Prevention of Medication Errors at the Federal Correctional Complex Butner, NC

by

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6 April 2003

A Master's paper submitted to the faculty of the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Master of Public Health in the School of Public Health, Public Health Leadership Program.

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Medication errors are one of the largest problems in the health-care system. They are prevalent in all aspects of the industry, weaken patient confidence in the health-care system, and are a major contributor to health-care costs each year. Patients harmed by medication errors require more diagnostic testing, treatment and follow-up care in an effort to overcome the occurrence. Medication errors not only produce extra financial burden, consume valuable assets, and decrease confidence in the system, but also extend patient and family suffering.

In 1999 the Institute of Medicine (IOM) report *To Err is Human* stated medication errors cost the United States up to $2 billion each year or $4700 per admission for inpatient care alone. In 2002 Trookskin stated that medication errors kill up to 7000 Americans annually. Since 1995 the Joint Commission of Health Care Organizations (JCAHO) has tracked medication errors that cause sentinel events. JCAHO (Sentinel event statistics) defines sentinel events as

an unexpected occurrence involving death or serious physical or psychological injury, or the risk thereof. Serious injury specifically includes loss of limb or function. The phrase, "or the risk thereof" includes any process variation for which a recurrence would carry a significant chance of a serious adverse outcome.

They report that from 1995 to March 19, 2003 medication errors have accounted for 11.4% of all Sentinel Events reported to them. In an attempt to reduce the number
reported, JCAHO has issued three separate alerts on medication errors yet after an initial
decline they have climbed back to their previous rates.

In only its forth year of existence, the US Pharmacopoeia’s voluntary medication error
reporting system received 105,603 reports of errors from 368 health care facilities
nationwide in 2002. Of those reported cases, over 2500 resulted in harm to the patient,
with 14 resulting in death. In 2001, Bond, Raehl and Franke reviewed 1991 data from
1116 hospitals and found 430,586 medication errors of which 17,338 adversely affected
patient care. When extrapolated out to cover the 5801 hospitals registered with the
American Hospital Association in 2003 the numbers become even more shocking and
reflect what could be argued as a crisis in the national health-care system.

According to the IOM (1999) a medical “error is defined as the failure on a planned
action to be completed as intended or the use of a wrong plan to achieve an aim.” It
further explains that there are two types of errors, errors of execution (correct plan is
made however not carried out) and errors of planning (original plan of action is
incorrect). These definitions can be applied to all types of errors, including provider and
patient errors and incorporate all areas within the medical field. Those areas include but
are not limited to: surgery, medication, device related, inpatient or outpatient, and patient
related errors.
Almost all previously published reports explain that medication error prevention is a complex problem with no one answer. Instead they suggest the solution is a matrix of actions and processes all influencing each other. The American Society of Hospital Pharmacists ([ASHP] 1993), Institute for Safe Medication Practices (Medication Safety, 1999), and the National Coordinating Council for Medication Error Reporting and Prevention ([NCC] 1996, 1998, 2001, 2002) all have recommendations for action on the national and local level. The IOM report specifically makes suggestions on a national basis however they are meant to spur preventative action on the regional and local level as well.

Prevention must focus on all areas of the medication use process and incorporate both clinical and administrative staff. Clinicians are required to be involved because they are part of every step of the medication administration and dispensing process. Administrative personnel are possibly even more important because they support the clinical staff by ensuring that the essential personnel, tools and systems are in place to provide an environment that maximizes accuracy and patient safety.

Organizations throughout the country are at different points in attempting to incorporate all of their functions and staff to produce a comprehensive approach to minimize the occurrence of medication errors. This report examines one of those institutions, the Federal Correctional Complex (FCC) Butner, NC. The FCC is a group of four prisons that provide all necessary medical services to over 3000 inmates with needs ranging from over-the-counter medications, to ambulatory services, to inpatient mental health services,
to sub acute services for those receiving chemotherapy. This report will only address the systems involving medication errors at the complex. It will not focus on actions taken by the Federal Bureau of Prisons (BOP), Health Services Division to prevent medication errors, although some points are addressed.

In its Guidelines on Preventing Medication Errors, ASHP (1993) divides medication errors into four basic areas: prescribing errors, dispensing errors, medication administration errors, and patient compliance errors. Recognizing that some of the systems used to overcome these errors overlap, this report is divided into three sections: administrative, prescribing, and dispensing / medication administration.

**Administrative**

*Reporting Systems*

Reporting systems are the center of all medication error systems. The National Coordinating Council (2002) and the IOM both recognize that the goal of medication error reporting systems is to gather and analyze information. This knowledge can then be used to improve systems to prevent errors from occurring and focus on actions with higher error rates. In order to facilitate information gathering, the IOM recommends the use of a voluntary, confidential reporting system that does not place emphasis on blame.

The authors do not discount mandatory reporting systems, which hold people accountable for their actions. Rather they write that in order to be proactive in preventing medication errors, voluntary systems also need to be in place. The IOM recognized several safety
conscious industries, such as aviation and occupational health that have successful voluntary reporting systems. The report points out that the purpose of these systems is safety first, and the non-punitive nature contributes not only to the success of obtaining reports for errors that have occurred, but also to learn about near misses - occurrences that have almost happened, but were averted.

In contrast to private industry, Crane (2000) indicates that the healthcare system is the exact opposite. She suggests that the culture of blame is so prevalent that inadequate reporting prevents us from understanding the scope or causes of errors. In addition to minimizing blame, she suggests that innovative strategies such as rewarding those who report errors and error-prevention solutions be considered.

To understand the data, ASHP (1993) recommends that an organization’s Pharmacy and Therapeutics Committee specify those responsible for error collection and analysis, and develop programs to decrease their occurrence. The group should be interdisciplinary and consist of both administrative and clinical staff. Finally this group should be supported with adequate resources to complete this task.

Leape (2000) suggests several options which would limit the resources needed to examine these reports such as exploring a percentage of reports, focusing on fatal or sentinel events, or targeting particular categories of medications that are commonly implicated in error reports. Some of these medications include chemotherapeutic agents, anticoagulants, potassium, or other high-risk medications. In addition, he suggests
national investigations, conducted by local institutions, of targeted events. The results would be reported to a central organization, which would disseminate the lessons learned. By performing these studies, actions that cause harm, but occur too infrequently to be realized on the local level, will be understood once combined in a national aggregate.

