



# **Incorporating Bar Code Technology Into the Health Care Sector**

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## Introduction: Solving the problem of Medical Errors

Bar code technology has been around for many years. It would be difficult for most people to remember their last trip to the grocery store in which bar code technology was not used; scanners and bar codes have become a part of everyday life. Yet until very recently this technology has not become as prevalent in the healthcare sector. The stakes are even higher in this sector. While bar code technology has lowered grocery store costs and increased efficiency of distribution of goods in these venues, their implications for the health care sector are far greater: reduction of pain and suffering and unnecessary deaths.

The incorporation of bar code technology into the health care sector is fertile ground. Healthcare leaders aim to provide efficient services at lower costs, vendors compete to provide new bar code technology, and the government tries to ensure that new technologies are safe and contribute positively to the nation's health.

This paper addresses several key questions of interest to those with a stake in health care services. What kinds of functions does bar coding technology accomplish? How are the main vendors incorporating this technology into their new products and services? What roles do the government and advocacy organizations play in attempting to influence both the possibilities of and limitations on bar coding technology in the healthcare sector?

## Bar Coding Benefits: Reduced Medical Errors

Bar codes can have a positive, significant impact in helping to reduce medication errors and enhance patient safety. The importance of positive patient identification (PPI) in reducing medical errors harshly hits home when we consider that between 44,000 and 98,000 patients die in the United States each year from medically related errors. Medical errors exceed the number of deaths from motor vehicle accidents, breast cancer, or AIDS. These errors account for the eighth leading cause of death in the U.S. The leading cause of death due to medical errors is caused by patient misidentification, and specimen or medication misidentification. This is a problem that affects healthcare institutions across the nation. National publicized cases include the death of 8-year-old Ben Kolb, who died during surgery due to a drug "mix-up," and Willie King, whose wrong leg was amputated during surgery. It is estimated that medical errors end up costing the nation between seventeen and twenty-nine billion dollars. These include costs for lost income, lost household production, disability, and health care expenses.

Much has been done in recent years to enhance medication safety including the implementation of unit dose distribution, pharmacy automation, and computerized order entry. Technology has been employed throughout the medication use process with one glaring exception—at the point of care where the nurse administers the medication to the patient. At other points in the process, during order entry, transcription, and dispensing, there are opportunities to detect and prevent errors. If the physician makes an error in prescribing, or the order is incorrectly transcribed, the mistake can be intercepted by the pharmacist or the nurse. However, when nurses give the wrong drug or wrong dose, there is no one to intervene. Bar codes can help reduce the risk of human error by automating this step in the process.

Studies have shown that bar codes may dramatically reduce the risks associated with improper dosing and/or administration of drugs, lowering medication error rates by up to 85 percent. For example, the Veterans Affairs (VA) Medical Center in Topeka, Kansas, reduced its medication error rate by 86.2 % after it implemented a bar coding system. This included a 75%

improvement in errors caused by the wrong medication being administered to a patient, 93% improvement in errors caused by the incorrect administration of dosage to a patient, and a 70% improvement in errors caused when medications scheduled for administration were not given. These numbers are not necessarily a fluke: studies of other hospitals that have implemented bar code technology have shown reduced medical error rates of around 80 %.

Bar coding technology offers the possibility of decreasing the reliance on human actions to administer drugs, and hence minimizing the potential of human error in this realm. Studies have found that as many as 20% of drugs given in a typical 300 bed hospital are given incorrectly (Archive for Internal Medicine, September 2002). Some are given at the wrong time, others the wrong dosage, or sometimes the medication isn't given at all. This translates to approximately two incorrect doses per patient per day. Even a momentary lapse in attention can have deadly consequences. A 1999 study by the Institute of Medicine attributed about 7,000 deaths per year to medication errors, or about 19 patients per day. Bar coding technology could increase accuracy and efficiency and decrease the chances of such errors. Healthcare providers experience a broad range of benefits using barcode technology. There is increased accuracy in gathering data, as human error decreases and efficiency increases. This produces many benefits: quality of care improves, staff productivity is enhanced, and employee morale improves. In addition, less reliance on manual data entry alleviates certain health problems such as carpal tunnel syndrome.

