



# Bar Code Scanner, Printer, and Wristband Media Selection

## Lessons Learned from the VA

**T**he Department of Veterans Affairs (VA), Veterans Health Administration (VHA), the health care arm of the VA, released its bar coded medication administration (BCMA) software application to all VA medical centers in August 1999, with a mandate for the software to be implemented VA-wide by June 2000. By 2002, 100% of medications were administered to VA inpatients using BCMA. The VA administers over 600,000 medications daily through the BCMA software. Although best practices and pre-implementation guidelines were shared with VA medical centers to facilitate BCMA implementation, challenges persisted following implementation due to bar code quality, dispensing, labeling, and coordination issues. It was apparent that continuous monitoring and control processes were needed to reduce BCMA workarounds.

### Creating Centralized Resource

In 2003, the BCMA Program Office was established to provide strategic direction, facilitate quality control reporting, and serve as the liaison between VA facilities and other stakeholders. The BCMA Program Office was renamed the Bar Code Resource Office (BCRO) to emphasize the importance of point-of-care bar code scanning technology throughout the VA, and is aligned under VHA's Office of Information, Chief Health Informatics Office.

An intranet website, quarterly newsletters, and bi-weekly conference calls serve as communication tools to aid in the BCRO's mission. Training updates on BCMA software enhancements, as well as training aids developed by VHA field "super users," are presented on the conference calls and made available on the intranet site. In this manner, training is a collaborative effort; each facility does not have to develop its own training materials. An annual face-to-face



Purchasing bar code imagers, which can read both linear and the increasingly prevalent two-dimensional bar codes on medication packaging, can help to "future proof" your facility's BCMA program.

conference brings BCMA support staff together to learn about quality improvement techniques, lessons learned, and evidence-based best practices to improve veteran patient safety.

### Bar Code Quality Verification

In 2004, two bar code verification laboratories were established by the BCRO. VA facilities send problematic bar coded products to one of the verification laboratories, where the bar codes are verified to meet American National Standards Institute (ANSI) and International Standards Organization (ISO) bar code print quality criteria. ANSI uses an A through F grading system for bar code verification tests – an "A" indicating the best possible bar code quality and "F" being the worst. All bar codes are compared to nine international parameters. A deficiency in any one of these parameters leads to bar code failure, and the failure point might not be visible to the naked eye.

A closed loop verification program was developed to track problematic bar coded products submitted by VA facilities. Products are tested and scored by the verification labs, and a database is used to track all problematic bar coded products and trend the results of bar

code verification testing. If a manufacturer's bar coded product verification grade results in a "D" or "F," a letter, along with the actual submitted product, is sent to the manufacturer requesting assistance in resolving the issue. This information also is sent to the VA National Acquisition Board, VA Pharmacy Benefits Management, the FDA, and Global Standards 1, an international bar code standards group. If a VA-produced bar coded product grades "D" or "F," recommendations are sent to the facility to help resolve the print-quality issue. This program has led to modifications in print quality by manufacturers and VA facilities, resulting in more reliable scanning of bar coded products.



Because of this program, a bar code quality clause has been written into all VA medication purchase agreements. This clause requires that all products purchased within the VA system contain a bar code that is graded at “C” or better. Should a product not meet this standard, it may be removed from the VA’s approved purchasing list.

### BCMA Equipment Standardization

Positive patient identification is the most basic piece of a point-of-care BCMA system. Therefore, ensuring the patient wristband maintains its scan-ability over the life of the hospital stay is an important concern. In May 2005, the BCRO conducted its first annual wristband media and printer combination survey. Each VA medical center provided wristbands to the BCRO for evaluation. The survey results provided the VA, for the first time, a means to identify combinations of products resulting in the most reliable and durable wristbands. As an end-result of this survey, wristband and printer guidelines were developed to determine the best-of-breed products to be used by the VA.

