D - DRUG DISTRIBUTION SYSTEMS

JANET HARDING

ORAL MEDICATION SYSTEMS

Drug distribution systems in the hospital setting should ideally prevent medication errors from occurring. When errors do occur, the system should facilitate their early detection, enabling corrective steps to be taken to prevent their recurrence and to minimize any adverse effects on the patient. Hospital drug distribution systems should also facilitate the appropriate allocation and use of available resources. The unit-dose drug distribution system is endorsed by The Canadian Society of Hospital Pharmacists as the drug distribution system of choice in organized healthcare settings because it provides improvements in medication safety, overall system efficiency, job satisfaction, and effective use of human resources.[1]

- Centralized unit dose systems, in which unit dose medications are selected and assembled in the pharmacy department, for each patient, were reported to be in use by 64% (103/162) of all respondents (Table D-1). For hospitals with 201-500 beds and for hospitals with more than 500 beds, there was little change in the per cent of respondents reporting use of centralized unit dose systems in 2007/08, compared to the results of the 2005/06 survey. The per cent of respondents reporting the use of centralized unit dose systems in hospitals with 100-200 beds was 48% (13/27) in 2005/06 compared to 36% (12/33) of hospitals with 50-200 beds in 2007/08. The inclusion of smaller hospitals in the 2007/08 survey may have contributed to this change.

- Regional differences in the use of centralized unit dose systems were noted with 48% (10/21) of respondents reporting a unit dose system in B.C., 50% (8/16) in Atlantic Canada, 66% (33/50) in Quebec, 67% (30/45) in Ontario and 73% (22/30) in the Prairies.

- The number of respondents reporting the use of automation in a centralized unit dose system was 66% (65/98) in 2005/06, compared to 75% (77/102) in 2007/08.

- Among respondents who reported using centralized automated dispensing systems, 94% (72/77) use a canister type system and 12% (9/77) use a robotic system (four respondents in Ontario, three in Quebec and one in each of B.C. and Atlantic Canada).

- Decentralized automated unit dose systems were reported by 36% (59/162) of respondents. Of the 59 respondents who reported the use of decentralized automated unit dose systems, 43 respondents indicated the percentage of beds serviced with these cabinets. It is possible that the 16 respondents who did not provide information on the percentage of beds serviced are only using the cabinets in areas like the emergency room and operating room, where there are no “inpatient beds”. Fifty one of the 59 respondents reporting use of decentralized automated unit dose systems provided information on the location where the cabinets are used (e.g. general inpatient units, operating room, etc.) and 8 respondents provided no information on the location or % of beds serviced with these systems.

- Among the 51 respondents reporting the use and location of decentralized, automated unit dose systems, 80% (41/51) reported that they use the technology in the emergency department, 51% (26/51) use it in critical care units for regularly scheduled medications, 49% (25/51) use it in critical care units only for narcotics and/or wardstock, 49% (25/51) use it in the operating room, 28% (14/51) use it in general inpatient units for regularly scheduled medications, 39% (20/51) use it in general inpatient units only for narcotics and/or wardstock, and 43% (22/51) use it in the recovery room.

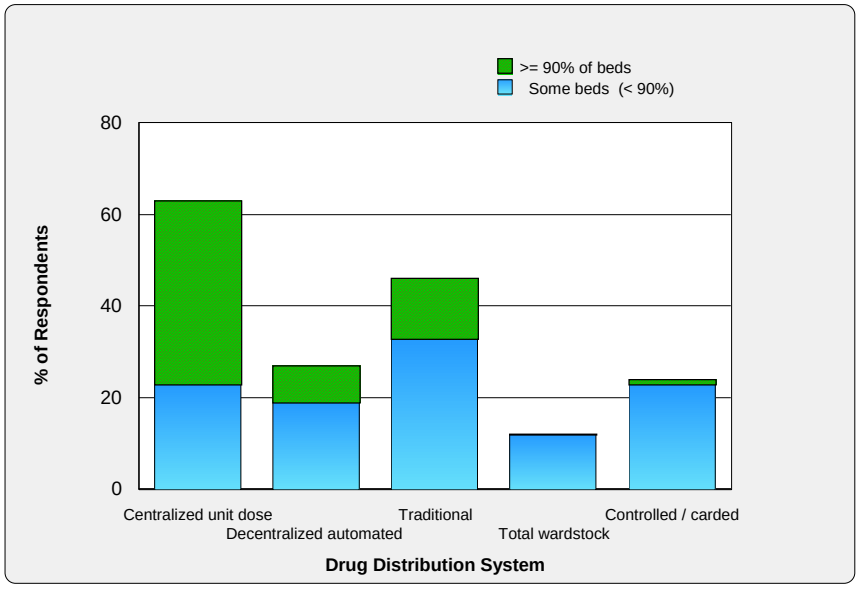
- Forty eight percent (78/162) of respondents reported that they provide unit dose drug distribution to 90% or more of the beds within their hospital, using either centralized or decentralized unit dose systems. These comprehensive unit dose systems continue to be more common in larger hospitals (Table D-1).

- Traditional drug distribution systems were reported to be in use for 90% or more of beds within the hospital by 13% (21/162) of all respondents (Figure D-1).

