

THE ROLE OF EVALUATION PHARMACY INFORMATION SYSTEM IN MANAGEMENT OF MEDICATION RELATED COMPLICATIONS

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Original paper

ABSTRACT

Introduction: As a natural phenomenon in the patient's medication therapy, medication clinical complications potentially or concretely interrupt medical care consequential productivity for the patients. Medication related clinical complications include drug errors, drug side effects, drug interactions and drug usage-related challenges. The present research intends to explore the role that the Pharmacy Information System (PIS) may play in the management of medication complications with reference to the pharmaceutical societies of America and Australia in selected teaching, private and social services hospitals of the city of Isfahan.

Methodology: As an applied, descriptive-analytical study, this study has been conducted in

teaching, private and social services hospitals situated in the city of Isfahan in 2011. The research population consisted of the PISs used in the hospitals under study. Research sample was the same as the population. The data collection instrument used was a self-designed checklist developed based on the guidelines of the American Society of Health System Pharmacists and Pharmaceutical Society of Australia validity of which was assessed by expert professors' views. The data, collected by observation and interview methods, were put into SPSS 18 software to be analyzed. **Findings:** The findings of the study revealed that among the 19 hospitals in question, the highest and lowest ranks in observing the societies of the pharmacists' established standards related to medication therapy, i.e. registration of drug use

status and drug interactions belonged to social services hospitals (mean score of %10.1) and private hospitals (mean score of %6.24), respectively. **Conclusion:** Based on the findings, it can be claimed that the hospitals in question did not pay due attention to standards established by the societies of pharmacists regarding the medication therapy including register of drug usage status, drug interactions and drug side effects in their PISs. Hence, more thought must be given to the capabilities of the PIS in supporting the medication-related decisions and drug errors management so as to promote the treatment quality and satisfy medication therapy goals.

Key words: pharmacy information system (PIS), drug errors, drug interaction, drug complications.

1. INTRODUCTION

In November 1999, the American Medical Institute in its report titled "Human being is not infallible: the Creation of a Safer Health Care System" drew the authorities' attention to errors in the health care system of the United States of America. Medical errors cost teaching hospitals \$ 5 million every year. Annual charges imposed upon USA's economy by medical errors has been estimated to be \$17 to 29 billion (1, 2). Medical errors in have been reported for about 4% of the inpatients in the USA's hospitals. Based on the America's National Institute of Health, the yearly hospital mortality rate due to drug errors among the inpatients is 44000-98000 (1, 2, 3). Medical errors ranks eighth

among the mortality causes in the USA (4). Meanwhile, according to the American Hospital Association's estimation, drug errors account for 30.5% of the mortal medical errors (1).

In 2003, over \$ 16 billion has been invested for the drug costs of each person in Canada and currently there is an increase of 10% in the investment devoted to this health care domain. In Australia, drug-related complications accounts for 2-3% of the stay causes of the patients with 50% of them of preventable category. Pharmaceutical Society of Australia, Medication Consultants Society of Australia and the Society of Hospital Pharmacists of Australia are the world foremost authorities on the medication management and drug-related

complications resolution (5). Among the measures taken in this regard, information technologies and automatic systems can be named, namely integrated system used for unit drug dosage distribution, bar coded drugs supervision and automatic prescription that form the computerized subdivision used for prescription control resulting in a safer storage and distribution of the drugs. Such computer systems can have a positive effect on the drug errors and omission at the time of prescription and dispensing, promoting the optimum use of drugs in the health care system (6). A PIS makes the practitioners aware of the non-safety coefficient of the drug, the prescribed overdose, the potential effect of the prescription of two drugs concurrently (7). According to

the Medical Institute of American's report (2006) on preventing drug errors, over 500,000 side effects occur in the USA's hospitals every year with proper knowledge on the prescription or drugs labeling recognized as the major and underlying effective parameter involved in preventing the occurred drug side effects (7). Based on the available data, 1,500,000 people have suffered from drug errors leading to a mortality rate of 70,000 of the patients in the USA every year. The Joint Commission on Accreditation of Healthcare Organization in its annual assessment in 2007 has referred to some steps taken by many health care organizations towards promoting the patient safety culture and decreasing drug errors. Lowering drug errors is deemed as a significant goal, but whole omission of such errors seems to be impossible. For instance, a teaching hospital with 600 beds and an estimated confidence level of 99.9% in accurate prescription order and dispensing reports 400 drug errors every year (8). With a stay rate of 2.2 million patients due to drug side effects (9), it can be argued that the hospital pharmacy department plays a significant role in reporting the drugs side effects (10). Compiling reports on drug side effects is one of the capabilities PIS (11). Accordingly, given the role of advanced technology which justifies the supremacy of electronic health system over the pharmacy activities (12, 13) and PIS capabilities in improving the quality of the services in drug procurement, distribution, maintenance and management as well as the significance of information in the efficient and effective management of the pharmacy are some reasons that rationalize the necessity of the evaluation of this system based on the standards given by the Societies of the Pharmacists in the form of drug information registration and drug-related complications management.

