

Pharmacist-Managed Toxicology Consult Service at the Ottawa Hospital: Epidemiology of Referrals, Evaluation of Written Consults, and Survey of Past Residents

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INTRODUCTION

The role of clinical pharmacy services in acute care settings such as the emergency department and the intensive care unit (ICU) has been documented since the 1970s. These studies have demonstrated that the participation by pharmacists in direct patient care exerts a positive influence on patient outcomes, cost containment, and prevention of adverse drug reactions.¹⁻¹⁰ In comparison, pharmacy-managed consult services in acute care settings are less common, and the few that have been described in published reports appear to have been limited to the monitoring of specific therapeutic drugs, medication history-taking, and the provision of drug information.^{5,7,8}

SERVICE DESCRIPTION

The Toxicology Consultation Service (TCS) at the General Campus of the Ottawa Hospital, a 482-bed university-affiliated teaching institution, has been operated by the Department of Pharmacy since 1978 and is a major component of the general practice Pharmacy Residency Program. The primary objective of the TCS is to provide verbal and written recommendations regarding toxicologic management and monitoring for referred patients who have presented with drug overdose or any other toxic chemical exposure. The service is available to all medical disciplines and operates 24 h/day every day of the year. The TCS is

staffed by a program coordinator (who is a pharmacist), the residency coordinator (also a pharmacist), a critical care intensivist, a board-certified toxicologist (who is an emergency department physician), 5 pharmacy residents, and 6 to 8 senior clinical pharmacists.

The 5 pharmacy residents who participate in the service each year undergo 12 h of intense training, consisting of didactic and practical sessions and self-directed readings, over the course of 4 weeks at the beginning of the residency program. The topics covered during these training sessions include clinical assessment of a patient who has had an overdose, the process of writing a consultation report, and the epidemiology, clinical presentation, and management of overdoses and toxic exposures involving a variety of agents, including acetylsalicylic acid, acetaminophen, toxic alcohols, sedatives and hypnotics, tricyclic antidepressants and selective serotonin reuptake inhibitors, lithium, theophylline, antihypertensive agents and digoxin, benzodiazepines, barbiturates, recreational and illicit drugs, carbon monoxide, cyanide, and organophosphates. All didactic and practical training sessions are conducted by the senior staff of the TCS.

New pharmacy residents are required to “shadow” outgoing residents for a minimum of 2 consults before taking call alone. Coverage for call duty is ensured through self-scheduling, and the residents are typically on call for 24 h at a time during the week and 48 h on weekends. Outside of regular work hours, the residents



are on call from home. The residents are required to confer with a senior clinical pharmacist on every call, before providing final recommendations to medical staff. Senior pharmacists undergo the same training as pharmacy residents before joining the service. External resources available to TCS participants include a regional drug information service and a provincial poison control centre.

When a patient is referred to the TCS, a pharmacy resident responds, assessing the patient's clinical status, reviewing the patient's medical record, and interacting with the clinical staff and the patient's family to evaluate the cause, severity, and most appropriate management care plan for the exposure, including a determination of the roles of decontamination, antidote therapy if possible, and monitoring parameters. After consulting with a senior pharmacist by telephone, the resident prepares written consultation notes using a standardized toxicology consult form. If the patient is admitted to hospital, the pharmacy resident is not required to monitor the patient throughout the hospital stay, but is required to follow up with the clinical pharmacist responsible for the medical service that has admitted the patient, to facilitate seamless care. Quality assurance and educational initiatives include a review of each written consult by the senior TCS staff person and the program coordinator, with the resident receiving feedback within 24 h. In addition, monthly toxicology rounds focusing on a review of cases and new topics are attended by both residents and senior staff.

EVALUATION OF THE SERVICE

The TCS was evaluated with the following objectives: first, to describe the epidemiology of patients referred to the service over a 1-year period; second, to evaluate written consultation notes for the same 1-year period to determine the presence of components perceived as essential by referring physicians; and third, to survey former pharmacy residents to determine their perceptions of values and skills gained from participating in the program.

This evaluation was approved by the Research and Ethics Board of the Ottawa Hospital.

Epidemiology of Referred Patients

Consecutive patients for whom toxicology consults were sought during the 1-year period from June 2005 to May 2006 were identified prospectively by the residents on call. Data related to demographic characteristics, severity of illness, source of exposure, resource

utilization, clinical outcomes, and recommendations made by the on-call resident were extracted from the written consults, medical records, and laboratory databases. The type of exposure was categorized by drug class. For the same study period, records from the emergency department were screened to determine the proportion of all patients with overdose who presented to the emergency department for whom toxicology consults were requested. The data collected from screening logs consisted of sex, date of presentation, type of overdose, and disposition of the patient.

