Pharmacy information systems in Tehran university hospitals and their relationship with pharmaceutical companies

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ABSTRACT

Background: A pharmacy information system must retrieve process and update the information it obtains for safe and effective use of drugs. It is used to manage drug usage in the patient health care process and to communicate a large volume of information to pharmacy and pharmaceutical firms. Bearing in mind such issues, the current study adopted a descriptive method of research to investigate the pharmacy information systems in university hospitals and their relationship with pharmaceutical firms. The research data were collected through observation and interview based on a checklist and a questionnaire. Validity and reliability of the data gathering tools were specified through content validity and test re-test methods. The collected data were then analyzed, using a set of descriptive statistics. According to the results, pharmacy information systems in the hospitals under study were partially computerized. Databases for drugs, patients and prescriber databases, with different values of 50.1%, 21.9%, and 33.3% respectively, were not complete, as had been recorded in the pharmacy information system of the hospitals. The pharmacy information system is normally used to support therapeutic activities and the inventory, but such support had not been provided for 43.9 % of the hospitals. 32.2 % of the hospitals under study had not reported pharmaceutical information such as statistical data and drugs' prices. Also, 27.3% of the pharmaceutical firms did not have any relationship with pharmacy information systems. Pharmaceutical companies had developed some relationship, on marketing issues, with hospital pharmacies. The findings were in favor of further therapeutic activities by pharmacy information systems, which could be achieved by improving relationship between hospitals and pharmaceutical firms, particularly in Tehran. This could help to manage drug consumption and supervision, after marketing, in order to eliminate adverse drug reactions and develop high quality pharmaceutical services.

Keywords: Hospital pharmacy; hospital pharmacy information system; Drug Company

INTRODUCTION

Hospital pharmacy supervision is to ensure that medicines are accessed and used safely by patients and professionals both within the environments of a hospital and beyond (1,2,3). Pharmacy involves information processing, which means retrieving information from one file and using it to compare, update, or display information from another file (4). The pharmacist could play an essential role in providing accurate data for managing patient care. Information systems are now necessary to help pharmacists to perform their expanding list of daily tasks efficiently (5). The pharmacy information system collects, stores and manages information related to drugs and supervises the use of drugs in line with patient care (6). The pharmacy information system can rely on management information system to track and dispense drugs to hospitals and health care organizations (7). Pharmacy information systems are also among the most widely used clinical information systems today (8).

Pharmacy information systems have regularly been used in the delivery of pharmacy services since the early 1980s. Today's systems perform many clinical decision support functions such as dose range checking, drug-drug interaction checking, food-drug interaction checking and drug-laboratory results checking (9). Pharmacy information systems could reduce the risks involved in drug dispensation and drug interpretation errors (10, 11, 12).

The chief medical officer, medical staff committee and pharmacy directors can use retrospective data, generated by the pharmacy

information system, to identify trends in drug use, and to support formulary or inventory management decisions. The information could also be used to achieve compliance with the relevant guidelines or protocols. Medications use evaluation, adverse drug reaction (ADR) review, and other clinical and regulatory requirements through the primacy information system (13). In addition, pharmaceutical firms and pharmacies are communicating everyday to transmit a large amount of information (14). Comprehensive and updated information transmission of the pharmacies and drug companies have significant role in drug use management. Pharmaceutical companies are commercial and scientific entities, which produce the necessary commercial and scientific information (15). Pharmaceutical industry spends much more time and a lot more resources on generation, collaboration, and dissemination of medical information than it does on production of medicines. This information is essential as a resource for development of medicines (16). Pharmaceutical firms collect information about the market, customers and products of the company, evaluate and analyze them, and then they deliver the information to the production, research and development units in order to improve their quality (17). Pharmacy information system is capable of delivering a list of drugs that need to be ordered. The computer using the program adopted for this purpose often provides reports on drug purchase histories that are invaluable for the hospital inventory control management. Such reports play an important role in fulfilling information needs of pharmaceutical industries (4). In line with such issues, the current research is intended to investigate the status of pharmacy information systems in university hospitals, on the one hand, and their relationship with pharmaceutical firms, on the other.

MATERIALS AND METHODS

This study is a descriptive and cross sectional research which investigates the informatics status of 13 university hospital pharmacies and their relationship with 22 pharmaceutical firms. The study used a random sampling formation system to choose and investigate 10 drug manufacturing firms and 7 drug distributing firms. The data were collected through observation and interview based on a checklist and a questionnaire. The validity of data gathering tools was specified based on content validity measures; also the reliability of research tools was identified by test re-test method, which showed a reliability coefficient of r=0.85%. The collected data were then analyzed using a set of descriptive statistics.

