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STUDY OF FACTORS INFLUENCING THE MEDICATION ERRORS IN THE HEALTHCARE SYSTEM

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ABSTRACT

Medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in control of the health care professional, patient or consumer. Studies done since the 1970's have shown the high incidences of medical errors and deaths resulting from these errors. Only 3% of physicians believe that medical errors are a principal health concern since there is more concern to car accidents. Medical error statistics in the United States are enormous and alarming. The American medical system is the number one killer in the U.S. In ten years; the deaths caused by conventional medicine are approximately 8 million. The proposal concerns with the determination of errors during the process of treatment such as self-medication, prescribing errors, lack of knowledge, lack of attention, poor drug selection and poor monitoring. The community pharmacy errors such as, wrong quantity, wrong drug, wrong dosage form, wrong strength and wrong information (label). Most of patient errors come from the drug administration, patient personality, education and culture. Health care cost savings, Improves the image of the pharmacist and helps pharmacy to become a true clinical profession. Teaching patients about their medication and their diseases also help to prevent medication errors. Most of countries have a statistical data concerning the medication errors and comparing these data may lead to reduce and detect the parameters of medication errors. This study Investigates the parameters of self-medication in the population and their relationship with the medication errors. The sample size of our study was 600 (n=600); healthcare professions (200) and public (400). The study suggests that

participants agree that factors such as, knowledge, information, self-medication and organization have an impact on medication errors with percentages of 78.2%, 61.8%, 67.2%, 83.6%, respectively. The rate of medication errors in one tertiary hospital was about 40%.

KEYWORDS: Medication errors, healthcare, pharmacy, patient, self-medication.

INTRODUCTION

Medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in control of the health care professional, patient or consumer. Studies done since the 1970's have shown the high incidences of medical errors and deaths resulting from them. Only 3% of physicians believe that medical errors are a principal health concern, yet there is more concern with car accidents. Medical error statistics in the United States are enormous and alarming.

The American medical system is the main killer in the U.S. It became dangerous, to take your prescription(s), to have surgery or to visit your doctor. Yet, not many people know about this. Most of us know of someone who has been the victim of an "error", or even ourselves have been. In ten years, the deaths caused by conventional medicine are approximately 8 million. Even the FDA (Food and Drug Administration) has published a report showing the alarming medical error statistics in the United States.[1,2]

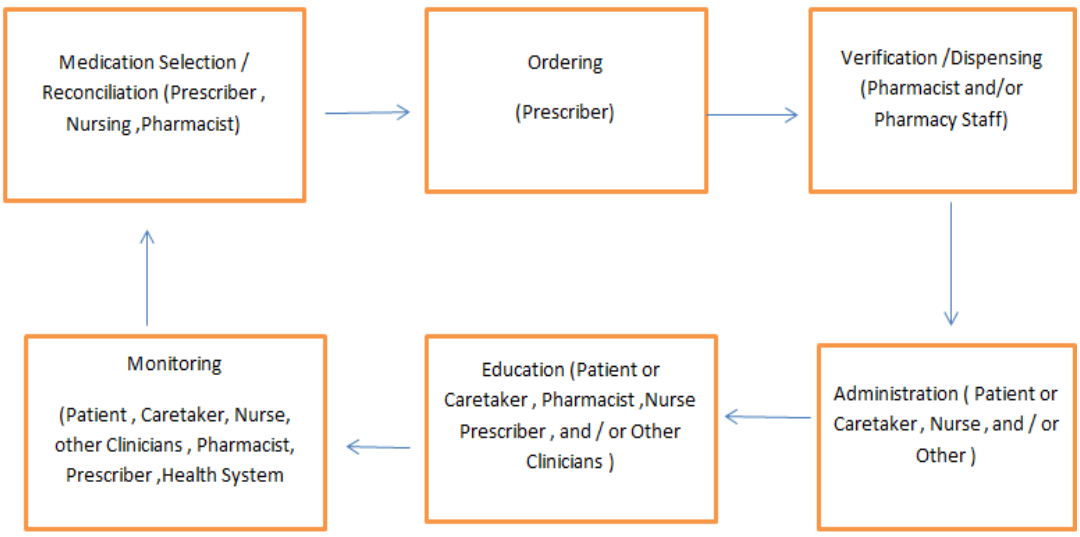

Figure 1: Showing the ordering pathway, from physician ordering the medication to nurse monitoring the medications for patient.

