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ORIGINAL ARTICLE

Medication safety practices in hospitals: A national survey in Saudi Arabia

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Abstract *Background:* Medication errors in hospitals are a worldwide concern. The World Health Organization has recommended the implementation of basic applications in healthcare systems to improve medication safety, but it is largely unknown whether these recommendations are adhered to by hospitals. We assessed the presence of core medication safety practices in Saudi Arabian hospitals.

Methods: We developed and validated a survey to assess medication safety practices in hospitals. Major headings included Look-Alike Sound-Alike (LASA) medications, control of concentrated electrolyte solutions, transitions in care, information technology, drug information and other medication safety practices. Trained pharmacists visited samples of hospitals from all regions of Saudi Arabia.

Results: Seventy-eight hospitals were surveyed. Only 30% of the hospitals had a medication safety committee and 9% of hospitals had a medication safety officer. Only 33% of hospitals had a list of LASA medications and 50% had a list of error-prone abbreviations. Concentrated electrolytes were available in floor stock in 60% of the hospitals. No hospital involved pharmacists in obtaining medication histories and only 37% of the hospitals provided a medication list to the

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patients at discharge. While 61% of hospitals used a computer system in their pharmacy to enter prescriptions, only 29% of these hospitals required entry of patient's allergies before entering a drug order.

Conclusions: Core practices to improve medication safety were not implemented in many hospitals in Saudi Arabia. In developing countries, an effort must be made at the national level to increase the adoption of such practices.

1. Introduction

Medication errors occurring in hospitals have become a worldwide concern for healthcare policy makers, professionals and the public. These errors harm at least 1.5 million United States residents annually, and treating injuries caused by these errors cost at least 3.5 billion dollars (Aspden et al., 2006). In one U.S. study in two academic hospitals, the incidence of adverse drug events (ADEs) for hospitalized patients was estimated to be 6.5 per hundred admissions (Bates et al., 1995). A more recent study in community hospitals found an even higher rate of ADEs of 15 per hundred admissions (Hug et al., 2010). In Australia, up to 4% of all hospital admissions are medication-related (Runciman et al., 2003). In Saudi Arabia, two recent studies estimated that the prevalence of prescribing errors in hospital inpatient ranges between 13 and 56 per 100 medication orders (Al-Dhawailie, 2011; Al-Jeraisy and M., 2011). These data suggest that medication safety is an important international contributor to morbidity and costs of healthcare.

In the past decade, research has shown that many interventions could decrease the frequency of medication errors. Many of these interventions include the use of information technology and automation, while others use other approaches such as involving a pharmacist with the medical team or the application of core practices aimed at preventing ADEs (Aspden et al., 2006; Bates et al., 1998; Poon et al., 2006; Cohen et al., 2005; Vira et al., 2006; Gleason et al., 2004; Cavin and Sen, 2005; Nester and Hale, 2002; Bond et al., 2000, 1999, 2002; McFadzean et al., 2003; Tam et al., 2005; Strunk et al., 2008). For example, the use of computerized physician order entry reduced the serious medication error rate by 55% (Bates et al., 1998) and the use of bar-code technology minimized the rate of dispensing errors by 31% (Poon et al., 2006). One study suggested that having a medication safety officer in the hospital may be associated with a lower rate of ADEs (Cohen et al., 2005). Also, studies repeatedly show that ascertaining a patient's medication history at admission by a pharmacist decreases medication errors (Vira et al., 2006; Gleason et al., 2004; Cavin and Sen, 2005; Nester and Hale, 2002; Bond et al., 2000, 1999, 2002; McFadzean et al., 2003; Tam et al., 2005; Strunk et al., 2008).

Though research has shown the value of these interventions in reducing medication error rates, the extent to which they are implemented in hospitals around the world is poorly understood. In 2005, the World Health Organization (WHO) launched the World Alliance for Patient Safety. In 2007, the Alliance recommended patient safety solutions to help prevent medication errors and adverse events. Adherence to the recommendations of the WHO regarding medication safety practices by hospitals is unknown. No study had previously been conducted in Saudi Arabia to assess the current state of medication safety practices in hospitals. Understanding the current status of activities and practices would guide policy makers and healthcare professionals on areas for improvement. The aims of the current study were to assess the presence of core medication safety practices in Saudi Arabian hospitals and assess the association between safety practices and hospital characteristics.

2. Methods

2.1. Design and setting

In Saudi Arabia, hospitals are either governmental or private. Governmental hospitals can be classified as either Ministry of Health or non-Ministry of Health hospitals. Healthcare in rural areas is provided mainly by the Ministry of Health which runs more than 220 hospitals in all regions of Saudi Arabia. Other governmental hospitals include National Guard hospitals, armed forces hospitals, security forces hospitals and specialized hospitals. Private hospitals have increased in number and size over the past few years and are mainly concentrated in major cities.

