

Original Article

Admissions for drug-related problems at the Emergency Department of a University Hospital in the Kingdom of Saudi Arabia

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ABSTRACT

Background and Aim: Medication Errors can result in drug-related problems (DRPs). Insight into the frequency, type, and severity of DRPs could help reduce their incidence. The aim of the present study was to estimate the prevalence of admissions as a result of DRPs at the Emergency Department (ED) of a university hospital in the Kingdom of Saudi Arabia. **Materials and Methods:** Files of suspected cases of DRPs reporting to ED in the year 2012 were scrutinized. Suspicion arose from the hospital record system based on Diagnosis Code Numbers (ICD-9-CM, Professional 2010) and from triggers, such as some drugs, laboratory tests, and signs and symptoms pointing to DRPs. **Results:** Of 5574 admissions, 253 (4.5%) were DRPs and were categorized as: Overdose toxicity and side effects of drugs 50 (19.8%), drug-interactions 29 (11.5%), accidental and suicidal drug ingestions 26 (10.3%), drug abuse 18 (7.1%), drug allergy 10 (4%), super-infections 8 (3.2%), and noncompliance to treatment 112 (44.3%). About 70% of DRPs were preventable; 67 (26.5%) required hospital admission for 7–102 days and 10 (4%) died. **Conclusions:** Noncompliance to treatment, overdose toxicity, drug interactions, and drug abuse are important causes of hospital admissions as a result of DRPs. Awareness of prescribers to the problem and their education would help to prevent them and improve patient care.

Key words: Drug-related problems, Emergency Department, Saudi Arabia, University Hospital

INTRODUCTION

A drug-related problem (DRP) is defined as “an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes.”^[1,2] Therefore, the definition of a DRP includes more types of problems than an adverse drug event / reaction (ADE / ADR), which is defined as “any unexpected or dangerous reaction to a drug,”^[2] or a drug therapy failure, defined as “an inadequate therapeutic response to a drug as evidenced by the presence of symptoms of a diagnosed disease state or condition.”^[3]

Drug-related problems, in most cases, are related to medication errors (MEs). The definition of a ME remains imprecise though attempts to develop an international definition have been made:^[4] “A ME is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures and systems, including prescribing; order communication; product labeling, packaging, nomenclature; compounding; dispensing; distribution; administration; education; monitoring and use.”^[5] The National Coordinating Council for ME Reporting and Prevention states that the consequences of DRPs are increased hospital admissions, extended hospital stay, lower patient satisfaction, and an increase in the cost of patient management. Therefore, prevention of DRPs helps not only to improve patient’s clinical outcomes, but also to reduce the cost of treatment.^[6-8]

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Assessing the actual safety of drug use has been historically difficult, mainly because the traditional methods such as chart audits and voluntary reporting of data have been shown to be expensive, insensitive, and largely ineffective means of detecting the mistakes in drug administration and drug-related adverse events or problems. The method of “trigger tool” is a “low-cost,” “low-tech” modification of an automated technique. The method is based on the detection of ADEs or DRPs from “tools” used in the management of patients. For example, some drugs used for the management of adverse effects of drugs (like antiemetics, antidiarrhoeals or antidotes); relevant laboratory tests (like prothrombin time, International Normalization Ratio, white blood cell count, or *Clostridium difficile* positive stool); plasma levels of drugs which have low therapeutic index (like digoxin, theophylline, phenytoin, carbamazepine, lithium, etc.) and some signs and symptoms (like oversedation, fall, and rash) could be tools. The technique appears to increase the rate of ADE detection approximately 50-fold over the traditional reporting methodologies.^[9]

The aim of the present study was to estimate the prevalence of admissions as a result of DRPs at the Emergency Department (ED) of a university hospital in Saudi Arabia, in the year 2012. The files of only suspected cases were scrutinized. The suspicion arose from the code numbers of relevant categories in the hospital record system and from the “triggers” of DRPs, like drugs that commonly cause or are used in the management of DRPs, laboratory tests, and the signs and symptoms.

MATERIALS AND METHODS

The files of the suspected cases of DRPs admitted to the ED of a university hospital in the Kingdom of Saudi Arabia in 2012 were sorted out. Certain categories in the record system of the hospital aroused suspicion. This was based on “Diagnostic Code Numbers” mentioned in ICD-9-CM, Professional, 2010 by MAG Mutual Health Care Solutions, Inc. USA, as well as from the method of “triggers tools.”

The method of “Diagnostic Code Numbers” was used to pick out the following categories of cases: (a) Drug abuse due to opioids, cannabis, benzodiazepines, and alcohol; (b) suicidal and homicidal drug ingestion; (c) drug overdose toxicity; (d) drug hypersensitivity; (e) drug interactions.