Teaching patients about their medication and their disease also help to prevent medication errors. Most of countries have a statistical data concerning the medication errors and we would like to compare these data with our healthcare system in Saudi Arabia.[3, 4] Self-medication of the over-the-counter (OTC) drugs available to consumers without a prescription, play an increasingly vital role in our healthcare system and are the most prevalent means of treating the majority of common health problems. There are over 80 therapeutic categories of OTC drugs which can be grouped in 12 broad therapeutic classes[5,6] such as, analgesics and antipyretics, cold, cough, and allergy products, night time sleep-aids, dermatological products, gastro-intestinal products, other topical products including; dermal, vaginal antifungal, rectal medications, head lice products, hair loss products, and tics, ophthalmic, oral health care, menstrual products, weight loss aids and vaginal contraceptives. Currently, 35% of adult Americans use OTC medications on a regular basis and there is a trend for increasing use as more drugs move from prescription to OTC status.[7]

The healthcare system of all countries relies heavily on the ability of an informed public to self-diagnose certain ailments and symptoms and to treat them successfully and inexpensively with the available non-prescription drugs. To put this in perspective, annual sales of OTC in the US are approaching 10 billion US$, and prescription drug sales are approaching 20 billion US$ annually, of the 3.5 billion health problems treated in a year, over 57% are self-treated with OTC drugs. The benefits of OTC drugs availability are[10,11] the followings: direct and rapid access to effective medicines, decreased healthcare system utilization vise-à-viewer physician visits, lower healthcare system costs, and allowing individuals to be in charge of their own health.[8,9] However, there are risks associated with self-medication and drugs uses, such as; incorrect self-diagnosis delaying diagnosis and treatment of serious illnesses from a healthcare professional, increased risk of drug-drug interactions, increased risk of adverse events when not used appropriately.

The use of OTC medications is one aspect of a growing movement toward medical self-care and has become a tool in gaining control over one's health. The findings of a survey of adult Americans demonstrated the important role of OTC medicines in the general population.[12] Female individuals are more likely to use OTC medications. In a 2002 survey, 87% of women reported the use of an OTC pain medication compared to 80% of men.[13] A study conducted in 2011 confirmed that OTC medications are the most American's popular treatment choice for common ailments such as headache, heartburn, allergies, and colds.[14] It

suggested that self-medication is not a parameter of medication errors which is in conflict with others studies.

Figure 1 shows the ordering pathway of medicines; from physician, nurse to patients' administration and monitoring. There are four areas to improve patient's safety proper communication, patient and drug information, patient education and proper packing and labeling. Pharmacists play vital role in minimizing medical errors. This can reduce patient's morbidity and mortality, proper fulfillment of their duty, prompt health care cost savings which, can ensue in improving image of pharmacist and thus help pharmacy to become a true clinical profession and profoundly integrated with the medical team.

In Abu Dhabi health authority workshop, the total reports received in the year 2010 from the program were 1380 reports, of which had about 40% medication errors. In Saudi Arabia in 2006, 10 000 patient's files were reviewed and 2627 medication errors were identified. The spectrum of these errors was variable; improper doses, over, under, or extra dose, wrong drug, wrong rout of administration, wrong duration, dose omission, wrong strength, or wrong dosage form.[15]

Most of patient errors come from the drug administration, patient personality, education, culture and attitude of medical staff. Our investigation here concerns the determination of errors during the process of treatment (figure 1) including prescribing errors which relates to lack of knowledge, lack of attention, poor drug selection and poor monitoring. Furthermore, this study highlights the common errors in the community pharmacy such as, wrong quantity, wrong drug, wrong dosage form, wrong strength and wrong information (label).

