

From Juicy Fruit to Low-Hanging Fruit

Resolving Unique Bar Coding Challenges at the Point of Care

Overview

Since the first 10-pack of Juicy Fruit was scanned in 1974, bar codes have become ubiquitous in our shopping experience. And while originally the customer was only a passive observer of the clerk's scanning, now the scanner and terminal have been turned around to face the customer, and self-checkout allows any of us to scan labels to record our purchases.

The simple act of reading a bar code is not tremendously challenging in a retail environment. However, translating this technology into healthcare has uncovered many unique challenges that had not presented in retail. Scanners originally designed for retail and other vertical markets have at times stumbled in deployments at the point of care.

Early adopters have found much success in using bar coding to improve patient safety at the point of care, and in the process have had to manage operational issues and other problems with equipment. It should be a lot easier to be safe, and this paper outlines some suggestions to guide the deployment of bar code readers that meet the unique challenges of healthcare.

From the Cash Register to the Bedside

From a societal benefit perspective, most would agree that preventing potentially harmful medical errors is more important than identifying packages in retail for inventory control and pricing. A hospital is not a grocery store, and this is obvious to anyone who has spent much time in both environments. The differences between the items labeled and scanned, the nature of the work performed, and some unique attributes of healthcare all conspire to explain why it's much more difficult to scan for safety.

Hospitals have been using bar coding for a number of years. The Healthcare Information and Management Systems Society (HIMSS) Auto-ID and Bar Coding Task Force conducted an analysis to determine the utilization in various hospital departments:¹

¹ Letter from HIMSS to JCAHO (The Joint Commission), January 22, 2007.



Hospital Adoption of Machine-Readable Technology

Department	Percent
All Application Areas	69.8%
Laboratory	46.6%
Radiology	28.2%
Nursing	28.1%
Pharmacy	28.1%
Materials Management	27.2%
Cardiology	6.4%

The methodology used by the task force was to review data from the HIMSS Analytics proprietary database that surveys technology utilization within hospitals. The study revealed that of 4,200 hospitals, more than 69% reported using machine-readable (mostly bar coding) technology in some fashion. These data support the notion that the technology is widely-adopted in hospitals in general.

Most of the current applications involve logistics and supply chain management. A greater opportunity is to leverage the accuracy of automatic identification (Auto-ID) to improve quality of care.

Many industry observers have commented on the importance of quality and patient safety, particularly since the Institute of Medicine's clarion call reports on quality, beginning in 2000. "For most healthcare executives, greater operational efficiency begins by picking the "low hanging fruit." Once these kinds of reductions are made, finding ways to further reduce costs without compromising the quality of care is extremely problematic—a situation clearly documented by the Institute of Medicine study indicating that as many as 100,000 people per year are killed by medical errors in U.S. hospitals. Adverse drug events (ADEs), or medication errors, were among the most common, accounting for thousands of deaths a year, and more than 2 million injuries. This is quality-of-care's low hanging fruit."²

² Curtin L, Simpson RL. Quality of care and the 'low hanging fruit'-Industry trend or event. *Health Management Technology*. September, 2000. Accessed April 18, 2008 at <http://archive.healthmgttech.com/cgi-bin/arttop.asp?Page=0900nursingtech.htm>.

In addition to medication safety, bar coding is helping to improve the safety of the blood specimen collection and transfusion administration loop, to match point-of-care diagnostic tests with the right patient, to verify right baby-right mother's milk match, and other therapeutic and diagnostic processes.

In general, bar coding is transitioning from utilization only in logistics applications into clinical care and safety. When used for supply chain improvement, the ease of bar coding is comparable to its ease in other vertical markets. It is the move to the point of care that significantly ratchets up the complexity of the dynamics of mobile computing in general and bar code reading in particular. Instead of controlled usage by a limited set of workers in laboratory, pharmacy, or materials management, bar codes are now being read by hundreds of individuals such as nurses, phlebotomists, respiratory therapists, and other caregivers whose primary focus is in care delivery. The point of care can be a chaotic place, and space constraints and other factors impose significant challenge to the proper implementation and usage of bar code-enabled systems.

