It's All in the Wrist: Improving Patient Safety with Bar Code Wristbands

A ZEBRA **BLACK&WHITE** PAPER



Zebra

Copyrights
©2006 ZIH Corp. All product names and numbers are Zebra trademarks, and Zebra and the Zebra head graphic are registered trademarks of ZIH Corp. All rights reserved. All other trademarks are the property of their respective owners.

Unauthorized reproduction of this document or the software in the label printer may result in imprisonment of up to one year and fines of up to $10,000 (17 U.S.C.506). Copyright violators may be subject to civil liability.

Executive Summary

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) placed "Improving patient identification" at the top of its list of National Patient Safety Goals (NPSG) again for 2006, a position it has held for years. "Reduce the risk of healthcare-related infections" is on the list for the third consecutive year. Also in 2006, the FDA will begin requiring unit-of-use bar code identification on medications to be dispensed in healthcare facilities. The *Hospitals and Health Networks* 2005 Most Wired Hospitals analysis showed for the first time that hospitals with broad use of information technology have better patient outcomes. Efforts to improve patient safety and quality of care must still be balanced against privacy requirements. Accurately identifying patients with bar coded wristbands is the key to all these initiatives. Numerous reports have shown bar code-based systems prevent medical errors. This white paper will show how.

By now most healthcare administrators are well aware of the Institute of Medicine (IOM) report *To Error is Human: Building a Safer Health System*. The IOM report stated preventable medical errors cause up to 98,000 deaths and 770,000 adverse events in the U.S. each year. Another 90,000 deaths result from the up to 2 million infections patients aquire in U.S. hospitals, according to Centers for Disease Control (CDC) estimates. The report helped motivate the FDA to create its first requirement for pharmaceutical bar code labeling at the unit-of-use level. The FDA's own research concluded that increased use of bar code-based bedside medication administration systems alone will prevent 500,000 adverse drug events and blood transfusion errors over 20 years, keeping an estimated $93 billion in treatment costs out of the healthcare system. Identifying patients with bar coded wristbands is a first step healthcare organizations can take to make these improvements.

Checking the "Five Rights"—Right Patient, Right Medication, Right Dose, Right Time and Right Method of Administration—prevents most medication errors. But all too often, the five rights check is flawed because it fails to guarantee the right patient. Today, approximately 5 percent of patient wristbands are erroneous or missing altogether. Missing, poor-quality, and incorrect wristbands are a major contributing factor to many adverse events.

Bar coded patient wristbands provide the necessary foundation for preventing errors by ensuring accurate patient information is always available at the point of care. Bar code wristbands will improve the effectiveness of five rights checks for drug administration and provide a platform to extend safeguards to other patient care activities. Wristbands are now available with antimicrobial coatings that help prevent infection by killing leading types of bacteria, including S. *aureus*, P. *aeruginosa* and E. *coli*.

Automated medication administration, electronic patient records, computerized prescriber order entry (CPOE), and bar code point-of-care (BPOC) and other automated procedures for improving patient care all rely on accurate input that bar coding can provide. This white paper will explain the role wristbands can play in improving patient safety and freeing nurses and other valuable medical personnel from paperwork and clerical tasks. It will clearly explain:

- How bar coded wristbands can satisfy JCAHO National Patient Safety Goals (NPSG) and other requirements;
- Infection-fighting wristband material options;

- Applications for bar coded wristbands, including medication administration, test and sample management, blood dispensing, CPOE and other patient-care actions, plus uses for billing and administrative activities;
- What information can be contained in the bar code and the types of bar codes that can be used;
- How radio frequency identification (RFID) fits in;
- Options for printing and reading bar code and RFID wristbands in patient care settings.