The method of “triggers” involved the detection of DRPs from “tools” used in the management of patients, which are pointers to DRPs. These include drugs used for the management of adverse effects or overdose toxicity of drugs, abused drugs, those that commonly cause problems because of low therapeutic index, relevant laboratory tests,

and signs and symptoms such as over-sedation, falls, and rash;^[9] [Table 1].

The data from the relevant files were entered in the prescribed questionnaire. A case detected in both the systems, “Diagnostic Code Numbers” and “Trigger Tools,” was taken as one. The data of the suspected cases thus detected were analyzed by a team comprising a physician, a clinical pharmacologist, and a clinical pharmacist. During the analysis, the opinion of doctors found in the clinical notes on the diagnosis and involvement of drug(s) causing the problem(s) was particularly noted. The Microsoft Excel Program was used for calculations.

RESULTS

Of 143,833 who reported to the ED of the university hospital in 2012, 5574 were admitted, and 253 (4.5%) of the admissions were DRPs. Drugs that frequently caused DRPs in our study were categorized as follows: Overdose toxicity and side effects of drugs, 50 (19.8%) drug-drug interactions, 29 (11.5%), accidental and suicidal drug ingestions, 26 (10.3%) drug abuse, 18 (7.1%) drug allergy, 10 (4%) super-infections, 8 (3.2%) and last but not the least, 112 (44.3%) for noncompliance to treatment which were mostly young adults who reported to ED with either seizures, stroke and malignant hypertension, etc. More than 70% of DRPs, including noncompliance, were possibly preventable, while 67 (26.5%) were of a serious nature and required admission in the hospital for 7–102 days. Unfortunately, 10 (4%) of DRPs identified in our study had died, which makes up 0.18% of admissions in the year 2012. A summary of various drug groups involved is found in Table 2.

Table 1: Triggers used in the study for the detection of DRPs

Trigger	Examples
Drugs used for the treatment of adverse effects of drugs	Antidiarrhoeals: Loperamide, diphenoxylate Antiemetics: Metoclopramide, droperidol Antihistamines: Diphenhydramine, chlorphenamine
Drugs as antidotes for drug poisoning	Vitamin K, protamine, flumazenil, naloxone
Drugs commonly causing DRPs, because of low therapeutic index	Warfarin, digoxin, theophylline, phenytoin, carbamazepine, valproic acid, lithium, haloperidol
Drugs of abuse	Opioids, cannabis, benzodiazepines, amphetamines, alcohol
Laboratory tests	INR, PTT, WBC count, <i>clostridium difficile</i> positive stool, blood positive for fungus, sputum positive for fungus
Signs and symptoms	Drowsiness, fall, skin rash

DRPs: Drug-related problems; INR: International Normalization Ratio; WBC: White blood cell; PTT: Partial thromboplastin time

Table 2: A summary of drug categories involved in DRPs at ED in a tertiary hospital in Saudi Arabia

Category DRP	Distribution (%)	Drugs involved	Presenting symptoms/signs	Number of cases		
Overdose toxicity and side effects of drugs	50 (19.8)	Phenytoin	Drowsiness ataxia and tremors	6		
			Liver damage and raised liver enzymes	3		
			Hypocalcemia and Vitamin D deficiency	1		
		Valproic acid	Cardiopulmonary arrest	1		
			Weight gain	7		
			Bone pain (hands and wrist)	2		
		Lithium	Hypothyroidism	5		
			Confusion, tremors, edema, etc.	2		
			Cardiac problem	1		
		Carbamazepine	Weight gain	1		
			Dizziness, vertigo and vomiting	3		
			Low WBC count	1		
		Haloperidol	Grey hair	1		
			Extrapyramidal reaction	3		
			Increased prolactin secretion	1		
Immune suppressants	Bone marrow suppression	3				
	Miscellaneous	9				
	Miscellaneous	9				
Drug-drug interactions	29 (10.3)	Enzyme inhibitors (valproic acid, atorvastatin, etc.) increased toxicity of phenytoin and benzodiazepines	Phenytoin: Liver damage, vomiting, vertigo, confusion	6		
			Clozapine: Weakness, pains	3		
		Digoxin with frusemide and other drugs	Diazepam: Loss of consciousness	1		
			Arrhythmia, hypotension, etc.	9		
		Aspirin/clopidogrel and enoxaparin	Increased bleeding, cerebral hematoma, etc.	2		
			Enzyme inducers (carbamazepine, phenytoin, etc.)	Valproic acid, lamotrigine, etc.: Poor seizure control	3	
		Miscellaneous	Metformin: Hyperglycemia	1		
			Miscellaneous	4		
		Accidental or suicidal drug ingestion	26 (10.3)	Accidental (valproic acid, carbamazepine, loratadine, etc.) by children 1-3 years	Drowsiness, vomiting, etc., or asymptomatic	19
					Suicidal (paracetamol, etc.) by young females	7
Abdominal pain, vomiting, etc.	7					
Drug abuse	18 (7.1)	Opioids (morphine, heroin)	Loss of consciousness, pin point pupil, respiratory distress, etc.	5		
			Cannabis	Drug induced psychosis	2	
		Cannabis and methanol	Loss of vision	1		
			Cannabis and alcohol	Alcohol withdrawal	1	
		Liver cirrhosis		1		
		Alcohol	Alcohol withdrawal	2		
			Drunk, drowsy, and poor orientation	2		
		Clozapine	Liver cirrhosis	1		
			Withdrawal: Confusion, agitation, and seizures	1		
		Amphetamine	Mania and psychosis	2		
Penicillin, ciprofloxacin, tazocin and vancomycin, carbamazepine	Skin rash		10			
Super infections	8 (3.2)	Antibiotics (ciprofloxacin, amoxicillin, imepenum, etc.)	Diarrhea, abdominal pain, otitis media and fungal pneumonia, etc.	4		
			Anaerobic infections, septicemia	2		
		Antibiotics and antisecretory drugs (esomeprazole, etc.)	Antisecretory drugs (esomeprazole, etc.)	2		
Noncompliance	112 (44.3)	Antiepileptic drugs (valproic acid, phenytoin, carbamezipine, etc.)	Anaerobic infection and Candidiasis	2		
			Seizures, falls, and injuries	94		
		Antipsychotic drugs	Status epilepticus	2		
			Agitation, insomnia, over-activity	12		
Antihypertensive drugs	Malignant hypertension, stroke	4				
	Total cases	253		253		

