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Automated Unit Dose Drug Distribution System Business Case

***...steps towards Safety, Integration, Standardization,
and Consolidation***

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EXECUTIVE SUMMARY

In keeping with the principles of patient safety, integration and strategies to consolidate, this business case identifies the urgent need to change the drug distribution systems across Fraser Health.

Errors and Adverse Drug Events

A medication error can occur at any point in the process of ordering, dispensing or administering medications. The proposed automated unit dose drug distribution system has the potential to reduce the error rate to < 2% and the costs related to ADE and avoidable days stay by 40%, together with:^{1,2}

- A significant reduction in morbidity and mortality and associated patient and family pain and suffering.
- A lower risk work environment for staff.
- Additional bed capacity from within.
- Reduced legal liability associated with avoidable patient harm.

Benchmarks^{2,3}

- A recent report on Canadian acute care hospital drug distribution systems indicates that of those responding to the survey, 59% beds have a manual or automated unit dose drug distribution system (FH = 22%) and 79% emergency rooms have implemented automated controlled access cabinets (FH = 10%).
- Reports from the US indicate that 83% facilities provide > 75% oral doses as unit dose with 71% facilities utilizing automated controlled access cabinets.
- With the exception of ARH and some of our Resident Care facilities, few changes have been made to the drug distribution systems within most of FH acute and resident care facilities for more than 20 years.
- All other B.C. Regions have implemented similar automation in many of their sites over the last 8 years.

There should be no doubt that unit dose, together with complementary automation, is the accepted standard of practice for drug distribution systems in North America. Delay in implementation puts FH patients at continued risk associated with medication errors and resulting adverse drug events. This proposal does not include a business case for computerized prescriber order entry (CPOE), or bedside medication verification (BMV); the recommended medication distribution option recognizes the need to position FH for subsequent implementation of these initiatives. Both have the potential to improve medication safety but without an improved drug distribution system, implementation of either or both CPOE and BMV would be significantly compromised.

Benefits of Automated Unit Dose Drug Distribution Systems

Patients / Residents / Clients

- Increased patient safety as a result of a decrease in medication error rates to 2% or less from 11-20%.⁴
- Decrease in significant human suffering, morbidity and mortality associated with adverse drug events
- Increased client and family confidence in the system.
- Increases the opportunity to further strengthen safety as medications are provided with bar code labeling that will facilitate the future implementation of bedside medication verification.

Care Providers

- Increase in provider acceptance and satisfaction as medications are provided in a ready-to-use form and in a timely manner, to all acute and residential care patients, limiting ward stock medications to a small number of low risk items, and providing a more “user-friendly” system.
- Increase in provider confidence and satisfaction as it ensures consistency and reliability in the drug distribution process for nurses and other professionals with a resulting increase in staff satisfaction and portability of skills throughout the region.
- Reduces stress by providing staff with a safer systems environment, with a reduced error potential.
- Increases the efficiency and effectiveness of professional resources, allowing pharmacists and nurses to spend increased time on direct patient care activities.
- Estimates of > 100,000 hours (approx. \$3.6 million; 50 FTE) nursing time recovered across the Authority offering partial work load relief from within current staffing.
- Increases workplace health associated with elimination of crowded medication rooms, manipulations associated with blister cards and heavy carts.
- Assist with recruitment and retention of pharmacy staff

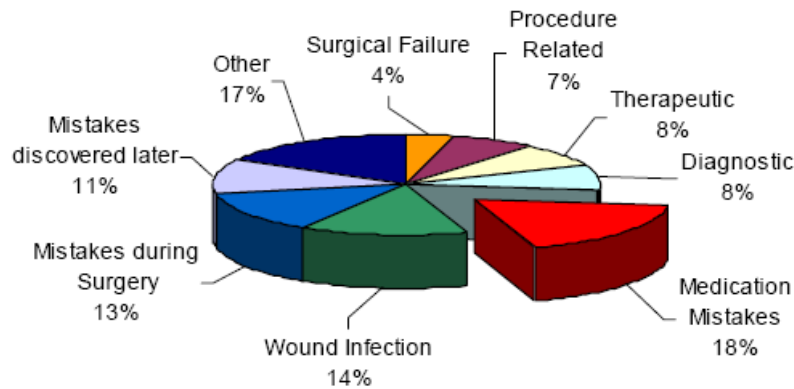
System/Organization

- Increases the level of compliance with Accreditation Canada requirements, specifically adoption of best practice standards and improvements in patient safety related to medication storage, distribution and administration.
- Increases available acute care beds by creating the opportunity to improve bed capacity from within current available beds. Adverse drug events are estimated to add approximately 2820-6029 days per year in FH acute care facilities. Drug distribution system changes could reduce this number by around 40%.^{3,4}
- Increases available critical care beds in the system as a result of reducing avoidable admissions to ICU due to serious adverse drug events (approximately 26% of avoidable days).^{4,5} This is estimated to be in the order of 1400 days or 4 ICU beds at a cost of \$1 million/bed/year.
- Increases medication inventory control and monitoring, with a consequent reduction in medication costs specifically associated with drug waste estimated to be at least \$1 million.
- Increases reporting capabilities with respect to drug use.
- Reduces liability for the organization.
- Together with the current pharmacy information system this proposal provides a foundation for fully integrated medication process including computerized prescriber order entry and bedside medication verification.

BACKGROUND

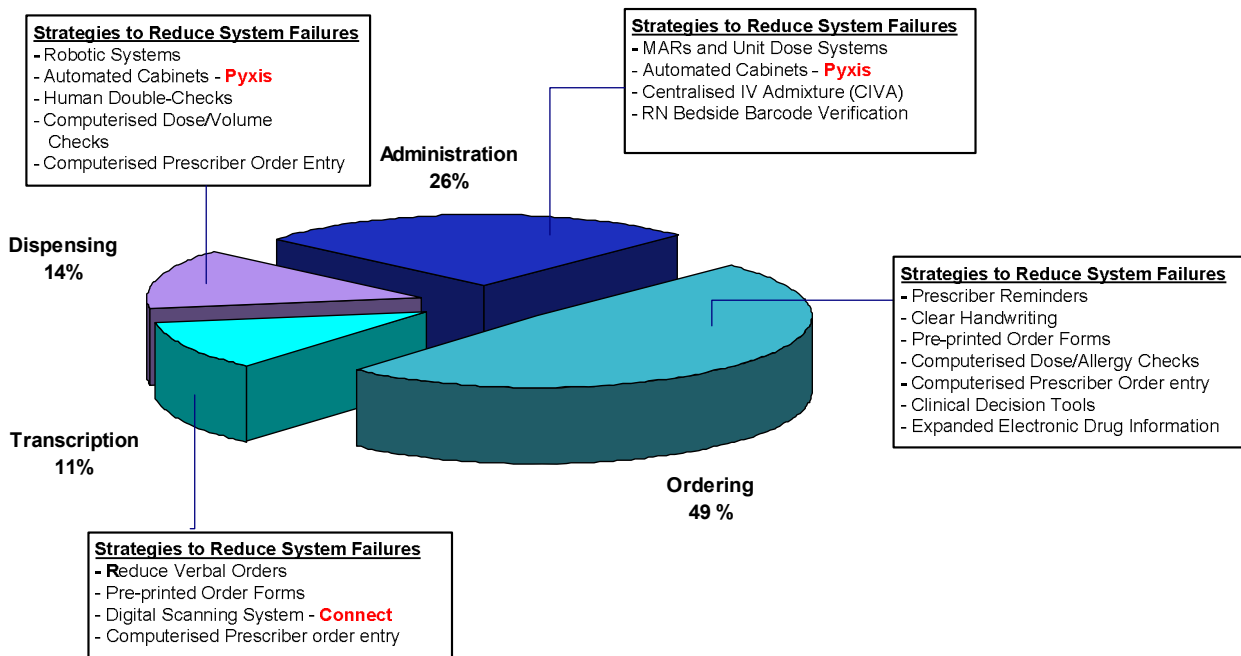
Several landmark papers in the medical literature over the last decade from the US, Canada, UK and Australia have reported that hospitals have unacceptably high rates of medical errors and adverse events with effects ranging from inconsequential to serious and up to death.^{1,4,6,8,9} A significant portion of these adverse events have been attributed to medications and include those that are preventable (errors) and non-preventable (adverse drug reactions). Figure 1 illustrates where preventable adverse events occur in hospitals.