Toxicology consults were sought for 58 (17%) of the 346 cases of overdose seen in the emergency department during the 1-year period. Forty-three (74%) of the referred cases involved intentional overdose, and 42 (72%) involved prescription medications (Table 1). Hospital admission was required for 53 (91%) of the referred patients but only 86 (30%) of the 288 patients who were not referred. More than half of the referrals originated in the ICU (35 [60%]), and the in-hospital mortality rate for all referred cases was 5% (3/58). Twenty-eight (48%) of the cases referred to the TCS involved multiple agents, and the most commonly ingested drugs (> 20% of cases) were antipsychotics, antidepressants, benzodiazepines, and opioids.

Assessment of Written Consultation Notes

To identify the components of the written consultation note that users of the service felt were essential, a questionnaire was created with input from both physicians and pharmacists who had various levels of involvement with the service. We identified staff ICU physicians, fellows, and emergency physicians from departmental administration records and asked them to complete the survey either manually or electronically. The participants were asked to rank the following suggested components of a written consultation note as essential, informative, or unnecessary: the patient's medication history, an overview of the toxidrome, findings on physical assessment, interpretation of the severity of the overdose, interpretation of drug levels and toxicity screens, identification of possible causes of the toxidrome, identification of drug-drug and drug-laboratory interactions, recommendations for pharmacologic and nonpharmacologic treatment, recommendations for monitoring, and suggestions for patient disposition.

The questionnaire was completed by 28 (42%) of the 66 emergency and critical care physicians who were contacted. Four components of the written consult were deemed essential by more than 75% of respondents: medication history, overview of the toxidrome, severity



Table 1. Demographic Characteristics of Patients with Overdoses and Toxic Exposures

Characteristic	Group; No. (%) of Patients*	
	With a Consult (n = 58)	Without a Consult (n = 288)
Age, yr (mean ± SD)	39 ± 15	37 ± 10
Sex, no. (%) males	31 (53)	141 (49)
APACHE score (mean ± SD) (n = 35)	16.8 ± 8.1	NA
Consults		
<i>Time of day</i>		
0800–1600	30 (52)	
1600–2400	19 (33)	
2400–0800	9 (15)	
<i>Service requesting consult</i>		
Intensive care unit	35 (60)	
Emergency department	21 (36)	
Ward	2 (3)	
Overdoses		
Single agent	30 (52)	165 (57)
Multiple agents	28 (48)	123 (43)
Intentional	43 (74)	None
Unintentional	15 (28)	
<i>Agents</i>		
Prescription drug	42 (72)	183 (64)
Nonprescription drug	12 (21)	83 (29)
Illicit substance	7 (12)	32 (11)
Hazardous chemical	10 (17)	15 (5)

APACHE = Acute Physiology and Chronic Health Evaluation, SD = standard deviation.

*Unless indicated otherwise.

of overdose, and provision of pharmacologic treatment recommendations (Table 2). Twenty (87%) of the 23 respondents who had referred patients to the TCS in the past reported that they had received both useful information and helpful recommendations. An audit of the consultation notes for the 1-year study period revealed that medication history (53/58 [91%]), overview of the toxidrome (45/58 [78%]), and pharmacologic treatment recommendations (52/58 [90%]) were consistently provided in the consultation notes; however, severity of overdose (37/58 [64%]) was reported less frequently.

Survey of Former Pharmacy Residents

Pharmacy residents who had completed the Pharmacy Residency Program and participated in the TCS during a 10-year convenience sample (from 1995 to 2005, excluding residents who were co-investigators for the current study) were identified from pharmacy records. During this time frame, there were no major changes in the background or number of residents sharing on-call responsibilities, no observable differences in the number of annual consults or resident workload, and no changes in the administration of the toxicology service.

The investigators designed a web-based survey (administered through <http://www.surveymonkey.com>), which was subjected to limited sensibility testing for clarity. The 2-part survey was anonymous and had no participation incentives. The first part of the survey was used to gather data on demographic characteristics (not reported). In the second part, participants were asked to report whether, during their participation in the TCS, they had developed specific values and skills that might be considered useful when starting a career, regardless of profession. The values and skills listed in the survey were independence, leadership, ability to work in a stressful environment, communication skills (verbal and written), drug information skills, ability to provide nonjudgemental patient care, time management skills, a sense of responsibility, and problem-solving skills. Residents were also asked whether they felt their participation in the service had been a significant source of stress during their residency and if this stress had compromised their learning experience.