RESULTS

According to the results, the pharmacy information systems in the hospitals under study were partially computerized. Regarding the incoming input, the data elements of drug, patient, and prescriber databases, with different values of 50.1%; 21.9% and 33.3%, did not indicate any satisfactory records. This means that the incoming data had not been sufficiently entered into the pharmacy information system of the hospitals under study (Tables 1, 2, 3).

Important data elements such as storage drug requirements, drug strength, time intervals and start-end date of drug consumption, formulary list, national and local instructions of the drug, and patient education information had not been entered into pharmacies databases. Patients' clinical information including pregnancy data, body immunity, function of kidney, cardiac, and nutrition qualification did not exist in the pharmacy information systems. Patient complaints, disease symptoms and disease processes, including present problem of the patient, prognosis of the disease (like the disease severity, patient inability and impairment) had not been entered into the hospital pharmacy information systems. Patient demographic information, qualifications of drug consumption, and other relevant data were not accurate while 45.1%, 25.7%, and 38.5% of the faulty data had been entered into the system.

In addition to the support provided for therapeutic activities, and preparations made for patient's administration records, online registration of drug orders and prescriptions are also very important functions, performed by pharmacy information systems, but none of these functions existed in the hospitals under study.

Most of the essential data items, such as the drugs consumed by patients (based on drug class and diagnosis) and drug consumption indicators (based on WHO), were not performed in the hospitals (Table 5).

The pharmacy information system did not issue any report concerning drug interactions although such reports could play a significant role in preventing interactions (Table 6).

Standards and instructions of the hospitals under study did not regard information exchange confidentiality and other internationally recognized standards of the American Society of Pharmacists in their databases. Only 43.7%, 23%, and 64.4% of the hospitals had the necessary hardware and software for collecting, processing and distributing information, including prescription information, computer network and barcode equipment.

Pharmacists, physicians, nurses, hospital managers, dentists and the administrative staff were major users of the drugstore informatics system. Pharmaceutical firms mostly used the hospital pharmacy information system.

Pharmaceutical firms received the greatest degree of information on drug marketing from hospital pharmacies but even this did not go beyond 31.8% of the marketing information. Merely one of the pharmaceutical firms received sufficient information to supervise the products' quality after they had been sold (Table 7). Only 27.3% of the hospital pharmacies received sale and purchase information of the drugs. The pharmaceutical firms did not receive any information on the quality of the drugs already used or those newly produced.

Only one of the pharmaceutical firms sent some information about adverse drug reactions to the hospital pharmacies. The firms did not send any information about their research on the development of the drugs to the hospital pharmacies.

Most of the hospital pharmacies, i.e. 68.2%, were critical of the low quality of the drugs produced by pharmaceutical firms. Nonetheless, they did not send any research-based information to the pharmaceutical firms to verify their claims. (Table 8)

Table 1. Data elements of drug database at the hospitals under study

Data elements	**Frequency (percent)**
Generic name	12 (92.3)
Brand name	3 (23)
Drug type	12 (92.3)
Drug dose	12 (92.3)
Storage requirements	0
Drug strength	0
Dose interval schedule	12 (92.3)
Expiration date	10 (79.9)
Start date of administration	0
Stop date of administration	0
Therapeutic code	1 (7.6)
Hospital formulary	0
Pharmacologic-therapeutic category	1 (7.6)
Drug identification number	9 (69.2)
Adverse drug reactions	10 (79.9)
Drug interactions	3 (23)
Drug guidelines (national/local)	0
Patient education information	0
Drug reference	7 (53.8)
Dispensing date of pharmacy	13 (100)
Quantity of drugs dispensed by pharmacy	13 (100)
Minimum inventory	13 (100)
Pharmacist verification code	2 (15.3)
Purchase contract information	12 (92.3)
Primary vendor	11 (84.6)
Secondary vendor	11 (84.6)
Manufacture name	1 (7.6)
Reorder quantity	8 (61.5)
Acquisition cost	12 (92.3)

Table 2. Data elements of patient database at the hospitals under study

Data elements	**Frequency (percent)**
Demographic information	13 (100)
Complications, symptoms and processes	0
Clinical information	0
Drug usage status	13 (100)
Other information	13 (100)

Table 3. Data elements of prescriber database at the hospitals under study

Data element	**Frequency (percent)**
Prescriber name	13 (100)
License number	13 (100)
Identification number	0
Signature	0
Telephone number	0
Address	0

Table 4. Functions of the pharmacy information system at the hospitals under study

