



Drug-Therapy Problems, Inconsistencies and Omissions Identified During a Medication Reconciliation and Seamless Care Service

Ann Nickerson, Neil J. MacKinnon, Nancy Roberts and Lauza Saulnier

Abstract

Seamless care is the desirable continuity of care delivered to a patient in the healthcare system across the spectrum of caregivers and their environments. Medication Reconciliation is one component of seamless pharmaceutical care. A randomized controlled trial, carried out over nine months with a six-month follow-up period, investigated the impact of a pharmacist-directed seamless care service. Intervention patients admitted to one of two general medicine units were subjected to a comprehensive seamless care discharge process as they were discharged from a regional, academically affiliated hospital in Moncton, NB. The number, type and potential clinical impact of drug-therapy problems for seamless monitoring (DTPsm) and drug-therapy inconsistencies and omissions (DTIOs) in hospital discharge medications were measured. A total of 253 patients, with 134 patients in the intervention group and 119 in the control group, completed the study. An average of 3.59 DTPsm per intervention patient, with 72.1% of these being scored as having a significant or very significant clinical impact level, were communicated to community pharmacists. Ninety-nine DTIOs were identified and resolved in intervention patients before discharge. A retrospective medical chart review demonstrated that the intervention resolved almost all DTIOs. In conclusion, a pharmacist-directed seamless care service had a significant impact on drug-related clinical outcomes and processes of care.

INTRODUCTION

In recent years, the average hospital length-of-stay has been shortened and, consequently, patients are being discharged into the community setting and long-term care facilities with a higher level of acuity. Regrettably, in most healthcare models, an effective means of communicating patients' drug therapies upon discharge from the hospital to the community setting has not been established across the continuum of care. This is a critical omission, as during hospitalization drugs may be added or discontinued from a patient's drug regime or dosing may be altered. It has been documented that following hospitalization, up to 40% of medications used at admission are not continued at discharge and up to 45% of medications prescribed at discharge are medications first prescribed to the patient during their hospitalization (Beers et al. 1989). To address deficiencies in these areas, cooperative systems are needed *between* settings (e.g., community and hospital care).

Although the exact terminology may vary, seamless care is a concept that has been widely viewed as being a fundamental component in the optimal delivery of healthcare services. In the profession of pharmacy, *seamless care* has been defined as "... the desirable continuity of care delivered to a patient in the health care system across the spectrum of caregivers and their environments. Pharmacy care is carried out without interrup-

tion such that when one pharmacist ceases to be responsible for the patient's care, another pharmacist or healthcare professional accepts responsibility for the patient's care" (Canadian Society of Hospital Pharmacists and Canadian Pharmacists Association 1998). Seamless care has been argued to be one of the seven most important strategies to improve the medication-use system (MacKinnon 2001). The Canadian Society of Hospital Pharmacists (CSHP) and Canadian Pharmacists Association (CPhA) formed a joint task force on seamless care, and two national workshops were held in 1998 and 2000. In 2003, a "how-to" book on this subject, *Seamless Care: A Pharmacist's Guide to Providing Continuous Care Programs*, was published by CPhA (MacKinnon 2003). In 2004, CSHP released an official statement on seamless care (Canadian Society of Hospital Pharmacists 2004).

Recently, much activity has focused on *medication reconciliation*, a subset of seamless pharmaceutical care. These activities include the adoption of medication reconciliation services in the 2005 Canadian Council on Health Services Accreditation (CCHSA) patient safety goals (Canadian Council on Health Services Accreditation 2004) and in the *Safer Healthcare Now!* campaign of the Canadian Patient Safety Institute (CPSI) (Canadian Patient Safety Institute 2005). "Medication reconciliation is a process which ensures the collection and communication of accurate client/patient medication information. The ultimate goal of medication reconciliation is to facilitate continuity of pharmaceutical care for patients/clients at admission/beginning of service and or at discharge/transition/end of service (Canadian Council on Health Services Accreditation 2005). Medication reconciliation involves clarifying medications a patient is taking (including non-prescription medications) and comparing actual medications taken with records (Institute for Healthcare Improvement 2004). Omissions and inconsistencies found through medication reconciliation will be communicated to necessary healthcare professionals and result in fewer medication errors. Incorporating medication reconciliation into hospital practice is a crucial step towards improving the safety of the medication-use system at transitions of care.