A sensitivity analysis for recall bias was conducted for data grouped by date of residency completion (before or within the past 5 years). Differences in responses to questions about skills and values gained were compared by year of residency completion and



Table 2. Physicians' Perceptions of the Value of Various Elements of a Written Consult

Component of Written Consult	Perceived Value; No. (%) of Respondents (n = 28)		
	Essential	Informative	Unnecessary
Medication history	23 (82)	4 (14)	1 (4)
Overview of toxidrome	26 (93)	2 (7)	0 (0)
Physical assessment (n = 27)	11 (41)	4 (15)	12 (44)
Severity of overdose	23 (82)	5 (18)	0 (0)
Laboratory, drug, toxicology screens	19 (68)	9 (32)	0 (0)
List of possible causes of toxidrome	21 (75)	7 (25)	0 (0)
Drug–drug or drug–laboratory interactions	17 (61)	9 (32)	2 (7)
Pharmacologic treatment	25 (89)	3 (11)	0 (0)
Nonpharmacologic treatment	13 (46)	11 (39)	4 (14)
Monitoring parameters	15 (54)	10 (36)	3 (11)
Patient disposition (n = 27)	11 (41)	9 (33)	7 (26)

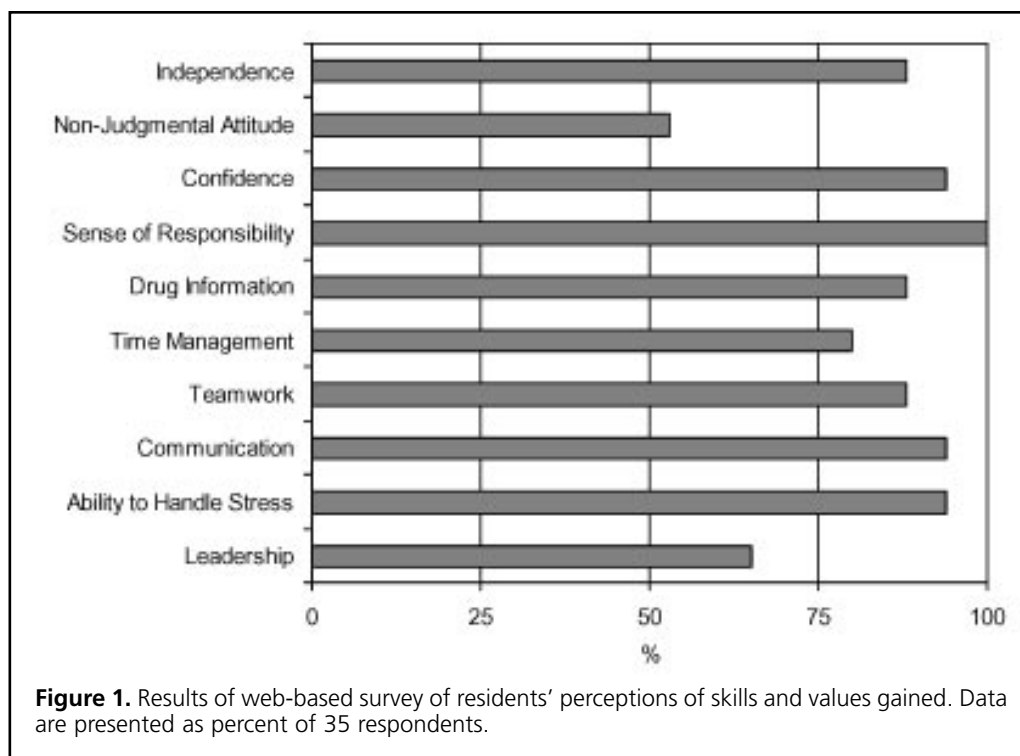
were analyzed with χ^2 statistics. Logistic regression analysis was used to determine the influence of date of residency completion on whether participation in the TCS had been a significant source of stress, whether it had compromised the learning experience, and whether it was reported as an important part of the residency program.

Forty-six residents had completed the Pharmacy Residency Program during the 10-year sampling frame; of these, 4 were excluded because they were co-investigators on the study, and 3 were excluded because they could not be located. In total, 39 former pharmacy residents were contacted, and 35 (90%) completed the web-based survey. Thirty-two (91%) of the respondents felt that confidence, independence, a sense of responsibility, communication skills, and the ability to work in a stressful environment were enhanced or developed during their time with the TCS and that these characteristics were useful in their subsequent careers (Figure 1). Although 21 respondents (60%) reported that participating in the TCS had been a significant source of stress during their residency, 31 (88%) felt that their learning experience had not been compromised. Thirty-two (91%) agreed that the TCS had been an important component of the residency program. The sensitivity analysis showed that time since completion of the residency was associated with perceived stress while participating in the service: residents who participated between 1995 and 2000 were more than 6 times more likely to report that the TCS had been a significant source of stress during their residency (odds ratio 6.7, 95% confidence interval 1.3–34.0), relative to those who participated between 2001 and 2005. When responses were stratified by time of residency completion, no significant differences were identified in terms of skills and values gained.

