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An evaluation of adherence to society of pharmacists' standards care in pharmacy information systems in Iran

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ABSTRACT

Introduction: Pharmacy information system (PIS) is a complex computerized system used for collecting, storing, and managing the medication therapy data in the course of patients' care. The purpose of this study was to evaluate the level of adherence to the standards established by the societies of pharmacists in the PISs employed in the hospitals in Isfahan, Iran.

Methods: The present study was an applied, descriptive-analytical study conducted on the PISs of 19 teaching, private and social insurance hospitals in Isfahan in 2011. Study population consisted of the PISs available in the hospitals under study. Study sample was the same as the study population. The data collection instrument was a self-developed checklist based on the guidelines of the American Society of Health-System Pharmacists and Pharmaceutical Society of Australia, whose validity was assessed and confirmed by expert professors' views. Having been collected by observation and interview methods, data were analyzed by SPSS 18 software using Mann-Whitney statistical test.

Results: The findings of the study revealed that the highest rank in adherence to the standards of societies of pharmacists was obtained by social services hospitals (32.75%), while the private hospitals obtained the lowest rank (23.32%).

Conclusions: Based on the findings, in the PISs in the hospitals under study, some standards of the society of pharmacists were ignored. Hence, prior to designing and implementing PIS, a needs analysis is required to increase its users' motivation to identify the system potentialities and to allow the system development in compliance with the world technology advancement.

KEY WORDS: Evaluation, pharmacy, pharmacy information services, system

Introduction

Pharmacy information system (PIS) is a system which continuously follows promotion of medication management in a hospital to achieve the highest standards.^[1] The PIS can review and validate all the medication usage-related policies^[2] and monitor the satisfaction of the requirements of the pharmacy department and the medication usage in the hospitals.^[3] According to the American Health System Society of Pharmacists, all significant medication information

must be recorded in the patient's medical file.^[4] Hence, the physicians must move toward a systematic computerized system.^[5] Using a computerized program will eliminate the problems due to illegible prescriptions.^[6] Prescription orders must at least contain the following information: Patient's name and address, drugs name, dosage, strength and bar coding, and prescriber's signature and date.^[7] The physicians can review the delayed orders by using PIS.^[8] As Novek argues by adopting PIS, the pharmacists can respond to the distribution demands more rapidly.^[9] Hence, medication usage policies must include procedures for adding or eliminating the drugs recorded in the system, ensuring safe prescription, distribution and control of medications including over-the-counter drugs, and management of drug products shortage and its relevant policies.^[10] This integrated information system includes medication databank, patient's demographic information, and medication's medical-pharmaceutical classification,^[11] assisting in monitoring the accuracy of the prescription

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orders.^[12] Karapiner *et al.* found that clinical pharmacists are in contact with the physicians through information exchange for purposes such as controlling medication errors, providing the inpatients with useful consultation and checking the list of prescribed medications at discharge. However, 75% of the studied physicians reported that medication information at the time of the discharge receipt occurred with some delay. In addition, 88% of them argued that the required information related to the order changes were not recorded during patients' stay and 88% of them reported that medication therapy advice given by the hospital clinical pharmacist played a significant role in the patients' care.^[13] In Malone *et al.* (2007) study, 81.1% of the PISs failed to identify drug interactions and just 56.1% of pharmacies' software tended to report negligible data on the medication interactions. Furthermore, pharmacists' labor load as determined by the number of dispensed prescription orders during their work shift decreased their ability to properly evaluate drug interactions.^[14] Accordingly, given the role of advanced technology as the highest priority in the electronic health system in the pharmacy activity,^[15,16] the capabilities of the PIS in improving the quality of medication procurement, distribution, maintenance, and management as well as the significant role of the data in the efficient management of the pharmacies,^[17] the present study aimed to evaluate this system using the society of the pharmacists' standards in terms of informational components and access to the necessary information.