Figure 1



Medication systems are highly complex, have numerous processes and involve multiple medical, nursing, pharmacy and other hospital staff. Errors may occur at any stage of the medication system. Studies have shown that typical error rates for the four main stages of the system are as follows (Figure 2):

Figure 2



Drug Distribution Systems

There are several types of drug distribution systems. Since the 1970's, the unit-dose medication distribution system has been well-recognized as the safest system.¹ Over the past fifteen years, the introduction of bar coding and automation has further increased the safety of unit-dose systems. Currently in Fraser Health, 22% of the acute care beds and 58% of the residential care beds are linked to a unit dose or multi dose system. The other hospitals, including the three largest and most acute sites (BH, SMH and RCH), have medication systems with much higher inherent medication error rates. Medication distribution systems currently provide one of the most significant challenges, and one of the best opportunities, to increase medication safety and decrease risk for the patients, residents and clients of Fraser Health.

The out-dated medication distribution systems in our largest, most acute facilities have a direct impact on patients and bed utilization. Patients experience a higher incidence of avoidable medication-related adverse events; patients undergo needless pain and suffering; there is increased demand for critical care beds and lengths of stay are prolonged. These effects could be ameliorated, or in many cases, avoided entirely by the introduction of an automated, unit-dose distribution system.

In financial terms, a single avoidable error that results in a critical care admission adds approximately \$3000 per day in avoidable costs to the healthcare system. The literature shows that significant medication-related adverse events also prolong patients' lengths of stay by 3.6 - 7.7 days per adverse event and in FH is the equivalent of an estimated 2820-6029 days per year.³

Medication-related deaths in Calgary and Red Deer, as well as the publication of the Canadian Adverse Events Study, also highlight the paramount importance of increasing the safety of our drug distribution systems.

The Pharmacy Drug Distribution Centre (PDDC) in Langley provides the foundation for efficient implementation of this recommendation. The PDDC has been configured to accommodate various automation solutions and this business case presents options to introduce an automated unit dose system of medication distribution across Fraser Health.

Traditional Drug Distribution System

In a patient prescription system, a 3-7 day supply of medication in a ziploc bag or vial is dispensed by pharmacy for each acute care medication order. In residential care, a 35-day supply of medication is dispensed in a blister or bubble pack. On the nursing unit, the prescriptions are placed in a medication cart drawer (acute care) or on a rack (residential care). In addition, commonly used medications are dispensed as ward stock. Ward stock consists of bulk medication bottles and are not designated for specific patients or residents.

A patient story....

January 2006 - Burnaby Hospital: an elderly, confused inpatient finds a stock bottle of digoxin tablets on the ward. He ingests an unknown quantity of tablets and, as a result, spends more than 72 hours in an intensive care bed.

The system issues...

Bulk bottles of wardstock medications can pose a danger to the confused patient and potentially to his visiting grandchildren. In a unit-dose system, only a 24-hour or less supply is available.

A security issue...

December 2005 – Ridge Meadows Hospital: A theft of medications from an ambulatory care area is discovered. There is a resulting police investigation.

The system issues...

Ambulatory care areas are ideal for cabinet-based unit-dose systems. The cabinets are secure and can be programmed to be locked and alarmed if a unit is closed.

BUSINESS CASE
Automated Unit Dose Drug Distribution System

Acute Care



Residential Care



Ward Stock Distribution System

Most of Fraser Health’s emergency and critical care units have ward stock medication distribution systems. All medications are stored on the nursing unit in bulk bottles or boxes in medication carts and/or cupboards. This leads to numerous opportunities for “pick” and preparation errors by nursing who are working in a busy, stressful environment. In many cases quantities of medications are pre-measured and stored at the bedside for future use with inadequate or absent labeling. This type of distribution system has reported error rates of 20% or greater. ³



Unit-Dose Drug Distribution System (includes Multi Dose System)

Unit-dose distribution systems are a pharmacy-coordinated method for dispensing and controlling medications. Unit-dose systems include both oral and intravenous medications although IV medications are handled through a separate central IV admixture (CIVA) program. The essential principles of a unit-dose distribution system are:

- Medication is contained in single unit-dose (acute care) or multi dose (residential care) bar-coded package
- Medications are dispensed in a ready-to-administer form
- Usually no more than 24 hour supply is provided (may be longer for residential care)
- Floor stocks are minimized and limited to drugs for “emergency” use and commonly used safe items
- A current medication profile for each patient is maintained by the Pharmacy
- The Pharmacy information system generates a medication administration record (MAR) for nursing.

BUSINESS CASE
Automated Unit Dose Drug Distribution System

Automated UD systems further reduce the risk of the following types of medication errors:

- Errors of omission (medications not given or delayed)
- Errors of commission (medications given after discontinuation or to wrong patient)
- Wrong drug, dose, form, strength.

A nurse's perspective...

"I have seen the dramatic reduction in medication incidents when an automated drug dispensing system was introduced at a large tertiary hospital. Once they adapted to the new technology, nurses found it much faster and easier. In the rare event a count or drug error was made, the automated system helped unit staff to track back quickly to the originator, allowing corrections and education to occur.

The medication incident rate went down very quickly after implementation."

Arden Krystal BScN, MHA.
Vice President, Acute Networks
Fraser Health



Fraser Health's Drug Distribution Systems

Although the problem of medication errors and the benefits of unit-dose distribution systems have been reported since the 1970's, little headway has been made in implementing unit-dose distribution systems in Fraser Health facilities. The predominant medication distribution system in Fraser Health acute is the traditional system and within residential care sites, the predominate system is automated multi dose. Figure 4 and 5 below outlines the current state of the drug distribution systems within Fraser Health.

The goal/target for each **Acute Care** Facilities is:

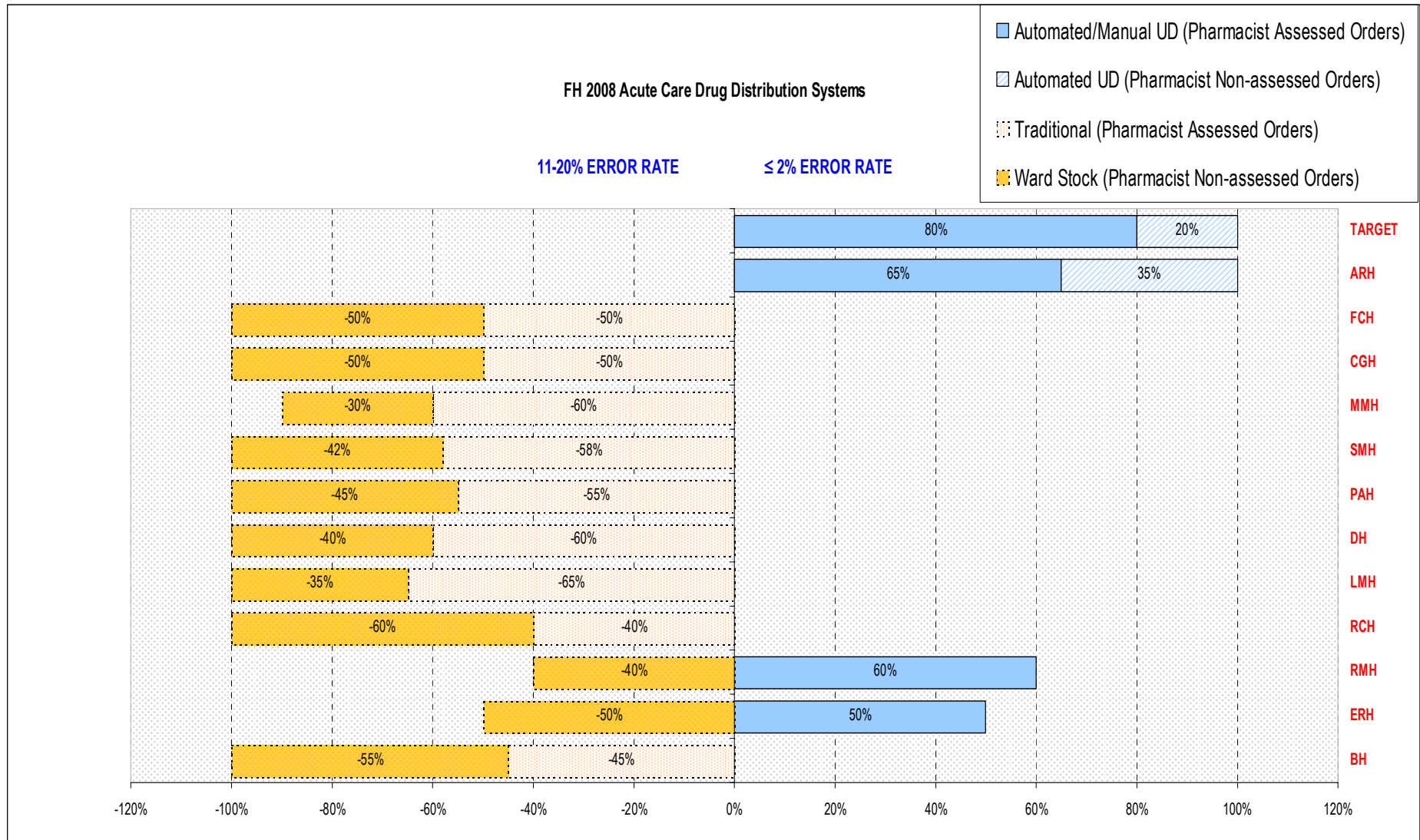
- **80%** - Automated Unit Dose (Pharmacist Assessed orders) and
- **20%** - Automated Ward Stock (Pharmacist Non-assessed orders)