2. METHODOLOGY

This study is an applied and descriptive analytical study conducted cross sectionally. The research population included all PISs in use in 10 public teaching hospitals, 7 pri-

The Societies of Pharmacists' Standards	The Type of Hospital	Teaching		Private		Social Services		λ test
	Statistical Parameters	Mean Score	SD	Mean Score	SD	Mean Score	SD	
Registration of drug information		44.75	8.86	36.40	6.73	36.29	0	4.75
Registration of the condition of drug use and drug interaction		6.50	4.74	6.24	3.77	10	0	1.50
Registration of patient's nutrition condition and body performance		26.87	19.99	24.33	11.11	31.25	0	1.09

Table 1. The Comparison of Mean Score Percentage for the Record of Drug Information and Medication Clinical Complications based on The Societies of the Pharmacists' Standards as per the Type of the Hospital

The Societies of pharmacists standards hospitals	Mean Score	SD	λ Test
Teaching	10.21	2.06	6.72
Private	6.72	3.06	6.72
Social Services	6.72	3.07	6.72

Table 2. The Comparison of Mean Score Percentages gained for different Hospitals for the Drug Interactions Processing based on the Standards given by the Societies of Pharmacists

vate hospitals and 2 Social Services hospitals situated in the city of Isfahan. The instrument used to collect data is a self developed checklist containing 106 informational components which was created according to the guidelines issued by the societies of health system pharmacists in America and Australia. Informational components included in the checklist were as follows: the registration of medication information, complains and disease signs, nutrition condition and patient body status, drug use condition, drug allergy and interactions, used drug dosage calculation, antibiotic and injective drugs usage percentage, drug side effects and interaction reports. The content validity of the checklist was assessed using research literature reviews and views collected from the study's supervisor and advisor professors and other experts and professionals in the computer science field as well as professors in the health information management field and pharmacists.

The researcher collected the required data through observation and the checklist which was distributed in person to PIS authorities and users. The collected data were entered into the SPSS software and analyzed using descriptive statistics including frequency and relative frequency intervals as well as the Kruskal Wallis and Wilcoxon non parametric tests. The researcher tried to analyze and compare the status of the hospitals in question in meeting the standards established

by the societies of the pharmacists in terms of the way of registration, estimation and reporting the data related to the medication complications in their PIS.

3. RESULTS

Among the total number of the hospitals in question (i.e. 10 teaching, 7 private and 2 social services hospitals), the PIS was of semi-automated type in 26.31 % of the hospitals and of automated type in 73.69%.

Table 1 represents a comparison of the mean score percentages gained for the hospitals under study for registration of medication related data and medication clinical complications as per the standards issued by the societies of the pharmacists. Kruskal Wallis test results indicated that the mean scores obtained for the registration of drug information in the PIS in different hospitals are statistically significant at the level of significance of 10% (p value= 0.09). In contrast, as for registration of drug use condition, drug allergies and drug interaction (P value=0.09) and patient's nutrition status and body performance (P value=0.57), there is no statistically significant difference between the hospitals are observed.

Table 2 compares the mean score percentage gained for the hospitals in question as for the drug interactions processing according to the societies. As per Kruskal Wallis test results, the mean scores obtained for the drug interaction for the inpatients and outpatients in the PISs

used in the hospitals in question were statistically significant at the significance level of 5% with a P value of 0.03. The mean scores percentages estimated for the selected hospitals for reporting the drug complications with reference to the standards of the societies of the pharmacists have been summarized and compared in Table 3. Again here, Kruskal Wallis test results showed that difference between the mean scores for reporting the inpatients and outpatients' drug complications in the pharmacy information system were statistically significant at a level of significance of 10% and with a P value of 0.60.

4. DISCUSSION

Considering the findings of the study, it can be claimed that as far as observing the standards related to the registration of drug related information, drug use condition, drug allergies and drug interactions and finally patient's nutrition condition and body performance is concerned, the hospitals under study (with a maximum mean score of 44.75, 10 and 31.25% for teaching, private and social services hospitals, respectively) are remarkably far from the desirable condition. It is noteworthy that the present study's findings are in line with Ursula's study titled "Pharmacy Services to UK Emergency Departments in 2010". This study revealed that just 40% of the medication information requirements are recorded in the PIS in form of drug description. This provides some evidence that the potential capabilities of this system in supporting the management of medication-related complications and order writing skills on the one hand and decreasing drug interactions and managing medication inventory on the other, have been ignored (14). However, a systematic survey in 2006 investigated the results of registration of drug information especially when the pharmacists cooperate with the health care teams, re-assess the prescribed drugs through interviewing with the patients, hence, supporting their usage condition (15). Phar-