FCC Butner has an extensive oversight system in place to review medication errors. The Chief Pharmacist is responsible for the overall program. The results are reported to the Pharmacy and Therapeutics Committee, Quality Management Committee, Governing Body, Associate Warden (Medical), and Warden. The program is voluntary and non-punitive. However, it is not been successful in collecting data about near misses or potential errors.

The Federal Bureau of Prisons does not have a centralized reporting system at this time. There has been a significant attempt to put such a program in place. Yet, due to reasons outside the scope of this paper the system is still far from becoming reality. In the interim, the Federal Medical Centers (FMC) within the Bureau of Prisons have expressed an interest in creating such a program. This program would only include FMCs. However, given the size and scope of their missions it would be able to concentrate on high-risk medications, many of which are commonly used at these institutions, and systemic weaknesses too small to be detected at a single institution. In addition, the coordinated effort will increase communication among the institutions, which in turn will promote the use of best practices to prevent medication errors.
Staffing

Inadequate staffing of clinical personnel has long been thought to contribute to medication errors. This is especially true with nurses and pharmacists. JCAHO (2003, Healthcare at a crossroads), ASHP (1993) and O’Shea (1999) all voice concern about inadequate staffing levels of nurses. ASHP goes on to voice recommendations that administrators ensure that sufficient staffing is available to perform all tasks without producing unreasonable workloads. In her review, O’Shea claims there are inconclusive findings whether staffing shortages contribute to increased medication errors. In contrast, JCAHO reports that staffing levels have been a contributing factor in 24 percent of over 1600 sentinel events reported to them over the past five years. In addition, they report that their review of the literature suggested that optimal nursing levels resulted in positive impacts on cost, quality, and improved patient outcomes.

In studies by Bond, et al (2001, 2002), the authors reviewed data from 1081 hospitals who self-reported information to the 1992 National Clinical Pharmacy Services Database. These studies were performed to determine if any relationships existed between clinical pharmacy services, health services staffing and medication errors in US hospitals. Although their data is only from one source it reportedly accounts for over thirty one percent of all hospitals in the US and includes over 430,000 error reports. The authors found that overall staffing was not as indicative of medication errors as the types of staffing they provided. After an initial analysis of the data, the authors found that as the number of registered nurses/occupied bed, and registered
pharmacists/occupied bed increased the number of medication errors increased. However, upon closer review they found that as the number of clinical pharmacy services increased error rates decreased. These services included: decentralized pharmacists, pharmacy teaching affiliation, dedicated drug information service, pharmacist-provided adverse drug reaction management, pharmacist-provided drug protocol management, medical rounds participation by pharmacists, and pharmacist-provided medication admission histories. The authors were not able to determine what types of errors these services minimized nor were they able to determine causality. In addition, information on specific services provided by other professionals was limited and therefore unable to be evaluated.

In a similar study Whitman et al (2002) found comparable results with nursing services. They found that on specialized units such as intensive care, medication error rates were less then those in general medical units. In this study the authors suggested that error rates in higher acuity level patients with more complex regimens were more sensitive to staffing changes then those in other units.

At this time, FMC Butner does not have decentralized pharmacists, nor do they have a drug information service, pharmacist provided adverse reaction management, or pharmacist provided medication admission histories. They have begun providing aminoglycoside management services and are assisting with prescribing total parenteral nutrition and peripheral parenteral nutrition. In addition, the FCC does have affiliation
agreements with three schools of pharmacy, and supports pharmacist participation on medical rounds on a limited basis.

Precepting students is an outstanding opportunity for the FCC, however more must be done to receive the full benefits of their presence. Students strengthen programs when they are present on a continuing basis with multiple providers. Their impact is a result of forcing preceptors, and the systems they are in, to continually strive to reach the peak of their profession. This continual improvement is not only in knowledge but also the services rendered by those professionals. The effort to provide the most current pharmacy practice is driven not only by pride, as no professional wants to be viewed as out of date by their students, but is also a requirement of the schools of pharmacy.

At the current time the FCC only receives an average of four to seven students a year. By only hosting a few students a year, the FCC may not be experiencing the push to continually update the organization and its pharmacists. In this writers opinion, when only a few students are hosted each year, only one or two pharmacists may be influenced by their presence. In contrast, an institution which precepts several students a month, is affected throughout its organization as students are exposed to multiple aspects of the organization over a greater period of time. Pharmacists, physicians, nurses, and other personnel, in addition to the systems they work with, are all positively influenced. FCC Butner needs to increase the number of students on rotation in order to truly gain the positive effects of their presence.
Education

Education and information continually are mentioned in the literature as major gaps in the healthcare system (IOM, O'Shea [1999]). By continuing to improve providers’ knowledge and skills, organizations can improve their chances of reducing the frequency of errors of planning. The Institute of Medicine defines errors of planning when “the original intended action is not correct.” These types of errors occur when not enough information is known to make the correct decision. This may be due to lack of information about the patient, unavailable information at the moment of decision (such as laboratory results) or insufficient knowledge of medications and disease states. Both the IOM and Institute for Safe Medication Practices (1999) feel so strongly about education that they suggest that physicians, nurses and other providers should be re-examined and re-licensed on a periodic basis for competency and knowledge of safety practices.

To quantify the problem of lack of education, Leape et al. (1995) found in a study of 334 errors at two tertiary care hospitals that the most common system failure was the dissemination of information. In that study, the authors divided medication process into four stages: physician ordering, transcription and verification, pharmacy dispensing, and nurse administration. In the physician ordering and nurse administration stage, information dissemination was the most common proximal cause and it was the second most common cause in the transcription stage. Within the information category, lack of drug knowledge was the most common proximal cause accounting for 22% of all errors. The authors also traced the adverse events back to sixteen different systems failures.
Drug knowledge dissemination was the most common system failure, with patient information availability listed as the third most common system problem.