While seamless care, including medication reconciliation, is widely accepted in healthcare at a conceptual level, implementation still has yet to occur in a majority of hospitals to date. Fortunately, this is starting to change with the activity surrounding medication reconciliation (Bussieres 2004). Still, at this time, there is little Canadian data to support the value of these services. The purpose of this study was to evaluate the impact of a pharmacist-directed seamless care service on drug-related clinical outcomes and processes of care.

METHODS

Study Design

This study was a randomized controlled trial, carried out over

nine months with a six-month follow-up period. The study was conducted at The Moncton Hospital, South-East Health Regional Health Authority, Moncton, NB. The Moncton Hospital is a 381-bed regional hospital that provides tertiary care services. Approval was granted by the hospital's research review committee prior to the start of the study.

Study Objectives

While the entire study measured the impact of this pharmacist-directed seamless care service on economic, clinical and humanistic outcomes and processes of care, this present paper focuses solely on drug-related clinical outcomes and processes of care. The randomized controlled study design was created to allow for comparison of the control and intervention groups on the economic and humanistic outcomes.

The specific study objectives were to determine: (1) frequency and potential clinical impact of drug-therapy problems for seamless monitoring (DTPsm) as identified by a seamless care pharmacist at the time of discharge and (2) frequency and potential clinical impact of drug therapy inconsistencies and omissions (DTIOs) in hospital discharge medication orders as identified by the seamless care pharmacist as part of the medication reconciliation process.

Study Population

Patients admitted to one of two family practice units from September 2000 to June 2001 were screened to participate in the study. The inclusion criteria were: family practice patient discharged from 3600 or 4200 (family practice patient units), discharged between 8h00 and 14h00, not discharged to another hospital, prescribed at least one prescription medication at discharge, completion of informed consent form, patient's community pharmacy had signed study participation agreement, and no previous enrollment in the study from a prior admission. Patients were excluded from the study if they were not able to answer the questions needed to complete the study (i.e., the surveys) or if they would not be available for follow-up after their discharge. Once consent was given and a patient was enrolled in the study, the patient was then randomized to the intervention or control group using computer generated random numbers produced by the hospital's Information Technology services. The physician and nursing staff were blinded to the patients' study group allocation to ensure that all patients received the same standard of care while hospitalized. The pharmacist was blinded to the allocation of the patients until the patient intervention at discharge took place.

Study Intervention

At the time of discharge, the patient care unit secretary contacted a designated pharmacy technician to determine if the patient was allocated to the intervention or control group.

Patients in the intervention group were subject to an intervention conducted by a clinical pharmacist (hereafter referred to as the seamless care pharmacist) at the time of discharge, whereas patients in the control group received the hospital's standard of care at discharge. The standard of care at this facility is for a nurse on the unit to perform the discharge counselling and manually transcribe the discharge notes from the patient's medical chart.

Within the intervention group, the seamless care pharmacist carried out the medication reconciliation process by reviewing discharge prescriptions (as written by a physician) and compared these with the Medication Administration Record (MAR) and the patient's medical chart to identify any discrepancies in the discharge orders. This pharmacist also reviewed the intervention patient's drug regime at discharge as part of a comprehensive pharmaceutical care work-up. The pharmacist also identified problems with drug therapy and communicated these to the patient's community pharmacy, hospital staff and family physician(s). Additionally, the seamless care pharmacist performed the medication discharge counselling to all intervention patients and provided them with a medication compliance chart

Drug-Therapy Problems for Seamless Monitoring (DTPsm)