It is increasingly recognized that the accuracy and efficiency of many processes can be improved through bar coding. The application that has been considered the "lowest-hanging fruit" and has received the most attention is bar code-enabled medication administration (BCMA).

Cracking the Code

In order to improve the safety of medication administration, a bar code on the medication package used at the bedside must be readable. The lack of availability of medications with bar codes on the package used at the bedside has been a significant hurdle to adoption of BCMA systems. For years, pharmaceutical manufacturers forestalled overhauling their production and labeling processes to apply bar codes at the unit-dose level. Their reasoning was that hospitals had not invested in information systems to make use of the bar codes.

The FDA stepped in to help resolve what had developed into a chicken-and-egg problem, and issued a rule that requires manufacturers to apply bar codes to packages at the lowest level shipped. As of April, 2006 the rule has been in effect to require bar codes on all immediate drug packages, but it doesn't necessarily require manufacturers to make unit-dose packaging available.

Pharmaceutical manufacturers claim that they will provide unit-dose packaging according to customer demand. As part of their compliance with the FDA rule, some manufacturers pulled back in some cases from providing unit-dose packaging. Some oral solids are available only in bulk and not in blister packs and must be packaged into unit-dose packages, labeled with a bar code.

In order to achieve success with BCMA, hospitals need to apply bar codes to as many of the medication packages as possible. Some have reached 100% compliance, and many others have bar-coded at least 95% of doses.

Pharmacy has several options in ensuring bar codes on packages. Hospitals can alter purchasing patterns in order to favor manufacturers that make a medication available at the unit-dose level over those that are delivering in bulk for that medication.

Pharmacy-prepared medications, such as large-volume IV bags, custom-prepared syringes, extemporaneous medications, and other custom doses require in-pharmacy labeling. All commonly-used pharmacy information systems are capable of printing bar-coded labels to apply on these custom packages. These pharmacy system-generated bar codes typically contain a combination of an order identifier and a patient identifier so that BCMA applications can match labels to corresponding orders in the patient's profile.

Between those medications available with bar codes from the manufacturer and those that are prepared in the pharmacy, a gap exists. This gap can be filled in a variety of ways. Most commonly, hospitals deploy automated solutions for packaging oral solids and liquids from bulk into unit dose. Also, labels can be printed and then manually affixed to packages. Another option is to turn to third-party services that repackage medications from bulk into bar-coded unit-dose packages. These operations provide an alternative that reduces the hospital's responsibility for in-house packaging operations.

Thus, medications arrive at the nursing areas with packages and bar codes that are printed by a variety of sources. Not all bar codes are created equal. The method of encoding data into a pattern of wide-and-narrow lines, or white and black points in a checkerboard, is referred to as a "Symbology." Different symbologies were developed over the years for specific applications starting with the ubiquitous "Uniform Product Code" for retail applications, and spreading to many other applications such as tracking the tiles on the Space Shuttle's heat shield and the now-familiar two dimensional symbols found on most drivers licenses.

Prior to 2004, the most common bar code symbologies in healthcare were the linear Code 128 and Code 39, chosen because they could encode letters as well as numbers. The small size of drug packages often made it difficult or impossible to contain both the FDA-required human-readable print and the standard Code 39 or Code 128 codes. When manufacturers label with Code 128, they often reduce them proportionally to fit into smaller spaces. Sometimes, they create truncated symbols that are half the height of the standard Code 128, or stacked symbols that place one half of a code on top of the second half of the bar code.³

Bar coding technologies (the symbologies and the readers) are continually advancing, in order to allow the encoding of more data in smaller spaces, improve the ease and performance of reading, and to become more resistant to damaged symbols. In order to address changing requirements, more complex symbologies have been developed and are becoming more widely-deployed. In addition to linear symbologies, "reduced space" and composite symbologies, and two-dimensional (2-D) symbologies have been developed and standardized.