Healthcare providers don't need to create full-scale, facility-wide systems to benefit from bar coded wristbands. Limited applications that can be developed fairly quickly can provide tremendous safety and time-saving benefits. By understanding the capabilities, options, and advantages that bar coded wristbands provide, organizations can begin planning systems that will provide the foundation for multiple improvements and long-term benefits. After all, the foundation of the "Five Rights" is "Right Patient." Once organizations can consistently and accurately identify the right patient, many improvements can follow.

Wristbands, Bar Codes, and JCAHO

Bar coded wristbands provide a convenient way to comply with the National Patient Safety Goal (NPSG) to "Improve the accuracy of patient identification," which JCAHO has included in its goals annually since 2003. Antimicrobial wristbands also contribute to fighting infection, which is another recurring NPSG. Compliance with the patient ID goal 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 identification number. JCAHO recognized the value of this approach in an FAQ item on its Web site that explains the safety goal: "*The two identifiers may be in the same location, such as a wristband…. Acceptable identifiers may be the individual's name, an assigned identification number, telephone number, or other person-specific identifier. Bar coding that includes two or more person-specific identifiers (not room number) will comply with this requirement.*" Once wristbands are bar coded to provide basic patient identification, numerous other identification, tracking, and data collection applications can be added to take advantage of bar code data entry.

How Bar Code Wristbands Work

The bar code is simply an alternative to text for expressing information. Anything that can normally be printed on a wristband can be encoded in a bar code. The bar code frequently serves as a key to a database. When it is read, the scanner decodes the symbol and instructs a computer to look up or update the specific record that corresponds to that patient. Bar code scanners are always used with computers, although they are frequently combined into a single handheld unit. Bar code scanners can also be used with virtually any type of computer including PCs, laptops, tablets, and PDAs. The bar code reader may communicate with the computer through a cable or wireless connection.

Bar code wristbands protect patient privacy because the patient's name does not need to appear anywhere on the wristband for the scanning system to recognize it. There is usually no patient information encoded in the bar code itself, but merely an ID number (like a serial number) that tells the software application where to look

up the patient information. Information encoded in a bar code instead of being expressed in text aids compliance with HIPAA privacy requirements. The patient may be identified by encoding their name in the wristband, or by assigning a random, unique patient ID number that can be encoded and printed in human-readable text. This approach satisfies both JCAHO and HIPAA requirements.

Because bar codes store data in less space than is required for the same text, bar coded wristbands can include more information than traditional text wristbands. In addition, two-dimensional (2-D) bar codes can store exponentially more information, so they can serve as portable records or could even allow a digital photograph of the patient to be encoded on the wristband and viewed on a PC or portable computer whenever the bar code is scanned.

The biggest advantage bar code wristbands provide in healthcare settings is not in the amount of information they hold, but in how they enable information to be presented and recorded. A study of wristband problems by the College of American Pathologists (CAP) found that 8.6 percent contained erroneous data and 5.7 percent had illegible data. With bar coded wristbands, as long as information is entered accurately at admitting, nurses, doctors, medical assistants, lab technicians, and other personnel can be sure that the patient will be identified correctly and the right information will be presented every time the wristband is scanned. Bar code scanning is extremely accurate—much more accurate than any manual means of information recording. Studies have shown that skilled typists make an average of one error per every 300 keystrokes. Busy nurses on their feet can scarcely be expected to do as well. The error rate for bar code data entry is less than one per 3 million scans. Bar codes improve patient safety by improving the quality of information in patient records.

Bar code data entry is also much faster than manual data entry. The Carilion Health System reported time savings of 2.75 hours per 12-hour nursing shift after switching to a bar code-based system to record medication administration.

Uses for Bar Code Wristbands

Bar code wristbands can be beneficial wherever patients need to be identified or information needs to be recorded. Improved accuracy and time savings translate into benefits in any environment. This enables facilities to earn a positive return on investment with relatively small, standalone applications, then extend the use of wristbands into additional departments. The best-known uses for bar code wristbands are in conjunction with automated medication administration or computerized prescriber 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.