In a review by O'Shea (1999), she writes about the difficulty nurses have in calculating doses. She goes on to say that results from testing of nurses to determine mathematical proficiency is at best controversial and is a poor determinant of who will make medication errors. The tests used to measure proficiency may, depending on the developer, actually measure knowledge less than that needed to practice. In addition, the test will not determine performance in practice.

O'Shea also stressed the need for nurses to continue their education. In her review, she found that nurses who continually update their drug knowledge make fewer medication errors. Education should come from a variety of sources including professional conferences and continuing educational programs. In addition, up to date references and colleagues, who have specialized in particular areas, also provide valuable sources of drug information.

Education for nurses at FCC Butner begins when they are hired at the institution with a formal training program. It continues with additional formal programs once a year. This program covers various issues, including medication use and calculations. Topics are chosen from a variety of suggestions and sources, and may include, but are not limited to medications, medical calculations, side effects, and policy. Subjects are drawn from a variety of sources including accreditation standards, internal policies, evaluations from
previous trainings, suggestions from nurses, and specific requests from the Director of Nursing. Training is coordinated by the Director of Nursing and the Nurse Educator and performed by various professionals within the institution.

For pharmacists, ASHP (1993) specifically recommends that practitioners should continue to update their knowledge through continuing education programs, medical literature review, and interaction with other healthcare professionals. At FCC Butner, pharmacists attend monthly educational programs presented by the Chief Pharmacist or her designee. These programs comprise both medication-specific and generalized disease topics. None of these in-house programs are accredited by any continuing education organization. As a result, pharmacists are still required to participate in continuing education programs outside the institution to support their licensure.

Physicians are also encouraged to stay abreast of current drug knowledge by ASHP (1993). Currently FMC Butner requires all providers to complete two hours of continuing education each month. At the current time there is no formal process to carry this out, nor is there any attempt to determine specific subjects that would meet providers specific needs.
Prescribing Errors

Computerized Physician Order Entry

The implementation of computerized physician order entry (CPOE) is arguably one of the most important pieces of technology an institution can implement in an effort to reduce medication errors. Several articles including those written by the National Coordinating Council for Medication Error Reporting and Prevention (1996), the Leapfrog Group (2001), the Institute for Safe Medication Practices (2000), and a Multidisciplinary Expert Panel of pharmacists, nurses and physicians (American Society of Health-System Pharmacists, [ASHP] 1996) reported diverse justifications for the implementation and use of such systems. Their reasons went well beyond decreased medication errors, and included decreased costs, decreased adverse reaction rates, decreased need for human memory, and increased speed and efficiency.

The first recommendation of ASHPs expert panel (1996) described the use of a CPOE system as preferred, and listed benefits of such systems as preventing prescribing, dispensing and administration errors. They noted that menu driven ordering minimized transcription processes and therefore decreased prescribing errors. By communicating orders in a standardized and legible format, as well as scheduling and documenting administration of medications, CPOE also decreases dispensing and administration errors. In addition the Panel described additional benefits of a computerized system to include reviewing of orders for interactions, allergies, dosing and “capture pertinent
information for electronic patient medical records.” Finally the panel points out that these systems can provide alert messages for many of the aforementioned capabilities.

In 1999 Bates et al. used a prospective time series analysis to review the impact of CPOE on the rate and type of medication errors. They divided errors into missed dose errors and non-missed dose errors. Missed dose errors occurred when medication was not available to nursing staff at the time of administration. Non-missed dose errors were defined as all other types of errors including: overdose, under dose, wrong dose form, dose omitted, incorrect or wrong route, incorrect frequency, frequency omitted, wrong drug, wrong patient, drug-drug interaction, inappropriate drug, illegible order, unknown allergy to drug, drug not available (due to formulary restrictions), preparation error, and avoidable delay in treatment.

Bates found that, with the addition of a computerized order entry system, non-missed dose medication errors decreased by 81 percent, and serious non-missed dose errors decreased by 55 percent. The authors also found that a positive impact was seen on a variety of medication errors in both general care and intensive care units. Furthermore they demonstrated these results with a basic system, and suggested that greater results could be obtained as the system was refined and support modules added.

In June 2001 the Leapfrog Group, a coalition of over 130 organizations providing health care benefits, recommended CPOE as a method to increase patient safety and increase efficiencies. In their report, the group acknowledged that although the cost of
implementing such a system could be substantial (greater than $500,000) the savings could be greater. Not only did they identify significant cost savings due to decreased adverse drug events and medication errors, but even larger savings due to increased resource utilization. Resource utilization included items such as medication substitution, decreased laboratory testing, greater clinical pathway usage, and improved clinician efficiency.

Although effective, these systems are not perfect. In their white paper, Bates et al. (2001) reported that many of the systems commercially available are error prone and time consuming. Wilson and Sheikh (2002) found some systems to have weaknesses in screening capabilities for unsafe orders, while others display so many alert messages that significant potential problems are often overlooked. In addition, one has to ensure that the system put in place does not increase the complexity of prescribing and therefore increase the chances for error to occur. Overall one must be cautious when purchasing an off-the-shelf system.

At the current time, FCC Butner does not have computerized physician order entry. However, there are discussions with the BOP Health Services Division and the vendor who currently designs and supports the pharmacy software, to implement a system in the future. Such a system would not only reduce errors due to illegibility but would also increase efficiency in the pharmacy by eliminating multiple communications to verify missing information, suggest alternatives to nonformulary medications, prevent over or under dosing, eliminate lost paper orders, decrease drug interactions, and prevent
prescriptions being written for patients who have a history of allergic reaction to that drug.

If a decision is made to implement a system at FCC Butner, the health services staff should attempt to provide as much input into the development of the system prior to implementation as possible. In addition, the staff should consider the recommendations and questions suggested by ASHP in Appendixes A and B to optimize their purchase and implementation of a system.

Although the vendor is already selected, the institution should attempt to address as many points as possible prior to installation to facilitate a smoother transition of the health services division to a CPOE system. Doing so will prevent some of the difficulties others have reported while implementing such a system. As the questions are answered and points are addressed, realistic expectations will be developed and a broad base of support, both clinical and administrative, should be created. This support will be needed in order to implement such a large change within the institution. It should assist in overcoming prescriber reluctance, addressing funding issues, increasing installation and implementation speed, and improving computer training support.