The GS1 DataBar family of symbols are designed to encode more data in a smaller space. GS1 (which has evolved from the US-based Uniform Code Council) is an international standards organization that polices the numbering used by manufacturers and maintains a set of symbology and data standards on a global basis. These symbols were known as Reduced Space Symbology (RSS) until a name change (to GS1

³ Wisz M, and Neuenschwander M. To the bedside 2: An expanded review of bar code point of care systems. October 2006. A Neuenschwander Report.

DataBar) in 2007. The DataBar codes are generally developed by stacking linear codes on top of each other, or by expanding the code.

The GS1 DataBar composite codes have been adopted in healthcare because some products, such as vials and ampoules, are delivered in very small containers with very small labels. Standard linear bar codes generally cannot be printed in sufficient quality to shrink them to a size that will fit on the label, let alone allow space for any human-readable information. The need to encode more information in less space continues to drive change. Some pharmaceutical manufacturers have approached the FDA with a request to allow the use of 2-D symbologies on selected products. In fact, some are already packaging certain products with only a 2-D symbol, as even a composite symbol would not allow enough reduction for the code to fit on a half-inch square label.⁴

The FDA has partially resolved the chicken-and-egg problem, and availability of bar codes on medication packages has been greatly improved, but compliance with the FDA rule as well as third-party and in-pharmacy repackaging has created a lot of real-world reaction that has created confusion for suppliers and users alike.



Shown above is a typical unit dose package with a stacked DataBar composite symbol encoding the NDC number, the Lot number, and the Expiration Date. These complex symbols require a high resolution 2D imager to reliably capture all fields simultaneously.

⁴ Wisz M, and Douglas BA. Bar coding primer: Reading is fundamental. April 2008. White paper distributed at the unSUMMIT for Bedside Barcoding.

Challenges at the Point of Care

Bar Code enabled Point-of-Care (BPOC) systems require a symphony of technologies to come together and (hopefully) work harmoniously. Servers, wireless networks, mobile computers, printers, labels and materials, and bar code readers are all required to enable successful use of the software applications at the bedside. The quality of each of these elements should be thoughtfully implemented so that the caregiver has the greatest chance of success for achieving an accurate scan the first time, every time.

Employee identification is typically accomplished by scanning a symbol on a badge, and patient identification is usually facilitated through the reading of a symbol on the wristband. Systems and industry factors make the point of care a challenging environment for bar code readers, especially with respect to reading medications, which involve the most complex and variable reading scenarios.

Patient Identification

Positive patient identification depends on scanning labels on people to ensure that the right patient is receiving the right therapy. Without being too obvious, the fact that the patient's scanned are very sick presents a very acute difference between the grocery store and the hospital.

"Healthcare-associated infections are an important cause of morbidity and mortality in hospitals. Each year more than two million patients acquire healthcare-associated infections, resulting in 90,000 and healthcare costs that are estimated to exceed \$5 billion."⁵ Infection control concerns demand that equipment be easily cleanable and resistant to chemicals.

Whereas in a grocery store, the customer doesn't need to be scanned, BPOC applications require that the user identify the patient, who can move around. In addition, their wristbands are curved, creating a more difficult scanning surface.

A critical success factor in BPOC applications is to prevent caregivers from having excuses to work around the system. In identifying patients, caregivers have been known to scan the patient's bar code from a paper document, which circumvents the need to check the patient, but also bypasses the benefit of positive patient identification. This workaround is partially motivated by nurses' reluctance to bother their patients more than necessary. This compassion heightens the emphasis on the ability to scan the wristband right the first time, in order to minimize motivation to work around the system.

