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Clinical pharmacy services in an Iranian teaching hospital: Type, severity, resolution, and accuracy

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ABSTRACT

Objective: Clinical pharmacy services are improving in hospitals. For assessing the impact of these services, first it is important to exactly describe them by categorizing into types, severity, resolution, and accuracy. The objective of this study is to provide a detailed analysis of the clinical pharmacists' services performed on in-patients in a teaching hospital during 28 months. Setting: Masih Daneshvari hospital, Tehran, Iran.

Methods: This is a descriptive study. The authors retrospectively reviewed the notes of all services and entered them in a designed SPSS sheet. Documentation was carried out based on the "findings, assessment, resolution, and monitoring" method. The data were descriptively analyzed. Main outcome measure: Types, subtypes, severities, resolutions, and accuracies of services were defined, documented, and analyzed.

Findings: In total 3152 records (2227 interventions and 925 visits with no intervention) were classified and analyzed in this study. Among all types of interventions, "improper medication use" (36.2%) was the most frequent intervention and among categories (subgroups) of "improper medication use," "untreated indication" was the most frequent (23.7%). From the aspect of severity, 75.4% of interventions were estimated as of minor potential inconvenience to the patient (severity degree 1). Most interventions (78%) were finally recommended to the prescriber and 97.6% of interventions were considered accurate on further evaluation.

Conclusion: Clinical pharmacists' interventions are highly demanded in the hospitals. Based on the results of this study, conditions needing medication to prevent later complications in the course of therapy are sometimes ignored, which emphasizes the positive role of the clinical pharmacists' involvements in clinical teams to improve outcome.

Keywords: Clinical pharmacy services; documentation; pharmaceutical care; pharmacist

INTRODUCTION

It is now obvious that the rational use of medications is a key factor in achieving positive outcomes in medicine. Nowadays, the role of pharmacists has changed from only dispensing activities to great involvement in the pharmaceutical care. Pharmacists and especially clinical pharmacists, now have a vital role in patient care. Changes of drug therapy that were initiated by well-skilled clinical pharmacists, not only have saved lives, enhanced patients' quality of life and reduced length of stay, but can also be significantly cost-effective.[1,2]

The positive effects on patient care outcomes, including the prevention of adverse drug reactions (ADRs) and medication errors, improvement of patient satisfaction and quality of life, and improvement of economic outcomes, even were proved in activities of pharmacy students and general pharmacists.[3-5]

In Iran, the skilled movement of pharmacists and their efficient involvement in hospital wards at Shahid Beheshti University, Tehran, has begun in recent years and needs more force.[6] In the university affiliated Masih Daneshvari hospital (Tehran, Iran), there have been several years of experience in the clinical pharmacy services.[7]

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Clinical pharmacy services were initiated to interested bodies of Masih Daneshvari hospital in 2004. The precise nature of this service was vague at first, but in subsequent discussions it was well-defined.

The ADR unit at Masih Daneshvari hospital was formally established in 2006[8] and several related publications intended to assist quality improvement of the pharmaceutical care.[9-12] It has a clinical pharmacist as the chief of the unit.

The pharmaceutical care activities, which was started in 2004 and officially established in August 2009 as "Pharmaceutical Care Department," focuses on the following activities: Ensuring safe and cost effective drug administration,[13] monitoring and management of drug use patterns,[14-16] providing drug information, training clinical pharmacy residents and pharmacy students, providing drug protocols and treatment guidelines,[7] appropriate prescribing[17-18], publishing monthly ADR bulletins,[19] and running anticoagulant clinic.[20]

Medication errors are a major concern to health-care professionals and medical institutions. Recently, many initiatives have been taken to reduce the number of errors and their impact on treatment of patients.[21-24] Clinical pharmacy residents' responsibilities on their rotation at the hospital include medication history reviews on admission and during hospital stay, counseling about patient medications with the physicians, nurses or patients themselves or their relatives, therapeutic drug monitoring, commenting in the selection or changing of drug therapy, ADR monitoring, prevent therapeutic duplication and some other activities.