DISCUSSION

Pharmacy-managed toxicology consult services are uncommon in North America. In this report, we have described a program that provides a unique service within our hospital and a valuable learning experience for pharmacy residents. This study sets a benchmark for our own quality assurance and educational initiatives and also offers a model for other residency programs. In an effort to improve the TCS at the Ottawa Hospital, we identified deficiencies in our written consultation notes on the basis of components perceived as essential by the physicians who responded to our questionnaire. Although pharmacy residents reported that participation in the program had been a source of stress during their residency, most agreed that the TCS had been an important part of the overall residency program and that their participation had allowed them to cultivate a variety of skills and values that were useful in their subsequent careers.

This study did not include an evaluation of the clinical impact of the TCS. We suspected that consults would be sought preferentially for more complex cases and more severely ill patients. A control group, consisting of patients with overdose for whom consults had not been requested, would have provided data for a comparison of outcomes, but differences between the groups in terms of causes of overdose and illness severity were likely and would have created selection bias. It was subsequently decided that an evaluation of consult content according to user-defined expectations could be used to indirectly determine the utility of the service. The response rate for the physician questionnaire was relatively low (42%), but the number of respondents (28) exceeded our minimum goal of 20; therefore, no further steps were taken to increase the response rate. The physicians' perceptions of essential



content for the consultation note allowed us to evaluate the written consultation notes for completeness.

The 1-year observational cohort revealed a wide variety of toxic exposures for cases referred to the TCS. It appears that consults were sought for the more complex or severe cases, such as ingestion of multiple agents, exposure to chemicals, and ingestion of newer medications (e.g., atypical antipsychotics) for which appropriate management is not well known. The study also provided a useful resource for tailoring future training sessions for residents and back-up senior pharmacists as the epidemiology of overdoses evolves over time. Anecdotal evidence indicates that acetaminophen and salicylates were traditionally the most common overdose agents seen by the TCS, but they now represent less than 20% and less than 10% of referred cases, respectively.

Studies based on reviews of medical records have limitations. The accuracy of the data depends on the adequacy of documentation and the ability to identify all eligible patients who meet the inclusion and exclusion criteria. To minimize the potential impact of these methodologic limitations in this study, patients with toxic exposure referred to the TCS were identified prospectively, and data were extracted from multiple sources, including written consultation notes, medical records, and electronic databases. As a result, less than 1% of the data collected were missing from our database.

We used a survey to gather information about residents' perceptions of the value of the TCS. The validity of survey data depends on the adequacy of sampling within the target population and the response rate within the sampling frame. Despite the lack of a participation incentive, the survey response rate was 90%, which meant that the risk of responder bias was low. The risk of coercion was minimized by ensuring that the survey was anonymous and that potentially identifying variables (e.g., year of residency completion) were changed to categorical variables. The sensitivity analysis showed no evidence of recall bias between the 2 groups of former pharmacy residents with respect to the skills and values gained by participating in the TCS. The only significant difference between groups was the level of stress encountered. Contributors to the level of stress may have been differing workload, requests for consultations at different times of the day, and different levels of training. Overall, the residents agreed that the TCS had been a valuable learning experience that had allowed the development of useful skills and values for those starting careers, regardless of profession. These results reinforce the importance of this component of the residency training program at the Ottawa Hospital. Given the nature of the survey, which focused on the impact of the TCS for residents, it was impossible to determine whether the residents would have

developed these attributes without participation in the TCS; however, this limitation is inherent to all surveys of this type.

CONCLUSIONS

The Ottawa Hospital's TCS is a unique service available to medical staff and their patients and represents an important component of the educational and experiential training of pharmacy residents. The components of a written toxicology consultation note that physicians perceive as essential were identified, and this information was used to evaluate the completeness of consultation notes prepared during the 1-year study period. The variety of overdoses observed during the study period illustrated the complexity of cases for which consults are requested and provided guidance for further training initiatives. Most former pharmacy residents felt that participation in the program had been an important part of their residency, and the skills and values that they developed were useful in their subsequent careers. This study provides a benchmark for the residency program at the Ottawa Hospital and perhaps a model for other pharmacy residency programs.

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