H - TECHNOLOGY

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Medication system technologies supported with clinical decision making, error prevention, and quality improvement capability are now more readily available for use in the hospital setting. These technologies have the potential to significantly improve the quality, efficiency and safety of the medication management system.[1,2]

In the wake of the Institute of Medicine's "To Err is Human" report [3] and The Canadian Adverse Event Study,[4] there has been a welcome increase in the attention being given to initiatives that could improve patient safety. Accreditation Canada recently introduced the Managing Medications Standard, which includes a significant number of medication safety-related standards that healthcare facilities are expected to address. With the increased focus on patient safety in healthcare, it would be reasonable to expect that hospitals and hospital pharmacies are taking full advantage of the opportunities that technology provides to improve medication safety, but are they? The previous Hospital Pharmacy in Canada Report in 2005/06 indicated that the uptake of technology in Canadian hospitals was slow, perhaps due to the cost of the technology and the challenges associated with successfully implementing new technologies. This Chapter provides a summary of the current state of medication technology use in Canadian hospitals.

PHARMACY INFORMATION SYSTEM - CLINICAL DECISION SUPPORT

Clinical decision support is defined as a computer program feature that provides automatic reminders, advice or interpretation, as data is entered for a specific patient and/or a specific medication order. Clinical decision support technology can be as simple as a software feature that warns a clinician when the dosage being prescribed/entered for a patient appears to be too high or low, and provides guidance on what an appropriate dose should be. In more mature clinical decision support systems, the technology guides the clinician through evidence-based, patient-specific algorithms and guidelines for care.

These types of systems have the potential to improve healthcare quality, efficiency and outcomes. Further development of clinical decision support systems (CDSS) is expected to occur, with the goal of insuring that new evidence can be incorporated into these systems as it becomes available.[5] While these evolving technologies hold great promise, they will only achieve their potential if practitioners embrace and use the technology. How well are we doing at optimizing the use of the clinical decision support technologies that are already available to us?

- All respondents, across all sectors and all sizes of hospitals reported that they have a pharmacy information system (PIS). Ninety-one percent of respondents reported that the pharmacy information system includes clinical decision support functionality (Table H-1), compared to 83% (118/142) of respondents in the 2005/06 report and 40% (58/144) of respondents in the 2003/04 report. The increase in 2005/06, compared with 2003/04, may have occurred, in part, because a definition of the term "clinical decision support system" was included in the 2005/06 survey. The 2007/08 increase was reported in all sectors and sizes of hospitals, except for hospitals in the 50 to 200 bed size range and hospitals in the Atlantic Provinces.

The use of specific dosage alerts is an example of clinical decision making support. The survey reviewed the availability of this functionality, the extent of use, and the presence or absence of policies governing how pharmacists respond to alerts. Among the 150 respondents that reported having clinical decision support within their pharmacy information system:

- Almost all respondents (149/150) indicated that their pharmacy information system had drug allergy alerts and 98% reported that the functionality was in use, similar to the 2005 /06 survey. However, only 21% (30/141) reported that they had an override policy to guide staff action in situations where the system user disregards the warning of an apparent drug allergy. Respondents from BC (36%, 8/22) and the Atlantic provinces (31%, 4/13) were more likely to report that they had an override policy than were respondents from other provinces (16-18%).

- All respondents reported that their pharmacy information system had drug interaction alert functionality and 99% of respondents reported that the drug interaction alert functionality was in use. However, only 16% (23/143) reported that they had an override policy for drug interaction alerts.