Training support will be crucial since substantial education of all system users will be needed prior to implementing the system. This not only includes prescribers, but also nurses, laboratory staff, medical records administrators, and pharmacy staff. Although pharmacists are fluent in the existing program, to which the proposed system will be
added, the CPOE component does add new features and pharmacists will need to function as on-site user support for the rest of the staff.

*Verbal Orders*

According to the NCC (2001) approximately twenty-five percent of all medication error reports to the US Pharmacopoeia Medication Errors Reporting System involves similarity of drug names. To address this issue, the Council has published several recommendations about verbal orders. They recommend that verbal orders be limited to urgent/emergency situations, the promotion of a culture to that encourages clinicians to discuss concerns with prescribers about questionable orders, and that verbal orders are NOT permitted for antineoplastic agents. In addition, they suggest that organizations develop policies and procedures addressing limitations or prohibitions (see table 1) and suggest specific elements and content of a verbal order (Tables 2 & 3). In order to verify the prescription, both the NCC and the Joint Commission on Accreditation of Healthcare Organizations ([JCAHO], 2003) suggest that all orders be read back to the provider after being communicated initially.

Currently FMC Butner does not use verbal orders in practice, except in cases of emergency. However written policies covering this practice are lacking. When a verbal order is used in cases of emergency, policy does not provide for guidance on who may issue them, what should be included, or the procedure for issuing the order. It does state that nurses may obtain verbal orders and that the nurse receiving and transcribing the order, as well as the ordering provider, must sign the order within a specified time frame.
Prescription Writing

As part of 1993 guidelines to prevent medication errors, ASHP made several recommendations for writing prescription orders. They recommended that prescriptions be complete, utilize standardized nomenclature, specify exact dosage strengths, use a leading zero when a decimal expression of less than one is written, avoid particular abbreviations and vague instructions such as “use as directed,” use the metric system except for medications where standard units should be utilized, and all prescriptions should be legible.

Illegible prescriptions are a major problem in the health care industry. They not only create potential for errors but also waste valuable time by other providers within the medication use system. Nurses, pharmacists, laboratory and other support staff spend significant periods of time each day clarifying unreadable orders. In their white paper about electronic prescribing, ISMP (2000) claims that more than 150 million calls each year are made by pharmacists to physicians in order to clarify orders. In addition, illegible prescriptions exacerbate the confusion created by over 17,000 generic and trade named medications, many of which have similar sounding names, marketed in North America.

In 1996 the NCC recognized that the illegibility of prescriptions has, in some cases, caused severe harm and death to patients. In addition to their primary recommendation of implementing a CPOE program to eliminate illegibility, they also expanded upon the recommendations of ASHP to include use of an indication on all prescriptions. This
indication would be an additional check to ensure that the medication read by the pharmacist was what the physician intended to order. For example if a prescription was poorly written for the antifungal medication Lamisil® without a purpose, it might be misinterpreted as the anticonvulsant, Lamictal®. If the same prescription were written as Lamisil® for onychomycosis, the pharmacist would know the prescription was for an antifungal medication and not Lamictal®.

As an added safety measure, ISMP issued a Medication Safety Alert in 2001 further defining the use of vague abbreviations and dose designations (Appendix C). In addition they recognized the fact that many CPOE systems do contain many of the same pitfalls that they were recommending against. For example, the abbreviation “U” to mean units is included as a standardized abbreviation in many systems.

Recently, JCAHO implemented their 2003 patient safety standards to improve the effectiveness of communication among providers. As part of this standard, JCAHO requires that each organization develop two standardized list of abbreviations, symbols and acronyms. One list would be abbreviations that can be used and the second list those that should not be used.

One other tool recommended by the Institute for Safe Medication Practices is the use of drug protocols and standardized order forms. Although providers limit the effectiveness of these methods when they don’t use them, if they are implemented, vulnerability from high-risk medications such as potassium, narcotics, antibiotics, and antineoplastic agents
can be reduced. To emphasize this fact, in 2003 JCAHO began requiring, as part of their Patient Safety Goals, that all organizations restrict and standardize the strengths of “high alert medications.” In addition to high-risk medications, protocols can decrease the threat of errors occurring from illegibility when other medications such as insulin or heparin are used.

FMC Butner has several systems in place to minimize errors from prescription writing. By using the Subjective, Objective, Assessment, and Plan (SOAP) method of writing medical entries in the outpatient chart, the medical staff at FMC Butner includes all of the information needed for a pharmacist to understand the purpose of the prescription. In addition, the metric system is widely used, and medication protocols for antineoplastic agents, peripheral parenteral nutrition (PPN) and total parenteral nutrition (TPN) have been developed and are awaiting governing body approval.

Given all of these positive systems, the FCC still has room for improvement. Non-metric units such as tablespoon, teaspoon, and ounce are still routinely used, and standardization of potassium strengths has not been accomplished. In addition the pharmacy department uses faxed copies of order sheets to dispense prescriptions.

Faxes are used since the charts, which are kept in the units where the inmates live, are not available to the centralized pharmacy staff for order entry. Faxes cause problems if additional information, such as a consult report, past progress note, or additional patient data is needed when a prescription is being filled. Additionally, inpatient charts are not
written in the SOAP format. The only information the pharmacist is able to see on the order sheets is the medications being prescribed. These orders do not include indications, or other data needed to fill some prescriptions such as height, weight, or vital signs. Faxes themselves can also contribute to errors if the clarity of the fax is not adequate, the fax does not arrive at the pharmacy due to a transmission interruption, or if the patient location indicated on the fax is incorrect.

These problems could be significantly reduced if some form of decentralized pharmacy services were available. These services could be either in the form of clinical pharmacists present in the units, decentralized pharmacies with pharmacy staff, or a combination of the two. Clinical pharmacists could review orders, recommend treatments, educate providers, or manage and run specialty clinics such as anticoagulation or diabetes. Decentralized pharmacies staffed with pharmacy personnel could also perform these same functions in addition to dispensing the medication. Either solution will decrease the possibility of medication errors associated with faxing orders and inadequate provider knowledge of medications.