How does bar coding technology reduce errors? Medication bar codes allow for the scanning of a patient's wristband, the nurse's ID badge and the drug to be administered, and then matching them with a computerized list of medications. So, for example, if a physician prescribed an overdose of a particular drug, a bar-code system will alert the nurse based on the pre-programmed maximum daily dose guidelines before the overdose is administered. Bar coding serves several other core functions in a health care environment: streamline the supply management system of hospitals; decrease the role of human actions and decisions in administering drugs and managing clinical data; decrease costs of charge capture and billing; and increase efficiency of patient identification and tracking.

One of the critical tasks of any hospital is to optimize the management of supplies throughout its organization, from point of delivery to point of use. Supply spending is the second largest area of expense in most hospitals. For many healthcare organizations, supplies are managed manually by pen and paper-based systems. This is a costly, labor-intensive and error-prone method that can be substantially improved by moving to automated barcode-based inventory control. By streamlining the process, organizations can improve efficiency and demonstrate immediate ROI. Scanned bar-coding can be an essential component of supply chain management. An effective barcode-based inventory control system is one way to help an organization in striving toward greater efficiency and balance the enhancement of services with improving the financial bottom line.

Bar coding also can facilitate the management of clinical data. The use of bar codes in combination with automated dispensing technology and robotics can free pharmacists from dispensing tasks to perform clinical duties. With the pharmacy work force shortage, automation will become critical to ensuring pharmacy services in some hospitals. Bar codes provide a means for inventory management and tracking as well as for automating patient billing. Point-of-care bar code scanning allows for critical checking of the "5 Rights" of medication administration, preventing errors before they occur: right patient, right drug, right dose, right route of administration, and right time. It also allows for real-time documentation of medication

administration, providing immediate on-line data for clinical care, and accomplishes accurate billing based on what was administered to the patient.

The medical staff scans the patient's ID bracelet bar code and the drug dosage package's bar code. If the medication is correct, the system will record the date, time, dosage, and the person administering the medication. A warning flash is emitted immediately if it is the wrong patient, an incorrect dosage, or a potential harmful drug interaction.

Surveys have shown that seventy-five percent of respondents said they favored the use of barcode technologies as a way to reduce medication errors. This technology garnered even more support from 18-34-year-olds, with 82 percent in this age group saying the government should require drug manufacturers and companies that repackage drugs to put barcodes on all prescription medications. In a related question, barcode scanning of medications came in second out of a list of five ways to increase medication-dispensing accuracy. Twenty-four percent of all respondents selected this choice. Interest was even higher among 45-to-54-year-olds, with 32 percent of these respondents choosing this option.

Greater use of automated technologies to count pills and check prescriptions before they are dispensed placed third, with 17 percent of respondents picking this. At the bottom of the list were "more pharmacists" (11 percent) and "more pharmacy technicians" (8 percent). However, when respondents were asked whether the government should provide low-interest loans to pharmacy students to address the current pharmacist shortage and encourage more people to enter the field, 83 percent of those surveyed said yes. Only 15 percent said no.

While hospitals must make an initial investment in such systems, a medication administration application can quickly pay for itself in terms of errors avoided and other cost savings. In fact, FDA estimates that bar code technology will save \$93 billion over the next 20 years. At the University of Wisconsin Hospitals and Clinics, the introduction of Admin-Rx, a McKesson point of care bar code scanning system, yielded an 89 percent reduction in medication administration errors. McKesson's ROBOT-Rx bar coded dispensing system at the same facility reduced dispensing errors from 1.43 percent to 0.13 percent.

## The Untapped Potential of Bar Coding: Planning for the Future

Despite these promising results, today only an estimated 10-15% of hospitals use bar coding technology at the bedside and only 25-35% of unit-dose medications are currently bar coded. The health care industry has therefore only begun to tap into the potential benefits offered by this technology. As it does so, the government will play a role in ensuring that this technology actively promotes the nation's public health.