MATERIALS AND METHODS

1. Study design

The current study aimed to investigate the relationship between factors influencing the medication errors such as knowledge, education, source of information and self-medication. Also to clarify the causes which lead the patients to used medication without visiting the physician, their effect on the patients, physicians or pharmacists and its reflection on the healthcare. The study was started with literature review and experts' interviews to develop the measurement model and explore the self-medication of drugs products profile. Moreover, the questionnaire was conducted to finalize the study items to be included. Finally, the results collected from questionnaire were coded using the Google scholar web site program.[16]

2. Sample: The study was performed at the Western region of Saudi Arabia. 600 questionnaires was distributed to patients, physicians, pharmacists at governmental hospitals and health centers under ministry of health administration, in addition, to private clinics, community pharmacies and public.

3. Data Collection Methods: The data that was used for fulfilling the purposes of this study can be divided into two groups: primary and secondary data. Primary data was collected from distributed questionnaires. Secondary data was gathered from journals, books, researches, thesis, dissertations, articles, working papers, and the worldwide web. Results were analyzed using descriptive statistical analysis method.

4. The questionnaire: Questionnaire was prepared in Arabic language and then translated into English language. The translated version of the questionnaire was carefully revised and then distributed to respondents to get their feedback.

5. Study Measures: The questionnaire included three main sections: the first one will try to measure the effect of medication errors by the physician, as well as their effect on both physician-patient relationship and its reflection on the healthcare**.** Patients' demographic characteristics assessed in this study were age, gender, race, marital status and level of education. Respondents of this study were 18 years old and above and able to read and write in Arabic as well as agreed to give a verbal informed consent. Level of patients' exposure to pharmaceutical products errors were measured by aided awareness items which is the cumulative number of drugs that respondent had used.

6. Utilization of awareness in healthcare system: Utilization of awareness in health care system will be measured as whether patient utilized awareness information for drug inquiry behavior, drug request behavior and medical condition inquiry. These three variables will be separate measures related to behavior in response to any awareness that the respondent may have been exposed to in the past.

RESULTS AND DISCUSSION

1. Effect of age on medication errors

The current study presents the necessary components of medication errors dimensions. A better understanding of the effect of medication errors dimensions on patient health draws conclusions that can be beneficial not only for pharmaceutical organizations but also for other

organizations, institutions and policy makers. The content also may be of an interest to academic studies related to the reporting of information concerning medication errors. This study might also be considered as one of initiative that presents the effect of medication errors methods on consumer's decision in Saudi Arabia and in Arab countries. If this study is put to use in the near future, it could present an important cornerstone that facilitates cross-disciplinary dialogue and hopefully establishes a research field of medication errors in Saudi Arabia. This research may lead to identify the best strategies of medication errors, which might help decision makers in government and professionals to get more information about patient preferences .The education level of patients plays an important role in this field and we know also that education level is variable from patients to patients and from society to another. Thus, the most important orientation for the promotion of drugs must be oriented not only to the medical professions but also to the patients. Hence, the study problem can be perceived by having detailed and scientific answers to the mean questions of this study. 600 questionnaires were distributed. The valid number of questionnaires for the medical profession including physicians, pharmacists and nurses were 200,and 400 questionnaires were collected from public. This study involved forced-choice questions about; professions, gender, marital status, age, and education level of the sample. This study is considered as a casual study. It aimed at investigating the cause/effect relationship between factors influencing medication errors. After collection of questionnaire, these were validated and distributed in table for more analysis as shown below. The frequency and the percent of both questionnaires, for public and healthcare profession are determinate. The descriptive statistics for each group of sample in relation with the dependent variables or for all the groups when all groups are combined(n=600) are presented in the following tables. The results were arranged according to the group of age as they are listed in Table 1 &2 and figure 2 and 3.In the case of surveyed public or health professionals, large number of age group 20-35 agreed that medication errors have an impact on patient's health with percentages of 79 or 85 %, respectively. As figure 4 shows, 62% of respondents were male, 57% were married and 62 % hold a university degree.

Table 1: medication errors for public.

Age	Yes	%
20-25	188	47.5
26-35	126	31.5
36-45	60	15
> 45	26	6.5

Table 2: Healthcare professionals.