Appropriate dosing of drugs in patients with renal or hepatic impairment is important for achieving optimal patient outcomes and the avoidance of toxicity. Some studies in the literature indicate that the most common medication error is excessive dosing in patients with reduced hepatic and renal function.[6]

- There was a considerable increase in the percentage of respondents (61%) who reported that their pharmacy information system had clinical decision support functionality with alerts when patients with renal dysfunction are prescribed certain drugs requiring dosage modification as renal function declines. This compares to 46% (54/118) who reported that their systems had this functionality in 2005/06. Of those with this functionality, 67% reported that the functionality was being used, compared to 59% (32/54) in 2005/06. Eight respondents reported that they had an override policy for dosage alerts for renal dysfunction.
- Thirty-eight percent of respondents in 2007/08, compared with 33% (39/118) in 2005/06, reported that their pharmacy information system included clinical decision support functionality with alerts when patients with hepatic dysfunction are prescribed drugs requiring dosage modification in the presence of hepatic dysfunction. Only 21% (11/55) of the respondents with this alert capability reported that they used the functionality, a number that remained unchanged since 2005/06.
- Seventy-three percent of respondents reported that their PIS had the capability to provide maximum dose alerts for adults. Of the respondents reporting this capability, only 28% reported that this functionality was in use. Only 5 respondents reported that they had an override policy in place.
- Sixty percent of respondents reported they have maximum dose alerts for cytotoxic oncology drugs, though only 29% reported that the functionality was in use and, of these respo*n*dents, only 4 reported that they had an override policy for oncology drug alerts. There was little difference in these responses, compared to the 2005/06 survey.
- Sixty-five percent of respondents reported that they had clinical decision support functionality for maximum dose alerts in neonates/pediatrics. Of these, 30% reported that the functionality was in use and only 4 respondents reported that they had an override policy. Respondents from the Prairies (8%, 1/12) were less likely to report use of this functionality than those from other provinces.
- The ability to input patient specific variables (e.g. creatinine clearance) that would be used by the system to calculate patient specific dosing was reported to be available by 51% of respondents, similar to 2005/06 (49%, 58/118). Of these respondents, 84% reported the functionality was in use, representing a slight increase in the percentage of respondents reporting use of this capability since 2005/06 (79%, 46/58).
- Twenty-four percent of respondents reported that their system had the ability to provide drug therapy guidance alerts, based on evidence-based guidelines or clinical pathways. Of these respondents, 49% reported that this functionality was in use.
- Overall, almost a quarter of respondents (23%, 35/150) reported the hospital has an override policy for alerts generated by the pharmacy information system. Teaching hospitals were more likely to report having a policy (36%, 13/36) compared with non-teaching hospitals (19%, 22/114). There were no provincial or bed size differences. Of those with hospital override policies, 29% (8/28) reported that they had specific alerts that were not permitted to be overridden and 54% (15/28) reported they required a documented reason for high-risk overrides. Almost 36% (10/28) reported that they required electronic tracking of overrides. Four respondents indicated that they required audit and follow up of overrides, of which 3 respondents reported this review is conducted by pharmacy personnel and 1 respondent reported the review was conducted by a committee responsible for patient safety.

Reasons given for not using the available functionality of pharmacy information systems include concerns related to the clinical significance of the alert 53% (59/111), insufficient pharmacist time 39% (43/111), out-of-date databases 14% (16/111) and because physicians rarely made any changes when notified of the alert 5% (5/111). Additional reported reasons for variable use of these alerts include:

- use of a computerized prescriber order entry system for this functionality
- lack of a database in the pharmacy information system to drive the functionality
- lack of integration with other modules, such as the lab system, that is necessary to enable dosing alerts such as those based on renal function
- lack of patient demographic information such as patient weight, age, etc.
- technicians perform order entry but have insufficient knowledge to act on alerts

The use of automated, computer-driven alerts can be a useful tool, both for improving patient safety and for enhancing evidence-based care. However, the results of this survey suggest that the full potential of computerized decision support systems is not being realized. The barriers to achieving the full benefits of these systems need to be examined and addressed.

