RESEARCH ARTICLE

Ranking Factors Contributing to Medication Error Incidents in Private Hospital: A Nurse Perspective

Seyed Saeed Tabatabaee [1], Vahid Kohpeima Jahromi [2], Mahbobeh Asadi [3], Rohollah Kalhor [4,5], Tahereh Sharifi [6]

[1] Research Center for Health Services Management, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran [2] Research Center for Modeling in Health, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran [3] Patient Safety Research Center, Mashhad University of Medical Sciences, Mashhad, Iran [4] Health Information Management Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran [5] Department of Health Services Management, School of Public Health, Qazvin University of Medical Sciences, Qazvin, Iran [6] Department of Health Services Management, School of Management and Medical Information, Kerman University of Medical Sciences, Kerman, Iran

Abstract

Background and Objectives: Medication error is the most important factor threatening patient safety. While the causes of medication error are extensively researched in the public hospitals, the corresponding data from the private heath settings is limited. To help fill this shortcoming, this paper presents and discusses the results of surveying the medication error factors as perceived by nurses in an Iranian private hospital.

Methods: This cross-sectional survey was carried out in a private general hospital situated in Mashhad, a Western Iranian city. The study sample included 97 nurses, randomly selected from the nurses working in different hospital departments. A literature-based researcher-made questionnaire consisting of 23 questions related to the causes of medication error incidents from the nurse's perspective was used as the survey tool. The content validity of the survey tool was explored by using nursing experts' opinions. The reliability of the tool was examined using test-retest method. Data were summarized using descriptive statistical methods. The factors contributing to the medication error were ranked based on their *importance* scores, and clustered into three major ranking categories: *very important*, *moderately important*, and *slightly important*. The relationship between the demographic variables and the perceived importance of the medication error factors was measured using Pearson's correlation coefficient. T-test and ANOVA were used for comparison of the edical error factors between the demographic groups.

Findings: *Low nurse-to-patient ratio*, *high workload* and *improper work assignment* were found to be the most important factors contributing to medication error incidents. Nurses of Male Surgery Department placed significantly more emphasis on the role of *low nurse-to-patient ration* and *heavy workload* in medication error incidents compared to other nurses. Also nurses of ICU gave a relatively higher weight to the *existence of very ill patients in department* as medication error inducing factor, as compared with their other counterparts. A significant inverse relationship was identified between the nurses' age and work experience, and their perceived importance of *low nurse-to-patient ratio*, *nurse's personal neglect*, and *nurse's illegible writing in kardex*; age also showed an inverse correlation with the perceived importance of *heavy workload*.

Conclusions: There is no fundamental difference in the medication error incident factors between the private and public hospitals. The perceived most important factors contributing to medication error incidents are those that influence the nurses' quality of work life. Hence, a comprehensive strategy for major improvement of nurses' quality of work life would concomitantly result in a reduced rate of medication error incidents. An effective medication error controlling strategy also should address the different nature of needs in different hospital department for successful results.

Keywords: Medication Error, Patient Safety, Hospital, Nurse, Quality of Work Life, Healthcare Workers

Background and Objectives

Patient safety is of prime importance for every health care providing organization aiming to guarantee the

quality of its care services [1]. Medication error has a major contribution to jeopardizing the patient safety [2]. Studies have shown that 19-28% of hospitalized patients are subject to medication errors in the European countries [3]. In the US, thousands of people die due to medication errors annually, and the financial burden of unintended events caused by medication errors reaches to $77M per year [4]. Given its fre-

Corresponding author: Tahereh Sharifi, Department of Health Services Management, School of Management and Medical Information, Kerman University of Medical Sciences, Kerman, Iran, Tel: + 98 341 3205223, Fax: + 98 3413 205221, Email: salinasharifi@gmail.com

quent incidence and high potential risks for patients, medication error is considered as an indicator of hospital patient safety [5,6].

Medication error is described as the administration of wrong medication to the patients [7]. The common known errors in administering medication include administering wrong type of medication, improper dosing, error in drug concentration, failure to follow the prescription schedule, and administering medicine to wrong patient [1].

Medication error has several undesired outcomes, including increased mortality, increased hospitalization period, reduced quality of care, and increased treatment costs [8-10]. It also harms the confidence of the patients and their families in the healthcare system. Furthermore, medication error induces stress and conflicts among nurses [11], thereby reducing the performance of health care human forces [1].