Age	Yes	%
20-25	55	27.5
26-35	114	57
36-45	26	13
> 45	5	2.5

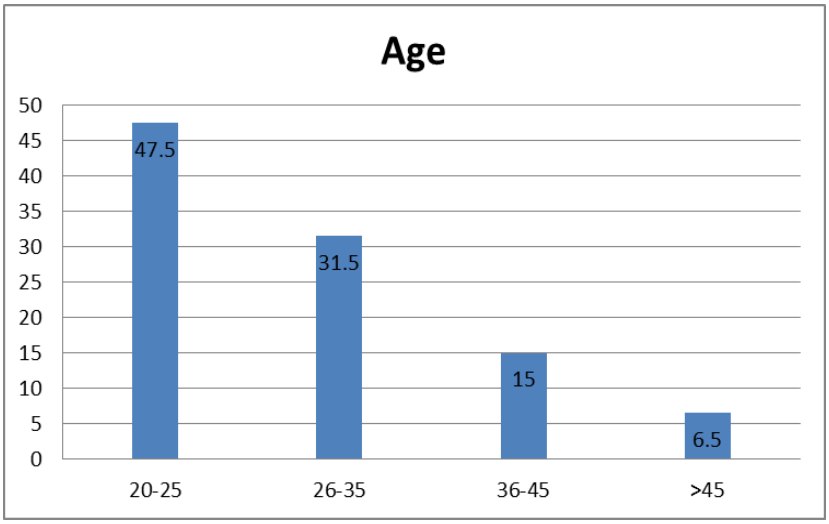

Figure 2: Response by age for public respondents with regards implication of medication errors on patients' health.

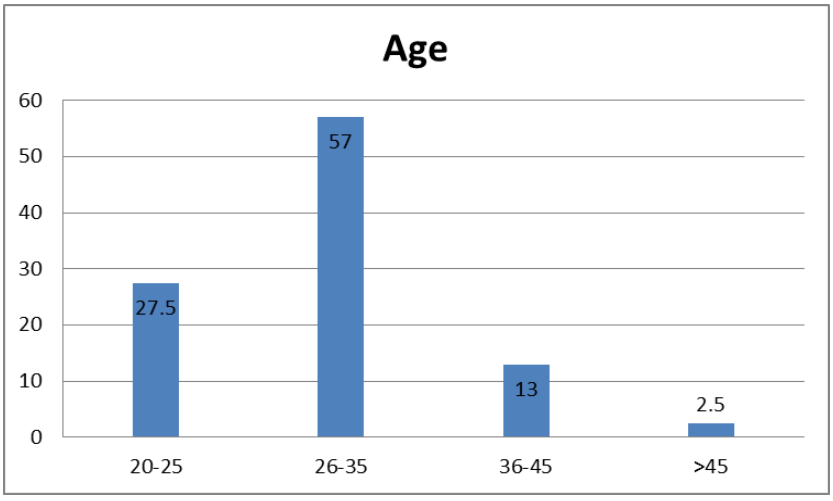

Figure 3: Response by age for health professional respondents with regards implication of medication errors on patients' health.

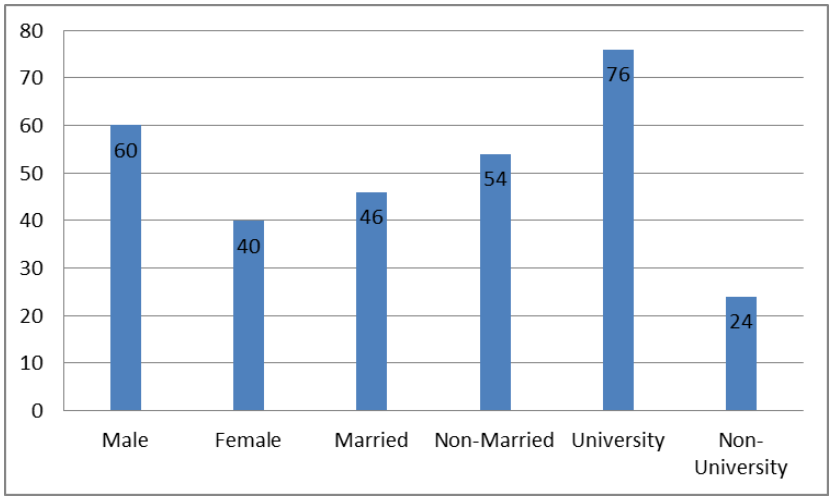

Figure 4: Socio-demographic characteristics of the surveyed participants.