Methods

This study was an applied, cross-sectional study. The research population included all users of PIS in the selected hospitals. This system has been used in 10 public teaching hospitals (i.e. Shahid Beheshti as a teaching gynecology and obstetrics hospital with 180 beds, Shahid Chamran as a cardiology hospital with 192 beds, Noor and Ali Asqar as general teaching hospitals with 275 beds, Imam Musa Kazem as a burn and accidents hospital with 120 beds, Isa Ibn Maryam as a general hospital with 261 beds, Al-Zahra as a subspecialty teaching hospital with 950 beds, Ayatollah Kashani as a general hospital with 394 beds, Feiz as an ophthalmology and ENT hospital with 172 beds, Seyed Al-Shohada as an oncology hospital with 130 beds and Amin general hospital with 152 beds). This system was also found to be used by seven private hospitals (Khanevadeh general hospital with 60 beds, Sa'adi hospital with 120 beds, Sina hospital with 60 beds, Sepahan hospital with 120 beds, Isfahan hospital with 50 beds, Mehregan hospital with 40 beds, and Hazrat-e-Zahra-e-Marzieh hospital with 60 beds) and by two social insurance hospitals (i.e. Shariati hospital with 350 beds and Qarazi hospital with 256 beds).

The instrument used to collect data was a self-developed checklist containing 143 information components developed according to the guidelines issued by the Societies of Health System Pharmacists in America and Pharmaceutical Society of Australia and Therapeutic guidelines of the drug (available at www.ashp.org/policies and procedure guideline, www.psa.org.au).

In view of the role of pharmacist, medication consultation, and the importance of information in medication therapy process, the selected components in the checklist were as

follows: Patient demographic data registration, medication information registration, the registration of complaints, patient's symptoms and medical information, the registration of medication use status, allergy and medication interactions, patient databank, prescriber's information registration, information registration of medication distribution among outpatients and inpatients, inventory management and medication purchase and store receipt control, adherence to standards, announcements, and instructions users.

The researcher collected the required data through observation, and the checklist distributed 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. Applying the Kruskal–Wallis and Wilcoxon nonparametric tests, the researcher tried to investigate to what extent the standards related to the input components were met across different types of hospitals and PISs. Then, the status of the selected hospitals was analyzed and compared.

Results

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

In Table 1, the comparison of the mean scores obtained for the hospitals in terms of meeting the input standards issued by the society of pharmacists is summarized. By Kruskal–Wallis test results, the mean scores of the input standards in the investigated PISs were not statistically different ($P = 0/17$, $\lambda^2 = 3/46$).

Table 2 shows the comparison of the mean scores obtained for the degree of meeting the input standards in the PISs per both the type of hospital and the informational components in the selected hospitals. Based on the results of Kruskal–Wallis test, the difference between the mean scores obtained for the following input standards in the PISs used in the selected hospitals was statistically significant at significance level of 10%: Medication information registration ($P = 0.09$, $\lambda^2 = 4.75$), the medication purchase, control, receipt and storage and medication inventory management ($P = 0.06$, $\lambda^2 = 5.58$). On the other hand, the mean scores gained for the following input standards were not statistically significant: Patient's demographic information registry ($P = 0.77$, $\lambda^2 = 0.50$), the registration of the status of medication use, patient's allergy and medication interactions

Table 1:

The comparison of mean scores related to the degree of meeting input standards in the PISs according to the type of selected hospitals in the city of Isfahan

Hospital type	Teaching		Private		Social services	
	Mean score	SD	Mean score	SD	Mean score	SD
The society of pharmacist's standards	29.68	8.94	23.32	6.53	32.75	0.48

SD=Standard deviation, PISs=Pharmacy information systems

Table 2:

Comparison of mean scores for adhering to the input standards in the PISs in terms of hospital type and informational components in selected hospitals of Isfahan

Hospital Standard	Teaching		Private		Social services	
	Mean score	SD	Mean score	SD	Mean score	SD
Medication information registration	44.75	8.86	36.40	6.73	36.29	0
Patient demographic data registration	30.96	22.43	31.86	14.34	38.46	0
The registration of complaints, patient's signs and medical information	1.81	3.83	0	0	0	0
The registration of status of medication use, allergy, and medication interactions	6.50	4.74	6.24	3.77	10	0
Patient databank	26.87	19.99	24.33	11.11	31.25	0
Prescriber's information registration	15.01	26.87	21.42	21.49	50.6	0
Outpatients and inpatient's medication distribution information registration	22.18	11.06	24.10	9.83	37.5	0
Inventory management and medication purchase and store receipt control	47.18	27.05	13.61	24.78	56.35	0
Observing standards, announcements, and instructions	19.16	7.40	12.90	13.26	27.08	2.94
Users	46	8.09	39.48	4.60	44.16	3.53