Functions	Frequency (percent)
Supporting clinical activities	0
Providing Patient medication profile	6 (46.1)
Reporting	13 (100)
Considering inventory management	12 (92.3)
Preparing the administration of medication records	0
Profiling prescriber records	3 (23)
Providing online order entry	13 (100)
Presenting drug purchasing support	13 (100)
Presenting drug dispensing support	13 (100)
Preparing medication billing	13 (100)

Table 5. Processing of the pharmacy information system in the hospitals under study

Processing		Frequency (percent)
Drug dose		4 (30.7)
Drug cost by the patient		13 (100)
Dispensing quantity of the pharmacy		13 (100)
Minimum and maximum reordering by the pharmacy		7 (53.8)
Hospital census (number of admissions, discharges and patients per day)		8 (61.5)
Total drug use		12 (92.3)
Drug usage by category		0
Drug usage by diagnosis		0
Drug usage by hospital service unit		12 (92.3)
Volume of injectable drugs		2 (15.3)
Total parental nutrition (TPN)		0
Medicines Prepared by the pharmacy (injectable fluids, ointments and mixtures)		4 (30.7)
Workload of the pharmacy		9 (69.2)
Drug purchasing		13 (100)
Calculation of drug usage indicators based on WHO's View points	Average of injectable items	0
	Percentage of injectable drugs with generic names	0
	Percentage of prescriptions with a minimum of one antibiotic drug	0
	The percentage of prescriptions with a minimum of one injectable drug	0
	The percentage of prescriptions based on the formulary list	0

Table 6. Reports of the pharmacy information system at the hospitals under study

Report	Frequency (percent)
Total number and value of items dispensed for outpatients and inpatients	12 (92.3)
Total number and value of items dispensed for inpatients	12 (92.3)
Total volume of drugs dispended from the pharmacy	12 (92.3)
Number of outpatient prescriptions	12 (92.3)
Emergency needs of wards for drug	1 (7.6)
Drug manufactures	2 (15.3)
Drug use review	1 (7.6)
Management report	8 (61.5)
Drug report	9 (69.2)
Statistical report	11 (84.6)
Inventory report	12 (92.3)
Summary report of interaction type	0
Drug listing for purchasing	12 (92.3)
Drug listing by product type	12 (92.3)
Annual report	13 (100)
Expired list of drugs with user defined period	8 (61.5)
Drug pricing	12 (92.3)
Drug cost, determined by the third party payer	12 (92.3)
Daily controlled substances, their dispensing report by location	4 (30.7)

Table7. Information transmitted to pharmacy information system by drug companies

Information	Frequency (percent)
Selling	6 (27.3)
Marketing	7 (31.8)
Adverse drug reaction	0
Research and development	0
Post marketing surveillance	1 (4.5)
Drug quality and complications	0

Table8. Information Transmitted to drug companies by the pharmacy information system

Information	Frequency (percent)
Selling	6 (27.3)
Marketing	7 (31.8)
Adverse drug reaction	9 (40.9)
Research and development	0
Drug quality and complications	15 (68.2)

DISCUSSION

The Pharmacy information system is vital in both inpatient and outpatient pharmacy service areas (13). Most pharmacy information systems both simplify and streamline medication dispensing and inventory control by automatically checking all drug orders and dosages against the patient profiles to ensure the intake of proper dosage, and to prevent contradictions. Such systems generally increase the efficiency of drugs' distribution and improve the monitoring of their proper usage (8). The information contained in pharmacy information systems is important to the management of the pharmacy (14). It enables pharmacists to maintain a database of patients, prescribers, and the drugs. The database (information) can also be used to reduce errors and to speed up the handling of subsequent prescriptions and refills (5).

According to Bates' assertions (18), it is essential to consult with specialists like pharmacists and medical informatics if we are to design our databases appropriately. Appropriate databases can reduce medication errors significantly (18). It can also help to reduce pharmaceutical errors significantly and to manage the inventory of hospital pharmacies effectively. Brown maintains that pharmacy information system must support checking functions such as dose range, drug-drug interaction, food-drug interaction, and drug-laboratory results. Studies have shown

that between 6.5% and 23% of adverse drug reactions are attributable to drug interaction and PIS is capable of controlling drug interactions (9). Regarding the study results, pharmacy information system must support pharmaceutical therapeutic processes. According to Reddy's studies (2004), the precise calculation of medication dosages is the most critical element in providing pharmaceutical care and in achieving optimal patient outcome. Sometimes, even minor dosage calculation errors can be dangerous to the patient and may prove very costly (19). According to Kaushal's study (2002), bar coding can decrease administration errors up to 80% (20), but only 30.7% 0f the hospitals understudy measure drug consumption dosage. Thus, it is necessary to prevent drug interactions and patient drug therapy issues through pharmaceutical data processing. According to a study carried out by Oraby (2008) on pharmacy information system reports, the system must prepare drug utilization review reports to analyze trends and costs of drug therapy (21).