These findings led to the development of VHA Directive 2006-069 “Purchasing Bar Code Scanners, Wristband Printers, and Wristband Print Media for Use with Bar Code Clinical Application Software.” This directive requires that all BCMA scanners, wristband print media, and wristband printers be purchased from a BCRO-approved list, resulting in a level of equipment standardization for BCMA that was unavailable in its early years of implementation.

The BCRO developed standardized, evidence-based scoring criteria to evaluate bar code scanners, wristband printers, and wristband media based on market research. Items in each category are evaluated on a number scale that designates each product as “least acceptable,” “meets the basic needs,” or “exceeds the basic needs.” For example, if a printer does not have an interface with the VA’s VistA software, its score would be “least acceptable.” If the printer already has an interface, it would meet the basic needs, and exceed them, if it can be set up at the factory to be “plug and play” when it arrives at a VA medical center. Having one central source develop criteria and complete the testing allowed all of the products to be compared against equal criteria and saved 145 VA facilities from having to individually test products.

Any VA facility interested in a new product may request that the BCRO evaluate it based on the standard scoring criteria. Also, the BCRO is constantly contacted by vendors concerning new products or upgrades to existing products for evaluation. This ensures that patient safety and quality improvements in the VA’s BCMA program will continue.

### Selection Criteria

Because scanners, wristbands, and wristband print media are all used in the

process of positive patient identification – the basic step from which all other point-of-care activities arise, they must all be evaluated carefully. So what characteristics are considered essential when the BCRO evaluates products and equipment?

End user satisfaction is a key consideration to evaluating any product. The BCRO stresses end users evaluations of any technology under consideration during product testing. So the BCRO is sure to include feedback from actual field

users in the overall evaluation of the product. It is also necessary to evaluate the vendor’s level of customer service. Since the VA has facilities across the country, it is essential that a help desk be available for facilities in different time zones.

### Scanners

Wireless scanners are first evaluated on the security of wireless communication. Do they meet all government security protocols? Do they decode the patient’s wristband in the base unit, or is it decoded by the scanner itself and then sent – unsecured – to the base station? The latter process leaves data prone to interception. The VHA currently uses a patient’s social security number as its unique identifier and, therefore, is extremely diligent about the security of wireless data transmission. Currently, the only approved scanner for VA BCMA decodes the wristband information in the base unit so it is not possible to capture that information through electronic eavesdropping.

Scanners are also evaluated on the type of scan engine used. While scanners with laser scan engines scan quickly and from a longer distance, they cannot read the multidimensional bar code symbologies now being applied to medications. Area imagers, which are becoming the industry standard, are essential for reading multidimensional bar codes.

Another consideration, ease of device setup relates to the type of interface the device offers. Does the product interface with your facility’s existing computer system, or will that interface need to be written and/or purchased?

Furthermore, due to the variety of bar code symbologies that may appear on medication packaging, scanners should be easily configurable. For example, the reduced space symbology (RSS) and composite bar codes that have begun appearing on unit dose packaging may include both a unique product identifier, as well as the lot number and expiration date of the item. If your BCMA software is not programmed to use the lot number and expiration date, this additional data will not be recognized by the software and could reject the entry. Hence, it is important that the scanners can be configured to ignore this extraneous data if your software is not programmed to handle the additional information.

Scanners are also evaluated on their ability to sustain repeated falls. The product should continue working after being dropped repeatedly from more



Because usability is important to end-user adoption of new technology, ensure it is easy for staff to load media into the printer, as well as remove printed wristbands from it.

Photo courtesy of Zebra Technologies



Photo courtesy of Endur ID Inc.

The printed material on patient wristbands must be able to withstand environmental factors such as hand lotion, soap and water, alcohol, friction, cold, and heat.

than 5 feet. Most products' fall rates are indicated in their specifications sheets. In addition, the scanner's battery must last longer than the average medication pass, without requiring a recharge. The battery life should be more than eight hours in case it does not get recharged after each medication pass. The ideal weight of a scanner should be less than a pound, as heavier scanners can cause repetitive motion injuries. The VA also assesses electro-magnetic and radio-frequency interference, electrostatic discharge, and United Laboratories electrical certification safety ratings to assure scanners will not interfere with other electrical equipment or result in injury to the users.