There are several clinical factors contributing to the medication error incidents (MEI). According to Tissot *et al.* (2003), nurses' heavy workload and their illegible and incomplete prescriptions are among the most important factors related to MEI by nurses [12]. Tang *et al.* identified nurse high workload, lack of new nurse staff experience, and nurse's personal neglect as the most important causes of medication errors [13]. A Japanese study identified limited knowledge of pharmacology as the main cause of MEI by fresh graduate nurses [14].Identifying and evaluating factors leading to MEI can help adapting proper measures to prevent them. Most studies on identification of factors affecting MEI have been performed in public hospitals [15-18]. Considering that private health settings have a major contribution to provision of health care to the community alongside the public hospitals, further research into the factors playing role in MEI in this category of health settings is required for development of comprehensive overcoming strategies. Accordingly, the present study surveyed factors leading to MEI as perceived by nurses in an Iranian private hospital.

Methods

Study Design

This study is a descriptive-analytical survey with a cross-sectional design, which was carried out in 2012.

Setting and Sample

A private general hospital, situated in Mashhad (Iran), was targeted for the survey. The hospital has 180 active beds in general surgery, obstetrics and gynecology, newborns, cardiac, angiography, CCU, ICU and NICU departments. The study sample included 97 nurses, randomly selected from the nurses working in different departments of the hospital.

Measurement Tool

The measurement tool was a researcher-made questionnaire consisting of two main parts. The first part comprised of seven demographic questions, and the second part contained 23 questions related to the causes of MEI from nursing perspective. Five-point Likert-type scale was used for quantifying the answers, ranging from 1 = 'Not important" to 5 = "Very important". While the tool was developed based on literature review [13, 15, 19, 20], its content validity was further explored by using nursing experts' opinions. The reliability of the tool was examined using test-retest method; the questionnaire was administered twice to 20 subjects, who were excluded from the main study after a two–week interval, and the correlation between the answers was calculated. A correlation of 81% between the answers ensured sufficient reliability of the survey tool.

Ethical Issues

An approval for conduction of the study was obtained from the Ethical Committee of Kerman University of Medical Sciences (KUMS). The target respondents were briefed on the study objective, and their verbal consent for participating in the survey was obtained.

Data Collection and Analysis

The questionnaires were distributed among the nurses in three working shifts (morning, afternoon and night). They were asked to return the completed questionnaire within three days after administration. The completed questionnaires were collected, controlled in terms of completeness, and coded and entered into the statistical analysis software package for analysis. The data were summarized using descriptive statistical methods. The factors contributing to the medication error were ranked based on their *importance* scores, and clustered into three major ranking categories: *very important*, *moderately important*, and *slightly important*. The relationship between the demographic variables and the MEI factors were measured using Pearson's correlation coefficient. T-test and ANOVA were used for comparison of the mean values. $P < 0.05$ was considered as statistically significant. All statistical analyses were carried out using SPSS Version 19 Software.

Table 1   Score mean, rank and importance of factors contributing to MEI as perceived by the nurses

Factors contributing to MEI	Score mean	Rank	Importance
Low nurse-to-patient ratio	4.8	1	Very important
High workload	4.7	2	Very important
Appropriate work assignment	4.7	3	Very important
Mandatory overwork and consequent tiredness	4.1	4	Very important
Illegible physician orders	3.9	5	Very important
Illegible nurses writings in drug kardex	3.8	6	Very important
Presence of very ill patients in ward	3.3	7	Moderately important
Using nurses in unrelated positions	3.1	8	Moderately important
Emergency condition of patients	3	9	Moderately important
Similarity of drug names	2.9	10	Moderately important
Type of shift work	2.9	11	Moderately important
Nurse's personal neglect	2.8	12	Moderately important
Lack of proper in-service training	2.7	13	Moderately important
High variety of drugs in the department	1.6	14	Slightly important
Inappropriate packaging and labeling of drugs	1.6	15	Slightly important
Inappropriate location of the drug shelf	1.5	16	Slightly important
Lack of pharmacy information text in the department	1.2	17	Slightly important
Dissatisfaction with the place of work	1.2	18	Slightly important
Lack of coordination with other colleagues	1.1	19	Slightly important
Lack of patient compliance with the nurse	0.7	20	Slightly important
Dissatisfaction with the nursing profession	0.5	21	Slightly important
Inappropriate working environment (light, temperature, noise, etc.)	0.5	22	Slightly important
Dissatisfaction with the hospital	0.3	23	Slightly important

Table 2 Difference of the perceived importance of factors contributing to MEI between the two genders

Factors contributing to MEI	Female		Male		Difference		
	Mean	SD	Mean	SD	t	df	Significance
Lack of pharmacy information text in department	1.35	1.35	4.10	0.91	-2.84	95	0.008
The high variety of drugs in department	3.30	1.47	4.10	1.12	-2.06	95	0.041
Improper packaging and labeling of drugs	3.24	1.55	4.13	0.91	-3.05	95	0.005

Results

Demographic characteristics of the respondents are summarized in Table 1. Of the total participants, 76 (78.3%) were females and 67 (69.1%) were married. The mean age of the nurses was 29.3 years and their mean work experience was 8.7 years. Fifty two (53.6%) nurses were working in rotating shifts. Most nurses were from Male Surgery Ward (n = 11, 11.3%), and the least were from Angiography Ward (n = 8, 8.2%).