Table H-1. Pharmacy Information System 2007/08

	____	Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(164)	(34)	(89)	(41)	(39)	(125)
PIS includes a clinical decision support system	150 91%	30 88%	83 93%	37 90%	36 92%	114 91%
Drug allergy alerts -- available (n=149)	149 100%	30 100%	82 100%	37 100%	36 100%	113 100%
Drug allergy alerts -- in use (n=146)	143 98%	28 100%	80 98%	35 97%	34 94%	109 99%
Drug interaction alerts -- available (n=150)	150 100%	30 100%	83 100%	37 100%	36 100%	114 100%
Drug interaction alerts -- in use (n=147)	145 99%	28 100%	81 98%	36 100%	36 100%	109 98%
Maximum dose alerts for adults -- available (n=145)	106 73%	24 80%	56 70%	26 74%	28 80%	78 71%
Maximum dose alerts for adults -- in use (n=102)	29 28%	5 22%	18 32%	6 26%	7 25%	22 30%
Maximum dose alerts for pediatrics / neonates -- available (n=144)	94 65%	21 72%	48 60%	25 71%	23 66%	71 65%
Maximum dose alerts for pediatrics / neonates -- in use (n=90)	27 30%	3 15%	18 38%	6 27%	5 22%	22 33%
Maximum dose alerts for cytotoxic oncology drugs -- available (n=146)	88 60%	21 70%	46 58%	21 58%	25 69%	63 57%
Maximum dose alerts for cytotoxic oncology drugs -- in use (n=85)	25 29%	4 20%	16 35%	5 26%	8 32%	17 28%
Maximum dose alerts for other selected drugs -- available (n=145)	93 64%	22 73%	50 63%	21 60%	25 69%	68 62%
Maximum dose alerts for other selected drugs -- in use (n=90)	30 33%	6 29%	18 36%	6 32%	11 44%	19 29%
Dosage modification alerts for patients with renal dysfunction -- available (n=147)	90 61%	16 53%	52 64%	22 61%	15 42%	75 68%
Dosage modification alerts for patients with renal dysfunction -- in use (n=87)	58 67%	9 60%	38 73%	11 55%	6 40%	52 72%
Dosage modification alerts for patients with hepatic dysfunction -- available (n=144)	55 38%	12 40%	26 33%	17 47%	10 29%	45 41%
Dosage modification alerts for patients with hepatic dysfunction -- in use (n=52)	11 21%	2 18%	6 23%	3 20%	0 0%	11 26%
Drug therapy guidance based on evidence/clinical pathways -- available (n=148)	36 24%	7 23%	19 23%	10 27%	6 17%	30 27%
Drug therapy guidance based on evidence/clinical pathways -- in use (n=35)	17 49%	2 29%	10 53%	5 56%	4 67%	13 45%
Ability to input patient-specific variables -- available (n=149)	76 51%	15 50%	39 48%	22 59%	13 36%	63 56%
Ability to input patient-specific variables -- in use (n=73)	61 84%	9 64%	34 87%	18 90%	11 85%	50 83%

LAB TEST RESULTS

Pharmacists require easy access to lab data, at the point of care, in order to optimize drug therapy and avoid the risks related to drug use in patients with renal dysfunction, hepatic dysfunction and other patient-specific clinical situations. Essential activities requiring lab interactions include drug choice, dosing, toxicity assessment, and drug-lab test interaction.[7] The benefit is two- way; not only is there a benefit related to the pharmacist's ability to manage drug dosing and track lab test changes over time, lab test interpretation could also be improved if laboratory personnel and clinicians interpreting lab test results were aware of the drugs that patients were taking. For example, one study reported 40% of patients sent for TSH levels were taking drugs that interfere with the lab test[6]. A real time lab-pharmacy interface is the most effective solution for insuring appropriate clinical decision making, by the pharmacist, at the point of order entry. However, as the results of this year's survey indicate, in the majority of hospitals, an integrated pathway is not in place.