Unique End User Characteristics

Bar coding at the point of care can involve hundreds of users that need to be trained on effective use of the bar code readers. And whereas these users are the best people in the world when it comes to compassion and caring, their job is to care and not necessarily to "work" technology. A nurse's job can be extremely stressful, with extensive multi-tasking and interruptions. Any technology introduced to make the nurse's

⁵ Burke JP. Infection control—a problem for patient safety. *New England Journal of Medicine*. 2003; 348:651-656.

job easier needs to work well intuitively, and appropriate training must be delivered to instill consistent proficiency.

Nurses' compassion does not necessarily carry over to the treatment of equipment. The point of care can be a chaotic place, and the hectic pace creates situations in which handheld equipment such as bar code readers are set down somewhere and then dropped. Any equipment used must be ruggedized to survive inevitable falls to hard floors.

Because of the pace and multi-tasking, and the supreme desire to take care of patients above all else, nurses can sometimes look to work around systems, especially when they are not designed or implemented properly. In addition to scanning bar codes on charts other than the wristband, nurses can over-ride medication verification by choosing the medication off of a list. Software applications need to provide this ability to over-ride in order to accommodate situations in which the medication is not labeled with a readable bar code, but if this over-riding is abused, it can defeat the point of the system.

Mobility of End Users

Because there are so many users of the system, and they are dealing with scanning patients that move around, point of care usage requires mobility. Mobility creates challenges in designing equipment that can keep up with the dynamic nature of usage. Scanners or workstations on wheels (WoWs) are not necessarily always dedicated to a fixed workstation.

Many hospitals have found that cordless readers are advantageous. They can be used on a one-per-caregiver basis, rather than one-per-workstation. The lack of a cord eliminates the chance that the cable will be dragged across a patient, and there is one less component that needs to be cleaned to prevent opportunity for infection.

However, cordless readers present several practical challenges. Batteries need to be recharged, and process needs to be established to ensure that the user always has access to charged scanner. Hopefully, the battery can last through repetitive use across 12-hour shifts. In addition, the advantage of portability also introduces the potential for them to be inadvertently "lost," or taken home, or getting caught up in linens.

According to Amy Graham at the UCSD Medical Center, "scanners are things that take attention and care. They get passed from nurse to nurse and it can be difficult to setup a usage process. Successful operation is reliant upon nurse adherence to process."

Packaging

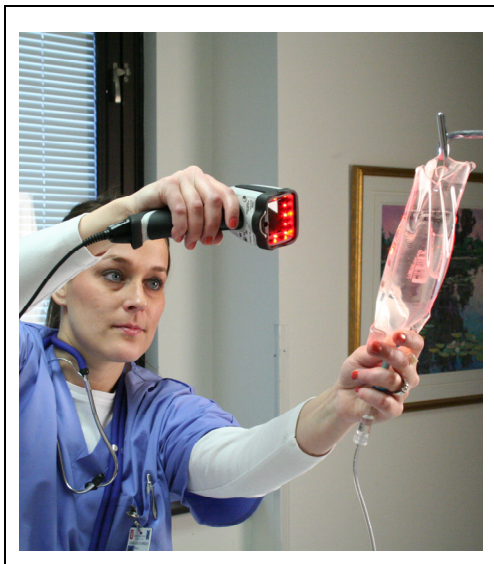
At the cash register, the clerk simply needs to scan a bag of pretzels, or a box of cereal, or a tin of peanuts. For use in the healthcare supply chain, scanning cases, cartons or other box-like containers of medications can be about that simple. However, at the point of care, the unit-dose level of the package needs to be scanned. Variation in symbol size and shape creates difficult reading unit doses.

When transitioning to the point of care, symbols need to be significantly smaller. A packager can't just shrink the UPC codes commonly used in drug stores, as reliability is lost. Respiratory medications, such as nebulizers, are particularly problematic, as

manufacturers have scrambled to apply whatever symbol they can to fit very small spaces.