### Government Policy

Several legislative acts have also led to the rise of bar-coding technology in the health care sector. The *Health Insurance Portability and Accountability Act of 1996* (HIPAA) was established to provide safeguards on the way healthcare facilities transmit, store, and access protected health information. HIPAA regulations state that healthcare facilities must use a common set of codes for all medical procedures as part of an electronic exchange of information to increase efficiency and reduce medical errors. HIPAA's administrative regulations went into effect April 2003 and they are designed to improve healthcare administration efficiency

by standardizing electronic data interchange (EDI) and protect the confidentiality of patient medical records and other individually identifiable health information using new standards. Failure to comply with any HIPAA regulations could result in steep penalties. These include hefty fines, imprisonment, insurance premium increases, and exclusion from Medicare, Medicaid, and other Federal or state health programs. In compliance with HIPAA regulations, bar code technology plays a key role in its ability to securely and automatically capture data. Automated systems can outperform humans in tasks requiring repetition, movement, concentration, memory retention, and record keeping. The improvement of work flow through automated systems also allows healthcare professionals to focus more of their time on patient care and medication management.

In February 2004, the Food and Drug Administration (FDA) released a final ruling requiring bar codes on the labels of human drugs and biological products such as blood and blood components by 2005. This final rule applies to most drug manufacturers, repackers, relabelers, private label distributors, and blood establishments, and is designed to help reduce medical errors in the hospital environment and ultimately save lives. At the same time, the ruling will help the healthcare industry to fully leverage and benefit from bar code technology much as the retail and consumer packaged good industries have done for years. The FDA is expecting this ruling to prevent nearly 500,000 adverse events and transfusion errors over 20 years; save over \$93 billion in 20 years by reducing: healthcare costs; lower patient pain and suffering; and decrease lost work time due to adverse events.

Health & Human Services Secretary Tommy Thompson announced new proposed regulations that will require bar coding on all unit dose medications and increase reporting of safety problems involving medicines. The new rules aim to improve patient safety by reducing medication errors and by more quickly identifying potential errors that may occur.

In an effort to influence policy outcome, a number of health care providers and vendors have formed group and lobbied on behalf of their favored policy goals. The *National Alliance for Health Information Technology (NAHIT)*, an American Hospital Association-backed coalition, was established to create voluntary standards for health information technology. The alliance believes that voluntary standards will not only enhance patient safety but will also pave the way for healthcare organizations to improve operating efficiencies, by creating systems that communicate better both internally and externally across organizations. Further, it believes that making patient-centered data more accessible will lead to more efficiently linked clinical, administrative and financial data to drive efficiencies across the entire healthcare organization. The alliance will begin by developing standards for applying bar coding to all medication and biological product packaging and will work with the FDA to be part of its bar coding regulatory process. Other areas of focus may include automated medication administration, electronic medical records and improving communication and transaction networks among physician offices, hospitals, and payers throughout the supply chain.

## Assessing Competing Vendors: Methodology and Results

The tables below are based on phone interviews and literature review aimed at gathering input from both vendors and health care providers. Not all vendors or vendor clients were available for comment. These results reflect our preliminary survey results and do not suggest that all users will have the same response or opinions. Furthermore, the results reflect how vendors position themselves in the marketplace and choose to emphasize particular qualities. As more systems are implemented, we will have greater accuracy and depth in assessing how

competing systems perform. TKG currently is gathering more information from providers to provide a more specific analysis of these products. Specifically, TKG is compiling survey results from providers who have used these products, and will use these results to compile a more detailed chart that includes comparisons of interface capability; interface requirements; and end user satisfaction. Specifically, 1) Does the system require new interface expenditures? Ideally, implementing new technology that incorporates bar coding will not require additional interface investments. If the system already can communicate with other hospital systems, this is a competitive advantage. 2) What is end-user satisfaction? Have health care organizations been satisfied with the results of the new systems? They expect their investments in these systems to produce quantifiable results: decreased medical errors, decreased administration costs, increased efficiency in providing health care services across the organization. Taking these different factors into account, we rate these vendors' average user satisfaction as low, moderate, or high. 3) What is the ease-of-training and use? Do the new systems require extensive investments in staff training and development? Or are the systems designed for ease of use with minimal additional training?

Given the advantages of bar-coding technology and the FDA requirements, healthcare organizations are undergoing a flurry of activity aimed at implementing this new technology. The following two tables provide basic information about vendors' products that incorporate bar code technology. The first table focuses on the major vendors, while the second table focuses on the niche vendors.