Dispensing/ Medication Administration

Bar Coding

In 1993 ASHP recommended bar coding as a method of decreasing medication errors. In 1996 their expert panel reaffirmed this recommendation. Along with ASHP, several other organizations including the Institute for Safe Medication Practices, and the NCC
(Recommendations to Health Care Organizations 1998) all recommend bar coding as a method to decrease errors in the medication administration area. One third of the ISMP program, Pathways for Medication Safety: Strategies for Leadership, is devoted to bar coding. The program points out that bar coding is often significantly easier and cheaper to implement than CPOE, although it should be noted that bar coding decreases dispensing and administration errors and has no impact on prescribing errors.

Reasons highlighted for implementing a bar code system include verification of patient, drug, dose, route and time. In addition, medication administration records (MAR) created by such systems are likely to be more accurate than those created manually. More advanced systems can provide reference information, reminders and alerts when administering medication, and capture data to allow for trending through retrospective analysis.

FMC Butner currently does have some bar coding in place in the dispensing portion of the medication use system, although further implementation should be considered. The pharmacy operates a robotic dispensing system that utilizes bar coding to verify that the drug in the prescription vial matches the medication name placed on the prescription label. This accounts for a significant portion of all prescriptions dispensed to patients but does not include any topical, rectal, and eye preparations, or medications that are not located in the robot. Once the medication is in the vial and verified there is currently no further use of the bar code.
The use of the bar code could be extended to the pharmacy window when the medication is handed to the patient or when a nurse administers a dose of medication to a patient. The pharmacy software could be designed to utilize the bar code on the inmate's identification card. The inmate's card would be scanned, and then the prescription label on the vial could be scanned to verify that the correct patient is receiving the appropriate medication. In addition, data such as time and date of pick up could be stored and retrieved if a question ever arose related to whether or not the patient picked up their medication from the pharmacy. At the nursing station the same could be done. When the patient identification card is scanned, a profile could be displayed or a picture of the medication could be displayed as a final check before the drugs are administered.

Given the advantages of bar coding and considering the size, complexity and variety of missions within the institution, FCC Butner should consider expanding their use of this technology. Like CPOE, bar coding is not perfect, and may present new opportunities for errors. The American Hospital Association Health Research and Educational Trust and the Institute for Safe Medication Practices have suggested several points for administrators to consider when implementing such a system (Table 4). By reviewing these points prior to expanding their current system, FCC Butner should have better success in realizing the benefits of this tool.

Medication Review

In 1996, the ASHP Expert Panel recommended that all medication orders be reviewed prior to first dose administration. The panel noted that this prospective review provides
an important chance to ensure clarity and prevent adverse drug events from occurring. In 1999 the NCC adopted this same recommendation, with the addition that any questions about the order be resolved using an established process. Recently, JCAHO felt that prospective review by a pharmacist was an important enough step that they proposed it for their 2003 standards. Although not implemented for 2003, it is expected that the standard will be implemented in 2004. In addition, prospective review by a pharmacist, or physician, is required in all fifty states prior to dispensing medication.

In anticipation of having to comply with this new JCAHO standard, FCC Butner has implemented a three-step process for all orders received when a pharmacist is not on site. When a nurse receives an order, they must first check a list of approved medications that nurses can administer without pharmacy prospective review. This limited list of approximately thirty medications has been reviewed and approved by the institution pharmacy and therapeutics committee. Second, they must review the inmate’s medication profile for a prior prescription for the same medication, and finally they must review the patient profile for allergies. If the medication is on the approved list, has been dispensed by a pharmacist previously, and the patient has no allergies to the medication then a single dose may be administered without pharmacy prospective review. Once administration occurs the order is sent to the pharmacy for retrospective review and a pharmacist fills the remainder of the prescription. If any of the above is not true then the prescription cannot be administered without prospective pharmacy review.
Counseling

When counseling a patient, using generally accepted standards, pharmacists can quickly determine patient understanding, increase the likelihood of compliance, and decrease the potential for drug interactions, adverse reactions and medication errors. Part of each counseling session should be used as an opportunity for a pharmacist to make one final check to ensure that the medication, directions, and patient identifiers are all correct. In 1993 Kuyper studied the effectiveness of pharmacists counseling patients to detect medication errors. In this study, 89% of all errors were identified at patient counseling sessions. To stress this point the NCC, as part of their recommendations to avoid dispensing errors (1999), suggested that patients be counseled by a pharmacist to ensure the accuracy of dispensing in addition to verifying patient understanding.

Due to the centralization of pharmacists, nurses or other health providers distribute prescriptions to patients at three of the four institutions comprising the FCC. Patient education is performed through printed education sheets handed out with prescriptions, and may be supplemented orally by the staff who hand out the medication. These providers do have some knowledge and training in medication identification and patient counseling, and for certain classes of medications, may be as informed as pharmacists. They do not, however, have the depth of knowledge to explain mechanisms of action, address adverse effects, screen for medication interactions, or review appropriateness of therapy for the broad and complex range of medications dispensed throughout the complex.
If an inmate does wish to speak to a pharmacist, an appointment can be arranged by a written request or through another provider. However, it can be argued that patients may be fearful of asking for help, unaware of what questions to ask, or unaware of the availability of a pharmacist. As a result, few requests are made for patients to talk to a pharmacist. To rectify this situation and take advantage of the opportunity to decrease medication errors, the FCC should attempt to decentralize some pharmacists to make them more accessible, and at the same time enable them to counsel patients.