Table D-1. Drug Distribution Systems 2007/08

		Bed Size			Teaching	
	All	50 - 200	201- 500	>500	Teach	Non-Teaching
Hospitals (n=)	(162)	(33)	(89)	(40)	(40)	(122)
Centralized unit dose	103	12	59	32	29	74
	64%	36%	66%	80%	73%	61%
>= 90% of beds	65	8	38	19	17	48
	40%	24%	43%	48%	43%	39%
Some beds (< 90%)	38	4	21	13	12	26
	23%	12%	24%	33%	30%	21%
Decentralized automated unit dose	43	4	24	15	18	25
	27%	12%	27%	38%	45%	20%
>= 90% of beds	13	4	8	1	4	9
	8%	12%	9%	3%	10%	7%
Some beds (< 90%)	30	0	16	14	14	16
	19%	0%	18%	35%	35%	13%
Traditional	74	17	38	19	18	56
	46%	52%	43%	48%	45%	46%
>= 90% of beds	21	9	9	3	5	16
	13%	27%	10%	8%	13%	13%
Some beds (< 90%)	53	8	29	16	13	40
	33%	24%	33%	40%	33%	33%
Total wardstock	19	5	11	3	3	16
	12%	15%	12%	8%	8%	13%
>= 90% of beds	0	0	0	0	0	0
	0%	0%	0%	0%	0%	0%
Some beds (< 90%)	19	5	11	3	3	16
	12%	15%	12%	8%	8%	13%
Controlled/ carded dose	40	12	23	5	3	37
	25%	36%	26%	13%	8%	30%
>= 90% of beds	2	2	0	0	0	2
	1%	6%	0%	0%	0%	2%
Some beds (< 90%)	38	10	23	5	3	35
	23%	30%	26%	13%	8%	29%
One system for oral medication for >= 90% of beds	101	23	55	23	26	75
	62%	70%	62%	58%	65%	61%

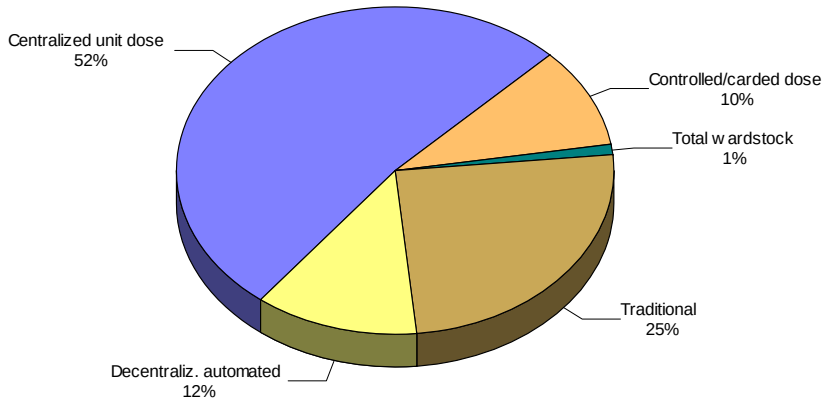
Figure D-1. Drug Distribution Systems 2007/08



Base: Facilities that provided drug distribution system information (162)

- Combined data from all respondents indicated that 74% of beds within the hospitals captured by this survey were serviced with either a centralized unit dose system, a decentralized automated unit dose system, or a controlled/carded dose system, while 26% of beds were serviced with traditional or total wardstock drug distribution systems (Figure D-2).

Figure D-2. Proportion of Beds Serviced by Each Drug Distribution System 2007/08



Base: Facilities that provided drug distribution information (162)

The reported use of centralized unit dose distribution systems and decentralized automated unit dose systems indicates that pharmacists are playing a leadership role in implementing and managing improved drug distribution systems that enhance patient safety and contribute to nursing efficiencies.[2] The use of decentralized automated unit dose systems in emergency departments, critical care areas and operating rooms suggests that some pharmacy departments are primarily employing this type of automation in areas that typically rely on extensive floorstock supplies. Although combined data indicates that 74% of beds overall receive the benefits of unit dose drug distribution, only 49% of respondents indicated that unit dose systems (centralized, decentralized automated, and controlled/carded dose) are being used for equal to or greater than 90% of the beds in their hospital. This indicates that there continues to be an opportunity to improve drug distribution systems in Canadian hospitals.

MEDICATION ORDER ENTRY AND VERIFICATION

- Pharmacists and pharmacy technicians continue to be reported as the categories of personnel who most frequently perform medication order entry (Table D-2). The percentage of respondents reporting that pharmacy technicians enter medication orders into the pharmacy information system has remained relatively constant at 78% (113/144) in 2003/04, 78% (111/142) in 2005/06, and 81% (134/166) in 2007/08.

- Medication order entry by pharmacy technicians was reported by 100% (51/51) of respondents in Quebec, 91% (20/22) of respondents in B.C., 74% (34/46) of respondents in Ontario, 69% (11/16) of respondents in Atlantic Canada, and 58% (18/31) of respondents in the Prairies.

- Twenty-seven percent (36/132) of respondents reported that pharmacists review and pre-authorize medication orders before a pharmacy technician is permitted to enter the order into the pharmacy information system.

Verification of medication order entry confirms that the entry in the pharmacy information system matches the intended medication order and ensures transcription and/or key-punching accuracy. It is worth noting that in 2003, nearly 15% of the error records (34,740 out of 235,159) reported to the USP MEDMARX program involved the use of a computer system. Computer entry errors, involving the incomplete or incorrect entry of information into a computer system used to support the medication use process, were the 4th leading cause of error in that year, cited in more than 27,000 records."[3] Pharmacists should be aware of the contribution of

computer entry to the errors in their hospitals and should ensure that there are adequate checks in the drug distribution system to prevent these errors from reaching the patient.

- Among respondents who reported that medication orders were entered by pharmacy technicians, 80% (105/131) reported that technician-entered orders were verified only by a pharmacist; 11% (15/131) reported that either a pharmacist or a second pharmacy technician verified technician-entered orders, 2% (3/131) reported that a second technician only was involved in verifying technician-entered orders, and 6% (8/131) reported that no verification was required for technician-entered orders.