In addition to really small symbols, many packages are subject to a high degree of curvature. Curvature imposes challenges of distortion and reflectivity. Disparate reflectivity points make it very difficult for laser readers to scan, particularly with the very challenging IV bags. Because of the fluid contents, labels on IV bags are highly-curved and variably-shaped. Hospitals have handled the problems of unreadable labels on manufacturers' "floorstock" IV bags in multiple ways, such as printing and applying labels from the pharmacy system, and trying to get nurses proficient at flattening the bag.



Symbols used in grocery and other retail operations conform to standard sizes, so that any given symbol is no more than about 20% smaller or larger than other symbols. If a major retailer receives a bar code that is out of specification, the manufacturer may be "fined" under the terms of their supply agreement. "I have heard of fines in the six-figure range, over-and-above the cost of replacing the product," said James Bagley, Code Corporation Vice President and industry veteran. While the Healthcare industry may not yet have such a mechanism to enforce consistency and quality, future supply

agreements may well call out bar code quality standards, as in other vertical markets. Because of the consolidated nature of the retail markets, giants such as Wal-Mart wield significant power over the manufacturers, and these giants can fine suppliers or refuse to accept shipments if symbols are not of sufficient quality (including size and readability). As of today, Healthcare provider procurement systems tend to be fragmented, and the large wholesalers may not deal with unit-dose packages.

Data Variation

A symbology is a carrier of information, and the bar code reader itself is responsible for identifying the symbology and then sending a string of data to the software application. This data should be encoded in conformance with data standards outlined by GS1 and the Health Industry Business Communications Council (HIBCC). Standards generally exist to cover the structuring of medication, patient, and employee identification data, but several real-world problems can cause lack of standard utilizations of data.

For example, the FDA rule required the NDC number to be encoded in a linear bar code, but it did not regulate secondary content, such as the lot number and expiration date. Some pharmaceutical manufacturers have chosen to encode lot and expiration information, as this is very useful to pharmacies in handling drug recalls, and managing out-dating of medications. However, suppliers have several ways in which they can label lot and expiration. For example, the NDC number could be encoded on one linear symbol, whereas lot and expiration could be encoded in a second linear symbol. According to Ashley Dalton, Pharmacy Director at the University of California, San Diego Medical Center, certain manufacturers' IV bags have been shipped with two linear bar codes in this fashion. The presence of two codes creates a problem for clinicians, as they don't know which code to scan. Lot and expiration can also be encoded in a 2-D symbol such as Data Matrix or Aztec symbologies, or it can be included in the 2-D component of a composite code. In these situations, the user will need to use an area imager in order to read the 2-D symbol, and the reader or the software application will need to be programmed to correctly extract the NDC, lot number, and/or expiration date in order to make use of the pertinent bit of information.

Dr. Dalton reports that UCSD Medical Center has received many medications that don't contain a NDC on the unit-dose level. She is not sure how this can occur, as this would be in violation of the FDA rule. It's possible that some of the non-bar coded packages could represent old inventory, and it's possible that some manufacturers are "skirting by," creating a compliance challenge for the FDA.

The variation in content and lack of practical adherence highlights the need to be able to program the scanners, or modify all of the involved software applications to accommodate this variation.

Multiple applications

Currently, most bar code readers are dedicated for use with one application. Even if several applications are in use somewhere within the hospital, typically the readers are used in different physical locations and remain dedicated to one application. In this simplified environment, application developers can write whatever characters they like into the data structure encoded in the bar code, by creating custom initializations of the reader. However, in the future, it will become much more common for hospitals to deploy

multiple applications at the point of care, where it is unrealistic or impractical to think that the same user will juggle back and forth multiple bar code readers.

For example, at least one leading BPOC system vendor developed a feature to enable a report that can show whether a medication was scanned from the bar code, or the nurse picked it from a list. In order to accomplish this feature, the vendor's scanner initialization inserts proprietary leading characters into the data string that is encoded on the bar code. This works fine, until a second application is implemented that also needs to read that same symbol. The proprietary symbol will cause problems for any other application.