The goal/target for each **Residential Care** Facilities is:

- **90%** - Automated Multi Dose (Pharmacists Assessed orders)
- **10%** - Automated Ward Stock (Pharmacists Non-assessed orders)

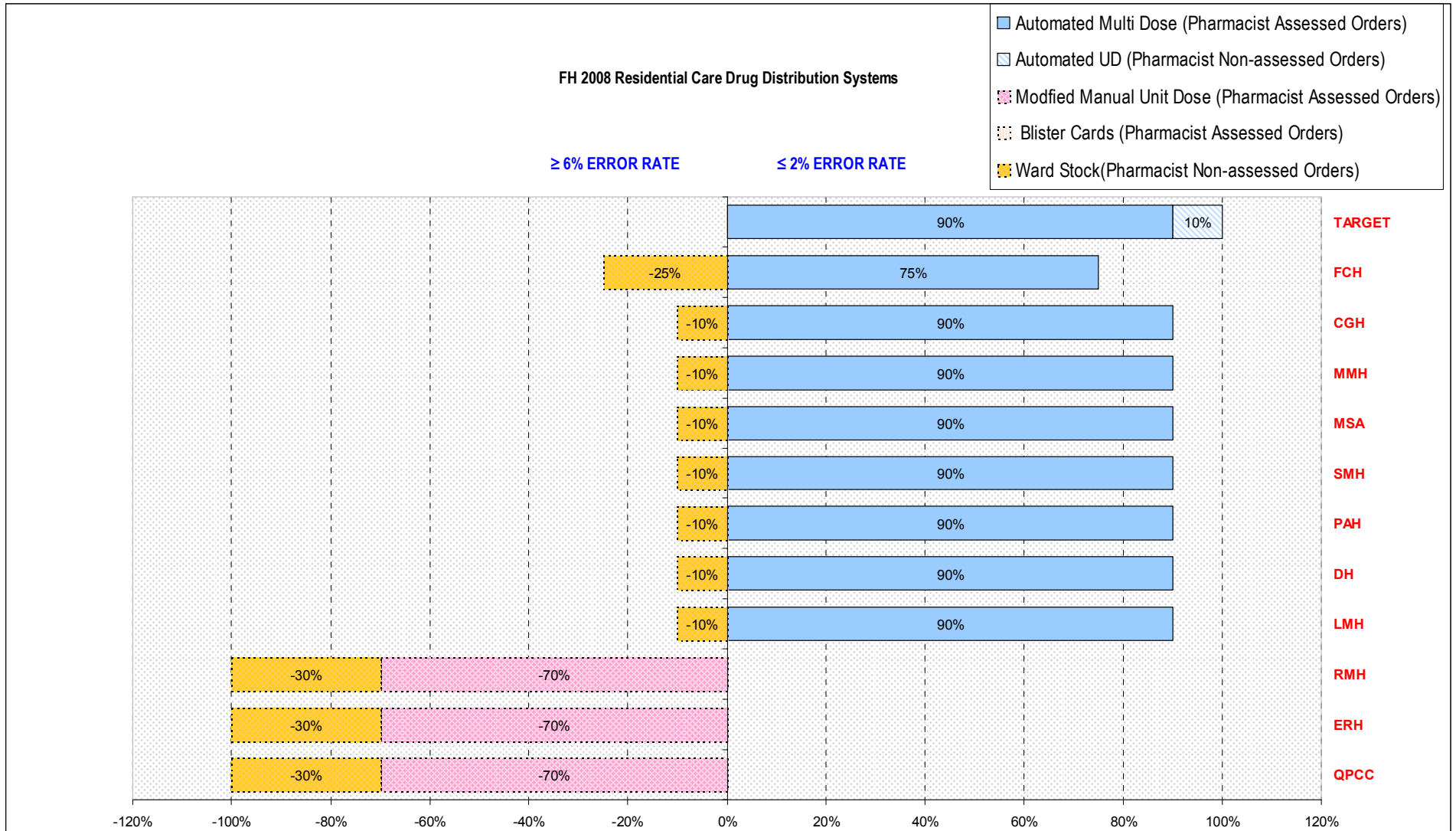
BUSINESS CASE
Automated Unit Dose Drug Distribution System

Figure 4 Acute Care Drug Distribution Systems



BUSINESS CASE Automated Unit Dose Drug Distribution System

Figure 5 Residential Care Drug Distribution Systems



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Automated Unit Dose Drug Distribution System

URGENT NEED TO CHANGE

Medication Errors & Adverse Events

Given the current drug distribution systems throughout Fraser Health, the opportunity to reduce adverse drug events resulting from medication errors is significant. One way the cost to the organization can be assessed is to look at the potential for avoidable increases to length of stay resulting from preventable adverse drug events. The following utilizes FH acute care admission data and projects the avoidable patient days associated with adverse medication events as determined by a recognized Canadian study.⁵

Literature Data on Adverse Event Incidence	Fraser Health Acute Care
Acute care admissions 2007/08	117,617
As per the Canadian Adverse Events Study 2004	
• 7.5 % of patients admitted suffer adverse events	= 8821 events
• 24% of these adverse events are medication related	= 2117 events
• 37% of the medication related adverse event admissions are preventable	= 783 events
• Preventable medication adverse events admissions adds between 3.6 - 7.7 additional days	= 2820 - 6029 days

This table does not consider the implications for residential care or the costs associated with adverse events resulting from medication errors in FH Emergency Departments where additional cost avoidance is probable.

Waste: Resources and Drugs

According to data retrieved from FH Meditech system, approximately 20% of all dispensed medications are returned unused. Depending on the drug, type of packaging and resource availability these returned doses are either wasted or recycled. Both add cost into the system, which is calculated to be approximately \$1 million annually.

The current narcotic control systems rely heavily on nurse resources to document, store, count and resolve narcotic discrepancies. Calculations indicate that approximately of > 100,000 hours (approx. \$3.6 million; 50 FTE) nursing time per year is spent on narcotic counts alone. Automated options for narcotic storage and control virtually eliminate the need for this activity (see Appendix B).

Until June 2007 most FH residential facilities drug distribution relies on blister card packaging. After a pilot at Langley Memorial Hospital transition to multi-dose (modified unit dose) has now resulted in implementation for all Fraser east sites with plans to complete the transition for Fraser South and North by April 2009. Changing to multi-dose packaging has been shown to recover approximately 23 hours per bed per year, which translates to more than 30,000 hours of nursing time in FH. In both these scenarios time recovered can be transferred back to direct patient care activities.

POTENTIAL SERVICE MODELS FOR PROVIDING UNIT-DOSE DRUG DISTRIBUTION SYSTEMS

Fraser Health Pharmacy Services has considered a complete range of service models for implementing safe and cost-effective unit-dose medication distribution systems.