Table 2 presents the ranked list of factors contributing to MEI. *Low nurse-to-patient ratio*, *heavy workload and working beyond power/capacity*, and *improper work assignment* were identified as the three most significant factors leading to MEI, respectively. On the other hand, *dissatisfaction with the hospital*, *unsuitable physical environment*, and *dissatisfaction with nursing profession* were identified as the three factors with the lowest impact on MEI.

Table 3 shows MEI factors with significantly different importance as perceived by the two genders. As seen, male nurses placed significantly higher emphasize on *lack of drug information resources* (df = 95, t = -2.84, P < 0.05), *high variety of drugs* (df = 95, t =

-2.06, P < 0.05), *inappropriate packaging and labeling of drugs* (df = 95, t = -3.05, P < 0.05) as compared with their female counterparts. The results of t-test also indicated that single nurses give a higher weight to *dissatisfaction with hospital* (df = 95, t = -2.42, P < 0.05), and *improper work assignment* (df = 95, t = -2.75, P < 0.05) as the causes of medications errors.

Results of ANOVA and Tukey HSD tests showed that *low nurse-to-patient ratio* (F = 3.60, P < 0.05), and *heavy workload* (F = 3.22, P < 0.05) are perceived to be more important as by the nurses of Male Surgery Department as compared with the nurses of other departments. Moreover, *existence of very ill patients in department* is a more important MEI factor to the view of the ICU nurses when compared with the other nurses (F = 2.38, P < 0.05).

Table 4 shows the results of correlation analysis between the nurse's perceived importance of MEI factors, and their demographic characteristics. The correlation analysis identified a significant inverse relationship between age and work experience of nurses and their perceived importance of *low nurse-to-patient ratio*, *nurse's personal neglect*, and *nurse's illegible writing in kardex* (Table 3). As shown, with increase of nurses' age and work experience, the per-

Table 3   Correlations between nurses' characteristics and their perceived importance of factors contributing to MEI

Factors affecting MEI	Age		Work experience	
	Correlation	Significance	Correlation	Significance
Low nurse-to-patient ratio	-0.283	0.005	-0.213	0.036
Nurse's personal neglect	-0.214	0.035	-0.241	0.017
Heavy workload	-.312	0.002	-	-
Illegible nurse writings in the drug kardex	-0.201	0.048	-0.341	0.001

ceived importance of these factors decreases. Also age shows an inverse correlation with the perceived importance of *heavy workload*.

Discussion

MEI is one of the most important patient safety challenges in the clinical units. Previous studies have documented several factors contributing to MEI [12-14]. Our study aimed to provide additional information on the causative factors leading to MEI in the private health settings from nursing perspective. Based on the obtained results, *low nurse-to-patient ratio*, *high workload*, and *improper work assignment* constitute the most important factors contributing to MEI in private hospitals as perceived by the nurses.

Low nurse-to-patient ratio was found as the leading cause of MEI in the surveyed private hospital. The impact of this factor on MEI has already been highlighted in previous studies [13]. In a study performed on 81 physicians, Blendon *et al.* identified staff shortage as the major cause of medication errors [21]. In a study surveying 284 nurses, Karen *et al.* (2004) identified *nurse-to-patient ratio* as one of the two most important factors increasing the probability of medi-

cation errors [22]. Evidence shows that the shortage of staff reduces the quality of care, and increases MEI [13]. Appropriate nurse staffing, hence, should be considered as the prime strategy for improving MEI in the private hospitals [19].

Associated with low nurse-to-patient ratio, the resultant heavy nurse's workload was identified as the second cause of MEI. The importance of this factor has been underscored in several previous researches [12, 23-25]. The expectation from the nurses in the contemporary limited-resources health systems to perform multiple and complex tasks simultaneously has emerged as a collaborative factor leading to an increased MEI [26]. This challenge again should be addressed primarily by appropriate staffing.

Consistent with a previous research [27], our results did not identify *lack of pharmacology information resources* among the most important factors in the occurrence of medication errors. Contrary to an earlier study [28], however, *nurse's illegible writings in drug kardex* was identified as a major factors leading to MEI. The contrast between the studies may lie in the lack of systematic prescription writing and electronic registration in our surveyed hospital. Therefore, training the care team about the importance of legible

prescription, as well as providing electronic systems for documentation of physician orders and nursing kardex can potentially lead to a reduced rate of MEI.