In his resent study, Semple (2009) highlighted the role of reports on understanding and preventing medication errors (22). Nonetheless, the results of the study show that just one of the hospitals under study provides review report on drug use. American pharmacists' health systems society demonstrates that pharmacy information system must provide integrated information based on standards related to availability of proper facilitates for health system components. Computer software vendors and pharmaceutical suppliers are in charge of providing standards for definition, collection, coding, and exchange of clinical data used in the medication process (23). According to a study by Zoutman (2004), the Act calls for informed consent for disclosure of personal information (24). The Patients` confidentiality of information must be safeguarded, as an essential necessity in the pharmacy information system. None of the hospital pharmacies under study properly observe the international confidentiality standards, although the existing standards not only do not allow information abuse but also present special measures to facilitate the collection and distribution of information accurately.

Moreover, despite the significance of proper communication between pharmaceutical firms and hospital pharmacies, 27.3% of the firms did not establish any communicative links with hospitals.

American society of pharmaceutical research and drug manufactures have demonstrated that pharmaceutical representatives can provide physicians and other health care professionals with necessary information about new studies on clinical data, new dosing information, and updates on safety and risk information. Due access to this information presented to care provider by pharmaceutical representatives would entail effective patient care (25). Moreover, many doctors cite pharmaceutical representatives as one of the main sources of information on the use of new drugs (26).

According to Zipkin (2005), pharmaceutical companies spend, on average, twice as much on marketing to physicians and the public as they do on research and development. The medical literature has demonstrated that promotional activities can influence the behavior of practicing physicians, such as prescription decisions and medication requests (27). Nonetheless, pharmaceutical firms submit less than 50% of drug marketing information to the hospital pharmacies. Thus pharmaceutical firms can play an important role in proper drug consumption by submitting precise and updated information to the relevant personnel. Pharmaceutical firms must particularly communicate with the relevant pharmacies to submit accurate information about the newly produced drugs to them. Although post marketing surveillance can play a significant role in improving health indicators and drug effectiveness, just one of the pharmaceutical firms collected data from the hospital pharmacies about the drugs that have been sold. Since complete assessment of a drug cannot, for practical reasons, be made before marketing, Post-marketing surveillance is essential in order to protect future patients against avoidable medication risks (28). Each manufacturer who wished to market a new drug was required to submit a request to the drug and food Administration, containing reports of investigations performed to show that the drug was safe for its intended use (29). The pharmaceutical firms under study did not receive any adverse drug reaction information from the pharmacies, although spontaneous reporting of suspected reactions is an important element of pharmacovigilance (30). pharmacovigilance is the science and activities relating to the detection, assessment,

understanding and prevention of adverse effects or any other drug-related problems (31). According to Carleton`s study (2005), the collection of relevant pharmacovigilance information and data is of special significance (32). The information system of a pharmacy is obliged to prepare the adverse drug reactions on the patient record independently of allergies (21). Moreover, pharmaceutical companies should provide accurate and complete warnings and contraindications for physicians and patients (33). The firms under study must deliver their reports to hospitals to reduce adverse reactions of the drugs and to safeguard Patients' drug consumption. Hospital pharmacies must also report adverse drug reactions to pharmaceutical firms in order to assist them in improving the quality of pharmaceutical products and reducing adverse drug reactions. Although Pharmaceutical companies are the prime users of information throughout the 10 to 15 years of drug development processes (34), the firms under study did not receive any such information which could be used to enhance the quality of hospital pharmacies. Hospital pharmacy information system is a vital resource of data for research and development of the newly produced drugs. The information provided by the System is vital for the research dealing with the development of new drugs (5). So drug companies are expected to rely on these information resources to produce more effective drugs.

The pharmacy information system has a key role to play in delivering efficient pharmaceutical services. Its respective information can reduce drug consumption and drug production faults and improve drug therapy procedures. Data elements of drug therapy have important roles not only in reducing pharmaceutical errors and controlling drug interactions, but also in achieving business and economical purposes. Thus pharmacy information system designers are required to design these information databases more accurately by performing user information needs assessment studies. Moreover, as the current study implies, pharmaceutical firms and hospital pharmacies should be more actively involved in marketing, sales and purchase of drugs. However, the study indicated that many firms and pharmacies had very poor record of information exchange on important issue such as post marketing surveillance, research and development and adverse drug reactions. If pharmaceutical firms communicate more effectively with hospital pharmacies on such issues, they can certainly improve the quality of their pharmaceutical products, reduce drug costs, and develop newer drugs.

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