Clinical pharmacy services at Masih Daneshvari hospital are aiming to reduce the adverse drug effects, to eliminate unnecessary drug administrations and to lower the costs of therapy. Sometimes, patients were intervened by the clinical pharmacist on the basis of receiving written consultation request from the physician in charge or as a verbal request during the clinical rounds or random visits.

Clinical pharmacists contribute to patient safety and rational drug therapy by detection and clarification of inappropriate prescribing. In addition, they serve as a dynamic drug information resources for physicians and medical residents.

Getting help from conversant clinical pharmacists is one of these initiatives. When trying to avoid medication errors, the first step is to develop a better understanding of the types of errors that occur. The documentation of clinical pharmacists' interventions and activities is of paramount importance because although such interventions occur every day if they are not documented it is not possible to accurately quantify their impact on patient care. Documentation of interventions also is vital in proving to hospital administration that pharmacists play an integral role in preventing medication errors and improving overall patient care.[25]

There is a systematized approach for the construction and maintenance of a record reflecting the pharmacist's contributions to care that is equivalent to physician's progress note.[26] This process includes provisions for identification and assessment of actual or potential medication-related problems, description of a therapeutic plan, and appropriate follow-up monitoring of the poblems.

Although there is no current uniform documentation system for the profession of pharmacy, students are encouraged to try this system as they learn to document patient interventions. In this system, problems that have been identified are addressed systematically in a pharmacist's note under the headings of findings, assessment, resolution and monitoring (FARM).[27]

In Masih Daneshvari hospital, the clinical pharmacy interventions on patient care has not been evaluated and quantified. The aim of this study was to provide a detailed description of the clinical pharmacy services over the course of study at this institute and to classify these interventions based on their type, severity, resolution, and accuracy.

METHODS

This descriptive study had 2 phases: (1) Intervention phase during, which clinical pharmacy interventions and drug information forms were filled. (2) Documenting phase during, which the interventions were documented and analyzed.

This study was carried out in a tertiary care respiratory hospital (Masih Daneshvari hospital, a university affiliated hospital, located in Tehran, Iran). Although the most patients in this hospital are patients with pulmonary diseases, other medical wards also are active (including internal medicine wards, pediatric ward, surgical and medical intensive care units, cardiac care unit and oncology ward).

Baseline study period (intervention phase) was from January 2008 to June 2011. Documentation, analysis, and interpretation of clinical pharmacists' interventions were accomplished between July and October 2011.

Intervention phase

Clinical pharmacy residents spend 2-month rotation in pulmonology ward as part of their residency

program (RP). Each month is covered by either one or two residents. The last 2 years of RP consists of 18 months of different hospital ward rotations. Residents are expected to fill in clinical pharmacy intervention and drug information forms during their educational program. In the 1st month of the rotation, an intensive training program was provided to the residents introducing pharmaceutical care philosophy and information gathering. In the second month, the residents visited the patients independently and/or intervened during the clinical rounds. This is also consistent with the current Doctor of Pharmacy program, during which students will rotate at a specific site for a limited period of time.[7]

Pharmacists should make notes in the medical record of at least 10% of new patients received medication(s) and had at least 1 day stay in the hospital.

In addition to making notes in medical records of the patients, the clinical pharmacy residents were required to write notes on specific papers (forms) to document them. These were kept at the department.

The interventions were made by either random visits of patients, continuous monitoring of drug utilization, and providing information to health-care providers. Medication counseling/advice was also given to patient upon physician, nurse or patient request. In addition, patients were instructed on their medication use, e.g., inhaler technique. All consultation requests were answered back by the preceptor, or verified if the recommendations had been written by the residents. All the forms were signed by the preceptor thereafter. The residents and their preceptor discussed and reviewed the patient medication histories and extracted Drug-Related Problems (DRPs). Patients' charts were reviewed to identify DRPs. Relevant laboratory data and vital signs were all recorded to support the appropriateness of the interventions.

Documentation phase

The authors retrospectively reviewed the notes and the filled forms of previous residents and documented them as a form of FARM note in the SPSS 17 program.

In this system, identified problems are addressed systematically in a pharmacist's note under the headings of FARM.[28]

Documentation and recording systems were based on FARM note, but were designed specifically for this study (modifications according to the hospital and limitations of the study were performed).