- Among respondents who reported pharmacist medication order entry, 23% (25/110) reported that pharmacist-entered orders were verified only by a second pharmacist, 12% (13/110) reported that either a second pharmacist or a pharmacy technician verified pharmacist-entered orders, 5% (5/110) reported that a pharmacy technician only was involved in verifying pharmacist-entered orders, and 61% (67/110) reported that verification of a pharmacist's order entry was not required. (Table D-2).

Table D-2. Medication Order Entry 2007/08

		Bed Size			Teaching Status	
	All	**50 - 200**	**201- 500**	**>500**	**Teaching**	**Non-Teaching**
Hospitals (n=)	(166)	(35)	(90)	(41)	(40)	(126)
Orders entered by pharmacists	115 69%	25 71%	61 68%	29 71%	30 75%	85 67%
Verified by (n=110)						
A second pharmacist only	25 23%	4 16%	18 32%	3 11%	5 17%	20 25%
Either a second pharmacist or a pharmacy technician	13 12%	3 12%	7 12%	3 11%	3 10%	10 13%
A pharmacy technician only	5 5%	1 4%	4 7%	0 0%	2 7%	3 4%
Verification of a pharmacist order entry is not required	67 61%	17 68%	28 49%	22 79%	20 67%	47 59%
Orders entered by technicians (n=166)	134 81%	27 77%	72 80%	35 85%	30 75%	104 83%
Pharmacists review and pre-authorize medication orders (n=132)	36 27%	3 11%	17 24%	16 47%	13 45%	23 22%
Verified by (n=131)						
A pharmacist only	105 80%	20 77%	59 84%	26 74%	22 76%	83 81%
Either a pharmacist or a second pharmacy technician	15 11%	2 8%	7 10%	6 17%	3 10%	12 12%
A second pharmacy technician only	3 2%	1 4%	2 3%	0 0%	1 3%	2 2%
Verification of a pharmacy technician order entry is not required	8 6%	3 12%	2 3%	3 9%	3 10%	5 5%
Orders entered by prescribers, through CPOE (n=166)	7 4%	0 0%	5 6%	2 5%	3 8%	4 3%

PHARMACIST REVIEW OF MEDICATION ORDERS FOR THERAPEUTIC APPROPRIATENESS

The absence of a pharmacist's review of all medication orders for therapeutic appropriateness, prior to administration to the patient, should be of concern to pharmacists, other healthcare providers and the public. The Accreditation Canada Qmentum Program 2010, Managing Medications Standards (11.1) address the need for a pharmacist review of medication orders prior to dispensing.[4] The review is to include the appropriateness of the medication, dose, frequency, and route of administration; any therapeutic duplication; actual or potential allergies or sensitivities; actual or potential interactions; variations from the medication's intended use; and other medication-related issues or concerns. In emergency situations or when there is no pharmacist available, the organization is to establish and follow a process to ensure a review occurs as soon as a pharmacist is available. In the U.S., the Joint Commission on the Accreditation of Healthcare Organizations included a similar requirement in

its 2004 Managing Medication Standards that a pharmacist must review all medication orders before dispensing a medication, accessing it from floor stock, or accessing it from an automated storage and distribution device. A number of companies have sprung up in the US that provide remote review of orders when the pharmacy is closed.[5]

- Ninety-six per cent (160/166) of all respondents reported that the pharmacy was closed for a period of hours each day. Two respondents in B.C., 3 in the Prairies, and 1 in Ontario reported that the pharmacy was open 24 hours a day.

- During the hours that the pharmacy is open, 90% (149/165) of respondents reported that a pharmacist reviews all medication orders for therapeutic appropriateness before a medication is dispensed from the central or a satellite pharmacy, 29% (46/159) reported that a pharmacist reviews all medication orders before medication is accessed from wardstock, and 42% (31/73) of respondents using automated cabinets on the patient care units reported that a pharmacist reviews all medication orders before medication is accessed from an automated cabinet. Regional variation occurs for a pharmacist review of medication orders before a medication is dispensed from the central or a satellite pharmacy; 59% (13/22) of respondents in B.C., 91% (42/46) in Ontario, 94% (29/31) in the Prairies, 94% (15/16) in Atlantic Canada and 98% (50/51) in Quebec reported that this occurs.

- During hours that the pharmacy is closed, 6% (9/159) of respondents reported that an on-call pharmacist reviews medication orders for therapeutic appropriateness before a medication is accessed from a night cupboard or similar after-hours system, 3% (5/155) of respondents reported that an on-call pharmacist review takes place before medication is accessed from wardstock, and 3% (2/79) of respondents using automated cabinets on the patient care units reported that an on-call pharmacist review occurs before medication is accessed from an automated cabinet.

Table D-3. Pharmacist Review of Medication Orders when the Pharmacy is Open or Closed 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201-500	>500	Teaching	Non-teaching
During Hours that the Pharmacy is Open, a pharmacist reviews all medication orders before:						
Medications being dispensed from the central or a satellite pharmacy (n=165)	149	30	81	38	40	109
	90%	86%	91%	93%	100%	87%
Medications being accessed from automated cabinets on the patient care units (n=73)	31	5	15	11	13	18
	42%	38%	39%	50%	50%	38%
Medications being accessed from wardstock (n=159)	46	6	27	13	14	32
	29%	17%	31%	35%	37%	26%
During Hours that the Pharmacy is Closed, a pharmacist reviews all medication orders before:						
Medications being dispensed from a night cupboard or similar (n=159)	9	1	5	3	1	8
	6%	3%	6%	8%	3%	7%
Medications being accessed from automated cabinets on the patient care units (n=79)	2	0	2	0	0	2
	3%	0%	5%	0%	0%	4%
Medications being accessed from wardstock (n=155)	5	0	4	1	1	4
	3%	0%	5%	3%	3%	3%

MEDICATION TICKETS, MEDICATION PROFILES AND MEDICATION ADMINISTRATION RECORDS

Manually prepared medication tickets and medication administration records were once widely used in hospitals as a means of scheduling and managing patients' medication therapy. These systems were error-prone and are no longer used by most hospitals. They have largely been replaced by electronic medication profiles and computer-generated medication administration records.