SD=Standard deviation, PISs=Pharmacy information systems

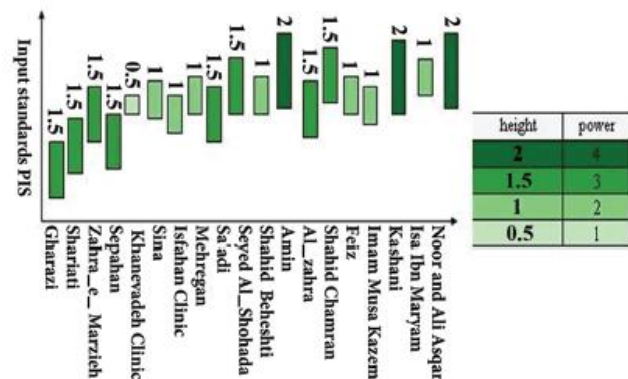
($P = 0.47$, $\lambda^2 = 1.50$), patients' databank ($P = 0.57$, $\lambda^2 = 1.09$), medication prescriber information ($P = 0.16$, $\lambda^2 = 3.55$), inpatients and outpatients' medication distribution ($P = 0.15$, $\lambda^2 = 3.17$), adhering to standards, instructions, and announcements ($P = 0.16$, $\lambda^2 = 3.57$) and finally users ($P = 0.12$, $\lambda^2 = 4.19$).

Figure 1 represents the comparison of the mean scores obtained for meeting the input standards in the PISs in terms of the type of hospital. Among Isfahan's teaching hospitals, Nour and Ali Asqar hospitals gained the highest score in satisfying the input criteria (mean score of 45.68%), while the PIS in use in Imam Mousa Kazim gained the lowest (mean score of 18.96%). Similarly, among private hospitals, Khanevadeh Clinic and Al-Zahra hospital obtained the lowest and highest mean score (mean score of 12.93% and 32.27%), respectively. For social services hospitals, the level of meeting input standards in Qarzi hospital with a mean score of 33.1% was higher than Shariati hospital.

Discussion

In terms of adherence to the input standards which involves informational components like medication information registration (usage cases, pharmacodynamics and pharmacokinetic properties, drug allergies and interactions, drug dosage, etc.), access to the patient's demographic information and the data on the complaints, the symptoms and disease progression, registration of information on drug prescribers, registration of purchase control and storage receipt, adherence to standards, instructions and announcements as well as documentation and data exchange in the PIS, the studied hospitals were very far from the desirable condition (i.e. full mean score of 100). Informational needs of the executive managers who can be helpful for future decision makings highlight the significance of input standards. Our results are in line with Collignon *et al.* study indicating that just 40% of the medication information requirements were recorded in the PISs as medication description and the potential role of this system in supporting the medication problems management, prescription writing skills, drug interactions decrease, inventory management, and medication storages was ignored.^[18] Azizi reported that the mean scores of adherence

Figure 1: Comparison of the mean scores of adherence to the input standards in the pharmacy information systems in terms of the type of hospital



to the American College of Physicians in Medical Universities of Iran, Tehran and Shahid Beheshti were 28.5%, 26.6%, and 31.1%, respectively, for prescription writing and maintenance of medication information.^[19] A recent study by Kirschenbaum indicated that medication therapy for 98% of the inpatients was subject to changes at the time of discharge with at least five cases of change recorded for 60% of the patients. The majority of general physicians have experienced delay in receiving medication-related information at the time of discharge, while about 86% have preferred to receive this information at the discharge day, because either they face questions from the patients and their families after discharge, or they want to regulate after-discharge care activities.^[8] When the pharmacists cooperated with the health care team or when interviewing the patients, they reconsidered the prescribed medications and supported their usage status.^[20] Pharmacists, physicians, and health care services providers must have access to the comprehensive medication profile of the patients and other data banks.^[7]