Manual Unit-Dose Systems

Fraser Health currently has two acute care, and three residential care, providing manual unit-dose distribution systems. While these systems are safer with an error rate of 2% versus 11-20% for traditional systems, they require significant pharmacy resources to package, pick, fill, and check patient-labeled cart drawers with a 24-hour supply of medications.^{1,7} Barcode verification of medications has not been implemented in these systems so human errors are still inherent in the system.

While the automated packaging machines at the PDDC could be utilized to package and pick a large portion of daily medications, significant pharmacy technician resources would still be required at each site to fill, check and deliver patient-labeled cart drawers. A preliminary costing estimate showed that the cost of rolling out manual unit-dose systems would be similar to implementing a fully automated unit-dose distribution system. Manual systems provide fewer safety benefits and little capacity for future growth. Professional organizations and current literature supports implementation of automated systems as best practice.

Automated and Bar-coded Unit-Dose Systems

Unit-dose systems can also be supported through centralized (pharmacy) automation or decentralized (ward- based) automation or a combination of both. Appendix D outlines the different automated components that could be used when designing a safe system.

In cart-based systems, Pharmacy utilizes centralized automation such as robots to supply a 24-hour supply of doses for each patient. Usually these are placed in a receptacle such as a drawer labeled with the patient name. Typically, these robotic systems package, store, and pick patient specific doses. In some cases, the robot will also fill patient specific drawers or pouches, significantly reducing the requirement for human resources and increasing the level of accuracy.

In ward-based (decentralized) systems, medications in unit-dose packages are stocked in automated dispensing cabinets. Access is controlled through a computer that displays each patient's current medication profile as entered by Pharmacy into Meditech. A nurse may only access that medication displayed on the computerized profile, and is guided by a variety of functions to pick the correct medication during the process. (See Appendix C).

There are advantages and disadvantages for both models depending on the type of care setting, the nurse-to-patient ratio, the layout of the nursing unit and the distance of the centralized robotics from individual sites. For example, automated cabinets are the preferred option in most acute care locations, whereas the physical environment and nursing staff levels of residential care make a cart-based system a better option. It appears that we will need to use a combination of unit dose systems to provide a safe and effective option to all types of FH patients and care givers.

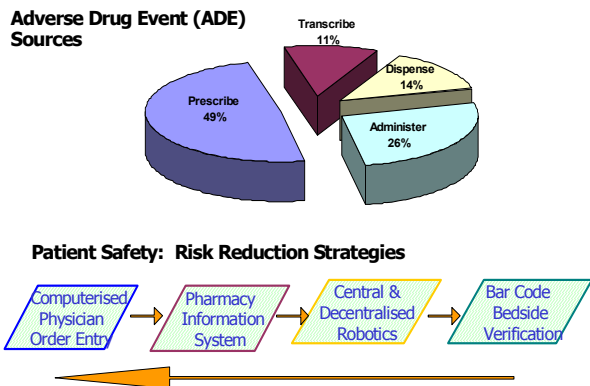
Fraser Health has recently implemented an automated multi dose distribution system in the following owned and operated residential care facilities, MSA, MMH, CGH, FCH and LMH. A plan is underway to complete the rest of the residential care areas by 2009. In 2008, Abbotsford Regional Hospital was the first site to implement automated unit-dose dispensing cabinets.

THE MEDICATION PROCESS: STRATEGIC VISION

We are aware that adverse drug events can be caused at any number of key steps in the medication process from the time a physician writes an order until the time the medication is administered to the patient by a nurse.

Various computerization and automation can be implemented for each of the major functions; prescribing; transcription; dispensing; and administration, to reduce the risks of many different types of errors. This schematic demonstrates the steps and corresponding automation.

Figure 6



A computerized pharmacy information system (Meditech) is currently in place. The next step is to implement an integrated automated unit dose distribution system to address many of the errors which occur at the dispensing and administration steps. This will provide the basis for future automated systems i.e. bedside medication verification using bar code checking by nursing. The ultimate goal is to have a system that is inclusive of the complete medication process including ordering, reviewing, dispensing and administration of medication.

This system is dependant on an integrated Information Technology structure incorporating the following key elements:

- Computerized prescriber entry with integrated decision support tools which incorporate rules based on data from multiple sources, patient demographics, disease state(s), lab, pharmacy
- Electronic order review
- Automated medication preparation, dispensing and distribution
- Bedside medication verification by nursing staff using bar code and/or radio frequency identification (RFID) technologies

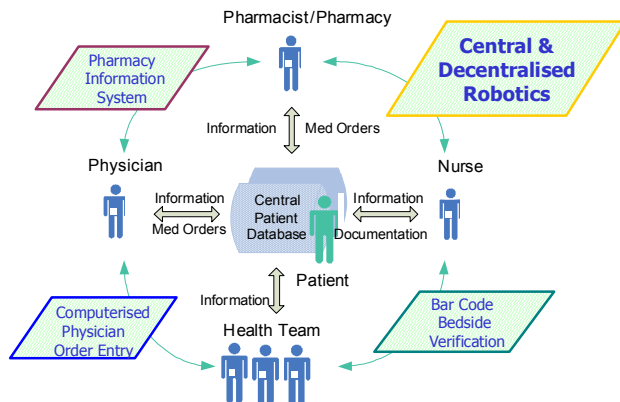


Figure 7

MAJOR POTENTIAL BENEFITS OF AUTOMATED UNIT DOSE SYSTEM

The system by which medications are moved from the pharmacy to the patient involves numerous steps and healthcare staff. The opportunity for error and patient harm exists at each step with a resulting potential impact on not only the patients and families, but also nurses, physicians, pharmacists and other staff. In addition negative impact on bed utilization, related costs and the reputation of an organization as a whole may result in unwanted headlines and publicity. It is essential that the safest drug distribution system possible is implemented throughout Fraser Health. The Canadian Society of Hospital Pharmacists (CSHP) and American Society of Health-System Pharmacists (ASHP) endorse a unit dose/intravenous admixture system as the drug distribution system of choice in organized healthcare settings. This section provides a summary of the potential benefits, both qualitative and quantitative, to patients, care providers and Fraser Health.

Patients / Residents / Clients

- Increased patient safety as a result of a decrease in medication error rates to 2% or less from 11-20%.⁴
- Decrease in significant human suffering, morbidity and mortality associated with adverse drug events
- Increased client and family confidence in the system.
- Increases the opportunity to further strengthen safety as medications are provided with bar code labeling that will facilitate the future implementation of bedside medication verification.

Care Providers

- Increase in provider acceptance and satisfaction as medications are provided in a ready-to-use form and in a timely manner, to all acute and residential care patients, limiting ward stock medications to a small number of low risk items, and providing a more “user-friendly” system.
- Increase in provider confidence and satisfaction as it ensures consistency and reliability in the drug distribution process for nurses and other professionals with a resulting increase in staff satisfaction and portability of skills throughout the region.
- Reduces stress by providing staff with a safer systems environment, with a reduced error potential.
- Increases the efficiency and effectiveness of professional resources, allowing pharmacists and nurses to spend increased time on direct patient care activities.
- Estimates of > 100,000 hours (approx. \$3.6 million; 50 FTE) nursing time recovered across the Authority offering partial work load relief from within current staffing.
- Increases workplace health associated with elimination of crowded medication rooms, manipulations associated with blister cards and heavy carts.

System/Organization

- Increases the level of compliance with Accreditation Canada requirements, specifically adoption of best practice standards and improvements in patient safety related to medication storage, distribution and administration.
- Increases available acute care beds by creating the opportunity to improve bed capacity from within current available beds. Adverse drug events are estimated to add approximately 2820-6029 days per year in FH acute care facilities. Drug distribution system changes could reduce this number by around 40%.³
- Increases available critical care beds in the system as a result of reducing avoidable admissions to ICU due to serious adverse drug events (approximately 26% of avoidable days).⁵ This is estimated to be in the order of 1400 days or 4 ICU beds at a cost of \$1 million/bed/year.
- Increases medication inventory control and monitoring, with a consequent reduction in medication costs specifically associated with drug waste estimated to be at least \$1 million.
- Increases reporting capabilities with respect to drug use.
- Reduces liability for the organization.
- Together with the current pharmacy information system this proposal provides a foundation for fully integrated medication process including computerized prescriber order entry and bedside medication verification.