- The use of manually prepared medication "tickets" or "cards" for 90% or more of beds in the facility was reported by 4% of all respondents and their use for less than 90% of beds in the facility was reported by a further 8% of respondents (Table D-4). Regional variation was apparent, with the use of manually prepared tickets reported by 24% (12/51) of respondents in Quebec, 10% (3/31) of respondents in the Prairies, 9% (4/46) of respondents in Ontario, and 6% (1/16) of respondents in Atlantic Canada. None of the respondents in BC reported the use of medication tickets within their facility.

- The manual preparation of medication administration records was reported by 32% of all respondents; 51% (23/45) of respondents in Ontario, 50% (8/16) in Atlantic Canada, 42% (13/31) in the Prairies, 18% (4/22) in B.C. and 10% (5/51) in Quebec.

Access to a complete medication profile is an important tool for prescribers to have when making decisions concerning drug therapy, and for pharmacists to have when reviewing medication orders.

- Fifty-five per cent of all respondents reported that prescribers have easy and reliable access to a complete medication profile for all patients, when writing medication orders. There was little variation across hospitals of differing bed sizes . However there was regional variation, with prescribers reported to have easy and reliable access to a complete medication profile for all patients by 18% (4/22) of respondents in B.C., 44% (7/16) in Atlantic Canada, 61% (19/31) in the Prairies, 63% (32/51) in Quebec and 65% (30/46) in Ontario.

- Seventy-seven per cent of all respondents reported that pharmacists have easy and reliable access to a complete medication profile for all patients, when reviewing medication orders.

Accreditation Canada states that organizations are responsible for obtaining a medication history for each patient upon admission and for maintaining the medication history and ongoing medication profile in a pharmacy information system. The ongoing medication profile is to include a current list of medications and drug therapy records for each episode of care. When prescribing medications, providers must have access to the medication profile.[6] The Institute for Safe Medication Practices also includes the availability of a complete medication profile as one of its self-assessment items in the Medication Safety Self-Assessment for Hospitals.[7] Although all respondents indicated use of a pharmacy information system, it appears that the role of this technology for providing easy and reliable access to a complete patient medication profile, as well as for generation of Medication Administration Records, is not being fully realized.

Table D-4. Medication Tickets, Medication Profiles and Medication Administration Records 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(166)	(35)	(90)	(41)	(40)	(126)
Manually prepared medication 'tickets' or 'cards' used						
yes (for >= 90% of beds in the facility)	6 4%	1 3%	5 6%	0 0%	0 0%	6 5%
partial (for < 90% of beds in the facility)	14 8%	2 6%	5 6%	7 17%	3 8%	11 9%
Prescribers have access to complete medication profiles						
Yes, ...access to ... profile for all patients	92 55%	20 57%	48 53%	24 59%	18 45%	74 59%
Yes, ...access to ... profile for most patients (50% to 99%) in the facility	62 37%	12 34%	35 39%	15 37%	18 45%	44 35%
Yes, ...access to ... profile for some patients (<50%) in the facility	4 2%	0 0%	4 4%	0 0%	1 3%	3 2%
Pharmacists have access to complete medication profiles						
Yes, ...access to ... profile for all patients	128 77%	27 77%	70 78%	31 76%	30 75%	98 78%
Yes, ...access to ... profile for most patients (50% to 99%) in the facility	35 21%	8 23%	17 19%	10 24%	10 25%	25 20%
Yes, ...access to ... profile for some patients (<50%) in the facility	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%
Medication Administration Records are:						
Manually prepared	53 32%	15 43%	28 31%	10 24%	15 38%	38 30%
Generated in hard copy through the Pharmacy Information System (Documentation is manual)	118 71%	23 66%	63 70%	32 78%	24 60%	94 75%
Electronic, and share a common database with the Pharmacy Information System (Documentation is on line)	11 7%	1 3%	8 9%	2 5%	8 20%	3 2%

TECHNICIAN ROLES

Table D-5 summarizes the functions performed by technicians, indicates whether or not technicians check the work of other technicians who perform these functions, and indicates whether or not a validation program must be completed by the technician prior to performing or checking the specific activity. Validation refers to an internal Pharmacy Department process designed to ensure that a pharmacy technician is qualified to perform a particular task. Validation is based on a defined policy and/or procedure that describes the required training and establishes the objective assessment criteria (e.g. accuracy rate) that are to be used to validate a pharmacy technician's ability to perform a particular task.

