology Findings”](#)
- March 1, 2011 [“Tests Pending at Discharge”](#)
- August 21, 2012 [“More on Missed Followup of Tests in Hospital”](#)
- October 2013 [“New AHRQ Toolkit: Improving Your Office Testing Process”](#)
- January 2014 [“Email Alerts for Pending Test Results”](#)
- July 2015 [“Technology to Avoid Delays in Follow-up of Significant Results”](#)
- November 17, 2015 [“Patient Perspectives on Communication of Test Results”](#)

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