A study showed that abbreviations, signs, and dosage monitoring played a significant role in decreasing the errors in paper prescription orders and administering their successful electronic registration in the computerized PIS. Noting the

generic name followed by its commercial name in capital English letters can also decrease medication errors.^[21] In the typical process, when a prescription order is entered into the computer system, the system can check to see if there is any interaction between two or more drugs taken simultaneously by the patient. If so, alerts and flags come up in the system. Some pharmacists are indifferent to these alerts.^[11] These studies revealed that the data on the side effects of the drugs were not recorded in the system, while annual estimate of preventable medication side effects is approximately 380,000–450,000 which impose \$3.5 billion on the hospitals.^[22] Medication side effects are the fourth main cause of mortality in the USA.^[23] In another study, in two large hospitals equipped with intensive care department, 2/100 admitted patients suffered from preventable medication side effects.^[24] Hence, instead of an exclusively a technical system, PIS must be regarded as a clinical system. PIS has three key functions that are as follows: Decreasing errors, increasing the speed and facilitating the processes of medication services optimum operation management (including medication procurement, maintenance and distribution), financial optimal management (including costs, profitability and investment) and medication therapy process scientific support (including the accurate estimating of the drug dosage, preventing potential interactions, and predicting medication allergies).^[25] However, the results of this study showed that the benefits that the studied hospitals gained from the PIS as an integral component of the hospital information system was only relevant to managerial and financial aspects of the medication services processes with no role in medication scientific aspects and usage. Hence, it is not helpful in decreasing medication errors. Due to ignoring the users' requirements and their expectations from the system and their lack of participation in executing the information system as well as inattention to the beneficial role of clinical consultations provided by the pharmacist, the PIS not only has failed to fulfill its pivotal role in promoting the medication process and decreasing medication errors, but also a PIS of the same type may give completely different results in different hospitals. Therefore, the necessity of an integrated PIS by the health system's authorities is one of the health care system requirements. In designing this system, the following criteria relevant to the standards and stipulated by the American Society of Health-System Pharmacists must be considered:

- Promoting the PIS by its integration with the decision support systems and computerized physician order entry system
 - Providing the capability of checking the medication therapy information to ensure the appropriate treatment and the medication regimen as well as the drug administration method
 - Data analysis for identifying the drug alerts to identify the drug allergies and its associated complications
 - Providing the capability of calculating the drug purchase and admission rates in the medication stock
 - Providing the capability of sending the pharmacy request electronically to the drug inventory upon the affirmation of the technical manager of the pharmacy
 - Continuous assessment of the increasing treatment courses, responding to the patients' needs and promoting the security capabilities and attributes of the PIS
- Implementing the instructions to decrease the direct return of the medications by the nursing staff and to decrease the errors
 - Capability of giving warning on the shortage of a drug in the inventory and producing an electronic request based on the medication products in the appropriate numbers to be submitted to the drug distributors
 - Providing up-to-date reports on the medication inventory based on their expiry dates
 - Maintaining and displaying the medication purchase-related information and their updating (e.g. the medication price, medication bills)
 - Producing purchase order automatically or per the need
 - The capability of supporting the patient's medication profiles in the frequent hospitalizations
 - Monitoring the medication inventory at critical times and the medication usage management in emergencies; and
 - Computerizing the medication care for controlling the medication dosage especially chemotherapy drugs or narcotics.

Conclusion

Pharmacy information system is composed of three databanks namely patient data, medication-related data (managerial, financial and scientific), and medication's prescriber data. This system may be efficient in three aspects of operation management, financial management, and medication services scientific support in the hospitals. In fact, implementing these data banks may lower the rate of errors and increase the speed of orders management and medication prescription and dispensing. Therefore, when administering the system, a great deal of attention must be paid to the informational requirements, hardware, software, personnel and training resources for putting the medication program, standards, policies and laws into action. In particular, inattention to one of the influential and significant components of the PIS, that is, medication scientific information, and failure to provide the prescriber with scientific support in decision-making process has led the medication prescribers to satisfy themselves with their own information, making medication errors in the health care probable.

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