Table D-5. Functions Performed by Technicians, Functions Checked by Technicians, and Validation Requirements 2007/08

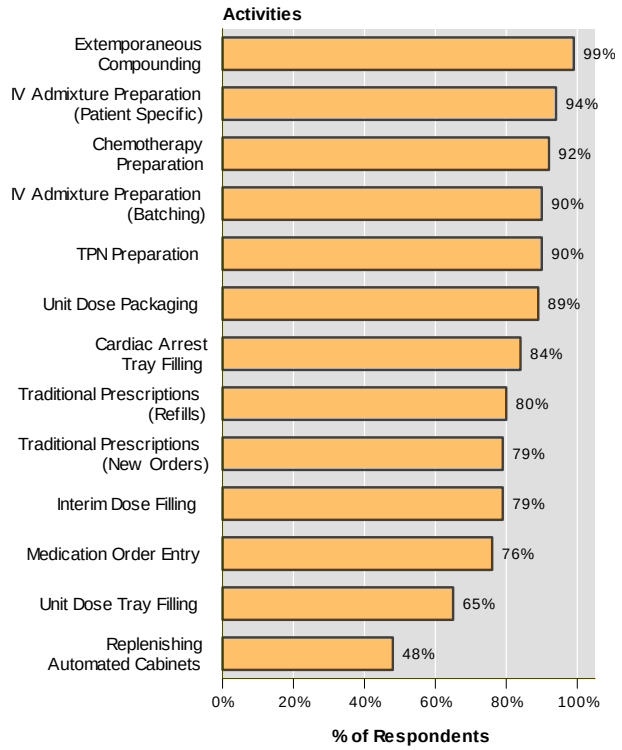
	A Function Performed (n=166)	B Validation required to perform task (n=A)	C Checked by technician (n=A)	D Validation required to check (n=C)
(01) Perform Medication Order Entry	126 76%	72 57%	17 14%	9 53%
(02) Fill Traditional Prescriptions, New Orders	131 79%	61 47%	50 38%	40 80%
(03) Fill Traditional Prescriptions, Refills	132 80%	56 42%	77 58%	67 87%
(04) Package Unit Dose Items	147 89%	73 50%	115 78%	91 79%
(05) Fill Unit Dose Trays	108 65%	56 52%	86 80%	73 85%
(06) Fill Interim Doses	131 79%	66 50%	69 53%	57 83%
(07) Prepare patient-specific IV Admixtures	156 94%	122 78%	51 33%	46 90%
(08) Prepare batch IV Admixtures	150 90%	111 74%	76 51%	69 91%
(09) Prepare TPN Solutions	149 90%	112 75%	34 23%	29 85%
(10) Prepare Chemotherapy	152 92%	121 80%	11 7%	9 82%
(11) Compound Extemporaneous Products	164 99%	80 49%	74 45%	55 74%
(12) Fill Cardiac Arrest Trays	139 84%	67 48%	91 66%	63 69%
(13) Replenish Automated Cabinets	80 48%	38 48%	48 60%	32 67%

A validation process, specific to functions delegated to technicians, is recommended by CSHP.[8,9] Validation ensures technicians are appropriately trained and qualified. It supports the role of technicians checking the work of other technicians and provides a tool for advancing quality in the drug distribution system. In the 2007/08 survey, respondents reported that validation of technicians who check the work of other technicians was more prevalent than validation of technicians who perform that activity, as illustrated in Figure D-5.

- For respondents who indicated that pharmacy technicians performed the functions in Figure D-3, 52% (85/165) indicated that there was a consistently applied policy and procedure for initial validation of pharmacy technicians for 90% or more of the functions performed and a further 31% (51/165) reported this in place for less than 90% of the functions performed. Seventeen per cent (29/165) responded that there was no consistently applied policy and procedure for initial validation for technicians performing these functions.

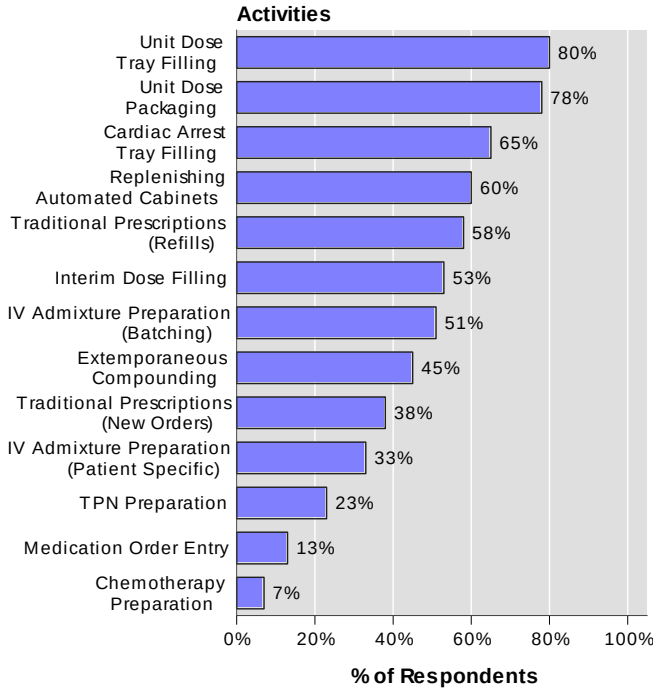
- Of those respondents who reported a consistently applied policy and procedure for initial validation before a technician is permitted to perform a function, 29% (40/136) reported that no re-validation occurs thereafter, 44% (60/136) reported that revalidation occurs for less than 90% of the functions performed and 26% (36/136) reported that revalidation occurs for equal to or greater than 90% of the functions performed.