A drug-therapy (related) problem (DTP) can be defined as an event or circumstance involving drug treatment that actually or potentially interferes with the patient experiencing an optimum outcome of medical care (Hepler and Strand 1990). The DTPs were classified into one of the categories previously established by Strand and colleagues (Strand et al. 1990). A research assistant entered all intervention patients' information into the Seamless Solutions Software® (Version 1.1, Seamless Solutions Corp., Winnipeg, Canada), and the data entry was verified by the seamless care pharmacist. Using the software, the pharmacist generated a list of the DTPs for each patient. To facilitate the community pharmacist in monitoring the patient's progress, each DTP was individually supplemented with additional relevant information such as laboratory findings, diagnosis and general patient notes. This provided the community pharmacist with a more complete picture of the patient's drug therapy and medical conditions. With this additional information provided to the community pharmacist for follow-up, the DTP was termed a *Drug Therapy Problem for Seamless Monitoring* (DTPsm) to better reflect its true composition. The complete list of DTPsm was generated for each patient and faxed to their community pharmacist and copied to the family physician at the time of discharge.

All of the DTPsm were scored for their potential clinical impact according to the Intervention Ranking system (Hatoum et al. 1988). Other researchers have used this scale to evaluate

the clinical impact of pharmacists' interventions (Wernick et al. 1996). The Intervention Ranking system has six categories to rank the potential impact of the pharmacist's intervention. The scale is Likert-type and ranges from 1 (*adverse significance*) to 6 (*extremely significant*). The seamless care pharmacist and a second clinical pharmacist independently ranked the DTPsm – the former at the time of discharge and the latter after the patient was discharged. Consensus was reached through discussion when any difference in assignment arose.

Drug-Therapy Inconsistencies and Omissions (DTIOs) at the Time of Discharge

The seamless care pharmacist also carried out a medication reconciliation process by reviewing the intervention patient's discharge medication list as prepared by the physician and/or hardcopies of discharge prescriptions and comparing these with the hospital's computerized MAR for the day of discharge, and progress and consultation notes. Variations between the discharge medication list and the MAR and patient's medical chart were identified and recorded as either a drug-therapy inconsistency or omission. An inconsistency was defined as an alteration in a drug order component occurring between the MAR and discharge medication list. An omission was defined as a deletion of a drug order component occurring between the MAR and the discharge medication list. All variations were further classified into sub-groupings according to the nature of the variation. The sub-groupings are: dose, drug, duration, frequency, and legal. These sub-groupings were chosen based on a previous pilot project (Breau and Nickerson 1998). All DTIOs were completely resolved by the seamless care pharmacist in consultation with the patient's discharge physician before the patient left the hospital. The physician's opinion was considered the gold standard by which it was determined whether a DTIO had actually occurred. Any communication between the seamless care pharmacist and the patient's discharge physician was documented on the patient's medical chart. Each DTIO was also ranked for its potential clinical impact with the same methods (or tool) used for DTPsm.

DTIOs in Intervention and Control Patients – Retrospective Chart Review

The seamless care pharmacist performed a retrospective review of the control patients' (n=119) hospital discharge medication lists and hospital medical charts. The purpose of reviewing the control patients' files retrospectively was to determine their rates of DTIOs and to compare this with the rate in the intervention group. This was done retrospectively as it was viewed that a prospective identification of DTIOs in the control patients that would not be resolved would be unethical. In the retrospective review, the discharge medication list was compared with the patient's medical chart and the MAR at the time of discharge.

Discrepancies between the chart/MAR and the discharge medication list were identified and recorded as either an inconsistency or an omission. DTIOs for this review were also defined in the same manner as for the prospective identification of DTIOs.

A second clinical pharmacist performed a retrospective chart review of the intervention patients. This was done to serve as a validity check that the seamless care pharmacist had properly resolved the DTIOs that were identified and that no DTIOs were missed during the study intervention phase. This process was performed in the same manner as the retrospective chart review of the control patients described above. Since this was a very time-intensive process, it was felt that every sixth chart would be reviewed (n=28), and if many problems were identified with the seamless care pharmacist's interventions, then all the remaining charts would be reviewed.