Administrators tend to be adopting the general strategy of completing three steps to implement bar-coding technology. The first stage is drug delivery: bar codes need to be put in place either by drug manufacturers or by the hospitals internally. The second stage is the "5 rights" of patients, ensuring patients are given the right dose of the right medication, and so forth. The third stage is the delivery system to the patient: hospitals must decide whether to purchase hand-held scanners or bedside technology to ensure that there is positive patient identification and so forth.

In putting this technology in place, administrators have a choice of vendors and will take into account several considerations. The summary tables below demonstrate several main points. First, administrators first began considering bar-code technology several years ago, but the costs of implementing such technology were prohibitively high. In recent years, though, costs have come down considerably. As costs have decreased and the potential benefits of this technology have become apparent, hospital administrators are moving quickly to adopt the technology. Second, this new trend towards adopting this technology is moving faster than even some manufacturers, so hospitals are responding by sometimes bar-coding medication. However, it seems likely that most drug manufacturers will eventually bar code all their medication and hospitals will not have to perform this function. Third, a key criterion by which administrators assess vendors for providing bar code technology is what vendor is currently in place to provide their clinical applications. Administrators are far more likely to select a vendor whom they already use, as they will not face interface issues, their staff will already be familiar with the products and systems, and the costs of building on their current system will be lower than if they were to implement a new system from an entirely different vendor.

While the key predictor of selection choice is their previous vendor choices, providers currently evaluating their options must still consider the pros and cons of competing systems. The tables below provide summaries of each product; highlighted features; and a description of the client base and some results of the product in terms of increased efficiency and cost savings.

## Major Vendors

Vendor Web Site Product(s)	Product Description	Highlighted Feature	Clients/Results
<p><b>Cerner</b> www.cerner.com</p>	<p>Bar coding is the engine of the <i>Cerner CareGuard™</i>. <i>Cerner CareGuard</i> is a wireless system that utilizes <i>Cerner Millennium™</i> database at the patient's bedside and alerts caregivers to potential errors automatically. Tied directly to the <i>Cerner Millennium</i> database, <i>CareGuard</i> compares what happens at the patient's bedside with current orders.</p> <p>Clinicians follow four basic steps: The clinician scans his or her ID badge to authenticate and access appropriate levels of information and clinical data. Next, the caregiver scans the patient's wristband to validate identification and review current orders. Bar-coded medications can be scanned to verify that patient, medication, dose, and timing are consistent and accurate. Clinical data is collected automatically from virtually</p>	<p><b>Ease of Use:</b></p> <p>Clinicians can use <i>Cerner CareGuard</i> to review, record and document clinical data and care activities with the touch of a button.</p>	<p><b>Reduced Errors:</b></p> <p><i>CareGuard</i> has enabled clients to reduce errors in meds administration, specimen collection and care documentation; make patient identification and documentation consistent, accurate and reliable; Improve workflow, reduce paperwork and raise caregiver productivity; improve charge capture for medications and clinical procedures right at the point of care.</p>
<p><b>McKesson</b> www.mckesson.com</p>	<p>McKesson division Automation produces ROBOT-Rx Ready™ line of drug packaging. This fully integrates bar coding at every level of unit dose handling, improving control and accuracy from ordering to dispensing to administration and electronic tracking at the bedside.</p> <p>Enables hospitals to reduce medication errors while creating cost savings in pharmacy labor and greater efficiencies in inventory management. Bar coding is currently used in Automation systems to drive drug dispensing, checking, crediting, restocking and administering functions.</p>	<p><b>Innovation:</b></p> <p>Leader in developing bar code technology in healthcare. Has created a wider range of applications for bar coding of any healthcare services provider in the industry.</p> <p>McKesson invented the first robotic dispensing system, which automates the dispensing of unit-dose bar coded medications. Has manufactured medication dispensing cabinets for nursing units that support bar code scanning for accurate drug restocking.</p> <p>McKesson has developed point of care bar code scanning utilizing a hand-held wireless scanner at the</p>	<p><b>Client Base:</b></p> <p>Over 10,000 hospitals, outpatient, and retail pharmacies use McKesson's bar code-based automation for pharmaceutical products.</p> <p><b>Reduced Errors:</b></p> <p>University of Wisconsin deployed Admin-RX, medication management system, and experienced 87% reduction in number of medication errors.</p>

