Best Practices for Deploying Zebra Print Solutions in the Healthcare Setting

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Executive Summary

The recent focus on patient safety in U.S. hospitals has yielded a flood of new technologies aimed at improving healthcare quality. These tools seek to integrate care delivery processes with medical information and software applications to provide decision support and safety checks to clinicians at the point of care. Among technology approaches, the adoption and use of bar code systems is growing rapidly because they provide a convenient, cost-effective way to minimize errors at the bedside. In fact, the 2007 HIMSS Leadership Survey revealed that nearly 75 percent of respondents plan to implement bar code technology over the next two years.

Bar code applications can either be implemented as stand-alone applications or as part of a larger patient safety initiative that includes e-prescribing, computerized physician order entry (CPOE) and electronic medical record (EMR) systems. When leveraged in combination with e-prescribing, CPOE and EMR, healthcare organizations can take advantage of a closed loop system that links bar code scanning, clinical knowledge databases, wireless networking and patient record technologies at the point of care.

From an ROI perspective, bar coding has been proven to generate not only clinical benefits but also measurable financial benefits. According to the FDA, the average hospital spends $9,705 per 100 admissions in treating the effects of medical errors. In addition to the cost avoidance aspect of patient safety that bar coding provides, bar code data greatly improve the accuracy of charge capture, pharmaceutical inventory management, drug utilization and best practice compliance.

As hospitals and health systems introduce bar coding in a variety of patient care and clinical settings, they must carefully consider how they will leverage bar codes. Whether your facility plans to utilize bar coding for patient identification wristbands, labeling in the pharmacy or laboratory, or generating specimen labels at the patient bedside, there are several key considerations to evaluate before formulating a strategy.

Introduction

Zebra Technologies has worked with hundreds of healthcare organizations to provide bar code print solutions at the heart of many patient safety initiatives. Through this experience, Zebra has learned best practices for producing patient wristbands as well as unit-dose and specimen labels that help to build the foundation of a successful patient safety program.

This guide will help your organization to navigate the selection and implementation of a bar code print solution to ensure a successful deployment. It will clearly outline a number of factors that will ultimately impact the day-to-day operation of your bar code system as well as process improvement, end-user acceptance and cost-saving objectives. These include:

- **Volume.** Failure to consider total daily, or monthly volume may lead to the placement of a printer that is not capable of handling normal daily use. It can also result in end-user dissatisfaction and lead to more maintenance calls.

- **Proximity to users.** End-user requirements, such as medical or physical limitations of the end-user, client-facing responsibilities, and the distance from the printer to the work environment are important factors to consider when developing a bar code solution.

- **Total cost of ownership.** The printer with the lowest price tag is not always the most cost effective. When selecting a print solution, determine how much time and money will be spent replacing parts, setting up new printers or clearing label jams. This downtime can reduce staff productivity and add significantly to the total cost of the printing system. In addition, expenses related to service contracts, extended warranties, wristbands, labels and other supplies often have a considerable impact on the total cost of the investment.

- **Physical layout of the facility.** The locations of walls, workgroups and nursing stations are critical to arriving at an optimal design. The easier it is for end users to access the printer, the easier it will be to drive adoption and boost efficiency.

- **Key applications.** Many organizations are working through different implementations with long-range plans to develop a closed-loop process within their patient safety systems. For example, they may start with bar coded patient wristbands and then rollout bedside medication administration at a later date. As a result, it's critical to consider both initial components and future needs during the decision-making process.

Based on the common questions and challenges resolved through customer support operations, Zebra provides the following tips to optimize printing for patient identification wristbands, unit-dose labeling in the pharmacy and specimen labeling for the laboratory and at the patient bedside.

Numerous studies have shown that between two and six percent of patients are not properly identified by their wristbands.

Patient Wristbands

The best known uses for bar coded wristbands are in conjunction with automated medication administration or computerized physician order entry (CPOE) systems. However, smaller applications that require less time and resources to implement can also provide many accuracy and time-saving improvements. Scanning the patient wristband can help prevent errors in sample collection and processing, administration of tests and therapies, patient transfers and meal management, plus several administrative and billing activities. Uses can be expanded without requiring changes to information on the wristbands or the equipment used to produce them.

Hospitals generally print bar coded patient wristbands in one of two ways. A centralized approach is when one department, such as admitting, is responsible for generating patient wristbands and managing all reprints. Traditionally, hospitals use a centralized model because the admitting department utilizes its printers to produce both the patient wristband and bar code labels sheets. Staff then places these small bar code labels on every piece of paper specific to that patient. Since new software applications allow bar codes to be printed directly on face sheets and other patient documents, many hospitals no longer need to print sheets of bar code labels in admitting. As a result, some organizations are moving toward a decentralized model for printing wristbands when they upgrade their ADT software.