Table 3: Type of profession of healthcare participants.

N	Profession	Numbers	%
1	Physician	25	12.5
2	Pharmacist	111	55.5
3	Nurse	20	10
4	Physiotherapy	10	5
5	X –ray	28	14
6	Lab Tech	6	3

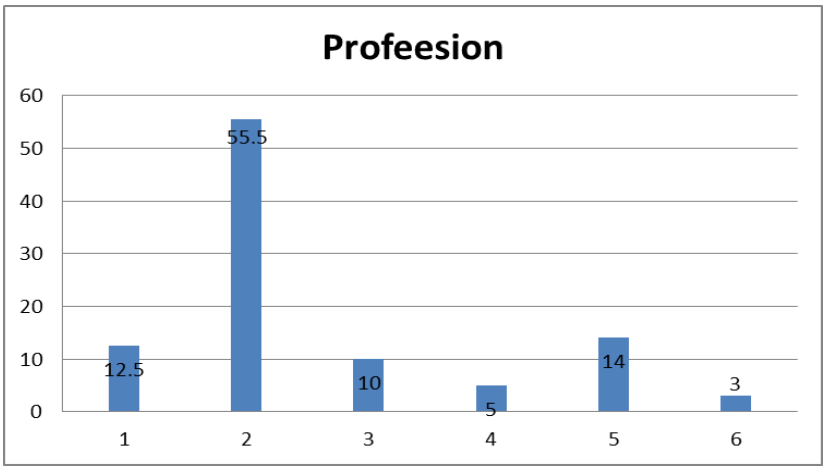

Figure 5: Type of profession of healthcare participants.

2 . Effect of profession on medication errors

As figure 5 shows, number of pharmacists who took part in the survey were the highest amongst the other healthcare professionals with a percentage of 56%, followed by physicians, nurses, physiotherapists, X-ray and Lab technicians.

Table 4 and figure 6 depict the various factors which affect medication errors. Mean response of the general public participants who agree that factors such as knowledge, information or self-medication can influence medication errors was about 66%. This is in comparison to 75 % as a mean response in the case of the surveyed healthcare professionals, see table 5 and figure 6. This reflects the awareness of the healthcare professionals with regards to knowledge, information, organization and self-medication and their role in preventing medication errors.

Table 4: Degree of awareness amongst public respondents with regards various factors influencing medication errors.

#	Items	N	Yes%
1	Knowledge	312	77.90
2	Information	246	61.28
3	Self-medication	241	60.25

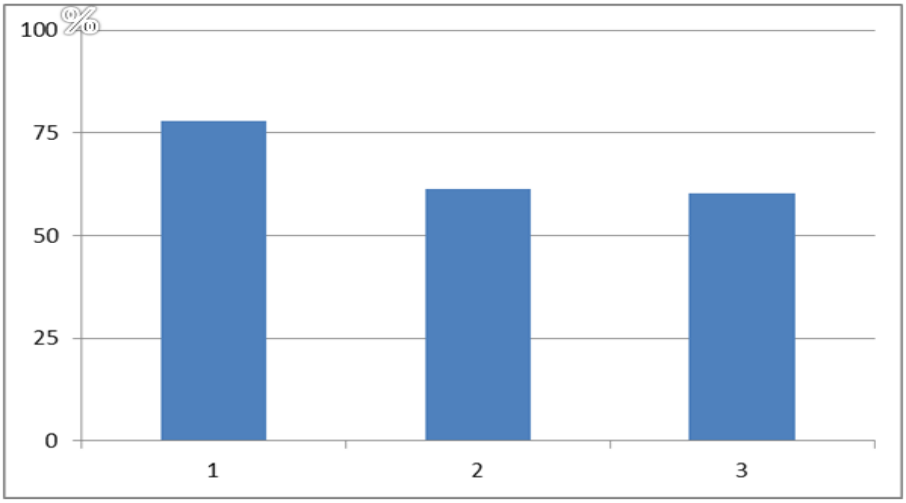

Figure 6: Distributions of result for public study.