**Summary**

All areas of the medication use process contribute to medication errors. They include administrative, prescribing, dispensing, and medication administration. FCC Butner performs many functions to minimize opportunities for medication errors. However, there are some areas for improvement. They include expanded education of clinicians, increased use of bar coding technology, implementation of computerized physician order entry, and decentralization of some pharmacy services. Decentralizing pharmacy services will enable increased pharmacy clinical specialty services, expanded counseling of patients by pharmacists, and increase availability of patient charts for pharmacist review. Finally, to fully analyze the scope of the problem at the FCC, reporting needs to be encouraged for both actual events and near misses. By implementing or expanding these activities, the Federal Correctional Complex Butner will further their goal to eliminate the potential for medication errors.
References


Leape, L (2000); Reporting of medical errors: time for a reality check, Quality in Healthcare; 9:144-145


### Table 1

**Suggested Polices and Procedures for Healthcare Organizations**

- Describe limitations or prohibitions on use of verbal orders
- Provide a mechanism to ensure validity/authenticity of the prescriber
- List the elements required for inclusion in a complete verbal order
- Describe situations in which verbal orders may be used
- List and define the individuals who may send and receive verbal orders
- Provide guidelines for clear and effective communication of verbal orders to include but not limited to the person receiving the order verbally repeating the order back to the prescriber


### Table 2

**Elements that should be included in a verbal order**

- Name of patient
- Age and weight of patient, when appropriate
- Drug name
- Dosage form (e.g., tablets, capsules, inhalants)
- Exact strength or concentration
- Dose, frequency, and route
- Quantity and/or duration
- Purpose or indication (unless disclosure is considered inappropriate by the prescriber)
- Specific instructions for use
- Name of prescriber, and telephone number when appropriate
- Name of individual transmitting the order, if different from the prescriber.

Table 3

Content of Verbal Orders

The following should be clearly communicated:

- The name of the drug should be confirmed by any of the following:
  - Spelling
  - Providing both the brand and generic names of the medication
  - Providing the indication for use
- In order to avoid confusion with spoken numbers, a dose such as 50 mg should be dictated as "fifty milligrams...five zero milligrams" to distinguish from "fifteen milligrams...one five milligrams."
- Instructions for use should be provided without abbreviations. For example, "1 tab tid" should be communicated as "Take/give one tablet three times daily."

<table>
<thead>
<tr>
<th>Table 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factors to Consider for Bar Coding Systems</strong></td>
</tr>
<tr>
<td>- Only about 35 percent of drugs currently contain manufacturer’s bar codes. In the future, regulation should cause this percentage to increase.</td>
</tr>
<tr>
<td>- There is a growing trend of fewer medications being made available by manufacturers in unit-dose form.</td>
</tr>
<tr>
<td>- There is no uniform standard for bar coding medications.</td>
</tr>
<tr>
<td>- No standard exists for relabeling/bar coding in-house. In the absence of such standards, hospitals are left to follow whatever commercial standards exist.</td>
</tr>
<tr>
<td>- In-house repackaging of medications and bar coding result in unreimbursed costs and, especially if done manually, may introduce new sources of error.</td>
</tr>
<tr>
<td>- Interfacing the bar-coded medication administration system with legacy IT systems may prove difficult and costly.</td>
</tr>
<tr>
<td>- Bar code scanners need to be readily available and set up to be user-friendly (e.g. placed in convenient locations) so as to minimize any disruption of a nurse’s workflow.</td>
</tr>
<tr>
<td>- During times of nursing staff shortage, temporary “agency” or “floating” nurses may be unfamiliar with the system and its proper use. Time and effort must therefore be expended to orient these practitioners to the systems within each hospital.</td>
</tr>
<tr>
<td>- Patient-specific medications, such as multiadditive intravenous solutions, most pediatric dosage forms, and pharmacy-compounded products, will always require bar coding by in-house pharmacy departments. Selecting the Right System Once an organization has determined that it is ready to move forward with a BPOC medication administration system, it still faces the daunting task of evaluating the products</td>
</tr>
</tbody>
</table>

Appendix A

Generalized Principles for Purchase and Safe Use of Computerized Provider-Order Entry Systems

- Commit from the beginning to work in an interdisciplinary manner.
- Identify an interdisciplinary team of key individuals who will interact with the CPOE system.
- Focus on the system features that will add value for patients. Ask team members to help convince peers that having a CPOE system is in their best interest.
- Do not forget to include key players such as the chief information officer, information technology (IT) staff, risk managers, and medical staff.
- Lead, but make the overall project a team effort.
- Outline the goals for CPOE (e.g., to improve safety, decrease costs, eliminate handwritten orders). You may have primary and secondary goals. Knowing and prioritizing your goals and their relative importance will be very valuable during implementation of the system. You may not be able to satisfy every identified goal. Your implementation team will appreciate the clarity of goals as the inevitable questions arise.
- Develop your wish list of desired features and determine which ones, given budgetary constraints, are practical. Find out about successes and failures by talking with individuals from other organizations who have implemented a CPOE system. Will the new system interface with your current information system? To what extent will customization be required?
- Do your homework at the beginning and develop a business case for the new system in order to garner resources. Perhaps include a technology-specific section that addresses the safe use of computers and automation in the entire medication-use system.
- Do not try to justify the CPOE system by promising that it will allow the institution to decrease the number of staff members, because it most likely will not. A good system, though, should enhance safety and improve efficiency by decreasing the number of repetitive and mundane tasks. You may see the number of steps in the medication-use process decrease, but the remaining steps will require highly-trained, competent personnel who understand and can deal with the complexity and importance of those steps.
- Assume that you do not know all the answers, and keep the culture of your organization at the forefront of this decision-making process. Consider using an outside party to identify

  (1) the organizational barriers to implementing a CPOE system and
  (2) ways to overcome those barriers so that your new CPOE system will do what you expect it to do.

- Beware of cumbersome features that may provoke users to override features of the CPOE system.
• As soon as the system is installed, it is important to commit in a meaningful way to its continual monitoring and improvement. Your health care environment is a dynamic one in which opportunities for new (and some old, but as yet unidentified) errors will likely arise. Identify key measures that will help you determine whether your CPOE system is really improving safety and quality and reducing costs.