In a decentralized model, individual departments generate patient wristbands utilizing their own dedicated printers and supplies at each nursing station or unit. This minimizes the amount of time admissions staff must spend managing wristbands and eliminates the delay that results from having the band printed in admissions and delivered to the corresponding floor. Eliminating this delay is a key benefit for patient safety because it ensures that caregivers can always verify a patient's identity when medications, blood draws or procedures are needed.

For organizations that are not planning to upgrade their ADT software, a centralized model is likely the best option. Those planning to switch systems, however, should investigate the workflow improvements that could result from a decentralized approach.

Print Options and Cost Considerations

Due to the curved nature of wristbands and the limited space that is typically available for text and the bar code, printers used to produce bar coded wristbands need to be configured slightly differently than printers used for other forms of bar code and label printing. Wristband printing will be unnecessarily challenging if these factors are not accounted for in the bar code design and printer configuration. For example, if printers are not properly calibrated for wristband media, it can increase supply loading time and result in unnecessary waste of wristbands.

PRINT SOLUTIONS: LASER VS. THERMAL		
TECHNOLOGY	**ADVANTAGES**	**DISADVANTAGES**
Laser	• Accessible and efficient office document printer • Document and bar code quality is high	• Prints labels in sheets, resulting in waste • Label and wristband adhesives can ooze from fuser and cause jamming • Bar codes require more ink, driving up toner costs • Output susceptible to toner flaking and smudging • Media typically requires laminate overlay which can lead to bacteria build up and smeared images if not properly placed
Thermal (Direct Thermal)	• Designed specifically for label printing • Sharp bar code printing with highest rates of scannability • Single unit printing—no waste • Simple to operate • Durable and low maintenance • No toner expenses • Media can be resistant to moisture, soaps, chemicals, temperatures, and bacteria	• Printers not readily available in hospitals today • Images sensitive to extreme heat and light—requires overcoated stock

When hospitals start planning their first bar code labeling applications, they are often tempted to try to modify their existing office printing systems to do the job. While laser printers already in use in admissions departments and nursing stations can be made to output bar codes, dedicated thermal printers are a much more convenient and cost-effective method.

Using dedicated printers for label generation prevents delays and saves labor associated with multi-purpose print operations. If wristband responsibilities are added to an office printer, wristband jobs may get stuck in a lengthy print queue while documents and reports are being printed. In addition, printing on wristband and label stock is a more complex operation than printing on plain paper and can result in jams, feeding issues and poor print quality when a general office printer is used.

Thermal printing's performance and total cost of ownership advantages more than offset the perceived convenience of using an office laser printer for creating wristbands. Thermal printers produce wristbands on demand, eliminating the need to feed through an entire form that includes other labels that are often thrown away. In addition to minimizing supplies waste, using a thermal printer for bar coded wristbands helps keep down the toner cost, as the density of bar codes requires significantly more toner than standard documents.

Healthcare quality requirements and usage environments also demand the excellent bar code symbol quality that thermal printers provide. If bar codes are difficult or impossible to read, staff will have to scan the symbol multiple times, resulting in lower productivity.

One way to streamline scanning and increase read rates is the use of the two-dimensional Aztec Code symbology for positive patient identification. Because this code does not require a quiet zone between symbols, it can be repeated along the entire length of a wristband. As a result, caregivers do not have to move the band in order to scan it, like is often the case with linear one-dimensional codes.

Since 2-D bar codes cannot be read by traditional bar code scanners and require special imagers, organizations that opt for Aztec Code should also

include a one-dimensional or linear bar code on the wristband. This step ensures the bar code can be used for other processes in the hospital that require positive patient identification.

Media Selection

The attributes of a good wristband are easy to understand, but surprisingly difficult to attain. Numerous studies have shown that between two and six percent of patients are not properly identified by their wristbands. Missing wristbands are by far the most common problem, accounting for about half of all wristband errors, but illegible text also presents a problem. To address these challenges, healthcare providers must utilize wristbands that are durable, stay on the patient's wrist and remain readable throughout the hospital stay.