A literature review on potential medication errors and pharmacists' clinical interventions served as the basis for the development of a data collection form for recording and classifying the interventions. The data were documented by two clinical pharmacists, who independently observed the clinical pharmacists' work; this method has been found to be superior to self-reporting by health-care professionals in the medication error research.[29]

Identification of DRPs

The first step in the construction of a FARM note is to clearly state the nature of the DRPs. Each problem in the FARM note should be addressed separately and assigned a sequential number. Understanding the types of the problems that may occur facilitates the identification of pharmacotherapy problems.[28]

The second phase included documenting types of interventions (such as dose adjustment, proper medication use, monitoring recommendations, drug interactions management, peri-operative medication management, ADR detection or management, order clarification, patient education, and compliance improving), severity of these interventions and the way to intervene (such as counseling, making recommendations to patient, making recommendations to the prescriber, making recommendations to the nurse, ADR reporting).

Seven types of medication related problems have been identified in this hospital [Table 1].

Severity

Each intervention was rated for seriousness in terms of assessment section in FARM note. This assessment was based on a modified version of safety assessment code-score[30] and was classified as below:

1. The error is estimated as of minor potential inconvenience to the patient.
2. The error is estimated to potentially influence the treatment of the patient, but correctable.
3. The error is estimated to potentially influence the treatment of the patient to the extent that intensive treatment would be necessary, i.e., admission to hospital.

These ratings reflect the predictive rather than actually observed degree of harm.

Classification into these categories was based on the authors' judgment as to both the severity of potential harm to the patient and the probability that a specific medication would result in harm for a specific patient, given their current health condition.

Resolution

In the resolution section in the FARM note, the result of the intervention was classified as counseling, making recommendations to the patient, making recommendations to the prescriber, making recommendations to the nurse, ADR reporting.

Table 1: Definition of categories and sub-categories of clinical pharmacists' interventions

Category	Definition and examples	Sub-categories	Definition of sub-categories
"Dose adjustment"	Adjusting the dose of drugs in renal or hepatic diseases or adjusting the dose of warfarin based on INR (international normalized ratio)	"Renal dose adjustment"	
		"Hepatic dose adjustment"	
		"Warfarin dose adjustment"	
"Improper medication use"	Refer to sub-categories	"Improper drug selection"	Suggesting the best medication for an indication based on safety, cost, and efficacy
		"Subtherapeutic dosage"	Recommending dose increase
		"Overdosage"	Recommending dose decrease
		"Improper route of administration"	Suggesting the best or correct route of administration of the drug for a specific patient
		"Transcription error"	Correcting errors that have been made by the staff or transcription of the order from the previous step
		"Administration or preparation error"	Recommendations were made for appropriate preparing or administering drugs to the nurses
		"Untreated indication"	Intervene when a patient had an indication for a drug but didn't receive it (for example stress ulcer prophylaxis or DVT prophylaxis)
		"Drug use without indication"	Discontinuation of an unnecessary medication
		"Polypharmacy or drug with same indication"	Discontinuation of duplicate medications
		"Improper interval"	Changing the interval of drug administration
		"Contraindication/ precaution"	Discontinuation of the medication when a contraindication existed
"Monitoring recommendations"	Recommending monitoring (e.g. a lab test request) to check for effectiveness, or detect toxicity or a side effect		
"Drug interaction"	counseling on possible pharmacodynamics and pharmacokinetic interactions that may arise when two or more drugs are used at the same time	"Detection"	Informing the physician of an interaction caused
		"Management"	Suggesting a plan for management of the interaction
		"Preventive measure"	Counseling to prevent the interaction
		"Lab request"	Suggesting to check a laboratory parameter or monitoring measures
		"Patient education"	Educating the patient on possible interaction
"ADR"	Adverse drug reactions	"Detection"	Informing the physician of an ADR caused
		"Management"	Suggesting a plan for management of the adverse drug reaction
		"Preventive measure"	Suggesting a way to prevent an ADR (for example using sunblock cream to prevent photosensitivity reaction)
		"Lab request"	Suggesting a laboratory parameter monitoring
		"Patient education"	Educating the patient on possible ADR
"Peri-operation""	Consultation about the use of drugs before, in and after surgeries		
"Order clarification/ patient education/ compliance"	Recommendations on the proper use of drugs to nurses or patients or to improve the compliance of a patient		

DVT=Deep vein thrombosis, ADR=Adverse drug reactions, INR=International normalized ratio

Accuracy of interventions

The authors evaluated the accuracy of interventions during documentation and it was determined whether the intervention carried out was accurate or wrong based on evidences.