To obtain a national estimate of the frequency of implementation of medication safety practices in hospitals, we stratified hospitals by region and type, and then a convenient sampling technique was applied. Saudi Arabia was divided into five regions (central, north, south, east and west). We selected stratified convenient samples of hospitals from each region in three categories: Ministry of Health hospitals, other government hospitals, and private hospitals. Hospitals from large cities and small towns were studied. The study was approved by the Medication Safety Research Chair committee and an approval was obtained from each hospital before survey completion.

2.2. Survey administration

Pharmacists interviewed the pharmacy director or inpatient supervisor to complete the survey. Interviewers were trained by one of the study investigators on medication safety elements and each section of the survey was explained in detail. Between March and June 2009, trained pharmacists visited conveniently selected hospitals in all regions of Saudi Arabia. Prior to visiting a hospital, a fax was sent which was followed by a phone call to the pharmacy director to schedule a meeting to complete the survey. At the beginning of the meeting, the pharmacists explained the purpose of the study and assured that the name of the hospital would be kept confidential. Then, pharmacists obtained answers to the survey's questions during a 1 h meeting.

2.3. Survey development

A survey to assess the presence of core medication safety practices in hospitals was developed based on the recommendations of the WHO patient safety solutions, the Joint Commission International, and the Institute for Safe Medication Practices (WHO, 2011; ISMP, 2011; JCI, 2011). We selected common core practices that we believed were most important for improving the safety of medications in hospitals, and could be feasibly implemented soon in nearly all hospitals in Saudi Arabia. The survey instrument underwent a face validity check with a number of pharmacists to ensure that the questions were understood. The final version of the survey contained 44 questions under seven main sections.

2.4. Survey content

Hospital name and contact information were collected at the beginning of the survey. Participant hospitals were asked in the first part of the survey if they had a medication safety committee or subcommittee, a medication safety director, an error reporting system and whether the error reporting system was electronic or paper.

The second part focused on the practices to prevent medication errors because of Look-Alike Sound-Alike (LASA) medications. Hospitals were asked if they have an updated list of LASA medications, mechanisms to prevent errors from LASA medications and were asked if they provide education to healthcare professionals about these medications.

The third part consisted of three questions regarding the hospital's policy in dealing with concentrated electrolyte solutions. It asked whether they keep concentrated electrolyte solutions in floor stock, require a second person to check the prepared solutions and include high risk warnings on the labels of diluted electrolyte solutions.

Ten questions on practices during transitions in care were included in the fourth section. The questions included whether the hospital ascertains a complete medication history and, if so, who conducts the history, and if the current medications list is kept in a highly visible location. Surveyed hospitals were also asked whether they have written policies regarding listing and updating medication lists, updating the current medication list when new orders are written, providing patients with lists of discharged medications, and educating healthcare professionals about medication reconciliation when health care transitions occur for patients.

The fifth section assessed the use of health information technology in patient care. Questions included whether pharmacists have electronic access to inpatient and outpatient laboratory values and if a medication bar-coding system is used to verify drug orders. Interviewers also asked whether the hospital has an electronic medication administration record and if patient allergy information is required before entering a prescription order.

The last two sections of the survey asked about the availability of drug information resources and the implementation of other practices. These practices included the use of maximum doses for high-alert drugs, implementation of a controlled drug formulary system, the presence of a list of error-prone abbreviations and the use of a unit dose system.

2.5. Statistical analysis

Descriptive statistics were performed to illustrate the results of the survey. Results are displayed as counts and percentages. Univariate analysis using chi-square test or fischer's exact test as appropriate was used to assess the association between the presence of important medication safety practices and the presence of medication safety officer, medication safety committee, or hospital size. We considered a p value < 0.05 as statistically significant. The Statistical Package for Social Science (SPSS) for windows version 14 (SPSS Inc., Chicago, IL, USA) was used for analysis.

3. Results

Seventy-eight hospitals were surveyed; 38 (49%) were Ministry of Health hospitals, 14 (18%) were governmental non-Ministry of Health hospitals and 26 (33%) were private hospitals (Table 1). Most of the hospitals had a capacity of 100–299 beds.

Only 22 (28%) hospitals had a medication safety committee and 7 (9%) hospitals had a medication safety officer (Table 2). More than 50% of the hospitals did not have a list of LASA medications, a mechanism to review LASA medications and did not include brand and generic names on the labels of medications.

Concentrated electrolytes (potassium chloride, potassium phosphate, magnesium sulfate and parenteral sodium chloride solutions with concentrations greater than 0.9%) were available in floor stock in 47 (60%) hospitals. High risk warning labels were applied on diluted electrolyte solutions in only 34% of the hospitals. More than 40% of the hospitals did not double-check final concentrations of prepared electrolyte solutions including calculations.