Besides serving as the key to accurately recording what is done with patient care, computerized systems can offer the additional safeguard of issuing alerts when things are not done. This is one of the most valuable aspects of medication administration applications. Approximately one in five doses of medication administered in hospitals and skilled nursing facilities is given in error according to an *Archives of Internal Medicine* study. Time of administration was the most common mistake. Computerized systems can issue alerts if the end of the prescribed time is nearing and the medication hasn't been administered. Different applications may also issue

alerts or reminders to collect samples, or check vital signs or other conditions. More details on the uses, functions, and benefits of bar code wristbands are presented in the following sections.

Medication Administration

One of the most effective ways to take advantage of bar coded wristbands is to combine them with automated medication administration systems. First, the nurse scans the wristband to identify the patient with a bar code scanner that is interfaced to a mobile or bedside computer. The nurse then enters information about the drug to be administered, typically by key-entering the NDC number, ideally by scanning a bar code on the pharmaceutical itself. (All pharmaceuticals dispensed in hospitals are required to have a bar code identifier at the unit-of-use packaging level by April, 2006, according to an FDA rule issued in February, 2004.) Application software compares the medication to information in the patient's electronic record, which was called up by the wristband scan, to verify that the patient should be receiving the medication at the indicated dosage at that time. The nurse continues after getting a confirmation or warning on the computer screen. Warnings are often accompanied by an audible beep. Finally, nurses scan their own bar coded ID badge to record who administered the medication. The system essentially automates the Five Rights check, with the wristband scan verifying right patient, and the database lookup from the medication scan verifying the other elements.

The FDA estimates the use of such systems would intercept 50 percent of all medication administration errors. In practice, healthcare providers have achieved much better results. The Veteran's Administration (VA) implemented point-of-care scanning for medication administration at all 173 of its hospitals after reducing errors by 86.2 percent during a trial.

Anecdotal information about the cost of automated medication administration systems is not especially useful, because the implementation cost varies widely according to the number of nurses that need to be equipped; the status of existing networks, databases, and information systems; the type of mobile computers that are desired; and the sophistication of the software. For example, the application could be an internally developed database lookup, or could be part of a much larger computerized prescriber order entry system. In documentation released with its unit-of-use bar code rule, the FDA estimated the average hospital would spend $448,000 to implement a computerized medication administration system. This figure gives some idea what a system might cost, but is not necessarily a good rule of thumb because of the variables described above. See the complete FDA unit-of-use rule at www.fda.gov/OHRMS/DOCKETS/98fr/04-4249.htm for a detailed analysis of projected implementation costs and benefits.

Better information is available regarding the benefits a system can provide. First and foremost, automated medication administration improves patient safety by preventing errors. The widely cited Institute of Medicine report *To Error is Human, Building a Safer Health System* estimated there are more than 770,000 adverse events, resulting in up to 98,000 deaths, in the U.S. each year from preventable medical errors. One study suggested one in five medication doses administered in hospitals or skilled nursing facilities is given in error. The FDA studied the incidence of adverse drug events (ADEs) and found they range from 2.4 percent to 6.5 percent per facility, with a mean rate of 4.3 percent. For its analysis, the FDA used an average cost per ADE of $2,257, although many other estimates have been put forth, most of them higher. Therefore, hospitals spend an average of $9,705 per 100 admissions in treating the effects of ADEs (4.3 ADEs per 100 patients x $2,257 per incident). This equates to ADE-related costs of $97 per admission.

Thus, there is a strong financial incentive to prevent medication errors in addition to safety and moral considerations. A facility that averages 20 daily admissions could expect to incur $708,100 in annual expenses related to

ADEs. If an automated administration system intercepted just 50 percent of potential medication errors, as the FDA suggests, the facility would avoid costs of $354,050. If the system was 86 percent effective, like the U.S. Department of Veterans Affair's (VA's), the cost avoidance climbs to $608,966, or $8,342 per 100 admissions.