DRPs: Drug-related problems; WBC: White blood cell; ED: Emergency Department

DISCUSSION

Errors in medication can lead to DRPs, and insight into their frequency, type, and severity can help to prevent them. The aim of the present study was to determine the prevalence of DRPs resulting in 4.5% of the total admissions (5574) in 2012 in the ED of a University Hospital in Saudi Arabia. Similar results are reported in the literature on studies on ADRs and DRPs. In a Moroccan study of the medical intensive care unit, the incidence of ADEs resulting in admissions was 10%; in a Swiss study, an overall admission rate due to DRPs was 7.5%; while in a Canadian study, 12% of admissions in the ED were identified as drug-related.^[10-12] Our figures are relatively low perhaps because of incomplete information on the DRPs recorded in the files.

Most of the DRPs in our study were possibly preventable such as, those related to overdosage toxicity (19.8%), drug interactions (10.3%), and noncompliance (44.3%). Together, these amounted to 74.4% of DRPs and 3.4% of admissions in ED. In the Canadian study mentioned above, the most common reasons for drug-related visits to the ED were ADR (39.3%), the use of wrong or suboptimal drug (11.5%) and nonadherence (27.9%). Of these 68.0% were deemed preventable.^[12] The higher rates of noncompliance in our set-up, particularly in young adults, are alarming.

In a 6-month study conducted in two large general hospitals of Merseyside, England, 6.5% of admissions were due to DRPs. The median bed stay was 8 days, accounting for 4% of the hospital bed capacity. The projected annual cost of such admissions to the NHS was ≤466 m (€706 m, \$847 m). The overall fatality was 0.15%. Most reactions were either definitely or possibly avoidable.^[13] Similar results were also observed in the present study. The admission rate in ED due to DRPs, as mentioned above was 4.5%; the median bed stay was 51 days (1–102 days) and 0.18% died. An assessment of the cost of patient care in the hospital for admissions due to DRP, most of which are preventable, will amount to millions of Riyals.

Few studies in the literature deal with MEs, ADEs, or DRPs in hospitals in Saudi Arabia. One of these determined the rate of admissions, mainly due to overdose toxicity or ADR, to a medical ward of a district hospital.^[14] Another study described the epidemiology of DRPs and the related risk factors in hospitalized children.^[15] The third investigated the impact of computerized physician order entry on MEs and ADE in an Armed Forces Hospital.^[16] Another, more related to our study, dealt with the incidence of admissions due to DRPs to the ED (DRPs) in a tertiary hospital over a period of 28 days only. Of the 557 patients admitted, 82 (14.7%) admissions were due to DRP, (53 [9.5%]

were definite, 29 [5.2%]) possible. The most common types of DRP were 25 cases (47.2%) of failure to receive medication, 13 cases (24.5%) of ADR and drug overdose in 6 cases (11.3%). In the definite DRP group, 83% were definitely preventable.^[17] These figures are not much different from the present work, and the minor variations are the result of differences in the methodology. All cases were screened over 28 days while in the present study only suspected cases were scrutinized for 365 days. Particularly, noteworthy in both studies is the failure to adhere to treatment. In a more recent study conducted in a teaching hospital in Riyadh, the incidence of ADEs was 8.5/100 admissions.^[18] Again, the relatively higher rates than what obtained in the present work are because of the difference in the methodology.