From: Generalized Principles for Purchase and Safe Use of Computerized Prescriber-Order Entry Systems, ASHP

http://ashp.org/patient-safety/genprinciples.cfm?cfid=13378627&CFToken=29639384
Appendix B

General Questions to Consider When Purchasing a Computerized Provider Order Entry System

1. Is the system truly designed for prescriber-only order entry (i.e., not simply a pharmacy order entry system to which prescribers are given access to enter orders)?
2. Does the system prevent access by nonprescribers?
3. Does the system integrate with the existing pharmacy order entry system, or must orders be reentered into the pharmacy system? Does the CPOE system integrate with the current information system? How many customizations and patches will be needed?
4. Does the system allow pharmacists to review and approve drug orders before printing labels?
5. What are the elements that the prescriber must enter (e.g., drug name, dosage form, dose, strength, duration of therapy, directions for administration, and quantity for outpatient prescriptions)?
6. What are the elements that must be entered by the pharmacist who reviews the prescriber’s order?
7. Does the system allow for off-site order entry, including from a prescriber’s home or office? Does the system allow for direct entry from a hand-held device?
8. Does the system store and allow access to patient information from previous hospital admissions and clinic visits?
9. To what extent does the system recognize only a standardized format for order entry (e.g., software-defined or institutionally defined fields)? Is "free text" entry an option? Can you foresee a situation in which pharmacy would have to reenter an order because the system lacked a standardized format? (Such reentry may be desirable.)
10. Is the system capable of wireless use without installation of additional equipment, or is it upgradeable to allow for wireless, remote order entry?
11. Does the system require the use of passwords? If so, can the system share passwords with other password-requiring systems in the organization? Or, does the system identify users on the basis of a measurable biological feature (e.g., thumbprint, retinal scan), thereby eliminating the need for passwords?
12. Can the system be used to manage the formulary?
13. Can the system accommodate multiple formularies? If so, how does it deal with multiple formularies?
14. What order-entry user interfaces are available (e.g., touch screen, voice recognition, keypad)?
15. Does the system have a feature that allows for input of notes about procedures, admissions, and discharges?
16. Does the system prevent the prescriber from using abbreviations and mnemonics during order entry, which are proven sources of errors?
17. Does the system automatically check medication orders for elements such as:
   a. Dose ranges, including high-dose, low-dose, and lifetime doses for antineoplastic agents?
   b. Pediatric and adult dosages of the same drug?
   c. Dosages of critical care drugs?
   d. Drug-drug interactions?
   e. Duplicate drugs?
   f. Drug allergies?

   Does the system check for interactions with and contraindications to the use of dietary supplements and over-the-counter medications?

18. Will the system alert the prescriber to dangerous orders?
19. Does the system display the cost of a therapy and provide suggestions for less-costly therapeutic alternatives?
20. Can orders for medical procedures also be entered and integrated into the system?
21. How are nurses notified of a new, discontinued, or changed medication order?
22. How is the pharmacy notified that a nurse has entered a change in the medication administration schedule?
23. Does the system handle orders for all medications and intravenous fluids including parenteral nutrition admixtures?
24. How does the system notify pharmacy and nursing of STAT and NOW orders?
25. How are medication administration records generated?
26. Does the system provide up-to-date, reliable drug information at the user interface?
27. How often is drug information updated by the computer company?
28. Can the institution update the drug information?
29. What is the quality of the drug information that the CPOE system uses to check for drug interactions?
30. Does the CPOE system's platform support an electronic medical record and real-time electronic charting?
31. Does the CPOE system integrate with the existing laboratory system to show real-time test results? Will the system cross-reference laboratory data with drug orders (e.g., allow the user to view an antimicrobial order and the results of culture and susceptibility testing and determination of minimum inhibitory concentrations)?
32. Does the CPOE system support machine-readable coding (e.g., bar codes)?
33. What decision-support features are available (e.g., order sets for individual or groups of prescribers, standardized admission or discharge orders, therapeutic guidelines, policies and procedures, standard orders, cost information, medical literature citations)?
34. Does the system display pop-up reminders for laboratory monitoring, standard orders, and other user-defined reminders?
35. Before installation begins, the system will need to be extensively tested for accuracy and safety. How will the vendor support this testing?
36. Ask the vendor whether it employs full-time human factors engineers as part of the CPOE system-design team. The ideal CPOE system should have been designed, evaluated, and tested by practicing professionals (e.g., pharmacists, physicians, nurses, IT staff) and human factors engineers. Well-designed user interfaces play a key role in ensuring safety.

37. How will the medication-use system safely operate when the CPOE system is not usable (e.g., emergency, planned downtime for maintenance)?

From: Generalized Principles for Purchase and Safe Use of Computerized Prescriber-Order Entry Systems, ASHP

http://ashp.org/patient-safety/genprinciples.cfm?cfd=13378627&CFToken=29639384
### Abbreviations that should not be used in Prescription Writing