Reduced errors also lead to reduced liability and exposure to malpractice suits. Medication errors are the basis of 5 percent of all malpractice claims, according to an analysis by Dr. Byron J. Bailey, a fellow of the American College of Surgeons (FACS); an article published in *Legal Medicine* reports approximately 30 percent of all malpractice suits involve drug-related injuries. In 2000, the average jury award in medication error cases was $636,844, according to Jury Verdict Research. An automated medication administration system could pay for itself by preventing one malpractice suit, while improving the safety of every patient in the facility.

Blood Administration

The process for verifying that patients receive the right blood products is very similar to the process for medication administration. Blood products carry a standardized bar code identifier, which makes it easy to create scan-based safety checks. There are an average of 414 annual transfusion errors in the U.S., or about one in 38,000 transfusions, compared with 1.25 million adverse drug events annually, according to the FDA. The maturity of bar code identification in blood collection, processing, and distribution may explain the tremendous disparity in the amount of blood administration errors compared to medication administration errors.

Sample Management

Bar codes are important quality assurance tools for tracking medical samples. Quality assurance procedures can be extended right to the patient's bedside by using bar code scanning to associate samples with the patients. For example, before taking a sample, a nurse could scan the patient's wristband and check a mobile computer to verify that the sample is needed and hasn't already been taken. While the sample is being drawn, a mobile printer would automatically produce a bar coded sample ID label, using information from the patient scan and the test order in the mobile computer. The label would be applied to the sample immediately, which would significantly reduce the possibility that the sample would be misidentified. An alternative is to produce a set of bar code labels during the admissions process and keep them with the patient's chart to be applied when needed. However, this process is not recommended because it is not failsafe. The wrong label can be put on the wrong sample, and labels can easily be lost or misplaced, or worse yet, attached to the wrong patient's chart.

In the lab, scanning the bar code on the sample container saves technicians the time of entering the patient information into their computer systems. The required tests could even be encoded on the sample label in a two-dimensional (2-D) bar code, to eliminate any chance of confusion as to what tests should be performed. Bar code data entry could also aid test result recording and improve patient record accuracy, while simultaneously providing time savings for laboratory staff.

Treatment

Imagine an x-ray technician telling his replacement during the shift change, "I'm running a little late. Can you take my last patient and give a portable chest x-ray to Mrs. Johansson down the hall?" The technician just coming on then takes the equipment down the hall, sees a patient room marked "Johnson" and enters to take the x-ray. A bar code-based confirmation system would prevent him from performing the procedure on the wrong patient. In this case, the error would probably have resulted in little more than having taken a wasted x-ray and having to redo the procedure on the right patient. Had the patient been misidentified for surgery, the result could have been fatal.

Wristband scanning for patient verification could help surgical teams, respiratory therapists, radiology technicians, physical therapists, and other professionals ensure they are providing the right treatment or service for the right patient. "Procedures performed when not indicated" trails just behind "Medication error" among causes for malpractice claims, according to the Bailey analysis. Avoiding these errors provides very significant safety and liability benefits.

Non-medical Applications

However it is used, bar coding provides fast, accurate data entry. The benefits of saving time for nurses are obvious. However, timesaving benefits also can be gained in a variety of administrative and non-medical activities where patient information is recorded. The wristband can serve as a credit card to be scanned to capture charges for supplies or optional services like telephone. Bar coding can even make hospital food more palatable: At some facilities, foodservice workers scan the patient wristband and enter the meal order into a PDA. The process helps ensure patients will get what they requested, without generating paper orders for foodservice staff to sort, read, and process. Many facilities use non-wristband bar code systems for materials management, asset tracking, and inventory control. Zebra's white paper "Increasing Profits and Productivity: Accurate Asset Tracking and Management with Bar Coding and RFID" provides a thorough overview of these systems, including guidelines for calculating return-on-investment. It can be found at www.zebra.com.

