

# How to Avoid Preanalytical Testing Errors: A Virtual Roundtable Discussion

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## Beth Wegerbauer

is a medical writer and editor with 14 years of experience covering the health-care field.

It is estimated that a majority of all laboratory medicine errors are errors that occur during the preanalytical phase of the laboratory testing cycle. Such errors have a significant impact on patient safety, staff workload, and hospital costs.

Correctly identifying patients and avoiding specimen-labeling errors are areas of particular concern for health-care professionals. Acutecaretesting.org interviewed several healthcare professionals for a “*virtual roundtable*” discussion on how to avoid errors during the preanalytical testing phase.

They represented the United Kingdom, Estonia, and the United States.

Although their approaches varied, there were common threads among our interviewees regarding how they avoid preanalytical errors, including the use of automation to track and report errors, consistent staff training, and the importance of frequent communication among departments.

According to several studies, a large number of errors involving laboratory medicine happen during the pre- and postanalytical testing phases [1].

In fact, it is estimated that 75 % of all laboratory medicine errors are preanalytical errors [2].

Such errors have an impact on patient safety on several levels, including: clinical consequences (lack of appropriate care or provision of inappropriate care for the patient); emotional distress from unnecessary or improper procedures; and increased staff workload and cost of staff labor [3].

In particular, specimen-labeling errors “*have significant consequences for patient care, for healthcare management, and for increasing costs that are often unaccounted for*” [4].

The typical preanalytical phase involves test “*ordering, collection, handling, transportation, and reception of samples*” prior to the testing itself being performed.

Paramount during this phase is *"maintaining the integrity between sample and patient and between sample and test request, as well as between the primary sample and its secondary preparations"* [5].

Acutecaretesting.org gathered several healthcare professionals for a *"virtual roundtable"* discussion on how to avoid errors during the preanalytical phase of the laboratory testing cycle.

Although there were problems unique to each facility and individual approaches varied, there were common threads among our interviewees regarding how they addressed these issues.

Correct patient identification, for example, seems to be the most important step taken to avoiding preanalytical testing errors. Most of the respondents have also invested in automation to track and report errors while virtually eliminating others, such as illegible handwriting and clerical mistakes.

They agreed on the importance of frequent communication within the laboratory and among various departments. Consistent staff training and competency evaluation also play a large part in reducing preanalytical errors.

Our interview participants were:

**Chris Royle**, Service Manager, Clinical Biochemistry and Haematology Departments, Royal Brompton and Harefield NHS Trust, Royal Brompton Hospital, London, England.

**Ken Goss**, Director of Pulmonary Medicine, Lancaster General Hospital, Lancaster, Pennsylvania, USA.

**Rick Brant**, Director of Lab Information Systems, Mount Carmel Health, Columbus, Ohio, USA.

**Carol Poehler**, Clinical Laboratory Scientist, Saint Luke's Hospital, Kansas City, Missouri, USA.

**Terry A. Smith**, Laboratory Manager, Methodist

Medical Center of Illinois, Peoria, Illinois, USA.

**Agnes Ivanov**, Quality Manager, United Laboratories, Tartu University Hospital, Estonia.

### **Acutecaretesting.org: What does your department or facility do to avoid preanalytical blood testing errors?**

**Chris Royle:** *"Correct patient identification is paramount. No use doing the tests on the wrong patient! We have standardized on one type of pre-heparinised syringe to avoid variations caused by individuals pre-heparinizing syringes themselves, a practice that led to highly variable results."*

*"This was probably the single most effective pre-analytical change. Staff are constantly reminded to mix samples thoroughly and remove air bubbles before sampling."*

**Ken Goss:** *"To avoid errors, we first verify the order in the patient's chart and then verify the patient with two identifiers."*

*"The specimen is labeled and bagged in ice. From the procedure standpoint, aside from standard operating procedures, we incorporate a pro-lock safety device. Once you collect the specimen, this device keeps the therapist from having to recap the syringe and avoid inadvertent needle sticks."*