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		<p>patient's bedside to ensure the "5 Rights" of medication administration. McKesson was also the first drug distributor to fully automate their distribution process by implementing radio frequency and scanning technology throughout our entire warehouse and distribution network.</p>	
<p><b>Meditech</b> www.meditech.com</p>	<p><i>Bedside Medication Verification (BMV)</i> allows caregivers to utilize bar code scanning technology prior to administering medications, to confirm patient identity and medication information against data readily available via MEDITECH's on-line Medication Administration Record. Immediate access to a patient's current results and medication administration information greatly reduces preventable medication errors. The use of bar code scanning increases accuracy and efficiency of caregivers completing medication administration records, providing physicians faster and easier access to critical information to manage patient care.</p> <p><i>AMTSystems' Materials Management (MatMan)</i> software provides inventory control in central stores and nurses' station carts. Data is collected on Psion Teklogix Workabout mx Scanners, lightweight integrated barcode-scanning computers that feature a 16-bit processor (CPU), 2 million bytes of internal memory (RAM), high-quality gray-scale display and 57-key keyboard. Data is collected on the Psion Teklogix devices and uploaded via a terminal or PC.</p> <p>JJWILD performs initial sales, integration and support services, while AMTSystems maintains the software and provides them with the solution to integrate into the hospitals.</p>	<p><b>Increased Accuracy:</b></p> <p>Improved inventory control in central stores and nurses' station carts. Bar-coded products are a major enabling factor to automate input and collection of transaction data. Eliminating handwritten documents and subsequent manual keystroke entries can result in significant productivity gains and a near 100 per cent accuracy level.</p>	<p><b>Client Base:</b></p> <p>MEDITECH currently has more than 600 Workabout mx Scanners installed at its clients' places of business. System is well-used and continues to see upward growth.</p>
<p><b>IDX</b> www.idx.com</p>	<p>Carecast™ and LastWord® clinical information systems provide wireless bar code capabilities, used for medication administration and electronic charting</p> <p><i>Integrated Solutions Division</i> of IDX has developed Advancing Fail-Safe Care™ which includes computerized physician order entry (CPOE) and a fully integrated pharmacy</p>	<p><b>Interface Capabilities:</b></p> <p>Bar code charting has an integrated system in which information can flow easily from module to module, without the need for complex interfaces. Because the module fully integrates with</p>	<p><b>Enterprise-wide Implementation:</b></p> <p>Lehigh Valley Hospital and Health Network (LVHNN), based in Allentown and Bethlehem,</p>

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	<p>system. <i>Carecast</i> and <i>LastWord</i> now incorporate bar code medication charting, adding another layer of safeguards to help prevent medication errors.</p> <p>To utilize bar code charting, each unit dose of medication, including every IV, receives a bar code before it leaves the pharmacy. Clinicians are equipped with wireless scanners with which to scan the codes on the medication tag and the patient's ID bracelet.</p>	<p>both <i>Carecast</i> and <i>LastWord</i>, scanning the tags automatically enters the drug, dose and time of administration in the patient's chart. Real-time charting ensures a more accurate record than entering the information manually at intervals during or at the end of a shift — and also gives nurses and other clinicians more time for direct patient care.</p>	<p>Penn., was the first IDX customer to purchase the bar code charting module. Lehigh LVHNN also has implemented enterprise-wide CPOE at its three hospital sites, supported by <i>LastWord</i>, for which it recently received one of the highest ratings from The Leapfrog Group.</p>
<p><b>Siemens</b> <a href="http://www.siemens.com">www.siemens.com</a></p>	<p>Siemens Med Administration Check™ (MAC) system is used to scan each medication administered and the patient's ID bracelet, and alerts nurses in real time to potential administration errors of drug, dose, route, time or patient.</p>	<p><b>Ease of Training and Use:</b></p> <p>Bar code system is relatively easy to understand, requires little customization</p>	<p><b>Reduced Errors:</b></p> <p>This system has been used by dozens of Siemens customers. Siemens customer Danville Regional Medical Center (DRMC) in Virginia has documented the prevention of 102 potential errors per month since it implemented MAC over three years ago.</p>