The surveyed nurses identified the presence of very ill patients in the Intensive Care Unit (ICU) as a moderately important cause of MEI. As pointed out by Rothschild *et al.,* some departments are especially more disposed to MEI relative to the other ones. For instance, in the ICU, patients are more vulnerable, their caring is more complicated, and a multidisciplinary expertise is required for the care process, all of which increase the chance of MEI [29].

Our results indicated that as the nurse's age and work experience increase, the perceived importance of *low nurse-to-patient ratio, nurse's personal neglect, and nurse's illegible writing in drug kardex* decreases; this is while that age shows an inverse correlation with the perceived importance of *heavy workload*, as well. The fact that all these factors, which are perceived to be *very important* in MEI, received lower importance scores on average by the nurses of higher age and work experience, highlights the importance of considering these nurse' characteristics when assigning critical tasks in order to control the risk of medication errors.

Our results showed that the relative importance of MEI factors is different in the views of nurses from different departments. For instance, nurses of Male Surgery Department placed significantly more emphasis on *low nurse-to-patient ration* and *heavy workload* as the important MEI factors compared to other nurses. Also nurses of ICU deem *existence of very ill patients in department* more problematic compared to their other counterparts. Hence, an effective MEI controlling strategy should address the different nature of needs in different hospital department for successful results.

Inappropriate work assignment to the nurses, the third perceived important MEI factor, was perceived to be more important among the single nurses as compared with their married counterparts. On the other hand, a number of factors related to information, variety and packaging of the drugs gained significantly more emphasis in the view of male nurses as compared with their female counterparts. While these observations are difficult to explain by the current level of information, they open interesting questions for future studies.

Overall, our findings indicate that the most important factors influencing MEI in the surveyed private hospital are not fundamentally different from those in the public hospitals, all of which being related to the nurses' quality of work life. This observation, however, does not comply with the expectation that the pri-

vate hospitals, thanks to their organizational independence and financial strength, should generally have a higher nurse satisfaction profile as compared with the public hospital. For instance, the independence and relative abundance of financial resources allow the private hospitals for adequate nurse staffing. Therefore, the high impact of insufficient nurse staffing and the resultant heavy workload on MEI as perceived by our surveyed nurses, reveals the inefficiency of hospital management. While the limited scope of this study does not permit generalization of the findings, this low hospital management performance which does not allow the private hospitals to perform significantly better than the public hospitals, especially in terms of healthcare workers staffing and nurse satisfaction, can potentially be the major root of MEI in many other private hospitals, a hypothesis remaining to be tested in the future investigations. Confirmation of such a hypothesis in future large-scale studies would imply the urgent need for developing up-stream strategies aiming at promotion of hospital management performance, with emphasis on improving nurses' quality of work life in order to reduce the rate of MEI in both the public and private hospitals.

Study Limitations

Our study is subject to the common limitations attributable to the self-report surveys. In addition, limited sample size and conduction of the survey in a single private hospital limit the extension of the findings to other private hospitals.

Conclusions

This study identified *low nurse-to-patient ratio*, *heavy workload*, and *improper work assignment* as the three most significant factors leading to MEI in the surveyed private hospital. Our results showed that the relative importance of MEI factors is different in the views of nurses from different departments. Hence, an effective MEI controlling strategy should address the different nature of needs in different hospital department for successful results. The fact that all factors perceived to be very important in MEI, received lower average importance scores by the nurses of higher age and work experience, adds weight to the importance of considering these nurse' characteristics when assigning critical tasks in order to control the risk of medication errors.

The results further showed that, MEI has a root in managerial issues, which was manifested in nurses' low quality of work life. While the limited scope of this study does not permit generalization of the results,

this low hospital management performance, can potentially be the main cause of MEI in many other private hospitals. If receiving support by the future studies, our findings would imply the need for comprehensive hospital management promotion strategies, with emphasis on improving nurses' quality of work life, in order to reduce the rate of MEI in both public and private hospitals.

Abbreviations

(MEI): medication error incidents

Competing Interests

The authors declare no competing interest.

Authors' Contributions

SST conceived the original concept, designed the research, participated in analysis and interpretation of the data, and contributed to the drafting and revising of the manuscript. TS developed and adapted the research tools and made the major contribution to the preparation of the manuscript. VKJ collected the data and contributing to preparation of the manuscript. MS contributed to data analysis and preparation of the manuscript. RK contributed collection, analysis, and interpretation of the data.

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