Table 5: Degree of awareness amongst healthcare respondents with regards various factors influencing medication errors.

#	Items	N	Yes%
1	Knowledge	158	78.62
2	Information	125	62.25
3	Organization	168	83.62
4	Self-medication	149	74.25

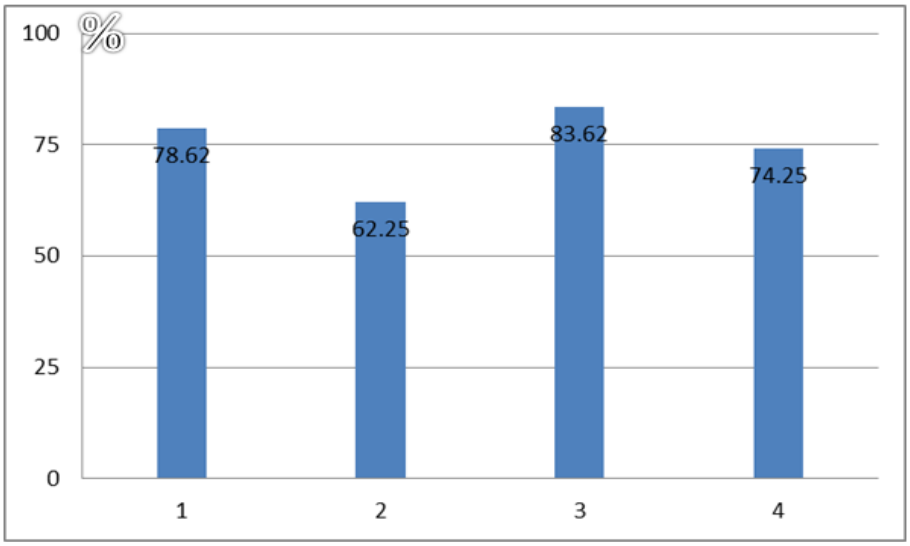

Figure 7: Degree of awareness amongst healthcare respondents with regards various factors influencing medication errors.

3. Effect of healthcare knowledge on medication errors

The debate about the effect of medication errors on patients' health is going on since long time. This study sheds some light on the relationship between medication errors and healthcare awareness, knowledge, information source and patient income level of treatment. Medication errors have a negative impact on the contrived plans by the healthcare professions to raise standards of the healthcare system. It appears that pharmacist has a substantial role in circumventing and dealing with medication errors due to his high level of awareness with regards parameters which influence medication errors such as; knowledge, income level source of information and consumers decision.

The healthcare knowledge affects medication errors. Questions in table 6 and 7 represent healthcare knowledge and their impact on medication errors. The mean positive answer for all of those questions was 65% in the case of the surveyed public in comparison to, 82% for the healthcare respondents. This reflects how the degree of knowledge interplays in the medication errors, and how it is more profound amongst healthcare professionals in comparison to public.

Table 6: Effect of knowledge level on the medication errors for public.

N	Questions	Yes	%
1	Does the diagnosis of diseases in wrong way is one of the causes of medical error?	392	98
2	Does the patient's health awareness of the misuse of drugs lead to damage?	278	69.5
3	Does the patient sometimes have a role in the occurrence of drug error?	347	86.75
4	Does the pharmacist sometimes have a role in the occurrence of drug error?	281	70.25
5	Does the physician sometimes have a role in the occurrence of drug error?	300	75
6	Do you know who the clinical pharmacist is?	211	52.75
7	Do you think that clinical pharmacist has sufficient experience with side effects of drugs?	163	40.75
8	Do you know what drugs are doing in the body?	115	28.75

Table 7: Effect of knowledge level on the medication errors for health professions.

