

Benefiting From Bedside Specimen Labeling



A ZEBRA BLACK&WHITE PAPER





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Executive Summary

Labeling blood and other samples at the time they are collected improves patient safety and helps prevent a host of problems related to misidentification—including many of the estimated 160,900 adverse events that occur in U.S. hospitals annually because of sample identification errors. There is a strong and growing body of evidence within medical literature that creating specimen identification labels on demand at the patient bedside with a mobile printer can significantly reduce errors. A Joint Commission on Accreditation of Healthcare Organizations' (JCAHO) National Patient Safety Goal (NPSG) for 2006 is to use two patient-specific identifiers whenever taking blood or other samples from a patient, and to label the sample collection container in the presence of the patient. Producing specimen labels at the patient bedside and encoding patient identification in a bar code satisfies both the JCAHO NPSG and Health Insurance Portability and Accountability Act (HIPAA) requirements. This white paper explains the point-of-care specimen labeling process, documents its benefits, outlines equipment and computer system requirements, and provides tips for successful implementation.

Identifying the Problem and Opportunity

Improved patient safety and care are the main reasons to implement mobile specimen collection labeling. Misidentified samples create a serious risk to patient safety by leading to misdiagnosis and inappropriate treatment. The case of Linda McDougal, a Wisconsin woman who underwent an unnecessary double mastectomy because her biopsy sample had been confused with another, drew national attention to the problem of sample identification errors and their consequences.¹ McDougal's experience is dramatic, but not isolated. Each year more than 160,900 adverse events occur in U.S. hospitals because of sample identification errors according to one study, which also found that one in 18 sample identification errors leads directly to an adverse event.²

Another study found 5.8 percent of phlebotomy samples are mislabeled.³ It is becoming increasingly clear that sample identification is a problem with serious patient safety consequences. Misdiagnosis, unnecessary treatment and wasteful tests all result from sample misidentification. There is also a significant financial impact—sample errors lead to redraws, retesting and additional treatment that cost hospitals an estimated \$200 to \$400 million per year.⁴

1. Accessed from CNN.com on November 14, 2006: <http://www.cnn.com/2003/HEALTH/01/20/medical.mistake/>

2. Paul N. Valenstein, MD; Stephen S. Raab, MD; Molly K. Walsh, PhD "Identification Errors Involving Clinical Laboratories: A College of American Pathologists Q-Probes Study of Patient and Specimen Identification Errors at 120 Institutions," *Archives of Pathology and Laboratory Medicine*: Vol. 130, No. 8, pp. 1106–1113.

3. Giuseppe Lippi, Gian Luca Salvagno, Martina Montagnana, Massimo Franchini, Gian Cesare Guidi, "Phlebotomy Issues and Quality Improvement in Results of Laboratory Testing," *Clin. Lab.* 5+6/2006.

4. Bologna L, Hardy G, Mutter M. Reducing specimen and medication error with handheld technology. Presented at 2001 Annual Conference and Exhibition. Healthcare Information and Management Society, Feb 4-8, 2001, Chicago, IL, cited by Margaret Herrin in "A Pledge of Safety: How one laboratory automated its specimen collection process to increase productivity, streamline workflow and improve patient care." *ADVANCE for Administrators of the Laboratory*, October 2006.s

Why Label at Collection?

Accurate labeling at the point of care can prevent many specimen identification errors and resulting problems. Specimen labeling errors accounted for 55.5 percent of identification errors in a study conducted by the College of American Pathologists.⁵ Specimen labeling, the most common error, occurred more than twice as much as the second-most common cause. By accurately identifying samples, hospitals can eliminate a leading source of identification errors.

The more time and distance between when labels are produced and when they are applied, the greater the chances they will be put on the wrong sample. For example, prior to converting from central printing to bedside specimen labeling, the staff at The Valley Hospital in Ridgewood, N.J., identified 63 steps in its phlebotomy collection process where errors could occur. Labeling specimens at the patient bedside eliminated 44 of these steps from the process. After implementing the bedside labeling system, The Valley Hospital reported zero misidentified patients and specimens, zero incorrect specimen containers, and zero unnecessary phlebotomies after six months and 8,000 phlebotomies.⁶

The hospital also analyzed specimen identification errors and found that carrying multiple labels into a patient room was the leading cause of specimen mislabeling. Labeling away from the bedside was the second-leading cause.