In the present study, because of a huge number of patients who came to the ED (143833 in 2012), including those who came for antiseptic dressings and refills of prescriptions, the method of “trigger tools” was used to screen the suspect files.^[9] The suspicion arose from the code numbers of relevant categories in the hospital record system and the triggers indicative of DRPs, such as signs and symptoms, drugs commonly causing DRPs and the relevant laboratory tests. It is suggested that further similar studies should be conducted on particular groups of drugs such as anti-cancer drugs, anti-microbial drugs, anti-diabetics, anti-asthmatics and anti-hypertensive drugs, etc.

CONCLUSIONS

Drug-related problems are a common cause of hospital admissions and the use of “trigger tools” is very helpful in detecting them. An insight into the prevalence and causes of DRPs would help to understand the extent of the problem. Knowledge and vigilance in the use of drugs in patient care will not only save human lives and suffering, but also reduce the extra burden of millions of Riyals in expenditure.

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REFERENCES

1. Strand LM, Morley PC, Cipolle RJ, Ramsey R, Lamsam GD. Drug-related problems: Their structure and function. *DICP* 1990;24:1093-7.
2. Westerlund T, Marklund B. Assessment of the clinical and economic outcomes of pharmacy interventions in drug-related problems. *J Clin Pharm Ther* 2009;34:319-27.

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3. Nelson KM, Talbert RL. Drug-related hospital admissions. *Pharmacotherapy* 1996;16:701-7.
4. Lisby M, Nielsen LP, Brock B, Mainz J. How are medication errors defined? A systematic literature review of definitions and characteristics. *Int J Qual Health Care* 2010;22:507-18.
5. NCCMERP. National Coordinating Council for Medication Error Reporting and Prevention, About Medication Errors: What is a Medication Error?. Available from: <http://www.nccmerp.org/aboutMedErrors.html>. [Last accessed on 2012 Jan 19].
6. Maaskant J, Bosman D, van Rijn-Bikker P, van Aalderen W, Vermeulen H. Preventable errors with nonopioid analgesics and antiemetic drugs may increase burden in surgical pediatric patients. *Eur J Pediatr Surg* 2014;24:381-8.
7. Morimoto T, Gandhi TK, Seger AC, Hsieh TC, Bates DW. Adverse drug events and medication errors: Detection and classification methods. *Qual Saf Health Care* 2004;13:306-14.
8. Rommers MK, Teepe-Twiss IM, Guchelaar HJ. Preventing adverse drug events in hospital practice: An overview. *Pharmacoepidemiol Drug Saf* 2007;16:1129-35.
9. Rozich JD, Haraden CR, Resar RK. Adverse drug event trigger tool: A practical methodology for measuring medication related harm. *Qual Saf Health Care* 2003;12:194-200.
10. Jennane N, Madani N, Oulderrkhis R, Abidi K, Khoudri I, Belayachi J, *et al.* Incidence of medication errors in a Moroccan medical intensive care unit. *Int Arch Med* 2011;4:32.
11. Hardmeier B, Braunschweig S, Cavallaro M, Roos M, Pauli-Magnus C, Giger M, *et al.* Adverse drug events caused by medication errors in medical inpatients. *Swiss Med Wkly* 2004;134:664-70.
12. Zed PJ, Abu-Laban RB, Balen RM, Loewen PS, Hohl CM, Brubacher JR, *et al.* Incidence, severity and preventability of medication-related visits to the emergency department: A prospective study. *CMAJ* 2008;178:1563-9.
13. Pirmohamed M, James S, Meakin S, Green C, Scott AK, Walley TJ, *et al.* Adverse drug reactions as cause of admission to hospital: Prospective analysis of 18 820 patients. *BMJ* 2004;329:15-9.
14. Ahmed M el-B. Drug-associated admissions to a district hospital in Saudi Arabia. *J Clin Pharm Ther* 1997;22:61-6.
15. Rashed AN, Neubert A, Tomlin S, Jackman J, Alhamdan H, AlShaikh A, *et al.* Epidemiology and potential associated risk factors of drug-related problems in hospitalised children in the United Kingdom and Saudi Arabia. *Eur J Clin Pharmacol* 2012;68:1657-66.
16. Al-Rowibah FA, Younis MZ, Parkash J. The impact of computerized physician order entry on medication errors and adverse drug events. *J Health Care Finance* 2013;40:93-102.
17. Al-Olah YH, Al Thiab KM. Admissions through the Emergency Department due to drug-related problems. *Ann Saudi Med* 2008;28:426-9.
18. Aljadhey H, Mahmoud MA, Mayet A, Alshaikh M, Ahmed Y, Murray MD, *et al.* Incidence of adverse drug events in an academic hospital: A prospective cohort study. *Int J Qual Health Care* 2013;25:648-55.

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