A database was developed to document all interventions. Data included the type of recommendation (dosing, medication change, etc.), sub groups, the estimated significance of the intervention, resolution and whether the recommendation was right or wrong. The year, month and a code for each resident, also were entered in specific columns in SPSS sheet.

Analysis of data was carried out by SPSS 17 software using the descriptive statistics on data.

RESULTS

A total of 3152 notes with or without intervention (patients that have visited but no intervention has been recorded) were documented and analyzed in terms of type, subtype, severity, resolution, and accuracy of services in this study.

The study period was 28 months, from January 2008 to June 2011 (the period from September 2008 to February 2009 and October 2009 to march 2011 were not documented since there was no resident rotation in those months). During this period, a total number of 2227 interventions were carried out. In addition, 925 cases were observed and medical records were reviewed without any specific intervention being made. Thirty clinical pharmacy residents were involved.

The mean ± SD number of interventions and visits without intervention were 105.0 ± 52.2 for each resident and 111.0 ± 39.8 for each month.

Identification of DRPs

The frequency and percent of different types of interventions in the study period is presented in Table 2. Among all types of interventions, "improper medication use" (36.2%) was the most frequent intervention, whereas "untreated indication" was the most frequent (23.7%) among "improper medication use" category [Table 3]. These untreated indications included recommendations for "stress/gastric ulcer prophylaxis" and "deep vein thrombosis (DVT) prophylaxis" mainly.

Recommendations for increasing the dose of drugs (16.8%) won the second rank, which was composed mostly changing ranitidine IV twice daily to three times a day.

In addition, 3.7% of all interventions were dose adjustments. Among those, 90.6% were renal dosage adjustments followed by warfarin dose adjustment (6%) and dosage adjustment in the hepatic diseases (3.4%).

About 33% of ADRs were only detected and recorded in medical records of patients, while most of the drug interactions (42%) were followed by recommendations to prevent them. Different strategies for dealing with "ADR" or "drug interaction" are presented in Table 4.

Severity

From the aspect of severity, 75.4% of interventions were estimated as of minor potential inconvenience to the patient (severity degree 1) and 24.6% were estimated to potentially affect the treatment of the patient, but correctable (severity degree 2). None of the interventions were estimated to potentially have an effect on the treatment of the patient to the extent that intensive treatment would be necessary, i.e., admission to hospital (severity degree 3). Percentages of the interventions with mild or moderate severity are presented in Table 5.

Table 2: Types and frequencies of clinical pharmacists' interventions

Types of interventions	Frequency	Percent
Improper medication use	1142	36.2
No intervention	925	29.3
Drug interaction	268	8.5
Order clarification/patient education/compliance	217	6.9
Adverse drug reactions	200	6.3
Monitoring recommendations	190	6.0
Dose adjustment	116	3.7
Peri-operation	94	3.0
Total	3152	100.0

Table 3: Sub-groups of "improper medication use"

Types "improper medication use"	Number	Percent
Improper drug selection	185	16.2
Sub-therapeutic dosage	192	16.8
Over-dosage	92	8.1
Improper route of administration	20	1.8
Transcription error	44	3.9
Administration or preparation error	16	1.4
Untreated indication	270	23.7
Drug use without indication	82	7.2
Poly pharmacy/drug with same indication	133	11.7
Improper interval	80	7.0
Contraindication/precaution	27	2.4
Total	1141	100.0

Table 4: Strategies to manage or control "ADR" or "drug interaction"

Intervention	Drug interaction *N* (%)	ADR *N* (%)
Intervention related to the ADR or interaction		
Detection	41 (15.3)	65 (32.7)
Management	87 (32.6)	59 (29.6)
Preventive measure	112 (41.9)	53 (26.6)
Lab request	26 (9.7)	17 (8.5)
Patient education	1 (0.4)	5 (2.5)
Total	267 (100)	199 (100)

ADR=Adverse drug reaction

Resolution

Most interventions (78% of all interventions) were finally recommended to the prescriber. The following were respectively recommendations to nurses (8.9%), recommendations to the patients (6.7%), written counseling (4.8%), and ADR reporting (1.6%).