- There was no change since 2005/06 in the number of respondents who reported that their pharmacists can access lab test results through interfaced lab- pharmacy systems (35%), or in the number of hospitals that reported that they had view-only, electronic access to laboratory data from computer terminals within the pharmacy, using a separate log-in (61%).

- Eight hospitals reported that they use a paper based system (e.g. the patient's paper-based medical record) to access lab data in 2007/08

Table H-2. Pharmacy Access to Lab Results 2007/08

	____	Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(165)	(35)	(89)	(41)	(39)	(126)
Pharmacists are provided with access to laboratory test results through						
Lab system interfaced with medication order entry system	57 35%	10 29%	33 37%	14 34%	10 26%	47 37%
View-only access available from pharmacy terminals	100 61%	21 60%	52 58%	27 66%	29 74%	71 56%
Through paper-based medical record only	8 5%	4 11%	4 4%	0 0%	0 0%	8 6%

COMPUTERIZED PRESCRIBER ORDER ENTRY SYSTEMS (CPOE)

Computerized prescriber order entry systems have been reported in the literature to reduce medication related errors, reduce unnecessary lab tests, and improve the efficiency and quality of care.[8] The Leapfrog group named computerized prescriber order entry systems as one of three changes that would result in the most significant improvements in patient safety in the U.S. (others are the presence of intensivists in the intensive care unit and evidence based practice).[9] Challenges related to implementation of computerized prescriber order entry systems include the high financial cost and human resource investment required to successfully implement these systems. Careful planning and well-executed change management strategies are required to ensure the CPOE system is used effectively and does not inadvertently introduce new ways to make errors in the prescribing process. Risks of error include the high percentage of orders that are entered into the CPOE system by someone other than the prescriber (e.g. support staff), since these systems are designed on the premise that an individual with the appropriate knowledge base and decision making authority will respond to the interactive alerts and prompts that are incorporated into the system.

- Implementation of CPOE continues to proceed very slowly across Canada. There has been little change from the previous two surveys in the number of hospitals reporting that they have implemented a computerized prescriber order entry system (9/165 in 2007/08 and 8/142 in 2005/06.

- The percentage of respondents in 2007/08 who reported they have an approved plan to implement a computerized prescriber order entry system was 22% (37/165) similar to 2005/06 23% (33/142) Although this

suggests that almost 1 in 4 hospitals are moving forward with implementation of a computerized prescriber order entry system, the number who have actually done so did not change over the previous two year period between our surveys. It remains to be seen how quickly hospitals will operationalize their intent to adopt a computerized prescriber order entry system.

- Of those with a computerized prescriber order entry system, 5 of 9 respondents reported that their system is not interfaced with the pharmacy information system. This clearly limits the value of such a system, increasing the chance of transcription errors and causing significant duplication of work. Similar results were reported in the 2005/06 survey, suggesting that an interface between the two systems has not been a priority for hospitals with CPOE over the past few years.

Clinical decision support is also an important feature of CPOE systems, and holds the promise of guiding prescribers towards evidence based practice.[10]

- Seven of the nine respondents with an active computerized prescriber order entry system reported that their system guides the use of formulary drugs, weight based dosing, and dosing of medications in special populations. Six of nine reported that their system alerts practitioners to unsafe orders during order entry, and 5 of 9 reported that their system is interfaced with the lab system. Only one respondent reported that their system is integrated with a clinical decision support system that guides the prescriber through established protocols and clinical pathways (Table H-3). The challenges related to implementation of CPOE are also evident in the U.S. where, in 2007, only 17.8% of hospitals reported using a computerized prescriber order entry system and only 12% of hospitals have a system with built-in clinical decision support functionality.