Usability and human technology interface evaluations are completed based on how the actual user and the product interact, the ability of the scanner to read from various angles, ease of and need for battery replacement at the point-of-care, and the scan success rate for bar codes of differing ANSI grades. The ability of a scanner to reliably read various symbologies is essential for any scanner evaluation. Therefore, various products with different verification grades must be scanned multiple times to demonstrate reliability of scanning accuracy.

### Printers and Wristband Media

Wristband printers and media are evaluated on print quality over a number of consecutive wristbands. The VA does a random sample of wristbands to be evaluated since the first and 100<sup>th</sup> wristbands may not print with the same quality, due to the change in ink levels with repeated use.

Longevity of the printed material on the wristband is also an essential evaluation criterion. The wristband must be evaluated against environmental factors that may affect longevity, such as hand lotion, hand washing, friction, alcohol, heat, and cold. To perform this evaluation, the wristbands are subjected to these factors and then scanned many times over the lifecycle of the test.

The printer must allow for on-site configuration adjustments such as formatting the wristband to print site-specific information. For instance, many sites want the ability to print several bar codes in different orientations, such as horizontally or vertically, on the wristband to require less manipulation during scanning.

Ease of use and setup significantly impacts end-user adoption. The more difficult the item is to maintain, the less likely the end user is to embrace it. Therefore, it is important to consider the effort required to set up the printer and load wristbands into the device.

Other questions to ask during the printer evaluation include:

- Does the printer interface with your computer system?
- How large is the printer?
- Will it fit in the area assigned to it?



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### Bar Code Scanners and Area Imagers

Vendor	Reader Service Number
Brady Worldwide, Inc.	54
Code Corporation	56
Honeywell Imaging and Mobility	57
Intermec Technologies Corporation	58
Metrologic Instruments, Inc.	61
Motorola, Inc.	62
Opticon Inc.	63
Precision Dynamics Corporation	64
Wasp Barcode Technologies	65

### Bar Code Printers

Brady Worldwide, Inc.	67
Cognitive Solutions, inc.	68
Datamax	83
Intermec Technologies Corporation	70
Precision Dynamics Corporation	73
Zebra Technologies	74

### Bar Code Verifiers

Axicon Auto ID	75
Barcode Planet	76
Honeywell Imaging and Mobility	78
Label Vision Systems	79
Printronix/RJS	80
Stratix Corporation	81
Webscan, Inc.	82

### Wristband Media

Datamax	84
Endur ID Inc.	85
General Data Company, Inc.	86
Precision Dynamics Corporation	87
Zebra Technologies	88

Usability and the manner in which the end user interacts with the printer will affect how nurses perceive the wristband media. To perform a sound evaluation of wristband media, ask the following:

- Is it easy to take the media out of the machine and place it on the patient?
- Does the nurse have to manipulate the wristband to be able to scan it properly?

Patient satisfaction with wristband media is also extremely important. It may be the greatest product in the world in a test environment, but if the actual wearer is not satisfied with its comfort, it will not be accepted in the field.

### Results of the VA's Product Standardization Program

Has the VA's attempt at product standardization shown any benefits? When the BCRO started testing products, wristband failures accounted for approximately 41% of the problematic bar codes reported in fiscal year 2006. In the current fiscal year, problematic wristband failures accounted for only 3% of the products reported to the BCRO. All VHA facilities now using recommended printers and following printer guidelines are exceeding a 95% wristband verification rate.

In addition, VA medical centers now have an approved list to choose from when purchasing new products or upgrading older products at the end of their lifecycle. The standardization process has saved the VA time and resources in evaluating products at each indi-

vidual facility, and has yielded more reliability in the scanning process, as well as overall satisfaction with administering medications through BCMA. Thus, we have made the medication administration process safer for all of our nations' veterans. ■



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