<table>
<thead>
<tr>
<th>Abbreviation/Dose Expression</th>
<th>Intended Meaning</th>
<th>Misinterpretation</th>
<th>Correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apothecary symbols</td>
<td>dram minim</td>
<td>Misunderstood or misread (symbol for dram misread for “3” and minim misread as “mL”).</td>
<td>Use the metric system.</td>
</tr>
<tr>
<td>AU</td>
<td>aurio uterque (each ear)</td>
<td>Mistaken for OU (oculo uterque—each eye).</td>
<td>Don't use this abbreviation.</td>
</tr>
<tr>
<td>D/C</td>
<td>discharge continue</td>
<td>Premature discontinuation of medications when D/C (intended to mean “discharge”) has been misinterpreted as “discontinued” when followed by a list of drugs.</td>
<td>Use “discharge” and “discontinue.”</td>
</tr>
<tr>
<td>Drug names</td>
<td></td>
<td></td>
<td>Use the complete spelling for drug names.</td>
</tr>
<tr>
<td>ARA'A</td>
<td>vidarabine</td>
<td>cytarabineARA'C</td>
<td></td>
</tr>
<tr>
<td>AZT</td>
<td>zidovudine</td>
<td>azathioprine</td>
<td></td>
</tr>
<tr>
<td>CPZ</td>
<td>COMPAZINE</td>
<td>chlorpromazine</td>
<td></td>
</tr>
<tr>
<td>(prochlorperazine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DPT</td>
<td>DEMEROL-PHENERGAN-THORAZINE</td>
<td>diphtheria-pertussis-tetanus (vaccine)</td>
<td></td>
</tr>
<tr>
<td>HCl</td>
<td>hydrochloric acid</td>
<td>potassium chloride (The “H” is misinterpreted as “K.”)</td>
<td></td>
</tr>
<tr>
<td>HCT</td>
<td>hydrocortisone</td>
<td>hydrochlorothiazide</td>
<td></td>
</tr>
<tr>
<td>HCTZ</td>
<td>hydrochlorothiazide</td>
<td>hydrocortisone (seen as HCT250 mg)</td>
<td></td>
</tr>
<tr>
<td>MgSO4</td>
<td>magnesium sulfate</td>
<td>morphine sulfate</td>
<td></td>
</tr>
<tr>
<td>MSO4</td>
<td>morphine sulfate</td>
<td>magnesium sulfate</td>
<td></td>
</tr>
<tr>
<td>MTX</td>
<td>methotrexate</td>
<td>mitoxantrone</td>
<td></td>
</tr>
<tr>
<td>TAC</td>
<td>triamcinolone</td>
<td>tetracaine, ADRENALIN,cocaine</td>
<td></td>
</tr>
<tr>
<td>ZnSO4</td>
<td>zinc sulfate</td>
<td>morphine sulfate</td>
<td></td>
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<td>-------------------------------</td>
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<tr>
<td>Stemmed names</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>“Nitro” drip</td>
<td>nitroglycerin infusion</td>
<td>sodium nitroprusside infusion</td>
<td></td>
</tr>
<tr>
<td>“Norflox”</td>
<td>norfloxacin</td>
<td>NORFLEX</td>
<td></td>
</tr>
<tr>
<td>μ g</td>
<td>microgram</td>
<td>Mistaken for “mg” when handwritten. Use “mcg.”</td>
<td></td>
</tr>
<tr>
<td>o.d. or OD</td>
<td>once daily</td>
<td>Misinterpreted as “right eye” (OD—oculus dexter) and administration of oral medications in the eye. Use “daily.”</td>
<td></td>
</tr>
<tr>
<td>TIW or tiw</td>
<td>three times a week.</td>
<td>Mistaken as “three times a day.” Don’t use this abbreviation.</td>
<td></td>
</tr>
<tr>
<td>per os</td>
<td>orally</td>
<td>The “os” can be mistaken for “left eye.” Use “PO,” “by mouth,” or “orally.”</td>
<td></td>
</tr>
<tr>
<td>q.d. or QD</td>
<td>every day</td>
<td>Mistaken as q.i.d., especially if the period after the “q” or the tail of the “q” is misunderstood as an “i.” Use “daily” or “every day.”</td>
<td></td>
</tr>
<tr>
<td>Qn</td>
<td>nightly or at bedtime</td>
<td>Misinterpreted as “qh” (every hour). Use “nightly.”</td>
<td></td>
</tr>
<tr>
<td>Qhs</td>
<td>nightly at bedtime</td>
<td>Misread as every hour. Use “nightly.”</td>
<td></td>
</tr>
<tr>
<td>Q6PM, etc.</td>
<td>every evening at 6 PM</td>
<td>Misread as every six hours. Use 6 PM “nightly.”</td>
<td></td>
</tr>
<tr>
<td>q.o.d. or QOD</td>
<td>every other day</td>
<td>Misinterpreted as “q.d.” (daily) or “q.i.d. (four times daily) if the “o” is poorly written. Use “every other day.”</td>
<td></td>
</tr>
<tr>
<td>sub q</td>
<td>subcutaneous</td>
<td>The “q” has been mistaken for “every” (e.g., one heparin dose ordered “sub q 2 hours before surgery” misunderstood as every 2 hours before surgery). Use “subcut.” or write “subcutaneous.”</td>
<td></td>
</tr>
<tr>
<td>SC</td>
<td>subcutaneous</td>
<td>Mistaken for SL (sublingual). Use “subcut.” or write “subcutaneous.”</td>
<td></td>
</tr>
<tr>
<td>U or u</td>
<td>unit</td>
<td>Read as a zero (0) or a four (4), causing a 10-fold overdose or greater (4U seen as “40” or 4u seen as 44”). “Unit” has no acceptable abbreviation. Use “unit.”</td>
<td></td>
</tr>
<tr>
<td>IU</td>
<td>international unit</td>
<td>Misread as IV (intravenous). Use “units.”</td>
<td></td>
</tr>
<tr>
<td>cc</td>
<td>cubic centimeters</td>
<td>Misread as “U” (units). Use “mL.”</td>
<td></td>
</tr>
<tr>
<td>X3d</td>
<td>for three days</td>
<td>Mistaken for “three doses.” Use “for three days.”</td>
<td></td>
</tr>
<tr>
<td>Abbreviation/Dose Expression</td>
<td>Intended Meaning</td>
<td>Misinterpretation</td>
<td>Correction</td>
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<tr>
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</tr>
<tr>
<td>BT</td>
<td>bedtime</td>
<td>Mistaken as “BID” (twice daily).</td>
<td>Use “hs.”</td>
</tr>
<tr>
<td>Ss</td>
<td>sliding scale (insulin) or ½ (apothecary)</td>
<td>Mistaken for “55.”</td>
<td>Spell out “sliding scale.” Use “one-half” or use “…½.”</td>
</tr>
<tr>
<td>&gt; and &lt;</td>
<td>greater than and less than</td>
<td>Mistakenly used opposite of intended.</td>
<td>Use “greater than” or “less than.”</td>
</tr>
<tr>
<td>/ (slash mark)</td>
<td>separates two doses or indicates “per”</td>
<td>Misunderstood as the number 1 (“25 unit/10 units” read as “110” units.</td>
<td>Do not use a slash mark to separate doses. Use “per.”</td>
</tr>
<tr>
<td>Name letters and dose numbers run together (e.g., Inderal 40 mg)</td>
<td>Inderal 40 mg</td>
<td>Misread as Inderal 140 mg.</td>
<td>Always use space between drug name, dose and unit of measure.</td>
</tr>
<tr>
<td>Zero after decimal point (1.0)</td>
<td>1 mg</td>
<td>Misread as 10 mg if the decimal point is not seen.</td>
<td>Do not use terminal zeros for doses expressed in whole numbers.</td>
</tr>
<tr>
<td>No zero before decimal dose (.5 mg)</td>
<td>0.5 mg</td>
<td>Misread as 5 mg.</td>
<td>Always use zero before a decimal when the dose is less than a whole unit.</td>
</tr>
</tbody>
</table>