Table H-3. Computerized Prescriber Order Entry Systems 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(165)	(35)	(89)	(41)	(39)	(126)
Computerized Prescriber Order Entry (CPOE) system						
Yes, CPOE operational	9 5%	1 3%	6 7%	2 5%	7 18%	2 2%
No, but approved plan to implement CPOE	37 22%	4 11%	22 25%	11 27%	13 33%	24 19%
No, and no CPOE plan approved	119 72%	30 86%	61 69%	28 68%	19 49%	100 79%
CPOE/PIS Interface (n=)	(9)	(1)	(6)	(2)	(7)	(2)
CPOE is interfaced to PIS (unidirectional)	1 11%	0 0%	1 17%	0 0%	1 14%	0 0%
CPOE is interfaced to PIS (bidirectional)	3 33%	0 0%	3 50%	0 0%	2 29%	1 50%
CPOE is NOT interfaced to PIS	5 56%	1 100%	2 33%	2 100%	4 57%	1 50%
Clinical Decision Support for CPOE						
integrated with a clinical decision support system that guides the user through established protocols and clinical pathways	1 11%	0 0%	0 0%	1 50%	1 14%	0 0%
is interfaced with the lab system to alert practitioners	5 56%	0 0%	4 67%	1 50%	4 57%	1 50%
alerts prescribers to unsafe orders during order entry	6 67%	1 100%	4 67%	1 50%	5 71%	1 50%
guides the use of formulary drugs	7 78%	0 0%	5 83%	2 100%	6 86%	1 50%
guides the use of weight-based or surface area based dosing for selected drugs and/or patient populations	7 78%	1 100%	4 67%	2 100%	5 71%	2 100%
guides the dosing of medications in special populations	7 78%	0 0%	5 83%	2 100%	6 86%	1 50%

WIRELESS NETWORKS

The use of wireless networks to support patient care activities is slowly progressing.

- There was an increase in the number of respondents who reported an operational wireless network within their hospital in this survey compared with 2005/06. Thirty-five percent of the respondents in 2007/08 reported that they had an operational wireless network in place in their organizations, compared to 26% (37/142) of respondents who reported having such a system in 2005/06. There were significant provincial differences in uptake of this technology. In Ontario 72% (33/46) of respondents reported having an operational wireless network, compared with 13-38% in other provinces.
- The wireless network was reported to be used by pharmacy mostly for access to drug information databases (64%), patient profiles (62%), and electronic health records 55%. Forty-three percent also reported using wireless networks for decentralized order entry and 30% reported using this technology for medication reconciliation.

Table H-4. Wireless Network Systems 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(165)	(35)	(89)	(41)	(39)	(126)
Wireless system installed and operable	58	9	34	15	18	40
	35%	26%	38%	37%	46%	32%
(n=)	(47)	(7)	(27)	(13)	(13)	(34)
for decentralized order entry on patient care units	20	1	14	5	7	13
	43%	14%	52%	38%	54%	38%
to access patient drug profiles from the pharmacy information system	29	4	19	6	9	20
	62%	57%	70%	46%	69%	59%
to access electronic health records	26	1	18	7	6	20
	55%	14%	67%	54%	46%	59%
to access drug information databases	30	4	18	8	8	22
	64%	57%	67%	62%	62%	65%
medication reconciliation documentation	14	1	10	3	3	11
	30%	14%	37%	23%	23%	32%
other	18	4	9	5	6	12
	38%	57%	33%	38%	46%	35%

SMART IV PUMPS

Smart pumps are designed to prevent potential adverse events/errors related to the administration of parenterally administered medications. Approximately 39% of medication errors occur during drug administration and this is typically the phase of the medication system where errors are least likely to be intercepted before reaching the patient.[4]

- The numbers of hospitals reporting the use of smart pumps in the 2007/08 survey was surprisingly high for this relatively new technology. Sixty-one percent of respondents (101/165) reported the use of IV smart pumps in their facilities. Non-teaching hospitals (64%) had a higher reported rate of implementation than teaching hospitals (51%). The Atlantic Provinces were less likely to report use of smart pumps than other provinces (25% compared with 50-75%).
- However, many hospitals do not appear to be routinely using the quality control data collected by these pumps to proactively improve the safety of parenteral drug administration process within their facility. Only 36% of respondents with smart pumps reported that they download and review quality control data from pumps at least annually. For those who do review the quality control data collected by their pumps, 71% of respondents reported they had made changes to policies, procedures or pump programming as a result of review of this data. This result supports the value of the quality control data, collected by the pumps, for making improvements in the parenteral drug administration process.