RECOMMENDATION:

MODEL: DECENTRALIZED CONTROLLED ACCESS CABINETS AND CENTRALIZED MULTI DOSE SYSTEM

Acute Care:

Controlled access cabinets be installed in each acute care location and stocked with unit dose packaged medications specific to the particular care area. Through an interface with Meditech access to medications is controlled by the medication orders entered into the system by the pharmacy. As previously described, when a nurse accesses the cabinet she will view a current profile of medications for each patient. The nurse generally cannot access a medication until the pharmacy has reviewed and approved the medication order. Cabinets also provide full control and documentation for narcotic drugs. This option will also provide for a robotic solution for acute care areas that currently have physical infrastructure issues associated with the installation of controlled access cabinets.



Residential Care:

Automated multi dose packaging system be installed in each owned and operated residential care location. There are some additional benefits to be realised by adding a limited number of controlled access cabinets in residential facilities to provide first dose/ night cupboard/ narcotic control options.



Ward Stock Areas:

Controlled access cabinets be installed in all emergency departments, operating rooms, and similar areas. These cabinets hold a full supply of line items in unit dose packaging where appropriate. In addition, these cabinets contain all narcotics and controlled drugs, providing all required security and documentation associated with these medications



BUSINESS CASE

Automated Unit Dose Drug Distribution System

Advantages

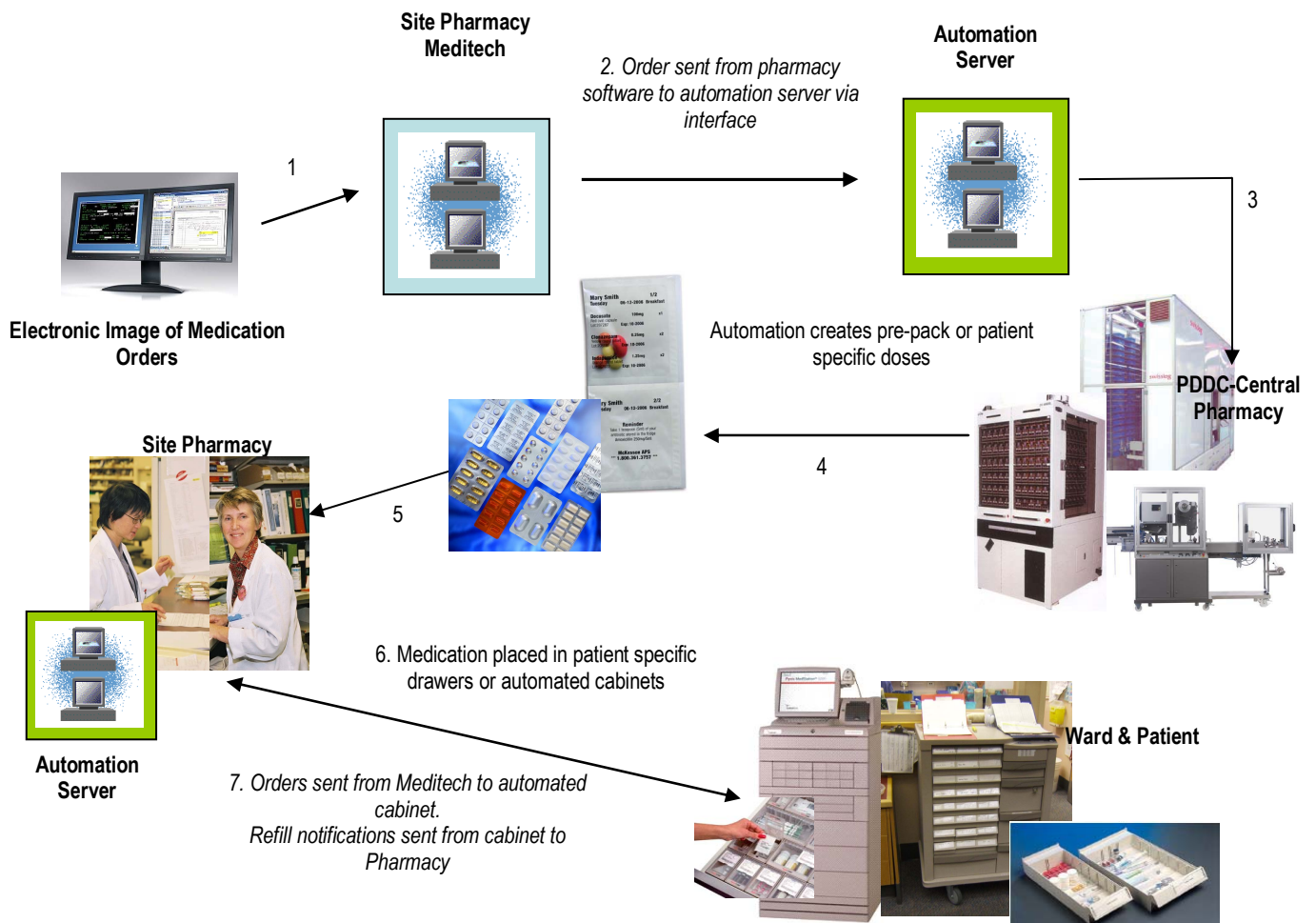
- Significant time savings for nurses related to narcotic drug control in acute care areas. -approximately 100,000 hours nursing staff recovered related to automated narcotic control. (See Appendix B).
- Nurse time recovered associated with replacing blister cards with unit dose packaging of approximately 30,000 hours
- Increased nurse satisfaction due to reduction of risk of medication errors; overall improved work environment
- Improved recruitment and retention of nursing and pharmacy staff to facilities with advanced medication distribution systems.
- Fast first dose/stat response.
- Less reliance on daily transport schedule between PDDC and sites.
- Flexibility to provide high quality service to different patient care areas.
- Can continue to operate when network is down.
- Ongoing upgrades to automation ensure retain “best in healthcare” status.
- Least amount of additional pharmacy staffing required.
- Greatest improvement in inventory management.

Disadvantages

- Greatest change to nursing practice (automation vs. cart system).
- Controlled access cabinets are stationary, requiring nurses to return to one or two locations for medications.
- Requires significant information systems integration and minor construction infrastructure changes.

General Process Flow

The recommended model described above relies on the general process flow shown in the following schematic:



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Automated Unit Dose Drug Distribution System

Each of the above requires the nurse to transport the medication from the automated cabinet or medication cart to the patient bedside. No “forced function” final check is available to ensure an error is not made at the point of administration. All options require a point-of-care verification module for further improved patient safety.

Status Quo

Maintaining the status quo, that is making no changes to the current drug distribution systems as described in the back ground section of this document, results in Fraser Health patients being at risk of the ongoing level of medication errors. Standards of practice around the province are to move to automation and unit-dose and most other regions have started or have implemented these systems. There should be no doubt that automated unit dose has become the accepted standard of practice for drug distribution systems in North America.

Risks Associated with Status Quo

There are no obvious benefits to maintaining the current systems but many ongoing risks:

Patients / Residents / Clients

- Continued high level of patient risk resulting from current out dated distribution systems.
- Continued misuse of resources resulting from morbidity, mortality, prolonged length of patient stay and avoidable critical care.
- Continued risk of avoidable pain and suffering for patients and their families.

Care Providers

- Lack of confidence in the drug distribution process for nurses and other professionals together with the stress associated with working in an environment where there is a high probability of error resulting in patient harm
- Continued inappropriate use of professional resources, where nurses and pharmacists spend more time on drug distribution processes than on direct patient care and physicians required to provide care to patients suffering from avoidable adverse drug effects resulting from errors.
- Ongoing potential for workplace injuries associated with crowded med rooms and old heavy carts.
- No option to introduce future bedside medication verification systems which rely heavily on unit dose packaging with bar code labeling.