The reasons for creating processes to prevent specimen labeling errors are clear. So is the value of bedside labeling for specimen identification. Numerous other studies and anecdotal results have shown the practice to be highly effective. The Valley Hospital had no identification errors on the first 8,000 phlebotomy samples that were collected after bedside labeling was implemented. Becton Dickinson reported two hospitals that installed its BD.id system for positive patient identification and specimen collection and conducted studies that found nearly a 100 percent reduction in specimen collection errors.⁷ Many other hospitals and laboratories have reported significant error reductions related to bar code-based patient and specimen identification and point-of-care labeling.

JCAHO 2006 National Patient Safety Goal 1A

Requirement 1A: Use at least two patient identifiers (neither to be the patient's location) whenever collecting laboratory samples or administering medications or blood products, and use two identifiers to label sample collection containers in the presence of the patient. Processes are established to maintain samples identity throughout the pre-analytical, analytical and post-analytical processes. (Applicable to Laboratories)

Implementation Expectations: 1A—Timely and accurate specimen labeling ensures the correct patient identification from collection through result reporting. The two identifiers used to label the specimen are not required to be the same two identifiers used to identify the patient. Neither of the two sample identifiers may be the patient's location. Acceptable identifiers may be the individual's name, an assigned identification number, telephone number, photograph or other person-specific identifier. Bar coding that includes two or more person-specific identifiers (not room number) will comply with this requirement.

Source: Joint Commission 2006 National Patient Safety Goals Implementation Expectations.

6. Lawrence J. Bologna, MBA, MS, FACHE, Michael Mutter, MS, RPH "Life After Phlebotomy Deployment: Reducing Major Patient and Specimen Identification Errors," *Journal of Healthcare Information Management*. Winter 2002 - Volume 16, Issue 1.

7. Becton, Dickinson and Company "Norwalk Hospital to Implement BD.id™ Patient Identification System for Specimen Management" June 2004.



Preventing Errors with Point-of-Care Labeling

There are three essential components to a successful point-of-care labeling system: a mobile computer (which may include a bar code reader) that provides access to real-time draw orders and patient records; a printer that can be conveniently used at the patient bedside; and label media that will remain affixed to the sample container throughout all testing and storage processes.

Wireless network coverage is not strictly required for bedside specimen labeling but can greatly improve the process. With wireless connectivity, phlebotomists and other caregivers get real-time notification of cancellations, new test requests, patient moves and other changes. The result is a reduction in unnecessary procedures and trips to the central lab for assignment updates. Wireless connectivity also enables activity performed at the point of care to be instantly recorded in the patient's electronic medical record or other computer system.


Bar coded patient wristbands are not required for point-of-care labeling, but can significantly enhance error reduction by facilitating a convenient, accurate positive patient identification. JCAHO compliance requires that at least two patient identifiers be used whenever blood samples are taken and medications or blood products are administered. A bar-coded wristband can provide two forms of identification in one easy-to-access place by encoding the patient name and medical record number.

Here's how a typical bedside specimen labeling procedure works. Draw orders are downloaded to mobile computers that are issued to the nurses or phlebotomists who collect the specimen sample. At the bedside, the patient is identified, ideally by bar code scanning. The patient ID is matched against a draw order on the mobile computer to verify that a sample is required and the correct patient is being tested. Confirmation can come from checking a record stored in the mobile computer, or through a wireless network connection to a central patient record system. After receiving instant confirmation of the patient identification and sample order, the sample is collected. The mobile computer or network immediately directs the printer to produce an ID label, which is applied to the sample container. Printing labels on-demand, one-at-a-time virtually eliminates the possibility of applying the wrong label to the specimen.

Bedside Labeling in Practice

Hamilton Medical Center in Dalton, Ga., uses an automated phlebotomy specimen collection system much like the one described above. The 282-bed hospital implemented the system because it wanted to require two patient identifier checks prior to sample collections, ensure samples were labeled accurately, and to give phlebotomists accurate test request information at the time of draw.

The staff of 23 phlebotomists now use wireless handheld computers and mobile printers to manage collection rounds and accurately identify patients and label samples at the bedside. As expected, the system produced highly accurate sample identification and reduction in redraws. Automating specimen collection at the bedside also produced significant time savings for phlebotomists and for laboratory management.



Hamilton Medical Center reported the system saved each phlebotomist 45 minutes per day. Computerized management reduced the number of variables phlebotomists have to deal with at the patient bedside, resulting in faster collections. Turnaround times decreased from 3 percent to 59 percent, depending on the test required.⁸

New draw orders can be communicated directly and instantly to the handheld computers, so phlebotomists do not need to return to the central lab to get assignments. Wireless communication helps make phlebotomists more productive, and the automated assignments the system software generates saves an additional 45 minutes per day.