- Forty-three percent of respondents reported that their organization reviews and updates the drug specific pump programming at least annually.
- Only 9% of respondents reported using a wireless network to upload or download information to and from smart pumps.

Table H-5. Smart Pumps 2007/08

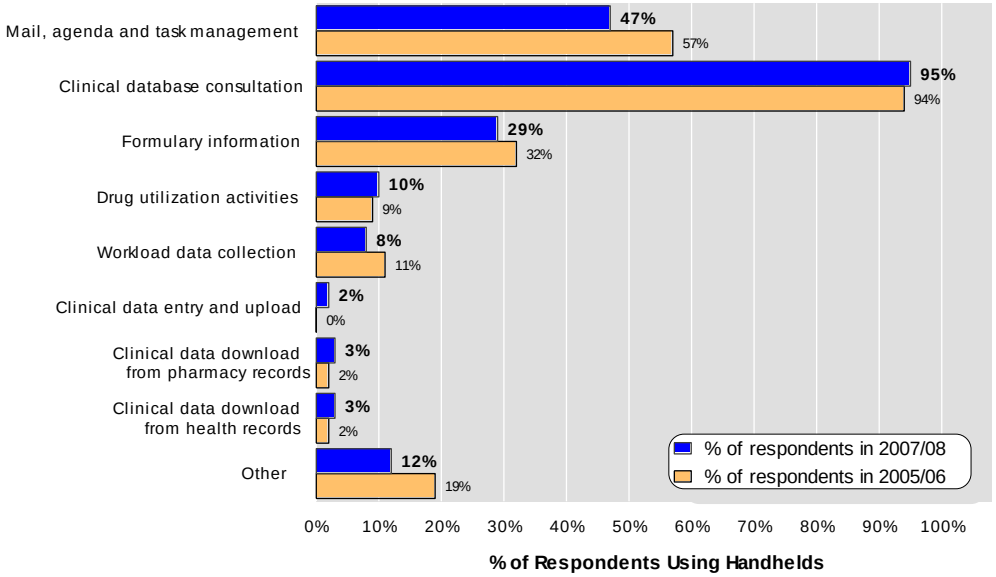
	All	Bed Size			Teaching Status	
		50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(165)	(35)	(89)	(41)	(39)	(126)
Hospital uses IV smart pumps (n=165)	101 61%	14 40%	61 69%	26 63%	20 51%	81 64%
Use of wireless network to upload / download data to smart pumps .. (n=99)	9 9%	1 7%	6 10%	2 8%	2 10%	7 9%
Annual review of smart pumps' drug-specific programming .. (n=99)	43 43%	6 43%	28 47%	9 36%	13 65%	30 38%
Annual review of smart pumps' quality review data .. (n=98)	35 36%	4 29%	25 42%	6 24%	7 35%	28 36%
Facility made changes following the review of the pumps' quality control data (n=31)	22 71%	0 0%	18 78%	4 67%	7 100%	15 63%

HAND HELD DEVICES

Hand held devices hold great promise for facilitating efficient access to information that is either stored on the handheld unit or accessed through wireless networks. This section contains data that was collected in the 2007/08 survey related to the use of hand held devices by pharmacy staff.

- Seventy-three percent of respondents reported the use of hand held devices within their pharmacy department. Similar responses were reported regardless of bed size or teaching status.
- Of those who reported the use of hand held devices by their pharmacy staff, 95% reported that hand held devices were used for data base consultation, 47% reported their use for task management, mail and agenda activities, and 29% reported their use for accessing formulary information. These results were similar to those reported in the 2005/06 survey. Additional uses of handheld devices that were reported included pharmacokinetic calculations, inventory management, access to policies, guidelines, stock lists etc required for on call purposes, clinical monitoring, identification of bar coded compounded solutions, and uploading/downloading of smart pump data and libraries.