Both thermal and laser printers can be used to produce bar coded wristbands. Laser printers produce wristbands in sheets, rather than one at a time. As a result, hospitals using laser printers must take several steps to assemble wristbands, such as releasing the adhesive, placing the label on the wristband, folding over any protective coatings and securing the wristband. This approach is not only cumbersome, but it is also problematic because any wrinkles or creases in the wristband may prevent the bar code symbol from being scanned at the bedside. In addition, these creases can create an opening for water and other substances that may damage the wristband or render the bar code symbol unreadable. After printing, laser output is also susceptible to toner flaking and smudging, making it unsuitable for wristbands that must last for an extended patient stay.

Thermal printers, by contrast, produce wristbands on demand, or one at a time. They feature a special topcoat layer that provides protection against the conditions a wristband may be exposed to during a hospital stay, including alcohol, soaps, foams, blood, water and UV light exposure. Some vendors also offer wristbands with an antimicrobial coating that protects bands from infection-causing bacteria.

Thermal print materials must be matched to the print method. There are two forms of thermal printing – direct thermal and thermal transfer – and each has

different media requirements. Thermal-transfer printers use a printhead to heat a ribbon that produces images on the surface being marked. The ribbon can retain the printed image, so it should be incinerated or shredded to meet HIPAA privacy requirements. No ribbon is used in direct thermal printing, which applies heat directly to produce the image.

Zebra recommends that organizations with an average patient stay of seven days or less utilize direct thermal printers to generate patient wristbands while those with average stays of 20 days or more, such as rehabilitation or long-term care centers, should utilize thermal transfer printers.

Finally, when selecting wristband media, hospitals must also choose between adhesive bands and clip bands. Adhesive bands are designed for comfort and ease of use. These bands include security features that indicate if the wristband has been removed or traded with a different patient. Clip bands offer additional security features and are often used in settings where patients may tamper with the bands, such as psychiatric units or departments treating elderly patients.

Print Volume

As your organization evaluates wristband printers, it's important to determine how many wristbands will be printed on a given day. Once the volume of patient wristbands is established, it will be easier to identify those print solutions that best meet your unique needs. Print volumes exceeding 200 wristbands a day is considered high, while anything under that amount is considered low volume.

When deciding how many wristband printers to purchase, consult your printer solution provider to discuss ways to best optimize your investment. They can provide real-world examples of previous implementations in the healthcare setting, including the number of wristband printers that are generally required. For example, if your organization is a 400-bed facility, they would be able to share the fact that an organization of a similar size using a decentralized print approach recently purchased 40 high-volume wristband printers.

Finally, because desktop surface space is precious in the hospital environment, it is important to consider the "footprint" of the bar code printer selected. Look at the areas where the printers will be located and evaluate how they will fit into the daily workflow. Thermal printers take up less space than their laser counterparts, and provide a viable option for space constrained environments.

Case Study: Atlantic Health

Atlantic Health System, based in Morristown, NJ, utilizes bar code wristbands at two acute care centers and a rehabilitation facility to ensure positive patient identification at the point of care. The health system recently deployed the wristbands with the goal of establishing a foundation upon which future point-of-care bar code applications could be built, including bedside medication administration, specimen collection and blood administration.

Today, the health system operates 133 thermal printers that are devoted exclusively to wristband printing. An interface between the thermal printers and Atlantic's existing ADT software allows users to print on demand directly from the ADT system.

This approach to patient identification has helped Atlantic to increase the durability and reliability of its wristbands. Previously, staff used a laser printer to generate adhesive backed labels that were then applied directly to the wristband. This two-step process meant wristbands were more prone to damage and often came off the wrist, causing clinicians to rely on alternate patient identifiers when providing care.

In addition to streamlining processes, the thermal wristband printers produce more readable bar codes and require fewer reprints. With an effective system for positive patient ID in place, Atlantic has been able to move forward with the implementation of its bedside medication administration system, allowing them to further improve the delivery of care to patients.

Bar Code Labeling in the Pharmacy & the Laboratory

One of the most proven and effective methods to prevent medical errors is to use bar coding to identify medications at the unit-dose level for dispensing and administration. By taking action to ensure all medications in the hospital include a bar code, pharmacists can set a strong foundation for patient safety initiatives and align their organization with patient safety goals established by the Joint Commission and American Society of Health-System Pharmacists.

Regardless of how many pharmaceuticals are marked with bar codes at the unit-dose level by the manufacturer, pharmacies must manually repackage certain medications as unit-doses bearing patient-specific or drug-specific labels. Patient-specific labels are most likely required for organizations with dispensing verification or bedside medication administration systems in place. Pharmacists responsible for creating these labels can use on-demand label printers to mark medications that are prepared specifically for a patient, such as compounds and IVs with patient-specific additives, partial doses and pediatric doses.