Figure D-3. Functions Performed by Pharmacy Technicians 2007/08



Base: All respondents (n= 166)

Figure D-4. Technician Functions Checked by Other Technicians 2007/08

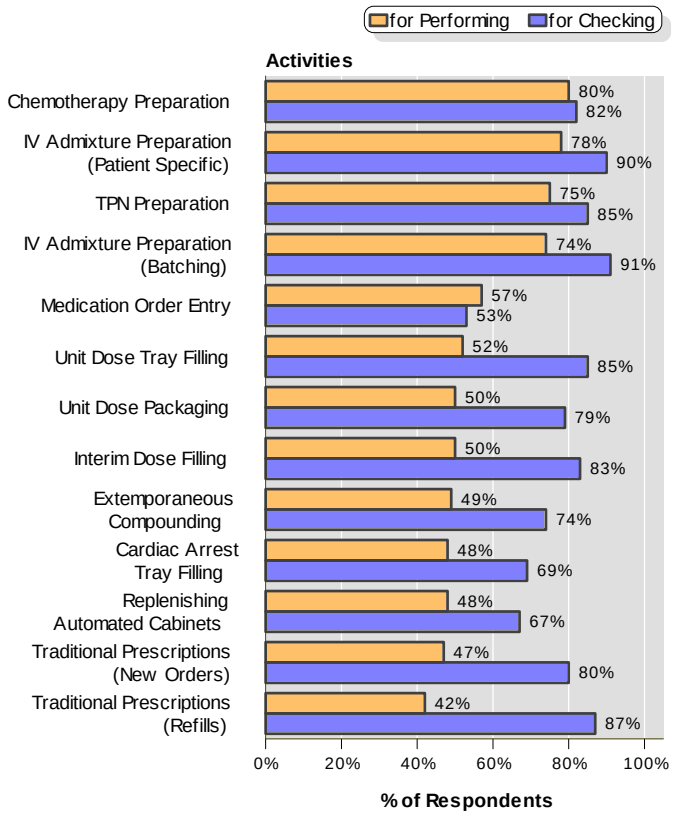


Base: Respondents reporting that function is performed

- For those respondents who reported that pharmacy technicians check the work of other technicians (Figure D-4), 70% (115/165) reported a consistently applied policy and procedure for the initial validation, of pharmacy technicians who check the work of other technicians, for 90% or more of the functions checked, and another 13% (22/165) reported this was in place for less than 90% of the functions checked. Seventeen per cent (28/165) responded that there was no consistently applied policy and procedure for the initial validation of pharmacy technicians who check the work of other technicians.

- Of those respondents who reported a consistently applied policy and procedure for the initial validation of a pharmacy technician checking the work of other pharmacy technicians, 28% (39/137) reported that no revalidation is required, 24% (33/137) reported that revalidation occurs for less than 90% of the checking functions performed and 47% (65/137) reported that revalidation is required for 90% or more of the checking functions performed.

Figure D-5. Technician Validation Requirements for Performing and Checking 2007/08



Base for Performing: Respondents reporting that technicians perform that activity;
Base for Checking: Respondents reporting that technicians check that activity performed by technicians

Certification refers to a Pharmacy Technician credential that is conferred by an organization external to the hospital.

- Certification of pharmacy technicians was reported by 98% (45/46) of respondents in Ontario, 58% (18/31) of respondents in the Prairies, 27% (6/22) of respondents in B.C., 8% (4/50) of respondents in Quebec and 6% (1/16) of respondents in Atlantic Canada. Forty-five per cent of respondents indicated that they employed one or more certified pharmacy technicians.

- Of the 74 respondents indicating that one or more of their pharmacy technicians were certified, 12 gave no response regarding the organization that had conferred the certification. Of the 62 respondents who did provide that information, 65% (40/62) reported that some or all of their technicians possessed certification from the Ontario College of Pharmacists (all of these respondents were from Ontario), 31% (19/62) reported that some or all of their technicians possessed certification from the Pharmacy Technician Certification Board of Alberta (all of these respondents were from the Prairies or B.C.), 6.5% (4/62) reported that some or all of their technicians possessed certification from the US Pharmacy Technician Certification Board and 8% (5/62) reported that some or all of their technicians possessed certification from other organizations. These latter 5 respondents named either technician training programs or the hospital itself; which are not organizations that confer technician certification. This indicates that not all respondents understand the meaning of the term "certification".

- Of the 74 respondents who reported that some of their pharmacy technicians were certified, 4 did not indicate the percentage of pharmacy technicians that possessed certification. Of the remaining 70 respondents, 23% (16/70) reported that greater than 90% of their pharmacy technicians possessed certification, 21% (15/70) reported that 51-90% of their pharmacy technicians possessed certification,

47% (33/70) reported that 10-50% of their pharmacy technicians possessed certification and 9% (6/70) reported that less than 10% of their technicians possessed certification.

The regional differences in technician certification largely reflect provincial differences with respect to the availability of, and regulatory requirement for, pharmacy certification. Ontario is in the process of regulating pharmacy technicians and the Ontario College of Pharmacists now operates a technician certification program. In Alberta, a Technician Certification Board is in place, also as part of the movement in that province towards pharmacy technician regulation.

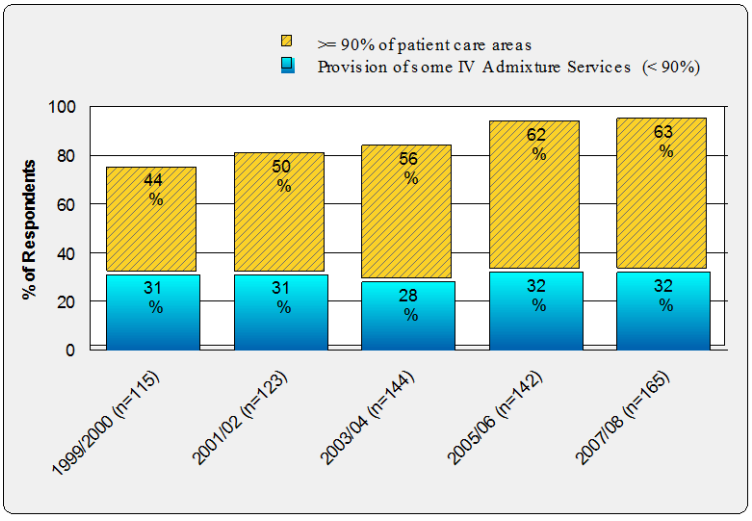
The scope of practise of pharmacy technicians continues to evolve. Making greater use of pharmacy technicians in preparing and delivering drug products is consistent with the profession's move towards having pharmacists focus more of their time on the delivery of direct patient care activities. In the context of a persistent shortage of pharmacists, it is important that technicians be given greater responsibility for the technical aspects of the drug distribution system. The significant number of respondents who reported that technician validation is required for pharmacy technicians who perform a function, and who report that validation is required for technicians who check the work of other technicians, is indicative of an increased awareness of the need to ensure that technicians are adequately trained and prepared for the new functions that they are being assigned. This attention to the changing role of pharmacy technicians is an important step. Ultimately it is anticipated that the accreditation of pharmacy technician training programs, the certification of all technicians by a nationally recognized organization, and the regulation of pharmacy technicians will largely replace the responsibility that individual hospitals now have to test and validate the skills and abilities of their pharmacy technicians.