Figure H-1. Functions for which handheld devices are used 2007/08



Base: Respondents reporting the use of handheld devices (113 in 2005/06, 120 in 2007/08)

Table H-6. Hand Held Devices 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(165)	(35)	(89)	(41)	(39)	(126)
Handheld devices are used in department	121	24	65	32	29	92
	73%	69%	73%	78%	74%	73%
Handheld devices are used for (n=)	(120)	(24)	(65)	(31)	(29)	(91)
Clinical data download from computerized pharmacy records	4	0	3	1	1	3
	3%	0%	5%	3%	3%	3%
Clinical data download from computerized health records	4	0	4	0	1	3
	3%	0%	6%	0%	3%	3%
Clinical data entry and upload to pharmacy or health records	2	0	2	0	1	1
	2%	0%	3%	0%	3%	1%
Clinical database consultation (Micromedex, Lexicomp)	114	24	61	29	27	87
	95%	100%	94%	94%	93%	96%
Drug utilization activities	12	1	8	3	4	8
	10%	4%	12%	10%	14%	9%
Formulary information	35	4	24	7	9	26
	29%	17%	37%	23%	31%	29%
Workload data collection	9	0	6	3	2	7
	8%	0%	9%	10%	7%	8%
Mail, agenda and task management (Outlook, Lotus Notes)	56	15	26	15	14	42
	47%	63%	40%	48%	48%	46%
Other	14	0	10	4	5	9
	12%	0%	15%	13%	17%	10%

BAR CODING

The use of bar codes is rapidly expanding in the pharmaceutical industry. The Veteran Affairs healthcare organization in the U.S has considerable experience in the use of bar codes within hospitals. The VA association has developed a Bar Code Resource Office to support bar code implementation and expansion, and to ensure consistency and integration throughout their network of hospitals. International working groups including the pharmaceutical industry, providers of non-pharmaceutical supplies, hospitals, legislators and the Institute for Safe Medication Practice (ISMP) are actively collaborating to develop global standards for pharmaceutical bar code applications. ISMP Canada and the Canadian Patient Safety Institute (CPSI) are collaborating with Health Canada, professional groups, hospitals, supply chain and pharmaceutical industry, group purchasing organizations and other stakeholders to develop a Canadian bar code standard. Many suppliers now include bar codes on the packaging for medications, and others are considering this application. The availability of readable bar codes on unit of use products will enhance the opportunity to realize the safety potential of bar-code scanning technologies.

- Thirty-seven percent of respondents reported the use of bar codes in the medication use system, similar to the response in the 2005/06 survey. The response was higher in teaching hospitals (56%), than non-teaching hospitals (30%), and in the Atlantic Provinces (56%, 9/16) and BC (46%, 10/22), compared with other provinces.

- Within the 60 hospitals that reported the use of bar coding, the most common uses were for returning doses to inventory (38%), verifying drug selection from pharmacy (31%), verifying stocking of unit dose bins (22%), and verifying stocking of automated dispensing cabinets (24%). These responses are very similar to those in the 2005/06 survey. Very little use of bar code scanning was reported for patient specific activities such as patient identification prior to drug administration (2 respondents), drug identification prior to administration to the patient (1 respondent) and the transfer of patient and/or drug specific information to smart pumps (1 respondent).