## Specialty Vendors

Vendor Web Site Product(s)	Comments	Highlighted Feature	Clients/Results
<b>Alaris</b>	<p>Recently released PDA application by BlueFish Wireless provides the following functions:</p> <p>Send clear, legible prescriptions directly to patients' pharmacy via handheld computer. Securely send patients' prescriptions from your wireless palm, from anywhere, with a few taps of your stylus. Increased compliance. Many pharmacies will follow up with the patient to ensure the prescription is filled. The handheld computer will allow users to keep better track of patient records and the medications you have prescribed. With the prescription sent directly to the Pharmacy, patient tampering is no longer possible. High end-user satisfaction: reduced errors and improved workflow</p>	<p><b>New Joint Venture:</b></p> <p>ALARIS Medical Systems' is embarking on a joint bar-code solution with McKesson Automation. This product will begin beta testing in late third or early fourth quarter of the year.</p>	<p><b>Client Base:</b></p> <p>Product is provided to over 5,000 hospital and health care systems, as well as alternative care sites, in more than 120 countries through its direct sales force and distributors. With headquarters in San Diego, ALARIS Medical employs approximately 2,900 people worldwide</p>
<b>Baxter</b>	<p>Baxter's Patient Care System, formerly called the <i>AUTROS</i> system, is a wireless patient information and medication management system that uses handheld computer devices. This system helps provide caregivers with access to the real-time information they need to safely and correctly administer medications. Baxter's Patient Care System is being designed to receive communication from the company's COLLEAGUE CX infusion pump. This connectivity will allow access to infusion information at the bedside and is designed to help enable the nurse to verify that the pump setting matches the physician order before starting the IV infusion.</p> <p>Deerfield, Ill.-based Baxter Healthcare's produces Patient Care System, an integrated medication management system that uses bar code scanning technology and personal digital assistants (PDAs).</p> <p>In the Renal business, products like Baxter's Twin-Bag system and other technologies that make PD solution-exchanges easier for patients also dramatically reduce infection rates. In Transfusion Therapies, the company's pathogen-inactivation technologies are designed to inactivate any pathogens that might be present in collected blood</p>	<p><b>Centralized database/interface capability:</b></p> <p>Baxter's <i>ENLIGHTENED(HRBC)</i> bar code features a 14-character Uniform Code Council/European Article Number (UCC/EAN), which is a globally recognized identifier used for automated tracking of products.</p>	<p><b>Client Base:</b></p> <p>North Adams Regional Hospital serves patients in northern Berkshire County, Mass., and southern Vermont. Each year, North Adams performs more than 2,200 surgeries, and its emergency department treats more than 20,000 patients.</p> <p>Implemented Baxter Healthcare's Patient Care System. Nurses have administered 16,380 doses using Patient Care System over a two-month period. North Adams</p>

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	<p>components as a final measure of safety before those components are transfused to patients. And in Medication Delivery, the examples are abundant, from the first "needle-less" IV access systems and premixed drugs to Baxter's ENLIGHTENED bar-code technology and Patient Care System, a wireless patient-information and medication-management system designed to reduce medication errors at the bedside.</p> <p>Baxter's COLLEAGUE CX infusion pump has a number of features that help ensure that drugs being administered to patients do not exceed programmed dose limits, and communicates other vital infusion-status data to clinicians at the bedside.</p>		<p>experienced immediate benefits with the automated program, such as missed-dose monitoring, accurate administration time tracking and simplified reporting for drug use statistics.</p>
<p><b>Bridge Medical</b> www.bridgemedicalc</p>	<p><i>The MedPoint™ Patient Safety System</i> is a suite of cost-effective software applications designed to assist hospital staff in improving medication safety and information management. Created by a team of concerned clinicians and technology experts, MedPoint acts as a bedside sentry on the lookout for potential error and providing a safety net where none previously existed.</p> <p>Bridge MedPoint bar-code-enabled point-of-care software developed by Solana Beach-based Bridge Medical Inc. The process: nurse or therapist wheels the cart into the patient's room. A computer bar code on each patient's identification bracelet is used to match and monitor the medication ordered by the doctor. Before administering medications, nurses and other caregivers scan bar codes imprinted on the nurse's ID badges, on the patients' armbands and on the medications, using a handheld device. The computer, already loaded with patient-specific information, reads the bar codes and will immediately alert the bedside nurse through a message box on the screen to any potential errors and provide other critical information that could prevent adverse drug effects.</p>	<p><b>Reduced Errors:</b></p> <p>System has two overriding goals: protect the patient from harm of adverse drug events; and provide the hospital with administration data that empowers them to achieve an error-free environment. The backbone of MedPoint consists of several feature-rich components: Point-of-care application; system manager application; and report application.</p>	<p><b>Implementation Problems:</b></p> <p>Problems reported include lack of wireless reception in certain areas of the hospital, as the system is put into wider use. Bridge Medical is working to respond to these problems as they arise.</p>
<p><b>Mardon Healthcare Information Systems</b></p>	<p>For nearly a quarter century, Mardon Healthcare Information Systems has provided sole-source turnkey health care information management system solutions. Mardon's HIPAA compliant integrated solutions cover all critical applications in rural and mid-size medical environments. Mardon also</p>	<p><b>Ease of Training and Use:</b></p> <p>Mardon serves a specialized marketplace: geographically remote</p>	<p><b>Client Base:</b></p> <p>Mardon stresses reduced costs of services with implementation of its</p>