N	Questions	Yes	%
1	Do you see that the cause of medical error is the lack of scientific experience?	127	63.5
2	Does the absence of professional practice of medical cadres from the reasons of medical errors?	197	98.5
3	Does the society neglect medical errors?	180	90
4	Does the multitude of patients and reviewers among the causes of medical errors' occurrence?	170	85
5	Is the medical negligence a start for medical error?	197	98.5
6	Are government hospitals more susceptible to medical errors than others?	115	57.5

The result concerning dimension of healthcare awareness and its impact in reducing medication errors is supported by Bozic et al.[17] and Keja[18] who have concluded that drug promotion for example increase health awareness. Paradoxically, in a study by Majed et al. concluded that drug promotion provides inaccurate, misleading, few factual information and not telling the truth which might have a negative impact on medication errors.[19] According to many researchers, medication errors can strongly influence prescribing behavior as it increases awareness, and improves discussion with health professionals.

4. Effect of medical information sources on medication errors

Questions in table 8 and 9 represent medical information sources and their impact on medication errors. The mean positive answer for all of those questions ranged from 40 to 65% depending on the surveyed population. Such results indicate that there is a varied moderate agreement among respondents on the medical information source variable.

Table 8: Effect of information sources on the medication errors in public.

N	Questions	Yes	%
1	Have you or one of your family members or one of your relatives ever witnessed a medical error?	127	31.75
2	Do you see that the cause of medical error is the lack of physician's experience?	240	60
3	Does the absence of continuous training of medical cadres lead to the increase of medical errors?	305	76.25
4	Is the medical negligence a start for medical error?	360	90
5	Does the society neglect medical errors?	373	93.25
6	Do you agree that there shall be laws of accountability for the physician who made a medical error?	229	57.25
7	Are government hospitals more susceptible to medical errors?	187	46.75
8	Does drug advertising affect drug error?	186	46.5

Table 9: Effect of information sources on the medication errors in health professions.

N	Questions	Yes	%
1	Have you ever witnessed a medical error?	188	94
2	Do medical errors, according to your opinion, develop medical profession?	69	34.5
3	According to your opinion, does the penal committee for medical errors perform its role effectively?	175	87.5
4	Does the patient sometimes have a role in the occurrence of drug error?	190	95
5	Does the physician sometimes have a role in the occurrence of drug error?	168	84
6	Does the pharmacist sometimes have a role in the occurrence of drug error?	160	80
7	Do you know who the clinical pharmacist is?	148	74

5. Effect of self- medication factor on medication errors

Questions in table 10 and 11 represent self-medication perception and its impact on medication errors. The mean positive answer for all of those questions was 50% for all surveyed population. Yet, 70 % of respondents consider self-medication is a bad behavior in the society. Nonetheless, the impact of self-medication on medication errors seems to be relatively moderate. Patient is affected by information quality, adequacy, validity, reliability, clarity and updated product price. In reality, the information provided in advertisements is incomplete and inadequate for making treatment decisions. Some Patient requests put pressure on physicians to prescribe drugs which may not be beneficial or for which the risks of errors increased.

Table 10: Effect of self-medication on the medication errors in the public.

N	Questions	Yes	%
1	Do you consider that self-medication is usual in the society?	177	44.25
2	Do you consider that self-medication is a bad behavior in the society?	320	80
3	Do you have confidence in your sources of information about drugs (internet, magazine, television, etc)?	162	40.5

Table 11: Effect of self-medication on the medication errors in the health professions.

N	Questions	Yes	%
1	If a specific number of patients is determined, does each health practitioner reduce mistakes?	26	13
2	If each department has its respective pharmacy, does this contribute in reducing drug errors?	160	80
3	Do you see, according to your opinion, that electronic recipes reduce the mistakes?	197	98.5
4	Does the treatment of patients of cities and villages differ regarding the basic information of drug?	197	98.5

6. Effect of organization factor on medication errors

Questions in table 12 represent organization factor and its impact on medication errors. The mean positive answer for all of those questions was 90% for all surveyed population, which is in the opinion of the surveyed population is considered the highest, nonetheless, all surveyed population; public and professionals agree that all studied factors have an effect on the medication errors. Organization factor appears to be the highest parameter contributing to medication errors incidents.