INTRAVENOUS ADMIXTURE SERVICES

When parenteral doses of medication are not available in a ready to administer form from the manufacturer, the preparation of admixtures by the pharmacy department is the recommended method for ensuring that these parenteral products are therapeutically appropriate, free from microbial/pyrogenic/ particulate contaminants, properly prepared and labelled, and stored and distributed in conformance with accepted standards.[10] It is noteworthy that this recommendation has been in place since 1980. Intravenous admixture services, staffed largely by pharmacy technicians, are also a cost effective alternative to nursing preparation of admixtures on the patient care unit. In an era of persistent nurse shortages, this should be a convincing justification for such a system.

- The percent of respondents reporting the provision of an IV admixture service has increased from 75% of all respondents in 1999/2000 to 94% in 2005/06 and 95% in 2007/08. This upward trend has also occurred for IV admixture services offered to 90% or more of patients or patient care areas (Figure D-6).
- A comprehensive IV admixture service, provided to 90% or more of patients or patient care areas, was reported by 90% (36/40) of respondents in teaching hospitals, and by 54% (68/125) of non-teaching hospitals (Table D-6). A comprehensive IV admixture service was also more commonly reported by respondents in larger hospitals; 76% (31/41) of respondents with more than 500 beds, 65% (58/89) of respondents with 201-500 beds, and 43% (15/35) of respondents with 50 to 200 beds.

Figure D-6. Percentage of IV Admixture Service Providers 1999/00 to 2007/08



Base: All Respondents providing data (165)

- Respondents providing an IV admixture service estimated that an average of 46% of total parenteral (IV, IM, SQ, epidural) doses administered in their institutions were either prepared through the IV admixture service or provided as commercially available, ready to use admixtures.

Table D-6. IV Admixture Services and Averages of Reported Annual Productions 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(165)	(35)	(89)	(41)	(40)	(125)
Provision of Some IV Admixture Services	156	30	86	40	40	116
	95%	86%	97%	98%	100%	93%
Provision of IV admixture services for >= 90% or more of patient care areas	104	15	58	31	36	68
	63%	43%	65%	76%	90%	54%
Automated Compounding Devices Used in Preparation (n=)	(156)	(30)	(86)	(40)	(40)	(116)
	71	9	33	29	34	37
	46%	30%	38%	73%	85%	32%
Average IV production per acute patient day (for facilities serving >= 90%) (n=)	(79)	(12)	(41)	(26)	(32)	(47)
	.82	.87	.84	.77	1.19	.57

- Of the respondents reporting the provision of an IV admixture service, 46% (71/156) reported that automated compounding devices were used in the preparation process. The use of this type of technology is more common in teaching hospitals than in non-teaching hospitals and is more common in hospitals with more than 500 beds (Table D-6).

- Respondents who reported the use of automated compounding devices, indicated that the technology is used to prepare parenteral nutrition solutions (63%, 42/67), large volume parenterals greater than 100mL (54%, 36/67), epidural infusions (27%, 18/67) and a variety of other preparations such as cardioplegia solutions.

A gap analysis is a tool used to identify potential deficiencies in the compounding of sterile preparations. It involves comparing standards for compounding parenteral admixtures, such as those that have been developed by the United States Pharmacopeial Convention (USP Chapter 797), against a hospital's current procedures, equipment and facilities. Although not formally required in Canada, Chapter 797 provides relevant practice and quality standards for compounding sterile preparations. Pharmacists and pharmacy technicians involved in IV admixture services should be aware of these practice and quality standards and make use of them in evaluating their own services.

- Of the respondents reporting the provision of an IV admixture service, 38% (60/156) reported that a gap analysis had been completed. Completion of a gap analysis was more commonly reported by teaching hospitals (60%, 24/40) than non-teaching hospitals (31%, 36/116) and was more commonly reported by hospitals with more than 500 beds (53%, 21/40) than in hospitals with 201-500 beds (34%, 29/86) and in hospitals with 50-200 beds (33%, 10/30).

- Fifty-nine per cent (34/58) of respondents who had completed a gap analysis reported use of the ASHP 797 Compliance Advisor, while a further 8.6% (5/58) had used the USP 797 Gap Analysis Survey from the International Journal of Pharmaceutical Compounding, and another 22% (13/58) of respondents reported that they had made use of an external reviewer or consultant.