Wristbands can also be incorporated into physical security systems, which is often done by using wristbands with radio frequency identification (RFID) chips. RFID is the same technology used in hands-free key cards used to open doors and parking gates. RFID chips can be embedded within bar code wristbands to provide an invisible, unobtrusive form of protection. The chip on the wristband is read when the patient attempts to leave the ward, which may sound an alarm, trigger a notification at the nurses station, or even lock the door. In healthcare settings RFID wristbands are typically used to protect infants, Alzheimer's patients, and others deemed a high risk for abduction or wandering.

Producing Bar Code Wristbands

The attributes of a good wristband are easy to understand but surprisingly difficult to attain. Numerous studies have shown that between 2 percent and 6 percent of patients aren't properly identified by their wristbands. Missing wristbands are by far the most common problem, accounting for about half of all wristband errors, but erroneous information and illegible text all plague healthcare professionals who rely on wristbands to accurately deliver care. A College of American Pathologist's (CAP) study of 142 institutions uncovered 22,267 patient identification errors. First and foremost, the wristband must stay on the patient and remain readable for the duration of the hospital stay. It also must uniquely identify the patient in a HIPAA-compliant manner. Bar code wristbands produced with purpose-built printers will conveniently and cost effectively satisfy all these conditions.

The process for planning and producing bar code wristbands is not much different than for traditional wrist banding. There are four decisions that must be made to plan a wristband printing system, and only one is unique to bar coding:

1. What information will be included on the wristband?
2. What kind of bar code will be used to encode it?
3. How should the wristband be printed?
4. What material should be used?

The following sections will help answer these questions so you can create a wristband program that provides the foundation for numerous quality and efficiency improvements.

What Information to Include

The information content of the wristband is a key factor in determining the type of bar code to use and how to produce the wristband itself. Ideally, the wristband will include two forms of patient identification. Encoding the patient's name in a bar code and printing an ID number in human-readable text will satisfy both JCAHO and HIPAA requirements. Any type of text can be encoded in a linear bar code, so blood type, allergies, primary physician, and other information could also be securely included on the wristband. The wristband material itself may also be color-coded to convey special cautions or other information. Still more information can be encoded in an RFID chip in the wristband.

Patient care practices and the information systems infrastructure also play roles in determining wristband content. The more frequently information needs to be accessed, the more it makes sense to include the information on the wristband, in text and/or bar code format. If nurses can't conveniently access routine information from the bedside, there is a compelling reason to investigate ways to provide the information on the wristband. Conversely, if nurses use mobile computers to access complete electronic patient records over a wireless LAN, there is little need for the wristband to serve as anything more than a key to a database lookup.

Selecting a Bar Code Type

There are many different types of bar codes, which are called symbologies. They vary by the amount and type (e.g. numeric only or alphanumeric) of data they can encode, the space they require to do so, and other factors. Virtually any bar code symbology can encode patient ID information to conveniently fit on a wristband and leave room for text and graphics. Two-dimensional (2-D) symbologies can serve as limited portable record files or to provide commonly needed patient information such as allergies, primary physician, blood type and reason for admission.

Bar code scanners can recognize multiple symbologies. Therefore, it is generally not necessary to match the symbology on the wristband with bar codes that may be scanned on blood bags or unit-of-use medication packaging. It is generally recommended to choose a symbology that encodes the desired information in the least amount of space. Extra space on the wristband can be used for additional text or graphics, or for the bar code to be printed larger, which makes it easier for scanners to read. Once the information content requirements are set, the bar code solutions provider will be able to recommend a symbology that provides the best combination of performance and space efficiency.

Popular options include Code 128 and Code 39 linear symbols, PDF417, Data Matrix and Aztec Code two-dimensional symbologies, and the reduced space symbology (RSS) family, which includes linear and 2-D formats. Laser bar code scanners cannot read matrix-type 2-D symbologies (e.g. Data Matrix and Aztec Code). These symbologies must be read with a CCD or imager, which are available as integrated units within handheld computers used for point-of-care applications, and as peripheral units that plug into handheld computers or PCs.