Bedside Labeling Essentials — Printers and Labels

The specimen label produced at the bedside is the crucial link between the benefits of automated management systems and real-world processes. There can be no specimen accuracy and patient safety benefits without durable labels and consistently excellent print quality.

Label readability is the most important criteria when selecting a printer for specimen labeling. Bar codes, text and graphics must be clear and long lasting to provide accurate identification from the time of collection through to final disposal or storage. Printers should also be fast enough to produce labels on-demand without inconveniencing the phlebotomist.

Printer ease-of-use is also important. Mobile printers can be worn on belts or shoulder straps, and can also be mounted on carts. Weight becomes an important consideration if the printers will be carried or worn. So does the ability to perform after being dropped to the floor multiple times. Check specification sheets for printer drop ratings. Evaluate user-friendliness by observing how easy it is to access controls and to check indicators during normal operation, and the convenience of changing media.

Mobile printers can connect directly to hospital wireless networks, which enables label orders to be sent directly from a laboratory information management system or other central application. If wireless printers are used, they should support all the same security protocols used for mobile computers.

Because exceedingly high bar code scan rates are essential to the success of specimen identification, thermal printing technology is an excellent option for specimen labeling. Thermal is the leading technology for bar code labeling applications because of its print quality and suitability for use in many challenging environments. To understand and appreciate the benefits that thermal technology has over laser and ink jet for bar code label production, you need a basic understanding of bar code symbols and how each print technology produces them. Scanners decode the information from bar codes by measuring the differences between narrow and wide elements, and the contrast between dark bars and light spaces. If the ratios or contrast are slightly off, the bar code may be difficult or impossible to read, or may be read incorrectly. Appropriate printers and supplies greatly reduce the chances of these problems occurring, and thus are important contributors to patient safety. The following sections outline the advantages and disadvantages of print technologies commonly used for specimen labeling.

8. Margaret Herrin, Kenneth Lowery, Larry Early and John Forrester, Hamilton Medical Center; Sandra Trakowski, Mary Wojcik, Care Fusion Inc. "Hamilton Medical Center Finds That Deployment of a Positive Patient Identification (PPID) Specimen Collection Solution Improves Both Patient Safety and Work Flow Processes."



Thermal

Thermal printing is classified as either direct thermal or thermal transfer. The two technologies are suited to different applications. Direct thermal printers create images by using a printhead to apply heat to selected areas directly to the chemically treated label material. There is no ribbon or ink required. In thermal transfer printing, the printhead heats a ribbon, which melts the image to the material. Thermal transfer is used for high-durability, long-lasting labeling applications. Direct thermal printing is the technology of choice for most unit-dose labeling applications. It has many advantages and a few limitations.

- Direct thermal printing produces sharp print quality with good readability.
- Direct thermal printers are simple to operate compared to most other print technologies, with no ink, toner or ribbon to monitor and replenish.
- Because direct-thermal printers don't use ribbons, they protect patient privacy, which helps comply with HIPAA.
- With no supplies to replace other than the material to be printed, long-term maintenance costs and total cost of ownership remain low.
- Direct thermal enables batch or single label printing with virtually no waste.
- With recyclable materials available, direct thermal printers offer environmental economy.
- Direct thermal printing is sensitive to environmental conditions such as heat and light. Long-term exposure to fluorescent light can reduce bar code quality. However, top coated media is available to mitigate these effects, and direct thermal labels are usually fully capable of meeting medication marking needs.
- Thermal printers accept roll media and cannot print 8 1/2- by 11-inch documents.

Laser

- Laser printers are good at producing bar codes on plain-paper documents.
- They can print high-quality text and graphics on paper documents and can double as a document printer when not being used to print bar codes.
- Bar code density and resolution are also quite high on laser printers, resulting in high-quality symbols.
- Laser printers can be wasteful because they cannot produce single or small labels. A minimum of half a page of media is typically required for the printer to maintain control of the sheet. Unless the label is at least that size or multiple labels are needed at once, the remainder is wasted.
- Laser printer label adhesives must be carefully selected to ensure stability under the heat and pressure of the fuser. Otherwise, the adhesive may seep onto the printer mechanism, where it will capture stray toner, or may cause the labels to curl at the edges.
- Because of the pressures used in the image transfer process, many laminated label materials are not compatible with laser printing. Those materials that are compatible may not always be available in the sheet form necessary for laser printing.
- A laser-printed paper label has limited durability. Laser printers cannot produce chemical- or water-resistant labels and images.