Table 12: Effect of organization factors on the medication errors in the health professions.

N	Questions	Yes	%
1	If each department has its respective pharmacy, does this contribute in reducing drug errors?	160	80
2	Do you see, according to your opinion, that electronic receipts reduce the mistakes?	197	98.5
3	Does the treatment of patients of cities and villages differ regarding the basic information of drug?	197	98.5

Adverse drug events are estimated to injure or kill more than 770 000 people in hospitals annually. Prescribing errors are the most frequent source.[21] Most of medications were ordered by handwritten paper prescriptions or verbally between physician and pharmacist.

Adoption of computerized prescriber order in healthcare system, the majority of medications are now ordered electronically.[22] This system creates multiple opportunities for protections that enhance patient safety, but also introduces the potential for numerous new types of both predictable and unpredictable prescribing and dispensing errors.[23, 24] Computerized physician order entry (CPOE) systems are widely viewed as crucial for reducing prescribing errors and saving hundreds of billions in annual costs. Computerized physician order entry system advocates include researchers, clinicians, hospital administrators, pharmacists, business councils, the Institute of Medicine, state legislatures, health care agencies, and the lay public.[25] Therefore, there is a need in our hospitals to create enhanced local reporting systems to produce an environment that systematically collects and brings together CPOE-related errors and opportunities for improvement from multiple sources and enhanced feedback from pharmacies and patients.

Table 13: Comparison of medication errors (%) in some countries.

Countries	% Medication errors	Reference
Saudi	40%	Dibbi H M ,AL-Abrashy HF , Hussain WA (2006)
Abu Dhabi	26%	Abu Dhabi -Health Authority(workshop), the statistics for the year 2010
Germany	30%	Journal of Patient Safety. Publish Ahead of Print:, Dec 2016
UK	14%	Arch Dis Child 2000 in U.K

Table 13 present a comparison of medication errors in various countries. It seems that variation of medical errors is relatively high between developing and developed countries. In 2014 in a symposium in Saudi Arabia concerning the medication error in the developing countries, it was acknowledged that medication errors are a wide world problem. Furthermore, it was, revealed that the percentage of medication errors are 68% during prescribing the drugs, 20% during writing prescription, 11% during dispensing and 37% during the administration.[26]

CONCLUSION AND RECOMMENDATIONS

The study results show that the average means of respondents' perception about the healthcare awareness dimensions, the medical information source variable, and patient benefit variable are varied, and the results reveal that there are medium effects of these factors on healthcare awareness. Finally, patient is affected by information quality, adequacy, validity, reliability, clarity and updated product price. In reality, the information provided in

advertisements is incomplete and inadequate for making treatment decisions. Some Patient put pressure on physicians to prescribe drugs which may not be beneficial or for which the risks of errors increased.

A better understanding of the effect of medication errors dimensions on patients and members of medical profession draws conclusions that can be beneficial not only for pharmaceutical organizations but also for other organizations, institutions and policy makers for the protection of public health. The study also may be of an interest to academic studies related to the reporting and decision making concerning medication errors. The current study might be considered as initiative that presents the effect of medication errors on patients healthcare. This study could present an important cornerstone that facilitates cross-disciplinary dialogue and hopefully establishes a research field of medication errors.

This research may lead to identify the best medication errors strategies, which might help decision makers in government and pharmaceutical industry to get more information about patient preferences. It also increase information and knowledge about medication errors and the well uses of drugs, furthermore the present work will assist healthcare administration for establishment of regulations regarding medication errors based in the collaboration between government and pharmaceutical industry oriented to the benefits of health care patients that respect the ethical aspect. They lead to increased morbidity and mortality rates, cost of treatment and at times hospitalization. Therefore identifying the causes of medication errors and developing need based strategies for increasing awareness of public by education, knowledge, new information technologies may prove cost-effective and prevent medication errors.

Our recommendations are enhancing the awareness of institution, professionals and patients, increasing the information about the risks of medication errors on the healthcare system and collaboration between all parts of healthcare system for the protection of patient's health. All staff of healthcare must stop the progress of medication errors by enforcing the policy and a strict application of regulation in healthcare institutions.

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