Other examples exist: on a patient identifier, a glucometer identification application might need the patient's medical record number, and a medication administration application might require the patient's account number.

In these scenarios, one of the applications needs to be changed, or the reader itself needs to be programmed.

Safety-Driven Design

The transition from retail to healthcare, and more specifically point of care safety, has challenged equipment manufacturers whose histories and development mindsets were formed in retail, and warehousing.

A select few vendors are further ahead of the curve in adopting a safety-driven mindset. This perspective requires viewing the world through the eyes of a caregiver, and not through an engineer's. The eyes of a nurse look at the world far differently.

At least one leading bar code reading manufacturer has reacted to this disparity by consciously employing a product design and development approach optimized for the unique challenges at the point of care. "At Code, we have chosen to explicitly focus our design efforts to effectively deal with real-world issues involved with improving patient safety," according to George Powell, CEO of Code Corporation.

A reorientation of development mindset has resulted in a stream of features and accessories that help deal with the quirks of the point of care.

Safety Requirements

Deploy Imagers and Read Anything that Comes Along

Perhaps the most compelling advantage of area imagers is that they can read all currently-defined symbologies, including linear, stacked, composite, and 2-D codes. Since positive patient identification is foundationally dependent on accurate reading, it is essential to ensure the tools deployed to read bar-coded symbologies are expected to perform well. With the influx of composite and 2-D codes in our industry, laser scanners no longer meet the expectation of reliably interpreting the encoded information, mandating a shift to area imagers for this task.⁶

⁶ Wisz M and Douglas BA. Bar coding primer: Reading is fundamental. April 2008. White paper distributed at the unSUMMIT for Bedside Barcoding

Partly because imagers are based on the same technology as digital cameras, their cost has decreased dramatically, and scanning performance has continually improved.

Because of the increasing numbers of 2-D and composite codes that are finding their way into pharmacy inventories, hospitals are finding that they need to deploy imagers. In fact, some hospitals that purchased laser scanners then determined that they needed to replace their fleet with imagers. "I would strongly recommend pursuing a 2-D imager over a linear scanner. The Aztec symbology has advantages over other types of 2-D symbologies. It's read from the inside out, so it may be more fault-tolerant. The size and placement of 2-D symbologies has advantages for patient wristbands and medications over a linear bar code. Our facility purchased linear scanners when we started our barcoding project. In less than a year, we found that we had to abandon those and purchase 2-D imagers. We made the right decision," according to Kevin Borchert, Pharmacy Informatics Coordinator at Nebraska Methodist Hospital, Omaha, NE.⁷

Another Right—Right Equipment

The importance of the right equipment is crucial in getting the right read the first time. If caregivers require several tries or fail to read a code, their confidence in the system diminishes and the potential for workarounds increases.

Users of Code Corporation's readers have avoided many of the potential problems associated with the reading challenges identified in this document. "We have been using bar code medication administration since 2006 and we have yet to find a bar code that we couldn't scan. I have talked with many other institutions that have had problems with reading a bar code. The primary reason is that they are not using a digital imager. We have been lucky, symbology-wise," according to Dr. Dalton.

In fact, Dr. Dalton has observed that a certain line item can one day be labeled with an RSS-stacked code, the next day with a Code 128 symbol, and the next day a Data Matrix code. Even with all this variation, she has yet to encounter a bar code that can't be recognized by the Code CR 2.0. On occasion, they have encountered a misprint, which generally turns out to be a printer quality issue. She has closely tracked these misprints by the manufacturer and has discovered these to often be a lot-specific issue.

Resolution Matters

Like digital cameras, area imagers rely on a range of resolutions or definitions. Code's readers utilize high definition sensors, with two separate lenses. One lens is optimized to see the big picture, and the other reads tiny dimensions on symbols. The Code reader uses a 1.3 megapixel imager, which provides 720p high-definition. Similar to the way in which a high-definition TV enhances viewing, high-definition greatly increases the precision of the reading process. Like bar codes, all imagers are not created equal.