None of the hospitals involved pharmacists to ascertain patients' medication histories and only 27 (37%) hospitals provided patients with a list of medications at discharge.

A unit dose system was implemented in 70 (90%) hospitals and computerized drug information resources were available in the pharmacies of 33 (43%) hospitals. Forty-five (61%)

Table 1 General characteristics of surveyed hospitals.

Factor	*Number of Hospitals N (%)
Region:	
Center	15 (19)
East	16 (21)
West	16 (21)
South	14 (18)
North	17 (22)
Types of hospitals:	
Ministry of Health	38 (49)
Government non-Ministry of Health	14 (18)
Private	26 (33)
Number of beds:	
Fewer than 100 beds	16 (21)
100–299 beds	32 (42)
300–499 beds	19 (25)
500 beds and over	9 (12)

* Total number of hospitals 78 hospitals.

Table 2 Medication safety practices in Saudi Arabia hospitals.

Factor	*Number of Hospitals N (%)
Medication Safety Committee and error reporting systems	
Medication safety committee	22 (28)
Medication safety director	7 (9)
Paper-based error reporting system used	59 (76)
Electronic error reporting system implemented	6 (12)
Look-Alike sound-Alike (LASA) medications	
List (LASA) medications	26 (33)
Mechanism for reviewing LASA medications	20 (47)
Mechanism to prevent LASA medications	35 (57)
Education on LASA medications	38 (50)
Medications stored in pharmacy alphabetically	57 (73)
Diagnosis field exists in the prescription or drug order	73 (95)
Both brand and generic names included on medication labels	20 (27)
Control of concentrated electrolyte solution	
Concentrated electrolytes found on floor stock	47 (60)
Second person verifies final concentrations of parenteral electrolyte solutions including calculations	39 (53)
High-risk warning label used on diluted electrolyte solution	26 (34)
Transition in care	
New order required with patient admission or transfer	46 (59)
Orders "resume the same medications" are accepted	44 (56)
Policy to update medication list exists	52 (70)
Complete drug history taken	71 (95)
Pharmacist takes medication history	0
Current medications list put in consistent highly visible location	61 (81)
Written policies and procedures to list and update the medication list	41 (57)
Current medication list updated with new physician orders	62 (83)
List of discharge medications	27 (37)
Health care professionals educated on procedures for reconciling medications	18 (24)
Information Technology	
Electronic access to inpatient laboratory values	34 (44)
Medication bar coding	9 (12)
Electronic medication administration record	21 (29)
Pharmacy uses computer to enter prescription	45 (61)
Patient allergy history is required to enter an order	13 (39)
Drug allergy verified	24 (55)
Pharmacy computer screens drug for drug allergy	13 (29)
Allergy list is clearly visible on all pages of medication administration records	53 (77)
Computer is directly interfaced with the laboratory	10 (14)
Body weight is a required field	8 (11)
Drug Information	
Drug information resources in all patient care areas	47 (61)
Computerized drug information resources in the pharmacy	33 (43)
Other Medication Safety Practices	
Renal or hepatic dosage adjustment for relevant patients	18 (24)
Maximum dose for high alert drug	20 (27)
Controlled drug formulary system	57 (75)
A list of error prone abbreviations is available	38 (50)
Unit dose system implemented	70 (93)
Medications brought from home by patient are not used	60 (83)
Discontinued medications are removed from patient supplies in a timely manner	62 (86)
Pharmacy staff receive baseline competency evaluation	42 (56)

*Total number of hospitals = 78.

hospitals use a computer system in the pharmacy to enter prescriptions but only 39% of these hospitals required patient allergy information before entering a drug order.

Other more advanced practices were also poorly implemented, such as pharmacist electronic access to inpatient laboratory data, use of medication bar-coding including robotic dispensing and electronic medications administration records. It was uncommon for a pharmacist to be involved in renal or hepatic dosage adjustment (24%) for relevant patients.

We examined the association between the presence of medication safety officer, medication safety committee, or number of beds and the presence of important medication safety

Table 3 Association between important medication safety practices and hospital characteristics (presence of medication safety officer and medication safety committee).

Variable		Presence of medication safety officer		*P* value (χ^2 test or Fisher's Exact test)
		Yes *n* (%)	No *n* (%)	
List of error prone abbreviation	Yes *n* (%)	7 (100)	31 (44.9)	0.012
	No *n* (%)	0	38 (55.1)	
List of discharge medication	Yes *n* (%)	4 (57.1)	23 (34.8)	0.245
	No *n*(%)	3 (42.9)	43 (65.2)	
List of LASA medications	Yes *n* (%)	7 (100)	18 (25.7)	<0.001
	No *n* (%)	0	52 (74.3)	
		Presence of medication safety committee		
List of error prone abbreviation	Yes *n* (%)	18 (81.8)	20 (38.5)	0.001
	No *n* (%)	4 (18.2)	32 (61.5)	
List of discharge medication	Yes *n* (%)	13 (59.1)	14 (28)	0.018
	No *n* (%)	9 (40.9)	36 (72)	
List of LASA medications	Yes *n* (%)	14 (63.6)	11 (20.8)	0.001
	No *n* (%)	8 (36.34)	42 (79.2)	

Table 4 Association between important medication safety practices and hospital size.