*"Our system may be antiquated but it is reliable, for we are heavily engaged in quality assurance initiatives to ensure that results posted are accurate."*

**Rick Brant:** *"We have barcoded wrist bands on all patients, with at least two patient identifiers. We are strict with our policy of asking the patient for their name unless the patient is non-communicative. We label all specimens at the bedside with pre-printed labels, including accession numbers, test name, and container type, with the appropriate number of labels for all testing and routing of specimens."*

*"Also, we rarely aliquot specimens and emphasize using the original labeled container. Our blood specimens are tubed to the laboratory and processed immediately. We also store all specimens for a week after receipt in a refrigerator or freezer as appropriate."*

**Carol Poehler:** *"Our approach to avoiding preanalytical errors at Saint Luke's Hospital (SLH) is very tried-and-true. Our laboratory information system (LIS) shows previous results on patient blood tests, no matter what Saint Luke's Health System (SLHS) entity last tested the patient."*

*"Only registered clinical laboratory scientists are employed in our CAP (College of American Pathologists)-inspected lab. SLHS labs have extremely detailed check-off lists for orientation of new employees."*

*"There are examples of policies and procedures relevant to arterial blood gas (ABG) preanalytical errors that must be initialed by those oriented to running ABGs. More specifically, a) room air ABGs with  $PO_2 > 105$  could be unreliable."*

*"We then refer to a decision tree before reporting the results; b) sources of error are explained, including: air bubbles in blood gas samples, clotted samples, samples too old/not preserved on ice, or venous vs. arterial; c) employees are educated about where to find in the SLH ABG Manual significant reasons that pulse oximetry  $O_2$  saturation and blood sample  $O_2$  saturation may differ."*

*"In terms of accountability, a clinical laboratory scientist's performance evaluation reflects how frequently he or she reported erroneous lab results, including those caused by preanalytical errors."*

*"Other measures for avoiding preanalytical errors that have proven successful are: never accept an unlabelled sample. Never allow unlabelled or mislabeled samples to be relabeled, if recollection is feasible."*

*"Document relabeling must be approved by an attending physician, with results footnoted. In addition, a focused, ongoing effort went into training our nursery staff to properly collect samples for newborn testing, for things*

*like thyroid and metabolic abnormalities."*

*"The quality of heelstick collection was so improved by this process that newborn ABG collections resulted in fewer clotted, improperly labeled, or unpreserved blood samples. And over 90 % of ABG samples are collected by registered respiratory therapists or registered nurses."*

**Terry Smith:** *"We use two patient identifiers to ensure we are collecting the specimen from the correct patient. The syringe or tube is not labeled prior to performing the arterial stick to ensure that the correct label is used to identify the specimen. The samples are mixed well before sampling."*

*"Furthermore, samples are kept anaerobic to prevent contamination from the environment. In addition, samples are checked for the presence of clots and then rejected when clots are present."*

**Agnes Ivanov:** *"In our hospital, every patient has a list of barcode labels for patient identification. A nurse fills a laboratory list of tests and puts one barcode to the paper. A second barcode will be put on the specimens (showing specimen ID) after blood sampling and on the syringe. After transport to the laboratory, the laboratory technician registers this order in the LIS."*

*"For the first step, the syringe is placed into the analyzer. Secondly, the specimen barcode is showed to the scanner. A scanner from the analyzer isn't able to scan the barcode from the syringe. Next, we scan the barcode from the order list. There is a very big probability for error here (a specimen barcode scan might mistakenly be replaced with a patient barcode scan)."*

### **Acutecaretesting.org: How has automation been used to reduce the risk of errors?**

**Chris Royle:** *"Again, we standardized one type of pre-heparinised syringe. Also, barcode entry of patient demographics has been a huge improvement, allowing results to be captured electronically by the laboratory computer system, and then re-broadcast and stored within the electronic patient record system."*

*"Printed results from the blood gas analyzers were often not filed in patient's notes, and furthermore, seldom were labeled with the patient's name. We now have a completely paperless laboratory requesting system being rolled out enabled by the use of barcoded wristbands, MCAs, wireless networks, and a lot of multidisciplinary team effort. We have been very busy recently as our laboratory is being refurbished and is in a state of chaos!"*