Statistical Analysis

The intervention patients' drug-related information was entered into Seamless Solutions Software®. All additional data for both the intervention and control patients were compiled in a spreadsheet using Microsoft Windows Excel 2000 (Microsoft Corporation, Redmond, WA). Data analysis was performed using SPSS Version 9.0 (SPSS Inc., Chicago, IL) and JMP Version 4.0 (SAS Institute Inc., Cary, NC). To determine statistical significance, statistical evaluation was performed with mean variables and chi-square tests. A *p* value of less than 0.05 was considered significant.

RESULTS

Over the nine-month enrollment period, 944 patients were screened for the study, with a total of 253 patients meeting the inclusion criteria and completing the study. One hundred thirty-four patients were randomized to the intervention group and 119 to the control group. The demographic characteristics of the two groups are contained in Table 1. Even though the two groups were randomized, the intervention group had a statistically significant greater number of home medication changes, and their mean age, number of medications upon admission and number of co-morbidities

Table 1. Demographic Characteristics of the Intervention and Control Patients

CHARACTERISTIC	INTERVENTION (N=134)	CONTROL (N=119)	STATISTICS +
Gender			
Male	42 (31%)	38 (32%)	NS
Female	92 (69%)	81 (68%)	NS
Mean age (years)	67.3	61.8	P=0.064
Mean hospital length-of-stay (days)	8.05	8.03	NS
Mean number of prescriptions at hospital admission	6.94	6.03	P=0.066
Mean number of prescriptions at hospital discharge	7.88	7.07	NS
Mean number of home medication changes	0.73	0.48	P=0.02
Mean number of co-morbidities	3.45	2.92	P=0.056

+ Chi-square tests

Table 2. Drug-Therapy Problems for Seamless Monitoring (DTPsm) Identified in Intervention Patients

TYPE OF DRUG -THERAPY PROBLEMS FOR SEAMLESS MONITORING	NUMBER OF EVENTS	PERCENTAGE OF ALL EVENTS
Needs additional drug therapy	160	33.3
Compliance (Not receiving drug)	103	21.4
Unnecessary drug therapy	59	12.3
Dosage too low	56	11.6
Wrong drug	37	7.7
Dosage too high	36	7.5
Adverse drug reaction	30	6.2

Table 3. DTPsm and the Potential Clinical Impact of the Pharmacist's Intervention

POTENTIAL CLINICAL IMPACT	NUMBER OF DTPSM IDENTIFIED	PERCENTAGE OF ALL DTPSM
Adverse significance	0	0
Not significant	3	0.6
Somewhat significant	131	27.2
Significant	272	56.6
Very significant	75	15.6
Extremely significant	0	0

ties were marginally significantly greater. No patients were lost in the six-month follow up, and all patients were included in the analysis.

Table 4. Drug-Therapy Inconsistencies and Omissions (DTIOs) at the Time of Discharge in Intervention Patients

NUMBER OF DRUG-THERAPY OMISSIONS & INCONSISTENCIES (DTIOS)	NUMBER OF PATIENTS	PERCENTAGE OF ALL PATIENTS
0	81	60.4
1	28	20.9
2	12	9.0
3	8	9.0
4	3	2.2
5	1	0.7
6	1	0.7

Table 5. Types of DTIOs Identified and Resolved at the Time of Discharge in Intervention Patients

	INCONSISTENCIES			
	DRUG*	DOSE†	FREQUENCY‡	DURATION OF THERAPY§
Total Number Of Events	29	11	5	0
Total Number Of Patients	24	8	3	0
	OMISSIONS			
	DRUG¶	DOSE¶¶	FREQUENCY**	LEGAL‡‡
Total Number Of Events	34	7	1	12
Total Number Of Patients	20	6	1	7

*Example: A patient was receiving metoprolol 100 mg once daily in hospital, but the discharge prescription is for atenolol 100 mg once daily.

†Example: A patient was receiving hydrochlorothiazide 25 mg once daily in hospital, but the discharge medication list reads hydrochlorothiazide 12.5 mg once daily.