Code 128

Code 128 can encode the full 128-character ASCII character set. It is popular for use on wristband bar codes because it is one of the densest linear symbologies, meaning it can encode information in less space than symbologies with lower densities. Code 128 is a variable-length symbology so symbols can be as long as necessary to encode required data. Code 128 is also the standard for identifying blood products. Codabar, an all-numeric symbology, was previously the bar code standard for blood bag identification.

Code 39

Code 39 (also called Code 3 of 9) is one of the oldest and most widely used symbologies in the industry. It is a variable-length alphanumeric symbology for encoding 26 capital letters plus numerals and seven special characters. An extended version is available that supports all 128 ASCII characters. Code 39 is less dense than Code 128.

PDF417

PDF417 is a two-dimensional symbology that can resemble a series of small 1-D codes stacked upon each other. PDF417 offers high data capacity in a relatively small space, and is a popular option when organizations want to include information beyond the patient name or ID number on the wristband. Alphanumeric text, photographs, signatures, and other images and file types can be encoded in PDF417 symbols. Up to approximately 2,000 alphanumeric characters can be encoded in a PDF417 symbol, although symbols printed on wristbands of normal width would hold less.

Data Matrix

The Data Matrix 2-D symbology is excellent for encoding information in a small space. Symbols are scalable and can hold a variable amount of alphanumeric information up to about 500 characters. Data Matrix is a matrix symbology made up of light and dark squares, and can't be read with laser scanners.

Aztec Code

Aztec Code is a 2-D matrix symbology capable of containing from 13 to 3,832 numeric characters or 12 to 3,067 alphabetic characters. Aztec Mesas are Aztec Code-based supplements that can be added to linear bar code symbols to encode additional information. The resulting symbol is a composite of linear and 2-D symbologies.

RSS

The RSS family of symbologies was created specifically for use in applications where space is limited. RSS-14 is an all-numeric symbology that is a leading option for unit-of-use pharmaceutical marking, but can also be used on wristbands. RSS Stacked is an alphanumeric symbology that provides additional data capacity by stacking a series of RSS symbols. Other symbologies in the RSS family, including RSS Truncated and RSS Composite, provide options for additional space savings and data capacity. The RSS family has primarily been used for item marking and not for patient identification.

Wristband Printing Options

Bar codes can be printed directly on wristbands when they are produced, or printed as separate labels and applied by hand. The one-step process is the most convenient, although separate label printing is a good option for organizations that want to use insert-type wristbands (more on this in the Selecting Wristband Material section). Bar code labels can also be applied to non-insert wristbands, but great care must be taken to ensure the label will not peel, the adhesive will not fail, and the symbol will not become damaged.

Either thermal or laser printers can be used to print bar code wristbands. Thermal printers are much better suited for producing bar codes, while lasers offer the convenience of using the same unit to output forms and wristbands. Both technologies can print bar code directly on wristbands and on adhesive labels.

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 is the dominant bar code printing

technology used throughout industry for mission-critical operations. Global express delivery services, manufacturers, military organizations, and logistics providers all use thermal printers to ensure their bar codes will get materials where they're needed without fail.

Healthcare quality requirements and usage environments demand the excellent bar code symbol quality that thermal printers provide. 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. Think about the times you've seen a supermarket checkout clerk struggle to get an item to scan. After multiple attempts the clerk becomes frustrated and key-enters the U.P.C. number. By valuing bar code quality, hospital administrators can prevent a similar scenario from happening at the patient bedside. A nurse's time is too valuable to waste by repeatedly trying to read poor-quality bar codes, and rushed, manual data entry by a frustrated nurse carries too high of a risk for errors. Printing the bar codes in vertical, or ladder, orientation, facilitates faster, easier scanning than when symbols are printed horizontally (a.k.a. picket fence orientation).