The same bar codes used for dispensing also support bedside medication administration applications. With a medication administration system in place, nurses scan bar codes on the unit-dose label, the patient wristband and the employee ID badge so that they can perform a five-rights check before administering medications. The five rights include right patient, right drug, right dose, right time and right method of administration.

BAR CODING SUPPORTS FIVE RIGHTS OF MEDICATION ADMINISTRATION
Right Patient
Right Drug
Right Dose
Right Time
Right Method

Print Volume

Whether implementing bar code printers for the first time or replacing an existing bar code printer, it is critical to determine the volume of labels being printed on a daily and monthly basis. Using these benchmarks, your organization can narrow its choices to those best suited for the unique requirements of your environment.

When assessing print volume, examine the total number of labels being printed a day as well as the size and type of labels being generated. For example, a pharmacy that produces more than 1,000 one-inch labels per day would be considered high-volume. Anything less than that would be considered low volume.

It's also important to consider what impact variable data may have on print speed. If lot codes and expiration dates are to be included in the bar code symbol on a unit-dose label, the printer must be able to process variable data efficiently. Variable data output slows some printers considerably, while others process variable data at top print speeds.

Print Options

Before evaluating specific printers, organizations should make a fundamental decision whether to use laser or thermal print technology. Thermal printers are purpose-built specifically for bar coding, while lasers offer familiarity because they are used in many pharmacies and laboratories as regular office printers. There are many important differences in how each technology handles unit-dose and specimen labels that must be considered when planning the print system.

Laser printers are good at producing bar codes on plain paper documents, but they can be wasteful for label printing because they cannot produce labels on-demand, or one at a time. 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 of the labels are wasted. This is a key consideration for unit-dose labeling which includes small labels that will be placed on vials, syringes and other items.

Laser adhesives must also be carefully selected to ensure stability under the heat and pressure of the fuser. Otherwise, the adhesive may seep onto the printer mechanism and capture stray toner, or it may cause labels to curl at the edges. After printing, laser output is susceptible to toner flaking and smudging, which makes the technology unsuitable for long-term bar coding required in many laboratory applications.

Thermal printers are particularly suited to pharmacy and laboratory labeling since they address the need for compact, highly defined, durable bar codes. While thermal printers cannot print letter size documents, they can print small labels on demand as they are needed. Direct thermal is the technology of choice for most unit-dose labeling and laboratory applications

while thermal-transfer is best suited for those laboratory applications where labels may be exposed to very extreme conditions and must be stored for a long period of time.

Finally, regardless of the print technology used, it is important to evaluate the connectivity and interface options of the solution. Some printers more easily integrate with pharmacy, laboratory and other HIT systems, so they will not need to be replaced as additional applications and systems are implemented. Before making a final selection, consult your HIT vendor to see what printers have been approved.

Media Selection

Labels should be tested and selected for each unique application within the hospital setting. One or two printer models may be sufficient to satisfy all healthcare labeling needs, but each application will probably require its own media. Adhesives and protective coatings that work perfectly well in the pharmacy may not perform well in lab or patient care environments.

Pharmacy and laboratory labeling often requires multiple label sizes and materials formulated to withstand cold storage, moisture, curved objects and other challenges. The printer must be able to produce sharp, long-lasting bar codes on these materials without wasting media, jamming, or hampering productivity by requiring frequent media changes or troubleshooting.

For these applications, the desired symbology, label sizes, and print volume will drive media selection. Key questions include:

- **What sizes of labels will be required?** Unit-dose labels are needed for everything from syringes to vials to ampuls. Likewise, specimen labels are used for sample containers that come in a variety of sizes and shapes, including Petri dishes, slides, test tubes, well plates, and cassettes. Before moving forward with a print solution, take a quick inventory of all of the label sizes that will be required to effectively label medications and specimens.

- **Does the label need to be temperature or moisture resistant?** Refrigerated medications and specimens often require moisture resistance since they are stored at low temperatures. Labels may also need to be applied directly to surfaces as cold as -20 degrees F. While general-purpose commodity-type labels may seem suitable because they can easily affix to the medication or sample container, the labels may fall off if the adhesive is not specifically formulated to endure cold temperatures or moisture. 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.

- **How long does the label need to last?** In the laboratory setting, it can be a challenge to find label media that will maintain excellent print quality throughout the life of the sample while also withstanding cold storage, sterilization, centrifuge and other conditions. Thermal transfer printing is the best option for applications that require the most durable, long-lasting labels.