‡Example: Rofecoxib 25 mg was dosed once daily on MAR, but the discharge medication list indicated twice daily dosing of the same strength.

§Example: The physician orders amoxicillin for 10 days, but the discharge prescription is only for seven days.

¶Example: A hypertensive patient with fluid retention is receiving continuing therapy with furosemide, but the discharge medication list does not contain a prescription for it.

¶¶Example: A patient's discharge prescription reads omeprazole once daily, but does not indicate its strength.

**Example: A patient's discharge prescription reads ibuprofen 400 mg, but does not include any instructions on how or when to take the medication.

‡‡Example: The doctor's signature may be missing, a part of a patient's name or any other component of a prescription that would render it invalid in the province of filling.

Drug Therapy Problems for Seamless Monitoring (DTPsm)

Within the intervention group (n=134), there were 481 DTPsm identified and communicated to the respective community pharmacists. Of the 134 intervention patients, only five did not have any identifiable DTPsm. The average number of DTPsm per intervention patient was 3.59 (S.D.=2.25). The most frequently identified DTPsm was *needs additional drug therapy* and it accounted for a third of all DTPsm (Table 2). Of the 481 DTPsm identified, only three were deemed *not significant* in terms of their potential clinical impact. The majority (83.8%) of the DTPsm identified by the seamless care pharmacist were *somewhat significant* or *significant*, with the *significant* category accounting for 56.6% of all events (Table 3). The average Intervention Ranking score per pharmacist intervention was 4.16 (S.D.=0.38).

Drug-Therapy Inconsistencies and Omissions (DTIOs) at the time of discharge

It was determined that 53/134 (39.6%) of the intervention patients had a DTIO at the time of discharge (Table 4). Ninety-nine DTIOs were identified and resolved before discharge, an average of 0.74 DTIOs per intervention patient (SD=1.18). A greater number of omissions (54) were identified compared to inconsistencies (45). A detailed breakdown of the resolved inconsistencies and omissions into sub-categories is provided in Table 5. An average potential clinical impact score for each patient with one or more inconsistencies was 4.33 (S.D.=0.69), whereas the average score for omissions was 4.35 (S.D.=0.60). Table 6 depicts the breakdown of resolved inconsistencies and omissions by their potential clinical impact category and score. Ninety of the 99 DTIOs had an Intervention Ranking of *significant* or *very significant*.

Unresolved DTIOs – Retrospective Chart Review of Intervention and Control Patients

In the retrospective medical chart review, it was found that 67/119 (56.3%) of the control patients had a DTIO. There were 19 patients that had an inconsistency and 59 patients that had an omission and 11 patients had both types of errors (Table 7). In the validation check of the seamless care pharmacist's interventions,

only 1 of the 28 (3.6%) randomly selected medical charts of the intervention patients was found to still contain an unresolved DTIO (Table 7). Therefore, further charts were not reviewed, as it appeared the seamless care pharmacist resolved almost all of the DTIOs.

DISCUSSION

By having a pharmacist accept responsibility to facilitate the continuity of pharmaceutical care for patients at hospital discharge, an improvement in the medication-use system was identified and the potential for preventable drug-related morbidities was decreased. In evaluating the results of a pharmacist-directed seamless care service, the pharmacist played a valuable role at the time of discharge in identifying potential and actual DTPsm and resolving DTIOs in hospital discharge medications.

The seamless care pharmacist was able to identify an average of 3.59 DTPsm per intervention patient at discharge. These were either resolved *or* they were potential drug-therapy problems that were communicated to the community pharmacist for follow-up. These numbers allude to the complexity of in-patient medication-use systems and the need for ongoing monitoring of patients post-discharge by their community pharmacist. Hepler and Strand have emphasized that identifying and resolving drug-therapy problems and ongoing monitoring is an integral part of providing pharmaceutical care (Hepler and Strand 1990). As patients move between sites of care, it may become more difficult to monitor the drug-therapy problems identified at the time of discharge and perform proper follow-up procedures. Communicating the patient's DRPs between sites of care, as was done in this study, allows all members of the patient's healthcare team to continually monitor patient progress, modify drug regimes as necessary and perform follow-up consultations, thereby preventing future drug-related morbidities. In our case, the community pharmacists were further aided by the additional information contained in the DTPsm such