Imager resolution directly impacts the range (in size and shape) of symbols that can be read.

⁷ Posted on pointofcareforum.com. Accessed on 4/17/08 at:
http://pointofcareforum.com/forums/aztec_bar_code_scanning_0

Imager Format	Total Pixels	TV Equivalent
VGA (640x480)	310,000	Standard TV
SXGA (1280x1024)	1,300,000	720 P HDTV

Although any type of imager can read the majority of symbols on medication labels, a high-definition imager greatly increases the chance of reading the smaller symbols correctly on the first try, and certain very small symbols may be unreadable by lower-definition sensors. For example, tiny DataBar (RSS) stacked codes on inhalers require high definition resolution. Code's two-lens approach allows the reader to be able to "zoom in" on very small symbols, while the other lens can see a wider area to read other, larger symbols.

As pointed out above, reading IV bags poses a significant challenge, because of the curvature issues. Code's dual field (or 2-lens) approach enables the reader to view a wide view of the bag and can decode from a distance, which is more convenient for the clinician. In addition, Code's readers can be configured to allow detection and implementation of different illumination and gain control settings to enable easy reading of IV bags.

Easy reading needs to be the goal in order to maximize end user confidence in the system. Inability to read symbols increases the chance that the caregiver looks for ways to work around the system by picking the medication off a list, partially defeating the safety and efficiency advantages provided by automated identification.

There is no substitute for resolution, as you zoom in on a picture, you eventually lose track of what the image depicts. You can't be too thin, too rich, or too high-resolution.

Cutting the Cord

Imagers are marketed in cabled (or tethered) or cordless (or wireless) versions. Although cordless imagers can cost more, fewer of them need to be purchased, as they can be deployed one per caregiver, rather than one per computer. The trend toward mobility is increasing interest in cordless imagers, because of infection control, patient satisfaction, and cost of operation benefits.

However, cordless imagers introduce challenges associated with their portability. Batteries need to be recharged, and process needs to be developed to replace batteries. Off-line charging can increase total cost of operation, since the site will require a larger spare pool to accommodate the off-line charging.

Code has developed a range of charging accessories that ease the burden of ensuring that the readers are fully-charged at any given time. A one-bay charger with a minimal footprint may be mounted vertically or horizontally. Other charger banks allow multiple batteries to charge simultaneously in a common area.

Because of the requirement for a battery charge to last for a 12-hour shift, Code has developed features to reduce power consumption and reduce wear on the batteries. An often-overlooked cost of operation is battery replacement. After power is cycled 500 times on a battery, it will run 50% as long. Since a battery's use life is directly related to how many times it is completely discharged and recharged, Code's reduced power consumption allows sites to delay battery replacement as long as possible, reducing cost of ownership.

Accessories

In addition to charging accessories, Code has surrounded its readers with an ecosystem of options that deal with the special challenges of mobile users. Users of bar code readers discover that a series of policy and procedure issues need to be addressed for successful operation. These issues will vary depending on whether cabled or corded readers are utilized.

Imagers don't rely on moving parts or motors, and thus the core imaging engine could last virtually forever (except for physical damage). However, batteries and switches associated with the power management of the reader can wear out and require replacement. Code has consolidated the components that do wear out into a battery handle, which can be easily replaced. The cost of the battery handle is much less expensive than the cost of the entire reader.

		
Code Reader 1200	Code Reader 2.0	Code Reader 3.0

The Code Reader 2.0 and 3.0 are sold as a base unit that is a very small form factor that fits comfortably in a user's hand. Additionally, the same base unit can fit into a holster, as with a more traditional reader, according to user preference.

In order to deal with durability requirements, Code has developed a synthetic, rubber boot that provides a non-slip grip, as well as a more rugged exterior.