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	<p>provides crucial EDI claims processing. Through the alliance, services such as nationwide medical search, medical forms acquisition, document imaging, financial management and leasing, targeted marketing and e-communications, and total system engineering and integration are available.</p> <p>Incorporated in 1981, Mardon serves the rural community hospitals. Its bar-coding products are part of a complete turnkey program that puts all the pieces together utilizing a powerful Unix Operating system and over 40 integrated applications. The Mardon System has evolved during the last few decades, with eight major software releases to date.</p> <p>This product is a single interface system: clients can avoid hassles of dealing with interfacing multiple systems with multiple vendors. In a hospital there are usually 8 - 15 stations that would be producing Bar Code labels for tracking patients documents or inventory items, Drug, Lab or Radiology department data.</p>	<p>and rural areas, with users who require simplicity. Many users have high school education levels and limited experience using computers. The Mardon product is designed with this in mind.</p>	<p>product. Clients include Tehachapi Valley, a Barrow area hospital that serves around 4,500 people spread out over an 88,000 square mile radius,</p> <p>Raymond Hino, CEO of Mardon's Tehachapi Valley Healthcare District selected Mardon because of Ease of use, efficiency and increased productivity.</p>
<p><b>Mediware</b></p>	<p>WORx Pharmacy Management System provides wireless bedside access to patient medication profiles and provides full clinical drug databases with alerts and recordkeeping.</p> <p>Medi-MAR provides a tool for hospitals to monitor the administration of medications at the bedside to ensure adherence to the five rights of medication safety. Medi-MAR operates with either wired or wireless technologies and with handheld, full screen PC, and touch-screen interfaces that confirm patient, nurse and medication identity and ensure administration of the proper medication at the proper time.</p>	<p><b>Centralized database/interface capability:</b></p> <p>Medi-MAR,'s hand-held scanner and keyboard connects wirelessly via radio frequency technology to the hospital's central WORx database. By scanning their own ID, the patient's ID, and the medicine label, nurses instantly create a complete electronic record of the medication event. Alerts are provided if the WORx database detects any irregularities such as drug-patient mismatch, an outdated prescription, or a potential overmedication.</p>	<p><b>Client Base:</b></p> <p>The Company's systems are installed in over 1,100 hospital departments. Recent clients include two hospitals operated by Capital Health in Trenton NJ: the Mercer Medical Center and Helene Fuld Medical Center, have a total of 589 beds.</p>