Thermal printers produce wristbands and labels on demand, one at a time. Laser printers, by contrast, often need to print an entire sheet of labels at once, which creates waste and unnecessary expense. Laser printers can be prone to jamming when used to print labels because of adhesive buildup, which isn't a problem for thermal printers, which are specifically designed to print labels, not documents. Thermal printers can accept a very wide variety of wristband and label media, so a single unit can be used to print wristbands, sample labels, asset tags, file labels, and other bar code identifiers. The differences in printing and media capabilities give thermal printers a total cost of ownership advantage over lasers for bar coding in healthcare. For more information about print technologies for bar coding, see Zebra's white paper "*Best-in-Class Bar Coding: The Business Case for a Dedicated Thermal Label Printer*" on Zebra's Web site at www.zebra.com.

Currently, only thermal printers can print a bar code wristband while simultaneously encoding an RFID chip embedded in either the label material or wristband itself. Thermal wristband printers are therefore an excellent, efficient choice whenever RFID is used, either in combination with bar codes or as the primary information carrier.

RFID is an emerging technology throughout healthcare, life sciences, and other industries. Labels with RFID chips embedded within them can hold more data than bar codes and be read automatically with no user intervention required. The FDA has strongly suggested the use of RFID to safeguard against pharmaceutical counterfeiting. Many other organizations are promoting the technology for inventory, asset, and supply chain management. To learn more about RFID and its potential implications in healthcare, visit www.rfid.zebra.com and www.lifesciences.zebra.com.

Wristband Materials

The print method, bar code symbol, and data content won't make any difference if the wristband doesn't stay on the patient's wrist. All too often, it doesn't. Missing wristbands are the most common wristband error identified in every published study on the subject. Missing wristbands account for about half of all wristband errors, and different studies have found between 2 percent and 10 percent of all hospital patients are without a wristband at any given time.

There are many secure and durable wristband materials that enable bar codes and text to be printed directly on the wristband. If bar code labels will be inserted into the wristband, even more materials are available because there are no limitations regarding thickness or fasteners that will run through the printer.

Because the wristband must remain with the patient and the bar code must remain readable for the duration of the admission, it is important to consider all the potential exposures and usage conditions when selecting material. Moisture, soaps and foam washes, temperature extremes, and repeated handling all have the potential to damage images, dissolve adhesives, or destroy the wristband. Using low-quality printers and materials may also cause fading, scratching, or wrinkling that renders the bar code useless.

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 the material to produce the image.

Introducing bar coding puts a few limitations on the palette of wristband colors to choose from. Because successful bar code reading relies on contrast between dark and light elements, dark backgrounds are not recommended because they may not provide enough differences between bars and spaces. Some bar code reading technologies are much more tolerant than others regarding contrast, and colorful bar coded wristbands are commonly used without causing problems. Printing a black bar code on a white label and applying it to any colored wristband is always an option.

Zebra Wristband Solutions

Zebra Technologies offers a complete range of thermal printers and wristband supplies, including antimicrobial wristbands that can be used in bar code and RFID applications. Zebra's solutions include multiple models of wristband printers, including those capable of encoding RFID tags and printing photos, and Z-Band® Direct wristband supplies, which are available in dozens of size, color, and fastener combinations. Z-Band Direct earned the 2004 Frost & Sullivan Product Leadership of the Year Award for healthcare informatics.

Zebra's Healthcare Starter Kit includes an H 2824-Z™ direct thermal bar code printer, a full roll of award-winning Z-Band Direct thermal wristbands, and a special adapter to ensure proper media handling and outstanding print performance on wristband sizes ranging from pediatric to adult.

The H 2824-Z printer is available with a variety of interfaces, including Ethernet, USB, serial and parallel, so it can be seamlessly connected with a variety of hospital computer systems. The printer is a direct-thermal model with an ultra-compact footprint that can accept a variety of wristbands with different protective coatings and fastener types. It can also accept label media and print labels to identify specimens, prescription vials, equipment, charts, test results, and other documents.