			
Handles	Stands	Modems	Bluetooth Adapters

			
Batteries	Chargers	Protective Coverings	Cables

Intelligent Readers

As detailed above, data content variation, lack of practical adherence to standards, and the use of multiple software applications all emphasize the need to be able to program the scanners.

Code Corporation has employed a unique approach that allows comparatively simple reader programming. Code enables the use of Javascript to make changes to the configuration of the reader. Competitive offerings generally require programming changes to be made at the machine level, which greatly increases the technical acumen required for the programming. Code's Javascript approach enables application engineers, third-party software developers, and even IT customers to make needed changes.

This flexibility will become increasingly important as many new applications of bar coding are implemented within an organization. Code's application engineers can create and document a custom reader setup in one 2-D code. This is not difficult to do, and is provided as a standard part of product support. With other readers, users have been used to scanning a series of symbols, often over several pages in order to program or initialize the reader. In addition to the hassle factor, a longer programming time exposes the chance that the battery runs out during initialization. Early adopters report that when this happens, it's usually not caught, and the changes are not updated properly, so the problem that precipitated the change will still occur in operation.

As part of Code's customer service, a comprehensive toolkit is available to all on their web site. This toolkit enables system managers at customer sites to access the latest configuration rules, including those that are specific to third-party software applications.

Playing Well with Others

In the future, the expansion of standards and adoption of new applications implies that the need for application interoperability will only intensify. Industry standards are being extended to provide data standards for a wider range of applications.

Harry Manopolous was the principal author and architect of work which lead to the development of the ANSI/HIBCC 3.0 data standards, and has served as a member of the HIBCC task force that has developed the standards. He is a certified developer of Code readers, and he has pushed the use of symbols to accomplish a host of new applications. For example, he has developed a pharmacy delivery tracking system

based on 2-D symbols and has worked on symbols that can help in the programming of infusion pumps. Mr. Manopolous uses Code readers to process the symbols used in the forthcoming ANSI/HIBCC 3.0 standards, and really appreciates the flexibility in programming the readers. Not all hospitals will push the standards in this fashion, but easy programming of the scanners can allow hospitals to avoid waiting for the software vendor to make changes to deal with a problem.

Code can rapidly respond to changes brought on by the market, evolving standards, and new applications. This flexibility will enable Code to update reader software in a more timely fashion than for competitors, since it is much less expensive to make changes in Javascript, rather than at the machine level. Plug and play is normally a term that invites skepticism in our industry, as IT folks like to use the term “plug and pray.” But, in the case of Code’s readers, plug and play is very easy to accomplish.

Conclusion

Hospital usage introduces problems associated with the mobility of end users, infection control, and size and shape variation in labels. High-definition imagers are necessary to ensure that even the smallest or most-curved symbol can be decoded accurately. Easy programming of the readers allows hospitals to deal with variations in data encoded for identification of medications, patients, and staff. Safety-focused development dictates changes to cordless technology, form factor, clean-ability, power consumption, and no-hassle integration. An ecosystem of deployment options and accessories enhance seamless deployment and reduce total cost of ownership. Code Corporation’s healthcare-driven approach to design and development is paying off for their users, as they are insulated from problems experienced by the market in general.

About the Author

Mike Wisz

Mike has worked closely with bar code-enabled point of care systems for over 10 years and speaks and writes extensively on the topic. Mike delivers results-oriented consulting to healthcare providers and vendors, leveraging his 18 years of experience with medication management, point-of-care safety and mobile clinical information systems. He served in executive roles with vendors that pioneered BPOC—including Bridge Medical and Cerner—in product management, field operations, and business development. Wisz has worked with other pioneers, including Pyxis and Nellcor Puritan Bennett. Mike is lead author of ***To the Bedside 2: An Expanded Review of Bar Code Point of Care Solutions, a Neuenschwander Report***. He holds a BA in Economics from the University of California, San Diego and an MBA from San Diego State University.