Table 6. Drug-Therapy Inconsistencies and Omissions (DTIOs) and Potential Clinical Impact Score

POTENTIAL CLINICAL IMPACT CATEGORY	POTENTIAL CLINICAL IMPACT SCORE	NUMBER OF DTIO	PERCENTAGE OF ALL DTIO
Adverse significance	1	0	0
Not significant	2	0	0
Somewhat significant	3	9	9.1
Significant	4	48	48.5
Very significant	5	42	2.4
Extremely significant	6	0	0

Table 7. Retrospective Chart Review: Unresolved DTIOs in Control and Intervention

OMISSIONS				
GROUP	DRUG	DOSE	FREQUENCY	LEGAL
Control (n=119)	Number of patients 52	Number of patients 10	Number of patients 3	Number of patients 0
	Actual number of events 249	Actual number of events 31	Actual number of events 11	Actual number of events 0
Intervention ¹ (n=28)	Number of patients 0	Number of patients 0	Number of patients 0	Number of patients 0
	Actual number of events 0	Actual number of events 0	Actual number of events 0	Actual number of events 0
INCONSISTENCIES				
GROUP	DRUG	DOSE	FREQUENCY	LEGAL
Control (n=119)	Number of patients 12	Number of patients 6	Number of patients 3	Number of patients 0
	Actual number of events 22	Actual number of events 6	Actual number of events 6	Actual number of events 0
Intervention ¹ (n=28)	Number of patients 0	Number of patients 1	Number of patients 0	Number of patients 0
	Actual number of events 0	Actual number of events 1	Actual number of events 0	Actual number of events 0

¹ Every sixth chart of the intervention patients was reviewed

as laboratory findings, diagnostic information and by having access to the intended medication regime at discharge. The current standard of care does not allow the community pharmacist access to this information. By providing the community pharmacist with this information, they have a more complete clinical picture and are positioned to uncover future potential drug-therapy problems.

Discrepancies between the prescriptions written at discharge and the patient's hospital medications are cause for concern. The retrospective medical chart reviews revealed that 67/119 (56.3%) of the control patients were discharged from the hospital with an inconsistency or omission in the printed medication discharge list, and that the seamless care pharmacist resolved virtually all DTIOs in the intervention patients. The number of discrepancies identified in this study is larger than results reported in previous studies. A 60-day pilot study determined that 5.8% of study patients' discharge prescriptions contained an error, as identified by a clinical pharmacist (Schumock et al. 1994). Wernick and colleagues (1996) conducted a six-week study which evaluated the frequency and types of variances that occurred in patients' discharge prescriptions. Their study reported that 11.9% of the participating patients' discharge prescriptions contained a variance that required an intervention, and, using the same Intervention Ranking system (Hatoum et al. 1988), 48.6% of pharmacist interventions were categorized as *significant* (Wernick et al. 1996). As discussed by others (Schumock et al. 1994; Wernick et al. 1996), comparing rates of prescription discrepancies between studies can be difficult when each study does not use the same definition of discrepancy and the same identification methods. Although the discrepancies identified in this paper are similar in nature to those identified in the previously mentioned studies, they are not classified in exactly the same manner.

... it is clear from the results of this present study that a comprehensive seamless pharmaceutical care program – not solely medication reconciliation – is required to fully optimize the patient's medication regime.