System/Organization

- Continued avoidable use of beds associated with prolonged stays resulting from adverse drug events.
- Ongoing drug waste associated with current distribution systems.
- Estimated costs to the system of between \$0.5-10 million annually attributable to medication errors.
- Continued potential for headlines associated with medication errors and out dated healthcare systems.
- Potential for litigation

PROJECT RISK ANALYSIS

Identified Risks	Potential Solutions
<ul style="list-style-type: none"> A delay in drug distribution system upgrade approval by the Hospital Executive will delay the start of implementation. 	<ul style="list-style-type: none"> Continue to provide Executive with required data to enable decision to proceed.
<ul style="list-style-type: none"> Ability of vendor to provide support implementation timeline shared implementation team from the vendor may threaten our ability to deliver the project on time 	<ul style="list-style-type: none"> Ensure adequate support available during contract negotiations.
<ul style="list-style-type: none"> Other Information System projects may affect project timeline 	<ul style="list-style-type: none"> Liaison with IM/IT department during final timeline development to ensure adequate & appropriate resources are available
<ul style="list-style-type: none"> Privacy issues and legislation regarding the accidental or potential sharing of patient data between organization and vendor. 	<ul style="list-style-type: none"> Ensure appropriate checks occur during vendor selection process
<ul style="list-style-type: none"> The implementation is an extremely complex process involving many operational considerations directly impacted by information system configuration decisions. 	<ul style="list-style-type: none"> Ensure liaison with vendor, pharmacy and IM/IT during implementation decision making process
<ul style="list-style-type: none"> The variety of interface and integration techniques has the potential to introduce expensive complications to the vendor's products. 	<ul style="list-style-type: none"> Give priority to one vendor decision for all components to limit interface complications. Ensure contract negotiations take potential complications into account
<ul style="list-style-type: none"> Training of support staff to handle the variety of interfaces, client environments, and networks. 	<ul style="list-style-type: none"> Build adequate implementation resources into project and ensure appropriate vendor support.
<ul style="list-style-type: none"> Hours and level of support to clients based on current Information Systems and Pharmacy infrastructure at all sites. 	<ul style="list-style-type: none"> Build contingencies as part of implementation process

BUSINESS CASE
Automated Unit Dose Drug Distribution System

High Level Timeline and Recommendation

Year 1 (complete 2008/09)	Years 2 - 3	Year 4 - 5	Year 5 +
Recommended Option: All Patient Care Areas Site by site implementation for all patient care areas requiring medication control and include both acute inpatients, together with emergency departments and other ambulatory care areas.			
<ul style="list-style-type: none"> Abbotsford 	<ul style="list-style-type: none"> Surrey Delta Langley Fraser Canyon Chilliwack Peace Arch Abbotsford (order management only) 	<ul style="list-style-type: none"> Burnaby Eagle Ridge Ridge Meadows Royal Columbian 	
Alternate Option – Ward Stock Areas Site by site implementation of automation in ward stock areas requiring medication control which includes but is not limited to Emergency, operating suites, intensive care and ambulatory care areas. Consider as Phase I with subsequent expansion as funding allows.			
<ul style="list-style-type: none"> Abbotsford 	<ul style="list-style-type: none"> Surrey Delta Langley Fraser Canyon Chilliwack Peace Arch 	<ul style="list-style-type: none"> Burnaby Eagle Ridge Ridge Meadows Royal Columbian 	
Residential (Multi-dose)- complete 2009 All residential care facilities are anticipated to implement the new multi-dose drug distribution system by mid 2009 which will result in a significantly safer system			
<ul style="list-style-type: none"> Langley Abbotsford Mission Surrey Chilliwack Fraser Canyon Peace Arch Delta Eagle Ridge Ridge Meadows Queens Park 			
Enhanced Residential Care System Addition of automated cabinets and order management systems to Residential Care facilities. Outstanding issues are related to the safe control and efficient provision of as needed (prn) medications and first doses which is especially significant where residential facilities are located at a distance from the acute care site pharmacy e.g. Fraser Canyon.			
	These sites are remote to acute site pharmacy. <ul style="list-style-type: none"> Abbotsford Mission Chilliwack Fraser Canyon Delta Surrey 		<ul style="list-style-type: none"> Eagle Ridge Ridge Meadows Queens Park Langley Peace Arch

APPENDIX A – FINANCIAL SUMMARY

Summary Costs by Site

- Costs include automated drug dispensing cabinets (Pyxis) and an order management scanning system (Pyxis Connect).
- Capital purchase, one time operational and annual operational costs provided.
- Tables provide estimated high level summarised costs by site.
- Costs are based on 2008/09 pricing. Increases of 5% per year should be anticipated

A. Recommended Option

Table 1 identifies site by site implementation costs for **all patient care areas** requiring medication control and includes both acute inpatients, together with emergency departments and other ambulatory care areas.

Table 1

All patient care areas			
	Capital ¹	Operational ² (one time)	Operational ³ Annual
BH			
ERH			
RMH			
RCH			
LMH			
DH			
PAH			
SMH			
MMH			
FCH			
CGH			
ARH (Connect)			
TOTALS			

Legend

1. Capital Includes
Automated Cabinets and order management system
Renovations
2. Operational (One time) Includes
Implementation Staffing
3. Operational Annual includes
Automated cabinets and order management system support costs
Staffing increase to base line

BUSINESS CASE
Automated Unit Dose Drug Distribution System

B. Alternate Option – Ward Stock Areas

Table 2 identifies site by site implementation costs of automation in **ward stock areas requiring medication control** which includes but is not limited to Emergency, operating suites, intensive care and ambulatory care areas. This is a sub set of the costs provided in Table 1 above. Subsequent expansion of automation at individual sites would be possible as funding became available up to the totals identified in Table 1.

Table 2

Ward Stock Areas (ICU, OR, Emergency, Day Care, PACU)			
	Capital¹	Operational² (one time)	Operational³ Annual
BH			
ERH			
RMH			
RCH			
LMH			
DH			
PAH			
SMH			
MMH			
FCH			
CGH			
TOTALS			

Legend

1. Capital Includes
Automated Cabinets and order management system
Renovations
2. Operational (One time) Includes
Implementation Staffing
3. Operational Annual includes
Automated cabinets and order management system support costs
Staffing increase to base line

BUSINESS CASE
Automated Unit Dose Drug Distribution System

C. Enhanced Residential Care System

Table 3 provides the costs associated with **adding automated cabinets and order management systems to Residential Care facilities**. All residential care facilities are anticipated to implement the new multi-dose drug distribution system by mid 2009 which will result in a significantly safer system.

Outstanding issues are related to the safe control and efficient provision of as needed (prn) medications and first doses which is especially significant where residential facilities are located at a distance from the acute care site pharmacy e.g. Fraser Canyon; Chilliwack.