Vendor Web Site Product(s)	Comments	Highlighted Feature	Clients/Results
<p><b>PHG Technologies</b></p>	<p>Uses barcode technology to provide positive patient identification. Provide inventory reduction, precise tracking and forecasting. Ensures all chargeable supplies are billed. Tracks the acquisition, maintenance and depreciation of capital assets. Implement electronic scheduling in surgery to manage patients, equipment supplies and personnel</p> <p><i>EasyID</i> is designed to interface with the registration process in order to capture patient information at the time of registration. EasyID allows print-on-demand of any document stored in the system through an easy to use browser-based interface. EasyID also includes an emergency downtime solution that assures you the ability to create patient identification labels even if registration system or network is unavailable.</p>	<p><b>Ease of Training and Use:</b></p> <p><i>EasyID</i> Integrates easily into information system environment so you quickly begin to realize the benefits. Designed with the non-technical user in mind, which eliminates lengthy, expensive end user training.</p> <p><i>EasyID:</i> uses barcode technology to provide positive patient identification while offering cost savings; eliminating embossers, imprinters and preprinted forms; and improving information efficiency and workflow throughout your facility. The "turn-key" system is fully customizable and includes installation, training and support.</p>	<p><b>Client Base:</b></p> <p>Growing client base. Recently awarded a contract to provide Universal Health Services Inc.'s corporate office and 24 member hospitals with a capital assets tracking and purchasing system .</p>
<p><b>Precision Dynamics Corporation</b></p>	<p>As part of a complete patient identification system, <i>PDC Bar Code Solutions</i> provide a solid automated solution, while complying with HIPAA regulations for streamlined operations and patient confidentiality. Caregivers use the product to capture data for medication administration, point-of-care-testing (POCT), transfusion verification, specimen collection/tracking, and patient charging.</p> <p>Organizations spanning the healthcare industry are uniting to set standards to reduce medical errors, costs, and improve efficiencies.</p> <p>PDC developed the first patient bar code ID wristband in 1984. Allows healthcare personnel to electronically capture and verify data for medication administration, suggested site, point-of-care testing (POCT), transfusion, specimen collection/tracking, and patient charging.</p>	<p><b>High Level of Security:</b></p> <p>Designed with security in mind, PDC's Bar Code Wristbands come in tamper-evident adhesive closure styles to provide maximum security and prevention against transfer.</p>	<p><b>Client Base:</b></p> <p>More healthcare facilities use PDC Bar Code Wristbands than any other bar code wristband system in the world.</p>

Vendor Web Site Product(s)	Comments	Highlighted Feature	Clients/Results
<p><b>Resource Bar Code System</b></p>	<p>The Resource Bar Code System helps simplify the process for caregivers with several products and technologies. The <u>Scan-as-you-go approach</u> allows caregivers to scan the product bar code at the point of use. The system captures the charge along with the time, date, and staff member. This method does not require product stickers to be put on the products. The piggyback label approach uses bar coded labels which are applied to the products. When the product is used the label is removed from the product and placed on the resident charge card. The charge cards are scanned in batches periodically by central supply or billing personnel.</p>	<p><b>Reports and Accountability:</b></p> <p>Reduce lost charges: The Resource System's proven lost charge report card features provides the controls necessary to eliminate lost charges and put accountability into the process. Lost charges can be identified for each nursing unit each day or shift.</p> <p>Reports: The Resource Bar Code Systems offers multiple reports for aspects of billing and nursing management.</p>	<p><b>Client Base:</b></p> <p>More than 2,000 long- term care facilities nationwide utilize the Resource Bar Code System. Some of the large customers include:</p> <p>HCR Manor Care (380 facilities); Ontegrated Health Systems (400+ facilities); Mariner Post-Acute Network (125 facilities); Good Samaritan Society (70 facilities)</p>

## Conclusions

This paper reveals several main points. Medical errors are one of the leading causes of death in the United States. Moreover, the main causes of medical errors are patient misidentification, and specimen or medication misidentification. Finally, bar-coding technology can help greatly reduce the number of these errors, for it offers the possibility of decreasing the reliance on human actions to administer drugs, and hence minimizes the potential of human error in this realm. While there is great potential for bar-coding technology to have a major impact in reducing medical errors and the death-rates associated with health care procedures, this still is somewhat fertile ground. Few hospitals and health care organizations have already implemented these new systems. Yet this is changing rapidly: the FDA has required bar coding systems to be in place by 2005, so health care providers are scrambling to meet these mandates. There is ample choice in selecting from vendors, ranging from major vendors such as McKesson and Cerner to specialty vendors such as PHG and Precision Dynamics Corporation. In selecting a vendor, providers can take into account any number of factors, but three stand out: interface capability, end user satisfaction, and ease of training and use. While these factors may vary across vendors, many providers are basing their decisions on previous decisions: they are likely to stay with the vendors they have selected previously to provide clinical applications, thus avoiding interface problems, reducing costs via-economies of scale, and avoiding the need to train employees on new systems. Regardless of what choices individual providers make, there is little doubt about the overall trend in the health care sector: bar coding will be integral to improving the quality of care and saving lives. As one provider said: "bar codes have the potential to be the penicillin of the new decade."