Table 5: Severity of clinical pharmacists' interventions

Intervention	Percent of interventions with minor potential inconvenience	Percent of interventions that have potentially impact on the treatment of the patient, but are correctable
Dose adjustment	13.8	86.2
Improper medication use	81.4	18.6
Monitoring recommendations	88.4	11.6
Drug interaction	79.1	20.9
Peri-operation	0	100
Adverse drug reactions	73.5	26.5
Order clarification/ patient education/ compliance	95.4	4.6

Accuracy

Most of the interventions were carried out correctly (97.6%). Only 2.4% of the interventions were evaluated to be inappropriate or irrelevant. Most of these inappropriate interventions were in the category of "improper medication use" (3.6%) and in the sub group, the most frequent ones were in "untreated indication" (7%).

DISCUSSION

This study was carried out on relatively large number of interventions (3152 cases). Although some similar studies were undertaken in as large population as this study,[31,32] but in most of them the study population was much less.[33-38]

In this study, clinical pharmacy residents performed intervention on the drug therapy of hospitalized patients whereas in some similar studies, community pharmacists or hospital pharmacists had carried out interventions.[30-38]

Clinical pharmacists were responsible for pharmacists' interventions in 24 of 32 studies in a large meta-analysis. Furthermore, the settings were out-patient clinics in 15 trials of this meta-analysis and community pharmacies in 2 of them. Offices and patients' homes were also places picked by a few of the trials. Hospitals were the selected setting in 8 of the trials.[39]

The duration of our study was relatively long (28 month) and this is one of the strengths of it.

Improper medication use and specially the subgroup of "untreated indication" was the most common intervention carried out (about 24%). In a study that was carried out in Iran, clinical pharmacists' interventions could improve DVT prophylaxis, as an untreated indication.[40]

In a similar study evaluating pharmacists' interventions at a university teaching hospital, order clarification and corrections and provision of drug information accounted for the most interventions (36% and 32%, respectively). Approximately, 60% of all interventions were classified as subtherapeutic dosing (21%), untreated disease states (13%), potential overdose (13%), and failure to receive drug (11%).

In this study, most of the interventions were considered as of minor potential inconvenience to the patient (severity degree 1). This finding is in contrast to another study that was carried out on twenty-one pharmacists' interventions at the Chemotherapy Preparation Unit in which 48% of the recorded interventions were ranked as "very significant" in terms of influence on patient care.[38] Furthermore, in another study which was carried out in Nephrology and Infectious Disease departments of a university hospital in Iran, about half of them were of moderate to life-saving clinical significance.[41] Hence, the severity of interventions can be varied according to the type of setting, the number of high alert medications used, and the patients' condition.

In this study, most interventions were recommended to the prescriber and it is not surprising considering the type of the most frequent interventions made.

The high rate of clinical pharmacists' interventions in comparison with "visits with no interventions" and the high rate of "appropriate" recommendations show the positive role of them in patient drug therapy and overall outcome.

Clinical pharmacists' interventions are highly demanded in hospitals. Based on the results of this study, conditions needing medication to prevent later complications in the course of therapy are sometimes ignored, which emphasizes the positive role of clinical pharmacists' involvements in clinical teams to improve outcome.

AUTHORS' CONTRIBUTION

All authors of this article made substantial contributions to conception and design, and/or acquisition of data. F. Fahimi, M. Mehrpooya and Z. Allameh analyzed and interpreted data. Also, Z. Allameh, F. Fahimi and S. Baniasadi participated in drafting the article, revising it critically for important intellectual content; and all authors gave final approval of the version to be submitted and any revised version.

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