CYTOTOXIC ADMIXTURE

Recommendations on the use of biological safety cabinets differ, based on provincial Occupational Health and Safety regulations. Workforce BC Regulations state, "All mixing, preparation and priming of administration sets with a cytotoxic drug must be performed in one centralized area in a specially designated Class II Type B biological safety cabinet that is exhausted to the outside atmosphere in a manner that prevents recirculation into any work area, has exhausts and ventilation systems that remain in operation for a sufficient period of time to ensure that no contaminants escape form the biological safety cabinet into the workplace and is equipped with a

continuous monitoring device to permit confirmation of adequate airflow and cabinet performance." The role of environmental sampling and medical surveillance programs for employees working with cytoxic drugs should be discussed in collaboration with Occupational Health and Safety practitioners. Elements of a medical surveillance program, as well as an overview of biological safety cabinets, can be found in the BCCA Pharmacy Practice Standards for Hazardous Drugs.[11] Pharmacists need to be familiar with the appropriate measures to protect workers from the dangers associated with cytotoxic drugs as well as the standards that exist to insure the safe preparation of these drugs.

Table D-7. Cytotoxic Drugs – Safety Practices and Chemotherapy Preparation Systems 2007/08

		Bed Size			Teaching Status	
	All	50 - 200	201- 500	>500	Teaching	Non-Teaching
Hospitals (n=)	(165)	(35)	(89)	(41)	(40)	(125)
IV cytotoxic drugs prepared and administered by hospital	153 93%	27 77%	87 98%	39 95%	39 98%	114 91%
IV cytotoxic drugs prepared by Pharmacy (n=)	(147) 146 99%	(27) 27 100%	(84) 83 99%	(36) 36 100%	(37) 37 100%	(110) 109 99%
Written policies and procedures to insure employee health and safety (n=)	(138) 95%	(25) 93%	(78) 94%	(35) 97%	(36) 97%	(102) 94%
Definition of cytotoxic drugs	113 82%	24 96%	63 81%	26 74%	32 89%	81 79%
Handling of cytotoxic drugs	131 95%	25 100%	75 96%	31 89%	34 94%	97 95%
Personal protective equipment	132 96%	25 100%	73 94%	34 97%	36 100%	96 94%
Safe practices for administering cytotoxic drugs	123 89%	22 88%	68 87%	33 94%	36 100%	87 85%
Equipment maintenance	113 82%	23 92%	64 82%	26 74%	30 83%	83 81%
Decontamination and cleaning	122 88%	24 96%	70 90%	28 80%	34 94%	88 86%
Waste handling	129 93%	24 96%	73 94%	32 91%	35 97%	94 92%
Response to spills	131 95%	24 96%	73 94%	34 97%	36 100%	95 93%
Environmental sampling	46 33%	6 24%	29 37%	11 31%	9 25%	37 36%
Medical surveillance program in place for employees who handle cytotoxic drugs (n=146)	39 27%	9 33%	19 23%	11 31%	9 24%	30 28%
Cytotoxic drugs prepared using a closed system (n=)	(145)	(27)	(82)	(36)	(37)	(108)
yes, for all drugs	10 7%	1 4%	6 7%	3 8%	3 8%	7 6%
yes, for some drugs	34 23%	8 30%	19 23%	7 19%	7 19%	27 25%
Cytotoxic drugs prepared in an approved Biological Safety Cabinet (n=)	(146)	(27)	(83)	(36)	(37)	(109)
Class II Type A2	25 17%	5 19%	16 20%	4 11%	6 17%	19 17%
Class II Type B1	28 19%	3 11%	18 22%	7 19%	5 14%	23 21%
Class II Type B2	86 59%	16 59%	47 57%	23 64%	20 56%	66 61%
Isolator	1 1%	0 0%	1 1%	0 0%	0 0%	1 1%
Other	5 3%	2 7%	2 2%	1 3%	3 8%	2 2%
Cytotoxic drugs prepared in a separate designated area	121 83%	20 74%	70 85%	31 86%	28 78%	93 85%

- Ninety-three percent (153/165) of all respondents reported that IV cytotoxic drugs were prepared and administered in their facility (Table D-7). Of these respondents, 146 reported that IV cytotoxic doses were prepared in the pharmacy department, one respondent indicated IV cytotoxic doses were not prepared in the pharmacy and 6 respondents did not indicate where IV cytotoxic doses were prepared.

- Among respondents reporting the preparation of IV chemotherapy, 95% (138/146) have written policies and procedures to ensure the health and safety of employees preparing, transporting, administering and disposing of cytotoxic drugs. Between 80 to 95% of respondents reported that they have policies and procedures in place that deal with a variety of topics including waste handling, personal protective equipment and safe practices for administering cytotoxic drugs. A third of respondents reported having policies and procedures that addressed environmental sampling (Table D-7).

- Among respondents reporting the preparation of IV cytotoxic drugs, only 27% (39/146) reported that there is a medical surveillance program in place for employees who handle cytotoxic drugs. There was no appreciable difference in these results between teaching and non-teaching hospitals, or between the 3 groups of small, medium and large hospitals. Regional variation was apparent with 45% (9/20) of respondents in B.C. reporting the presence of such a program, compared to 31% (8/26), in the Prairies, 5% (2/41) in Ontario, 32% (14/44) in Quebec and 40% (6/15) in Atlantic Canada.

- Among respondents reporting the preparation of IV cytotoxic drugs, the use of closed systems for the preparation of some drugs increased from 13% in 2003/04 to 20% in 2005/06 and 23% in 2007/08. The use of closed systems for the preparation of all cytotoxic drugs also increased from 3% in 2003/04 and 2005/06 to 7% in 2007/08.

- A designated separate chemotherapy preparation area was reported by 83% (121/146) of respondents who indicated that their Pharmacy prepared IV cytotoxic doses (Table D-7).

- Among facilities reporting that Pharmacy prepared IV cytotoxic doses, 99% (145/146) reported that these doses were prepared in an approved Biological Safety Cabinet (Table D-7). An isolator intended for asepsis and containment of cytotoxic residue was reported by one respondent in Atlantic Canada.

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