Several barriers will have to be overcome to establish pharmacist-directed seamless care services as a standard of care that patients can expect to receive when they are discharged from a hospital. A service such as this requires significant human and financial resources from the hospital pharmacy department. This can be difficult to justify, given that the benefits of these programs occur outside the walls of the hospital. These programs

will require additional resources in community pharmacies as well. In order for community pharmacists to optimally incorporate the information provided by their hospital colleagues in their practices, they will need to allocate time to perform comprehensive pharmaceutical care work-ups and on-going monitoring. The financial incentives for community pharmacists to participate in these programs are few. Still, despite these barriers, all pharmacists should strive to provide this level of seamless care. A motivation for hospital pharmacists is that the 2005 CCHSA patient safety goals require a hospital to incorporate medication reconciliation in their processes of care. While the inclusion of medication reconciliation into these goals is to be commended, it is clear from the results of this present study that a comprehensive seamless pharmaceutical care program – not solely medication reconciliation – is required to fully optimize the patient's medication regime. Almost five times as many DTPsm were identified and resolved through the pharmacist-directed seamless care service as the number of DTIOs identified and resolved through the medication reconciliation process at the time of discharge.

There are some limitations of this study that need to be considered. The seamless care intervention was carried out by one clinical pharmacist at one hospital site. A multi-pharmacist and multi-centre study would have been preferable to increase the generalizability of the results. This seamless care service only occurred in one direction – from the hospital to the community. In the future, other seamless care evaluations that bridge the gap in the opposite direction should be conducted. An additional limitation is the number of intervention patient medical charts reviewed in the retrospective chart review. As mentioned previously, every sixth intervention patient medical chart was reviewed as opposed to all charts. This was done to "spot-check" the seamless care pharmacist's work to ensure that all DTIOs were actually identified and resolved. In the 28 charts reviewed, only one inconsistency and no omissions were identified; thus, the researchers felt justified in reviewing only a portion of the intervention charts, as the rate of error for the seamless care pharmacist was so low – 1/28. Reviewing the medical charts for all intervention patients would have given a more complete picture but was not feasible due to pharmacist staff shortages at the Moncton Hospital.

CONCLUSION

The interventions performed as part of this pharmacist-directed seamless care service identified and resolved an average of 3.5 DTPsm per patient, and eliminated almost all discrepancies related to DTIOs. Overall, the majority of the issues identified by the seamless care pharmacist were viewed as being significant. This study identified the need to enhance the safety of the medication-use systems and care processes in hospitals that have not established pharmacist-directed seamless care services.

References

Beers M.H., J. Dang, J. Hasegawa and I.Y. Tamai. 1989. "Influence of Hospitalization on Drug Therapy in the Elderly." *J Am Geriatr Soc* 37: 679–83.

Breau, D. and A. Nickerson. 1998. "Seamless Pharmaceutical Care – Linking the Moncton Hospital and the Greater Moncton Community." In *Proceedings of the Seamless Care Workshop*. Canadian Society of Hospital Pharmacists and Canadian Pharmacists Association. Ottawa, ON.

Bussieres, J.J. 2004. "Clinical Pharmacy Services." In *2003/04 Annual Report Hospital Pharmacy in Canada*. Toronto, ON: Eli Lilly Canada. Retrieved August 6, 2005. <http://www.lillyhospitalsurvey.ca/hpc2/content/2004_Report/2003_04_full.pdf>.

Canadian Council on Health Services Accreditation. 2004. "CCHSA Patient Safety Goals and Required Organizational Practices." Ottawa, ON. Retrieved August 6, 2005. <<http://www.cchsa.ca/pdf/PSCommunique2.pdf>>.

Canadian Council on Health Services Accreditation. 2005. "CCHSA Patient/Client Safety Goals & Required Organizational Practices. Frequently Asked Questions - Updated June 6, 2005." Ottawa, ON. Retrieved August 6, 2005. <<http://www.cchsa.ca/pdf/patientsafety-FAQJune062005.pdf>>.

Canadian Patient Safety Institute. 2005. "Safer Healthcare Now!" Edmonton, AB. Retrieved August 6, 2005. <http://www.cpsi-icsp.ca/news_eng/Final-Release-Eng-June28.pdf>.

Canadian Society of Hospital Pharmacists. 2004. Statement on Seamless Care. Ottawa, ON: Author.