- **Does supply have to endure direct heat or sunlight?** Labels printed using direct thermal printers are sensitive to environmental conditions such as heat and light. Top-coated media is available to mitigate these effects. In addition, thermal-transfer printers, which are designed for applications requiring a long shelf life, can also be used to produce labels for pharmacy and laboratory applications.

Deviating from recommended combinations of printers, labels and ribbons can cause quality problems that compromise the effectiveness of a patient safety program. As a result, it is important that healthcare providers take steps to match printers with the correct supplies.

Total Cost of Ownership

Thermal bar code printing provides total cost of ownership advantages over other print technologies. Because printheads and other components are designed for printing bar code labels rather than documents, labeling operations will not add excessive wear to the equipment or lead to premature repair and replacement. Thermal printers are built to better withstand dust, dirt, moisture and vibration, and should last longer than printers designed for general office use.

Also, because thermal printers can print labels on demand, they eliminate the need to purchase sheets of labels as used in document printing. Sheet printing is extremely wasteful for unit-dose labeling and can increase labeling expenses.

When selecting media, remember that the most inexpensive option you can find may not be the most cost-effective over the long-term. Low-cost, low-quality labels and ribbons can lead to premature printhead failure. The cost of replacing a printhead or the entire printer will more than offset the few dollars saved on a label roll or replacement ribbon. Be wary of suppliers who propose one or two media options to meet all needs – the recommended media may indeed perform well for all uses, but may not be the most efficient and cost-effective option for less challenging applications.

Once you find the right media, stick with it. Thermal print heat settings, which are adjustable, need to be matched to the specific label and ribbon material and coating to print efficiently. Changing to another brand of supplies could produce unreadable bar codes that are too light, resulting in underburn, or too dark, resulting in overburn.

Case Study – Aurora Health Care

As a part of its patient safety efforts, Milwaukee-based Aurora Healthcare embarked on a bar code project that will eventually lead the health system to its ultimate goal: a closed-loop, integrated point of care medication administration system that includes computerized physician order entry (CPOE).

The first phase toward realizing this vision was to label 100 percent of unit-dose medications with bar codes. To achieve this goal, Aurora deployed a combination of high-volume thermal printers at its 11 hospital pharmacies. On average, it finds that its low volume facilities range from 6,000 to 25,000 orders per month

while the larger volume sites print anywhere from 43,000 to 53,000 bar code labels per month.

As Aurora transitions to a centralized medication re-packaging operation for all hospitals, it will continue to use Zebra printers for those medications and preparations, such as patient-specific IVs, that require unit-dose labels be printed at the local level.

One of the biggest benefits Aurora experienced through the use of pharmacy labeling is a more efficient method for processing charge credits for medications that are returned to the pharmacy. In the past, a staff member would have to manually key in the order number or patient name into the pharmacy information system before processing the credit. Now, staff members can quickly scan the bar code to add the medication back into the inventory—saving a significant amount of time.

With medication labeling in place, Aurora was also able to begin the implementation of its bedside bar code medication administration system in the summer of 2007. As the system goes live throughout the enterprise, Aurora will be well positioned to prevent the vast majority of medication errors.

Point of Care Labeling

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 satisfies the Joint Commission 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 re-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 mobile 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.

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 scanning a bar coded wristband. 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 clinician scans her badge and collects the sample. A record of the draw is entered into the mobile computer and automatically stored in the software application, creating an audit trail for future verification and reporting. The mobile computer or network then 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 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 bedside 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. During the selection process, check specification sheets for printer drop ratings to see how the printer will perform after being dropped on the floor multiple times. Evaluate user-friendliness by observing how easy it is to access controls, check indicators during normal operation, and change media.

Because exceedingly high bar code scan rates are essential to the success of specimen identification, thermal printing technology is an excellent option for labeling specimens. It produces sharp print quality with good readability, which ensures clinicians and laboratory staff can easily scan the bar codes throughout the life of 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 a 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 also improved.

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 valuable staff time.

Conclusion

Bar coding is a proven, accurate and reliable way to enhance patient safety. Identifying patients with bar coded wristbands, producing unit-dose labels in the pharmacy and applying specimen labels at the point of care helps to minimize errors and improve overall efficiency. By taking the steps outlined in this guide, your organization will benefit from an efficient bar code system that produces the required print quality for the applications used. To access other free resources about different aspects of bar code printing, applications and supplies, visit the resource library section of Zebra's Web site at www.zebra.com.

Zebra Technologies is a leading manufacturer of specialty thermal printing solutions, including wireless, mobile, high-volume and wristband printers designed to meet the unique needs of the healthcare market. Zebra solutions help 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.