	Number of beds					*P* value (χ^2 test or Fisher's Exact test)
	Fewer than 100 beds (%)	100–299 beds (%)	300–499 beds (%)	500 beds and over		
List of error prone abbreviation	Yes *n* (%)	4 (25)	18 (58.1)	10 (52.6)	6 (66.7)	0.119
	No *n* (%)	12 (75)	13 (41.9)	9 (47.4)	3 (33.3)	
List of discharge medication	Yes *n* (%)	4 (26.7)	10 (33.3)	6 (33.3)	7 (77.8)	0.078
	No *n* (%)	11 (73.3)	20 (66.7)	12 (66.7)	2 (22.2)	
List of LASA medications	Yes *n* (%)	3 (18.8)	11 (34.4)	7 (36.8)	4 (44.4)	0.553
	No *n* (%)	13 (81.2)	21 (65.6)	12 (63.2)	5 (55.6)	

practices (Table 3 and Table 4). We found that the presence of a medication safety officer or committee within a hospital was highly associated with the presence of a list of error prone abbreviations and LASA list.

4. Discussion

We assessed the presence of core medication safety practices in Saudi Arabian hospitals, and found that, there was substantial opportunity for improvement, even for relatively low-cost interventions. Only 30% of the hospitals had a medication safety committee and 9% had a medication safety officer. Furthermore, only 33% of the hospitals carry a list of LASA medications and 50% had a list of error-prone abbreviations. Concentrated electrolytes were available as floor stock in 60% of hospitals. None of the hospitals involved pharmacists to ascertain patients' medication history and only 37% of hospitals provided patients with a list of medications at discharge.

All of the above interventions can be implemented with a relatively modest increase in resources allocated, and while this remains to be demonstrated, they might well pay for themselves. Further improvement in medication safety might be expected with the implementation of other more costly solutions such as computer order entry and bar-coding, but the basic interventions should be implemented first.

The results of this study have important implications on practice in other developing countries similar to Saudi Arabia. Action should be taken by the healthcare professionals and hospital administrators to implement low cost practices. These practices include lists of LASA medications, lists of discharge medications and lists of prohibited abbreviations. None of the surveyed hospitals involved pharmacists to obtain medication histories. However, previous studies show that inconsistencies in medication histories occur in up to 61% of patients admitted to hospitals (Vira et al., 2006; Gleason et al., 2004; Cavin and Sen, 2005; Nester and Hale, 2002; Bond et al., 2000, 1999, 2002; McFadzean et al., 2003; Tam et al., 2005) and pharmacists could help to significantly reduce these errors by

obtaining the patients' medication history at the time of hospital admission (Strunk et al., 2008).

When hospitals are preparing for accreditation they will implement many practices required for accreditation, which in turn will improve the safety of medication practices in these hospitals. However, not all countries require that hospitals obtain national or international accreditation. In Saudi Arabia, accreditation was not required for hospitals until the establishment of the Central Board of Accreditation for Healthcare Institutions (CBAHI) in 2006. Pharmacy standards for CBAHI included most of the practices included in the current study. One may argue that to benefit from these practices education and culture change are also essential, which is unlikely to be gained by accreditation alone. Future studies need to focus on changing the culture and studying the reasons for not implementing medication safety practices in hospitals.

In Saudi Arabia, a national center to address medication safety is needed to focus on research and work collaboratively with CBAHI and various health care systems. This center could evaluate innovative interventions, including their cost-effectiveness, disseminate knowledge and assist in implementing applications to improve the safe use of medications. Because resources are scarce in developing countries, it is especially important to determine which interventions have the most impact, although some such as removal of concentrated electrolyte solutions from floor stock should simply be implemented. Installation of state-of-the-art applications in a particular hospital does not automatically result in a safer environment for patients in that hospital.

This study has several limitations. The responses of pharmacy directors to the survey were not verified. Such verification for the presence of practices would require inspection of the pharmacy which was not welcomed by most hospitals. Another limitation was that the survey asked general questions regarding the presence of certain practices and we did not ascertain the details about each practice.

In summary, core practices to ensure medication safety were not implemented in many hospitals in Saudi Arabia. To improve the safe use of medications in developing countries, an effort at a national level is needed in hospitals and this effort should include standards, certification, regulation, and support for research, regulation and education.

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