Table 3

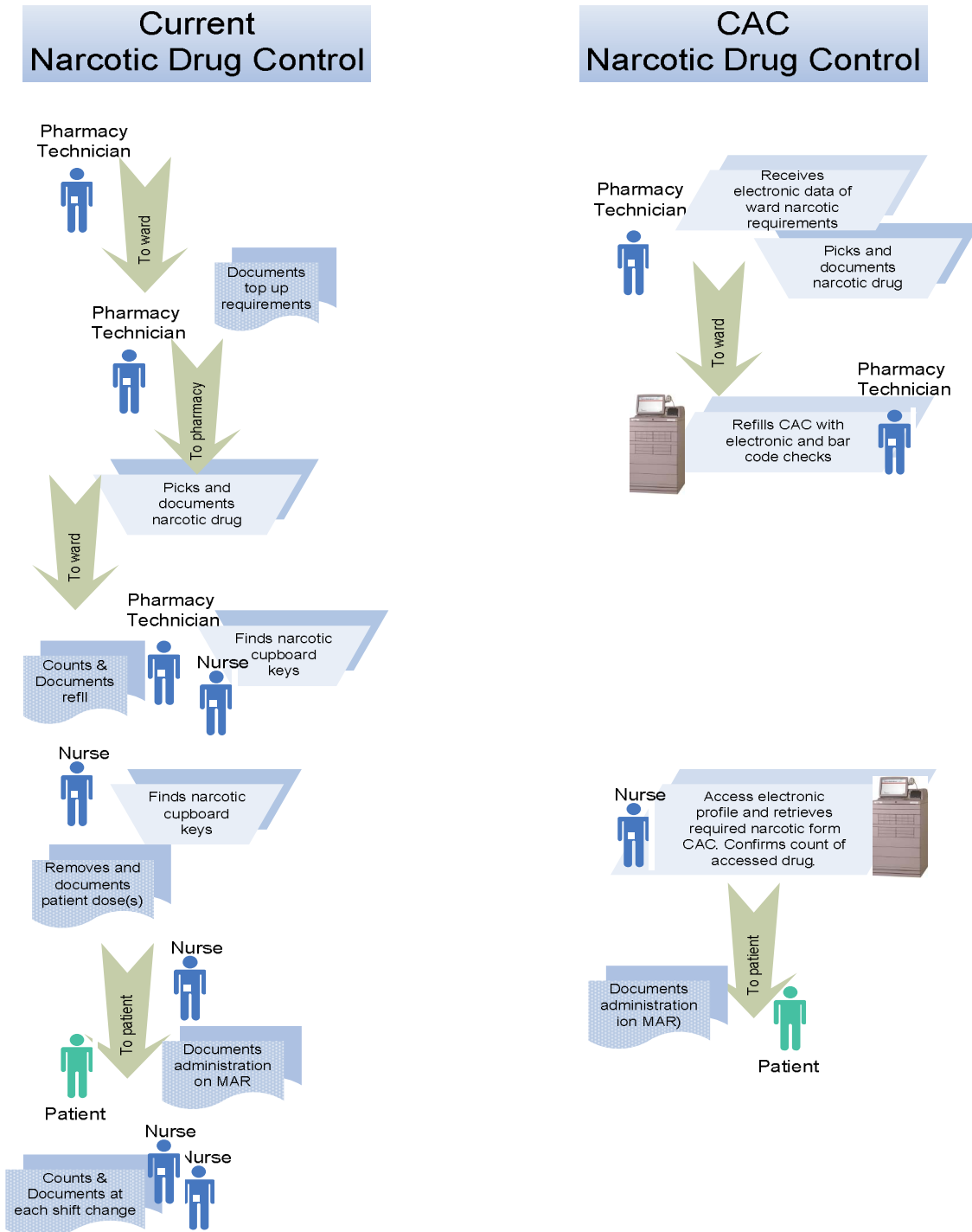
Residential : Automated Cabinets to Supplement Multi-Dose System			
	Capital¹	Operational² (one time)	Operational³ Annual
QPCC			
ERH			
RMH			
LMH			
DH			
PAH			
SMH			
MSA			
MMH			
FCH			
CGH			
TOTALS			

Legend

1. Capital Includes
Automated Cabinets and order management system
Renovations
2. Operational (One time) Includes
Implementation Staffing
3. Operational Annual includes
Automated cabinets and order management system support costs
Staffing increase to base line

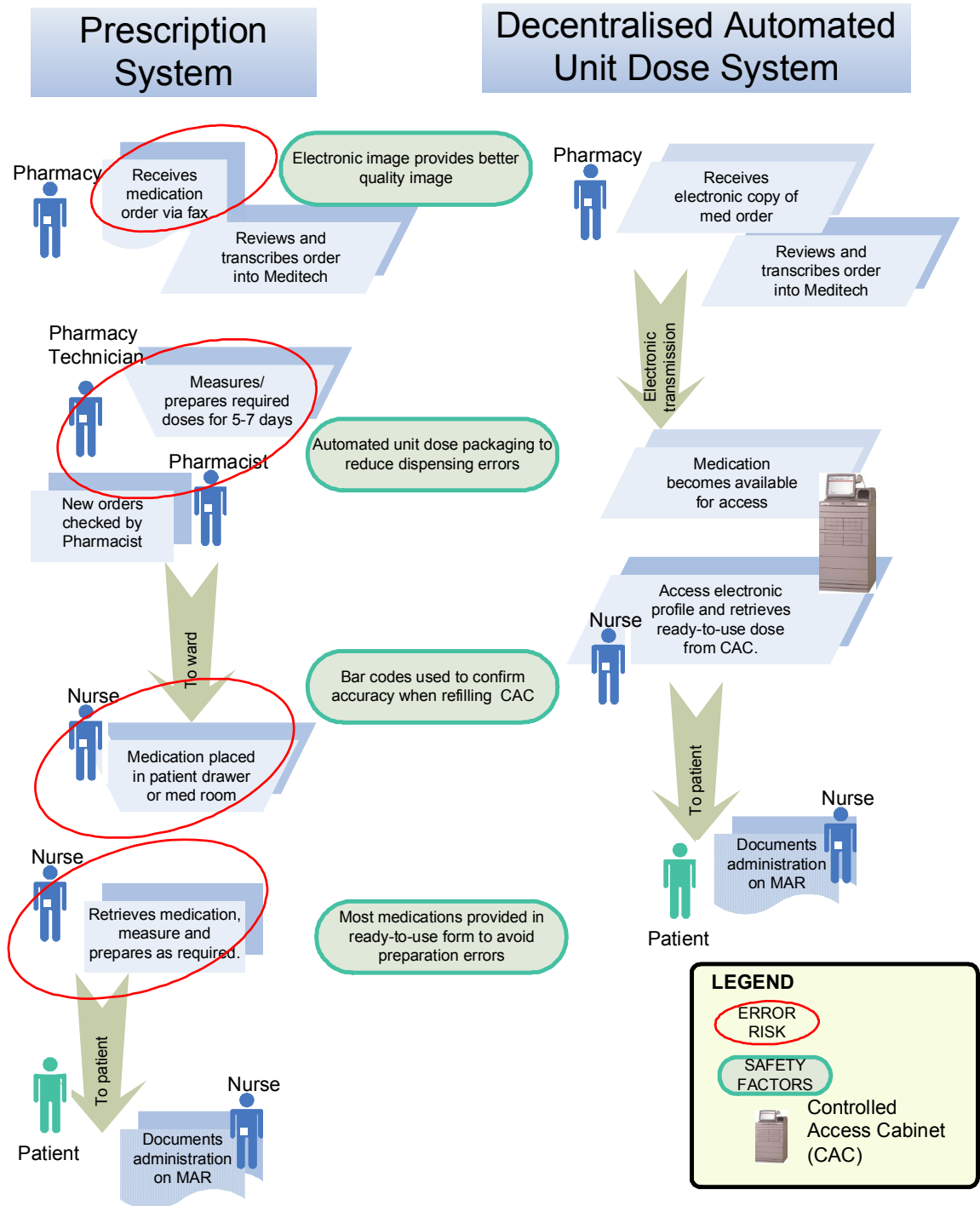
APPENDIX B – NARCOTIC CONTROL PROCESSES

Comparison of Manual and Automated Narcotic Drug Process



APPENDIX C - PROCESS FLOW CHARTS

Comparison of Current Traditional - Prescription vs. Automated Unit Dose Systems



APPENDIX D – AUTOMATION SYSTEM COMPONENTS

New Automation-System Components

Automated Packaging Device

The three previously purchased packaging units located at PDDC can be used in a variety of ways:



- a) Packaging of bulk unit dose, bar coded, oral medications. This packaging can be stored in any or all of the automated options described and can be provided to the site pharmacies for first doses and ward stock.
- b) Packaging and sorting of patient specific unit dose medication for 24 hour (or longer) exchange systems driven by an interface to the Pharmacy Meditech system. This packaging would be placed in cart drawers labeled with the patient name for delivery to the patient care areas.
- c) Packaging and sorting of patient specific multi dose medication for 24 hour (or longer) exchange systems. This packaging would be placed in cart drawers labeled with the patients name and is typically used in residential facilities. In contrast to unit dose packaging for acute care patients this type of packaging incorporates all the medications for a single dose time into a single packet.

An additional high speed packager (Pentapak) has been purchased to support the automated unit dose system implemented at the Abbotsford Regional Hospital.

Inventory System

An automated inventory store and pick system located at PDDC. This system would facilitate the move to centralized purchasing Phase II where medications would be purchased and stocked at PDDC for re-distribution to the site pharmacies. An anticipated decrease in the total inventory-on-hand for the region should be realized. Several options are available but all have the following common elements:

- High-density, automated centrally located system for the storage and retrieval of drug inventory, providing up 50% reduction in space requirements.
- Systems can be interfaced with other pharmacy automation to provide additional efficiency and accuracy related to refill functions for CAC and other stock locations.
- Bar coding provides additional accuracy for inventory control, picking and distribution functions.
- Standardizes process for both UD and bulk medications.
- Improved inventory control and reporting
- Some provide additional software and/or hardware for narcotic inventory management both within pharmacy and individual patient care areas.