The S600™ tabletop printer is recommended for high-volume operations requiring between 1,000 and 5,000 wristbands daily. It also supports a variety of interfaces and accepts multiple types of wristband material.

All Z-Band Direct wristbands are latex-free and formulated to resist blood, soaps, lotions, alcohol, and other fluids that can make text and bar codes unreadable. Tamper-evident features and a UV varnish are standard on all Z-Band Direct Wristbands to provide additional protection. Z-Band Direct wristbands are available in multiple colors, which can be used to provide quick visual references for allergies, special types of care, privileges, wards, etc. Z-Band QuickClip™ has a clip closure to provide a secure seal.

Z-Band 4000 wristbands are for use with thermal-transfer printers. They are available in white, yellow, and blue in many size and coating options. Antimicrobial coating is available for Z-Band Direct and Z-Band QuickClip

wristbands. Antimicrobial wristbands can still include topcoats that provide other protection. Zebra's antimicrobial wristbands kill S. *aureus*, P. *aeruginosa* and E. *coli* bacteria, which are the three leading causes of infection in U.S. hospitals.

Zebra also has numerous other printers and supplies that are well-suited for a variety of healthcare labeling needs, including unit-of-use pharmaceutical marking, specimen tracking, file and form ID, asset management, inventory control, RFID tagging applications, and more. Visit www.zebra.com and browse the Industry Solutions section for more information about bar code and RFID printers and supplies and how they can be used to improve patient safety and procedural efficiency.

Conclusion

There are many ways to benefit from bar coded patient wristbands, which means there is no need to wait for mandatory bar code drug labeling to take effect to begin taking advantage of the accuracy and convenience that bar coding provides. Bar coded patient wristbands can help healthcare facilities comply with JCAHO National Patient Safety Goals today, while positioning them for dramatic safety and quality improvements enabled by complementary systems. Quality care begins with quality wristbands.

Zebra Technologies is a world leader in bar code, RFID and ID card printing with an installed base of more than 4 million units, including systems at healthcare facilities for patient identification, pharmacy, materials management, security, and employee identification. Together with its partners, Zebra has the experience, industry knowledge, and specialized products needed for successful healthcare implementations. Zebra is also a leader in bar code and RFID standards development that actively participates in the work of life sciences industry associations so that it will be prepared to meet the emerging needs of its customers. Contact Zebra at +1 800 423 0442 or visit www.lifesciences.zebra.com for more information about bar code printing solutions for healthcare.

Notes

Notes

GLOBAL/AMERICAS HEADQUARTERS
Zebra Technologies Corporation
333 Corporate Woods Parkway
Vernon Hills, IL 60061-3109 U.S.A.
T: +1 847 793 2600 or
+1 800 423 0442
F: +1 847 913 8766

EMEA HEADQUARTERS
Zebra Technologies Europe, Limited
Zebra House, Unit 14,
The Valley Centre
Gordon Road, High Wycombe
Buckinghamshire HP13 6EQ, UK
T: +44 (0) 494 472872
F: +44 (0) 494 450103

ASIA-PACIFIC HEADQUARTERS
Zebra Technologies Asia Pacific, LLC
16 New Industrial Road
#05-03 Hudson TechnoCentre
Singapore 536204
T: +65 6858 0722
F: +65 6858 0838

OTHER LOCATIONS
USA
California, Rhode Island, Wisconsin
EUROPE
France, Germany, Italy, Netherlands, Poland, Spain, Sweden, United Kingdom
ASIA-PACIFIC
Australia, China, Japan, South Korea
LATIN AMERICA
Florida (USA), Mexico
AFRICA/MIDDLE EAST
South Africa, United Arab Emirates

Web: www.zebra.com

GSA#: GS-35F-0268N
©2006 ZIH Corp.
#13636L Rev. 2 (9/06)