- With laser printers, toner, drum and supply costs can skyrocket when printing bar codes instead of typical text. While text printing requires only about 5 percent black toner, bar code needs can exceed 30 percent to ensure proper contrast between dark and light elements. Toner costs alone could be six times higher when printing bar codes rather than text.
- Laser printers are too large to be carried or worn. They require a cart and a plug-in power supply.

Ink Jet

- Desktop ink jet printers are inexpensive to purchase and easy to replace.
- Sheet-cut adhesive label material for desktop ink jets is readily available from office supply stores and catalogs.
- Many hospitals already have ink jet printers for document printing.
- Many desktop ink jet printers can only print labels by the sheet, resulting in waste and inefficient handling required for loading and handling label material.
- Processing variable data and formatting bar codes significantly slows print speed. Productivity suffers when operators must wait for labels to come out of the printer.
- There is limited bar code and label design software support for desktop ink jet printers.
- Media options are limited to paper, which is insufficient for many sample tracking environments.
- Durability and reliability are limited when desktop ink jet printers are used in non-office environments. Desktop ink jet printers are not designed to withstand dust, dirt, vibrations and other environmental conditions common in shipping areas, which leads to increased maintenance and reduced lifespan.
- Ink jet printers are too large to be carried or worn. They require a cart and a plug-in power supply.

For more information about the merits and limitations of different print technologies, see Zebra's white paper, *Evaluating Print Options for Hospital Bar Code Labeling*, available free at www.zebra.com.


L a b e l Q u a l i t y M a t t e r s

Label media works in concert with the printer and is a major variable in the image quality and durability. The finished label includes a substrate material, adhesive, and often a protective coating. Each element must be carefully selected for the specific usage environment and checked for compatibility with the specific make and model of mobile printer. Otherwise, print quality and longevity problems can result.

It's fairly easy to find substrate, coating and adhesive combinations that work well at the bedside. The challenge is finding label media that will maintain excellent print quality throughout the life of the sample and withstand all test and storage conditions, even if exposed to blood, water, xylene, disinfectants and UV light.

General-purpose, commodity-type labels may seem suitable because they can easily affix to the specimen container when the sample is taken. However, the labels may fall off if the adhesive isn't specifically formulated to withstand cold storage, sterilization, centrifuge and other conditions. Even if the label remains on the container, the bar code and text may become unreadable if moisture causes smudges or tears, or if air pockets form between the container and the label.





Thermal printers are compatible with a variety of label materials engineered specifically for use in laboratory environments. Hospitals and labs should consult with a supplies specialist when specifying specimen tracking labels, because of the many variables involved and the many product options available. See Zebra's brief *The Do's and Don'ts of Selecting Hospital Bar Code Labels and Wristbands* for more information on the subject.

C o n c l u s i o n

Bar coding is a proven, accurate and reliable way to identify samples. Printing and applying specimen container identification labels at the point of care promotes patient safety by improving sample identification and reducing opportunities for errors to enter the process. It also satisfies the JCAHO National Patient Safety Goal, and by encoding patient identifiers in a machine-readable bar code, protects patient privacy in accordance with HIPAA. Point-of-care labeling also saves time for phlebotomists, nurses and technicians who collect samples because they don't have to return to the lab to pick up the labels, while saving time in the lab by eliminating the need for relabeling.

Zebra Technologies is helping healthcare organizations reduce errors and increase productivity while protecting patient safety and privacy. Thermal printing solutions from Zebra incorporate text, graphics, bar codes and/or RFID to produce the on-demand labels, tags, ID badges and wristbands at the heart of today's patient safety initiatives. With the broadest product line, largest installed base and highest customer satisfaction ratings, Zebra printers and supplies are the preferred choice.

Zebra Technologies Corporation delivers innovative and reliable on-demand printing solutions for business improvement and security applications in 100 countries around the world. More than 90 percent of Fortune 500 companies use Zebra-brand printers. A broad range of applications benefit from Zebra-brand thermal bar code, "smart" label, receipt, and card printers, resulting in enhanced security, increased productivity, improved quality, lower costs, and better customer service. The company has sold more than five million printers, including RFID printer/encoders and wireless mobile solutions, and also offers software, connectivity solutions and printing supplies. Information about Zebra bar code, card and RFID products can be found at www.zebra.com.



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