The Societies of pharmacists standards hospitals	Mean Score	SD	λ Test
Teaching	45.30	12.33	5.54
Private	28.57	13.74	5.54
Social Services	45.50	6.36	5.54

Table 3. The Comparison of Mean Score Percentages gained for different Hospitals for the Medication Complication Report based on the Standards given by the Societies of Pharmacists

macists, physicians and health care providers must have access to the patients' comprehensive drug profile and other related data banks (e.g. drug history) (16). According to the results of one study conducted by the Agency for Healthcare Research Quality, controlling drugs' abbreviations and labels and determining the drug dosage by means of their electronic registration in the PIS found to be very effective approaches for minimizing the paper order errors. Writing drug's generic name followed by its commercial name in Latin capital letters may reduce drug errors (2). Commonly, when entering the drug prescription related data into the computer system, if drug interactions occur, flags and alerts come up. Rap (2000) and Murphy (2004) in their studies found that some pharmacists are indifferent to such flags and alerts and do not devote much time for their evaluation (17). Based on their findings, data related to the drugs' side effects are not recorded in the system. The results of the research conducted by Sepidan and Batman (2006) made clear the significance of this point. They estimated that 380,000-450,000 preventable medication drug interactions occur every year accounting for \$3.5 billion costs of the hospitals (18). According to Dr. Michel (2001), considering the stay of 2.2 million patients in the hospitals annually and death of 106,000 patients due to drug side effects, drug side effects is the four cause of mortality in the USA (19). Another study carried out by Bats and Spell (1997) in two large hospitals with Intensive Care Unit showed that among every 100 admitted patients, two patients suffered from preventable drug side effects.

Using their developed decision-analysis model, Johnson and Boatman (1995) carried out an extensive review on the medication re-

lated complications including overdose, inadequate dose, improper drug viewing the patient's condition, drug side effects, drugs interactions and using an unnecessary drug. Based on their estimation, the costs cause by drugs side effects and its resultant mortality exceeds \$6.74 billion (2). In the New York Accident Reporting System, among the 105 drug error related accidents recorded in the system, 23% belonged to the death accidents due to the physician's errors, 48% to the near death accidents, 74% to the accidents attributable to the written orders and 15% to the oral prescription errors. The errors made by the physicians, nurses and pharmacists accounted for 58%, 77% and 18% of the total recorded errors, respectively (2). In their studies, Yuta and Noda (2000) claimed that most drug errors can be attributed to the complexity of the systems which need user's attention and alert. They asserted that despite the fact that a procedure with weak standards governs the drug use on the one hand and the relation and interaction between the hospital personnel is weak on the other, the promotion of the information technology and automatic systems is accompanied by a 500,000 decrease in the yearly drug errors and hence, making a saving of \$549 million (20). Therefore, prolific research on the modern technologies and the role of PIS in the health care domain indicates that looking at the PIS from the perspective of providing the medication therapy process with scientific support (including calculating of the drug dosage accurately, preventing potential drug interactions, predicting drug allergies, controlling drugs side effects) deserve attention and research (21). However, the reviews conducted in this research established that the use of PIS as a part of hospital information system is merely limited to managerial and financial processes of medication services without having any role in the drugs scientific and usage aspects. Hence, it plays no role in decreasing the drug errors. Form the analysis of the results of this study, it can be concluded that due to the inattention to the users' needs and

requirements and their expectations from the system and their lack of participation in implementing the information system and overlooking the role of pharmacist's clinical advice in the process of patient treatment, PIS has failed to perform its central role in promoting the treatment process and decreasing the drug errors. Hence, the necessity of implementing an integrated medication related information system by the health system's authorities is one of the inevitable requirements of the health care system (21, 22, 23, 24).

5. CONCLUSION

Using patient medication databanks may lead to a decrease in the errors and an increase in the speed of order and drug prescription management. Hence, when implementing the system, informational requirements, hardware, manpower and teaching resources must be given due consideration to move towards executing the drug related programs, standards, policies and regulations. All in all, the study findings showed that ignoring one of the influential and integral components of the PIS i.e. drugs scientific databank and overlooking the medication related parameters and drug interactions have resulted in an undesirable situation. To put it differently, due to such position, the physicians have contented with their own information; consequently, drug error in the health care domain is a predictable challenge.

Acknowledgement

It is necessary to express our sincere gratitude to Dr. Zargarzadeh who assisted us in conducting the present research with his insightful and valuable advice and knowledge. Research Department of Health Information Management Faculty of Medical University of Isfahan

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