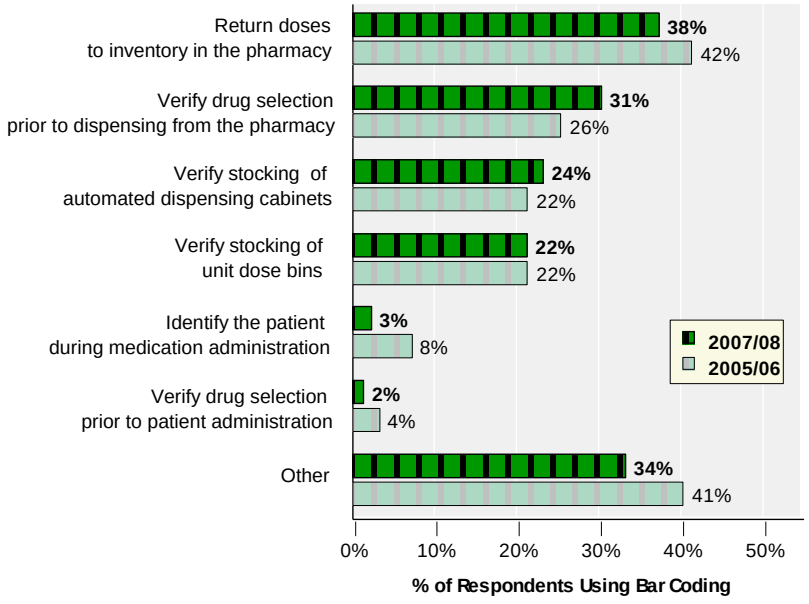
The slow adoption of this technology may be a symptom of the difficulty in both implementing and maintaining these systems. Some of these issues include the financial cost of implementation, the human resources required to maintain the bar code data within the hospital computer system, software incompatibility

with Canadian bar codes, and the requirement for packaging technology that can handle bar-codes as part of the labeling process. A recent study on technology in the U.S reported that over 25% of doses need to be re-packaged in order to apply the necessary, readable bar codes, which represent a considerable burden to organizations.[10]

Table H-7. Bar Coding 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=164)	(164)	(35)	(89)	(40)	(39)	(125)
Bar Coding is used in the Medication System	60 37%	9 26%	32 36%	19 48%	22 56%	38 30%
Bar Coding is used in the medication System to (n=)	(58)	(9)	(31)	(18)	(21)	(37)
verify drug selection prior to dispensing from the pharmacy	18 31%	4 44%	9 29%	5 28%	5 24%	13 35%
verify drug selection prior to patient administration	1 2%	0 0%	1 3%	0 0%	0 0%	1 3%
identify the patient during medication administration	2 3%	0 0%	1 3%	1 6%	0 0%	2 5%
return doses to inventory in the pharmacy	22 38%	2 22%	13 42%	7 39%	6 29%	16 43%
verify stocking of unit dose bins	13 22%	1 11%	5 16%	7 39%	4 19%	9 24%
verify stocking of automated dispensing cabinets	14 24%	2 22%	8 26%	4 22%	8 38%	6 16%
transfer patient and/or drug specific information to smart pumps	1 2%	0 0%	1 3%	0 0%	1 5%	0 0%
other	20 34%	4 44%	8 26%	8 44%	8 38%	12 32%

Figure H-2. Uses of Bar Coding 2007/08



Base: Respondents reporting use of bar coding in medication system (50 in 2005/06, 58 in 2007/08)

CONCLUSION

Each of the technologies described above contribute to the improvement of patient safety at the point of care. However, hospitals are only slowly adopting these technological advancements. The greatest gains in the last

couple of years have been made in the availability of wireless networks and smart pumps, perhaps due to the relatively lower implementation costs associated with these technologies. However even these applications are underutilized. Bates reports that many errors, including but not limited to medication errors, could be prevented using electronic systems with prescribing guidance and controls.[2] Other literature supports this recommendation. Accreditation Canada is focusing more extensively on medication safety. Hospitals need to evaluate the efficiency and patient safety benefits of technology, and weigh those against the costs of adopting these technological support systems. It is hoped that this process will result in a higher priority being given to the implementation of these technologies.

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