**Ken Goss:** *"Currently, it hasn't. We are, however, in the building phase of going to a new LIS, in which we will incorporate auto verification of the specimens and the results. Our 'going live' date is scheduled for this fall."*

**Rick Brant:** *"The printing of barcode labels has eliminated errors due to poor hand writing. In addition, specified containers on the labels allow for proper volume and container type to be used for unusual tests and training."*

*"We are currently implementing a hand-held device with a printer that will print the labels at the bedside showing both the user ID and collection time. In addition, we are writing new policies for labels being printed in real time."*

**Carol Poehler:** *"In terms of automation, our analyzer barcode readers are used to put patient ID with sample results. We never enter patient lab results into the LIS by hand, but rather type in data using a keyboard."*

*"Also, we resend results from bi-directionally interfaced instruments. Every blood sample not identified by hand-held devices (HHD) at the bedside must be accompanied by a form explaining why the HHD wasn't used. Within the next 12 months, SLH expects to install a new tracking system for automatic ID and sampling, along with new chemistry analyzers. Our blood gas analyzers are currently one of the few areas where samples (i.e., test tubes or syringes) are not labeled by barcodes read by the lab analyzer."*

*"Also, our intensive care nursery can use in-line analysis for blood gases, lytes, and glucose."*

**Terry Smith:** *"The barcoded labels on patient armbands can be scanned to enter the financial number and then name entered, which reduces clerical errors. On subsequent testings, the name will come up as a second check when the barcode is scanned. In addition, the use of interfaces to post results helps to further reduce clerical errors."*

**Agnes Ivanov:** *"So far, automation has reduced the risk of identification errors, but has increased the time for test order in the different departments."*

*"Automation reduced two steps in our lab: 1) the registration of an actual order and a specimen in the LIS, and 2) the manual scanning of the barcode from the test order list in the analyzer. Automation system customers used identification bracelets with patient data and prebarcoded syringes with the specimen ID. We have no data about how much preanalytical errors we have, but we will be measuring this indicator very soon when our LIS will be able to generate those results for us."*

### **Acutecaretesting.org: What departments have been involved in these efforts?**

**Chris Royle:** *"Surgery, anesthesia, nursing, perfusionists, intensivists, clinical engineers, laboratory medicine, and information technology/services."*

**Ken Goss:** *"Pulmonary, laboratory, and information systems, which will have an impact on all aspects of laboratory procedures from the bedside to billing."*

**Rick Brant:** *"Laboratory, patient care services, information technology, respiratory therapy, and organizational learning and development."*

**Carol Poehler:** *"Many other departments are involved. Laboratory employees at SLH are informed monthly of error rates and sources of error that are the laboratory's responsibility."*

*"Our balanced score card data is posted and read by the staff. Our phlebotomists (99 % work for departments other than Pathology) are advised monthly of the rate*

*of preanalytical errors (along with what those specific errors were, e.g., mislabeling or IV contamination) via a newsletter written and distributed by the supervisor of our laboratory's Specimen Processing section."*

*"Also, our medical director has a dramatic and pervasively positive impact on preventing preanalytical errors. He is respectful to staff questions and highly approachable."*

**Terry Smith:** *"Our preanalytical testing is performed in the laboratory, intensive care units, and the emergency department."*

**Agnes Ivanov:** *"In addition to the laboratory, our automation system is used by the cardiosurgery and pulmoanesthesiology departments."*

Although these healthcare professionals come from different countries and hold different positions in different types of facilities, all of them recognize the impact that preanalytical testing errors can have not only on the quality of care delivered, but also on healthcare costs.

Automation and technology can affect significant change in minimizing these types of errors, but staff training and open communication provide equally important opportunities for quality improvement.

As Carol Poehler commented, *"We are well aware that preanalytical errors can be very cost prohibitive. We are eager to learn from others and welcome the development of new technology to eliminate the possibility for humans to err."*

## References

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