Controlled Access Cabinets (CAC)-a.k.a Pyxis©

Controlled access cabinets (CAC), also known as automated dispensing units, are located in patient care locations and provide secure storage for all medications including narcotics. Two levels of control are available, the first allows access by the user to any item stored in the cabinet at all times (ward stock) and the second (recommended) where access is controlled by the pharmacy order entry system restricting access to only those medications ordered and approved for a specific patient. In the absence of a point-of-care verification system the nurse uses a manual medication administration record (MAR) to record doses administered. Stored medications are packaged in a non-patient specific, unit-dose format.



CAC provides the following benefits:

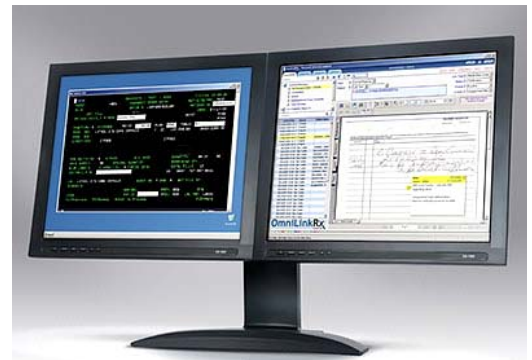
- Provides “real-time” medication profile based on pharmacy order entry.
- Reduces opportunity for administration of discontinued medications.
- Reduces opportunity for “wrong patient” errors.
- Reduced waiting time for first dose delivery.
- Narcotic and controlled drug secure storage and documentation.
- Significant reduction in nursing time on narcotic and controlled drug access and documentation (see schematic)
- Secure storage in absence of med room space or nurse monitoring.
- Allows additional warnings/security to be applied to designated high risk medications.
- Provides single unit dispensing as required e.g. operating room narcotics for anaesthesiologists.
- Documents all access to medications.
- Night cupboard for sites where there is not 24hr coverage. All removals are recorded and can be reviewed by Pharmacy the following day.
- Provides medication control solution for patient care areas such as Emergency departments, Operating suites, day care areas, etc.
- Reduces pharmacy resource requirements due to:
 - Electronic refill process allowing centralized picking
 - Barcode-enabled refill for additional speed and accuracy
 - Reductions in narcotic discrepancy follow up
 - Reduction (elimination) of returned drugs and crediting functions
- Allows more flexibility in pharmacy staff scheduling.

Medication Order Management

Medication order management systems provide an option to enhance communication and efficiency of medication order management between pharmacy and nursing in the absence of computerized physician order entry and clinical information system. Medication (and other) orders are scanned into the system in the patient care area and an electronic image is viewed by the pharmacy (and/or other) departments. This electronic data provides the opportunity for a variety of added benefits over a faxed copy of the order.

Significantly improved quality.

- Ability to view images in multiple locations simultaneously.
- Electronic storage and retrieval of previous orders
- Enhanced communication and decreased order turnaround time
- Eliminate lost orders and reduce transcription errors.
- Overall reduction in medication errors due to misinterpretation and loss of medication orders.



APPENDIX E – GLOSSARY OF TERMS

ADVERSE DRUG EVENT (ADE)

An injury resulting from a medical intervention related to a drug. ADEs associated with an error are considered preventable.

BEDSIDE MEDICATION VERIFICATION (BMV)

A system used by nurses utilising bar coded patient wristbands and medications. A hand held device or bedside computer combined with a bar code scanning device provides an electronic medication profile after scanning the patient wristband. Each medication is scanned prior to administration to confirm that it is correct.

CART EXCHANGE

Term used to describe the method of replenishing stock. In a unit dose system, this applies to the exchange of patient specific bins. Each bin is filled by Pharmacy with all the doses required for the patient for a specified timeframe (usually 24-48 hours). A duplicate set of bins is used by nursing to provide medication to their patients on the care areas. At a pre-set time, the empty bins are exchanged for filled bins. The bins reside in a cart.

This may also apply to a cart that is stocked with non-patient specific drugs or supplies in preset quantities. A duplicate cart is kept in Pharmacy and restocked before the exchange.

CENTRAL INTRAVENOUS ADMIXTURE (CIVA)

Intravenous medication doses are prepared in the Pharmacy under controlled aseptic conditions and supplied in a patient-specific, ready-to-administer form. CIVA is typically part of a unit dose system (see below).

COMPUTERISED PHYSICIAN ORDER ENTRY (CPOE)

A system that allows physicians and other care users to enter orders directly into a computer system. Typically these systems are tied to a common database that provides access to lab, pharmacy, radiology etc.

CONTROLLED ACCESS CABINETS (CAC)

Controlled access cabinets (also known as point-of-use and automated dispensing cabinets) are placed in the patient care area and contain the drugs generally ordered for the patients in that area. The drugs are released once a user enters their password (or other identification), selects the patient and then selects the medication(s) required for that patient from a medication profile generated from the Pharmacy computer system. This technology provides a controlled inventory of unit dose packaged medications available for just in time dispensing according to physician orders and provide a secure, audited environment for all medications including narcotics.

ELECTRONIC CHART (EC)

Either stand-alone or as part of a complete clinical information system and allows medication administration data to be entered directly onto a computer database and accessed by multiple users. Administration data from a bedside medication verification system can be electronically recorded on the electronic chart.

ERROR - MEDICATION

Medication errors are errors in the process of ordering or delivering a medication regardless of whether an injury occurred, or the potential for injury was present. Some medication errors result in adverse drug events (ADE – see definition above).

Medication errors can occur at any stage in the drug ordering, dispensing and administration process.

MONITORED DOSE

A system commonly used in residential facilities. Patient specific medications are provided in a 35 day card. Each medication time has one card. This system requires significant packaging time and does not lend itself to automation.

MULTI-DOSE (MD)

Similar to unit dose except that all doses for a specific administration time (e.g. Bedtime, 2200hrs) are placed in the same unit of use package. The label identifies each medication in the package, the patient name and the time it is to be administered.

Medications where the dose may fluctuate often should not be included in the multi-dose package to minimize wastage. Drug distribution systems using multi-dose packaging which are exchanged every 24-48 hours are now commonly used to replace monitored dose systems in residential facilities and can be provided from centralised automated packagers within the Pharmacy.

BUSINESS CASE
Automated Unit Dose Drug Distribution System

TRADITIONAL (TRAD)

Patient specific medications are supplied from the pharmacy, typically in quantities sufficient for 5-7 days treatment. It is usually found in combination with large ward stocks of medications. This system allows for a significant degree of error, and wastage

UNIT DOSE SYSTEM

A unit dose system provides only a 24 hour supply of medication. Each dose is supplied individually packaged and in a ready-to-use form. Ward stocks are minimised, a complete medication profile is maintained and pharmacy generated medication administration record (MAR) is provided. UD dose systems can rely on a cart based exchange system (see cart exchange below) or more recently, unit dose systems have included using unit dose packaging in automated point-of-use cabinets (see CAC definition below). In addition UD packages usually have bar codes to facilitate quality assurance procedures within pharmacy and in the patient care area.

APPENDIX F – REFERENCES

1. Sourcebook on Unit Dose Drug Distribution Systems; *American Society of Hospital Pharmacists* 1978.
2. Pedersen CA et al. ASHP National Survey of Pharmacy Practice in Hospital Settings! Dispensing & Administration – 2005. *AMJ Health System Pharmacy* 2006 Feb 15; 63(4): 327-45
3. Hospital Pharmacies in Canada Annual Report. [www.lillyhospitalsurvey.ca] *Lilly report; 2003/04*
4. Bates DW et al. Incidence of Adverse Drug Events & Potential Adverse Drug Events. *JAMA* 1995;274(1);39-34
5. Baker GR, Norton PG et al. The Canadian Adverse Event Study: the incidence of adverse events among hospital patients in Canada. *CMAJ* 2004;170 (11):1678-86
6. An Organization with a Memory; Report on Learning from Adverse Events in the National Health Service London [UK] Department of Health; 2000
7. Mann JL, Kribs WJ. Unit Dose! It's Feasible. *Healthcare* February 1984.
8. Leape LL, Bates DW, Cullen DJ et al. Systems analysis of adverse drug events. *JAMA* 1995;274(1):35-43.
9. Kohn LT, Corrigan JM, Donaldson MS, eds. *To Err is Human: Building a Safer Health System*. Institute of Medicine, Washington, National Academy Press, 1999.