Canadian Society of Hospital Pharmacists and Canadian Pharmacists Association. 1998. Proceedings of the Seamless Care Workshop. Ottawa, ON: Author.

Hatoum, H.T., R.A. Hutchinson, K.W. Witte and G.P. Newby. 1988. "Evaluation of the Contribution of Clinical Pharmacists: Inpatient Care and Cost Reduction." *DICP Ann Pharmacother* 22: 252–59.

Hepler, C.D. and L.M. Strand. 1990. "Opportunities and Responsibilities in Pharmaceutical Care." *Am J Hosp Pharm* 47: 533–43.

Institute for Healthcare Improvement. 2004. "Getting Started Kit: Prevent Adverse Drug Events (Medication Reconciliation) How-To Guide." Boston, MA. Retrieved August 6, 2005. <http://www.ihl.org/NR/rdonlyres/47D5AE1C-0B29-4A59-8D58-BABF8F4E829F/0/ADEHowtoGuideFINAL5_25.pdf>.

MacKinnon, N.J. 2001. "Seven Strategies to Strengthen Our Medication-Use System (editorial)." *Can J Hosp Pharm* 54: 72–74.

MacKinnon, N.J. ed. 2003. "Seamless Care: A Pharmacist's Guide to Providing Continuous Care Programs." Ottawa, ON: Canadian Pharmacists Association.

Schumock, G.T., A.J. Guenette, T.V. Keys and R.A. Hutchinson. 1994. "Prescribing Errors for Patients about to Be Discharged from a University Teaching Hospital." *Am J Hosp Pharm* 51: 2288, 2290.

Strand L.M., R.J. Cipolle, P.C. Morley, R. Ramsey and G.D. Lamsam. 1990. "Drug-Related Problems: Their Structure and Function." *DICP Ann Pharmacother* 24: 1093–97.

Wernick, A., C.J. Possidente, E.G. Keller and G. Gilroy. 1996. "Enhancing Continuity of Care Through Pharmacist Review of Discharge Medications." *Hosp Pharm* 31: 672–76.

About the Authors

Ann Nickerson, B.Sc. (Pharm.), is a Clinical Pharmacist, South-East Regional Health Authority in Moncton, NB. She has spoken widely on medication reconciliation and seamless care and still provides these clinical services at The Moncton Hospital.

Neil J. MacKinnon, Ph.D., R.Ph., is the Associate Director for Research and Associate Professor in the College of Pharmacy at Dalhousie University. He has led several studies on medication safety and edited a book published in 2003 by the Canadian Pharmacists Association on seamless care.

Nancy Roberts, B.Sc. (Pharm.), is Vice-President, Planning and Professional Services, South-East Regional Health Authority in Moncton, NB. She is a past-president of the Canadian Society of Hospital Pharmacists (CSHP). She was a member of the joint CSHP/Canadian Pharmacists Association Task Force on Seamless Care.

Lauza Saulnier, B.Sc. (Pharm.), is Chief of Pharmacy Services, South-East Regional Health Authority in Moncton, NB. Lauza heads a pharmacy department, which has been a national leader in medication reconciliation and seamless care, having first participated in a pilot project in the late 1990s.

Corresponding Author: Dr. Neil MacKinnon, 5968 College St., Halifax, NS, Canada, B3H 3J5, Phone: (902) 494-6379, Fax: (902) 494-1396, E-mail: neil.mackinnon@dal.ca

The authors have no declared conflicts of interest.

Acknowledgments: Emily Black, Dianne Breau, Debbie Carson, Christopher Daley, Jennifer Dykeman, Heather Robertson, Margaret Willan and Lesley Zwicker.

Acknowledgement of financial support: Atlantic Blue Cross Care, Canadian Society of Hospital Pharmacists – New Brunswick Branch, Eli Lilly, Friends of The Moncton Hospital, Hoffman LaRoche, Medbuy Corporation, New Brunswick Pharmacists Association, Shoppers Drug Mart, South-East Regional Health Authority.

Acknowledgement of support in kind: Medicare/Prescription Drug Program, Department of Health and Wellness, NB.