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Knowledge of and Attitude Towards Medical Errors among Medical Students, Jeddah, KSA

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Abstract

Background: Failure to complete the intended plan of action or implementing the incorrect plan to achieve an aim or intended outcome is an example of medical errors. It is a deviation from the care process that may or may not result in harm. **Objectives:** To determine the knowledge and attitude of medical students towards medical errors and predictors for their perception among medical students, Jeddah, KSA 2022. **Methods:** A cross-sectional study was conducted including convenient sample of 306 Saudi medical students using specially designed pre-coded, closed ended online format. Data was presented as frequencies, means and standard deviations and analyzed using Chi-square and independent t-test. Scores for knowledge of general concepts, preventive aspects and attitude and perception scores were calculated. Multivariate analyses were conducted with forward stepwise (Wald) method to determine independent predictors for medical errors. $P < 0.05$ was considered significant. **Results:** There were significant difference between studied students' groups regarding knowledge of general concepts ($p = 0.025$) and preventive methods ($p = 0.000$), attitude towards some aspects of medical errors ($p = 0.000$) and total perception of medical errors ($p = 0.031$). College type (OR = -3.8, $p = 0.000$), curriculum-based patient safety course (OR = 4.2, $p = 0.000$) and history of previous exposure to medical errors (OR = 2.9, $p = 0.035$) were predictors for the level of student perception. **Conclusion:** Medical errors reporting and patient safety are among the main pillars of quality in healthcare system. Its achievement necessitates individual and team commitment. Medical students who had patient safety course before showed significant different perspectives regarding incidence and management of medical errors between private and governmental hospitals.

Keywords: Malpractice, Medical Errors, Medical Negligence, Patient Safety Based Medical Education, Perception

1. Introduction

Every year, an inadmissible number of patients suffer from either reversible or irreversible effects up to death because of medical errors[1]. There is under estimation and shortage of documentation of medical errors all over the world although it is the third leading cause of death after cardiovascular diseases and cancer in the United States (US)[2].

Medical errors could be defined as failure to complete the intended health care plans of action or implementing the wrong action to achieve an aim or intended outcome. Though it is a deviation from the process of care, it may or may not

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result in harm[1]. Meanwhile, medical malpractice is failure of a physician or other health-care professionals to render proper care services intentionally or through negligence or without obtaining informed consent[3]. Medical errors do not usually correlate with malpractice in healthcare but used to include both malpractice and negligence[2].

Most errors result from problems created by complicated or complex health care system. They also happen when there is miscommunication between physicians, healthcare team and their patients[4]. From the perspective of the patient, it could be due to "grab and go" medication dispensing, administration or restocking, reluctance to ask for help or clarification, using medications without complete knowledge of their indications, contraindications, interactions and hiding important information such as patient allergies, diagnosis/comorbid conditions[4].

Medical errors can happen anywhere in the healthcare system, including hospitals, clinics, outpatient surgery centers, doctors' offices, pharmacies and patients' homes[4]. Errors can encompass medicines, surgery, diagnosis, equipment and lab reports[1]. They are more frequently occurring among cases with cancer, neurological diseases and cardiac cases, surgical and urological patients[5].

Medication errors are the most common kinds of errors in health care system[6]. While no universal definition exists, the National Coordinating Council for Medication Error Reporting and Prevention defines it as "...any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is under the control of the healthcare professional, patient or consumer"[6]. Such incidents could be associated with professional practice, healthcare products, procedures and systems, such as prescribing order, communication, product labeling, packaging and nomenclature, compounding, dispensing, distribution, administration, education, monitoring and use"[7]. Medication errors typically occur during one of the following stages: Ordering/prescribing, documenting, transcribing, dispensing, administering and monitoring[8].

So, they take many forms (e.g., wrong dose, wrong drug delivering or prescribing, known allergy, wrong time or route or missed doses), the most common one is dosing errors. There are numerous causes for these errors, including inadequate dissemination of drug knowledge to physicians, incomplete patient information, rule violations, transcription errors and lapses in judgment and performance. Medication mistakes are the most common during the ordering or prescribing process. Errors are common when a healthcare provider writes the wrong medication, route, dose or frequency. These ordering errors are responsible for nearly half of all medication errors. Nurses and pharmacists, according to data, detect 30-70 % of medication-ordering errors. Medication errors are clearly a widespread problem, but they are usually avoidable[7].

Surgical errors are common, representing 40-45 % of all in-hospital adverse events[9,10]. Another common form of medical errors is hospital acquired infections (as Catheter-Associated Urinary Tract Infection, Surgical Site Infection, Ventilator-Associated Pneumonia and Central Line-Associated Bloodstream Infection)[11].

In addition to undermining public trust, these events have increased patient morbidity and mortality while also raising health-care costs[11]. In the United States alone, 7,000 to 9,000 people die each year because of medication errors. Hundreds of thousands of other patients experience adverse reactions or other medication complications but they do not report them[7]. As medical errors and their grave consequences have proliferated, so has public awareness; a high percentage of patients fear medical errors; a higher percentage believes that the healthcare providers should be more strictly monitored, though this can be reduced by modifying procedures and protocols[2].

Medical professionals are critical personnel who must have a positive attitude toward medical errors that may occur during medical practice. The most effective approach for reducing the prevalence of medical errors is to disseminate all relevant information to undergraduate medical students as part of their curriculum. The goal of this initiative is to reduce medication-related harm caused by unsafe medication practices and errors. The challenge aims to improve medication safety by fortifying systems for reducing medication errors and avoidable medication-related harm[7]. As a result of this early exposure, the prevalence of medical errors will be reduced later in their future practices[12].

Medical errors studies investigated claims in Saudi Arabia are limited due to organizational complexity to access claims data. Also, there is no accurate estimation of the knowledge and attitude for medical errors neither among health care providers nor medical students.

So, this study was carried out to achieve the following objectives. Determine the knowledge pattern of medical students about medical errors.

- Measure the attitude of medical students towards medical errors.
- Identify predictors affecting perception of medical errors.

2. Subjects and Methods

2.1 Study Type and Setting

A cross-sectional survey study was conducted among medical students in Jeddah, KSA during the period from August to September 2022.

2.2 Study Participants and Sampling Methodology

A convenient sample of Saudi medical students (in both private and governmental colleges in Jeddah) were included in the study. Participants were selected consequently using non-randomized involuntary response sampling. The sample size was calculated as 306 medical students using the following equation:

$$N = Z2P\,(1-P)/d2;$$

Where (n) is the sample size, (Z) is the statistic corresponding to confidence level, (p) is the expected prevalence, and (d) is the precision[13].

The participants were divided into two groups according to whether they had previous curriculum-based patient safety course (including medical error part) or not. Non-Saudi and non-medical students were excluded.

2.3 Study Instrument

Data were collected by an online questionnaire which specially designed based on literature review, pre-coded, closed ended pilot tested online format was constructed and utilized. It was included socio-demographic data as gender, age, grade, marital status and college and data about student knowledge and attitude towards medical malpractice. The Questionnaire was validated by 8 experts and they recommended a few modifications to some items. Such modifications have been discussed between the researchers and were made accordingly before the questionnaire made ready for sending to the participants. The final version of the online survey was prepared and distributed, using Google form. The reliability of the questionnaire was tested by SPSS using the Cronbach's alpha test (where r = 0.79).

2.4 Statistical Analysis

Data was collected and coded, then they were entered and analyzed with SPSS version 25.0 and were presented as frequencies, means and standard deviations. Bivariate analysis was conducted to test significant differences. Chi-square and independent t-test were used to analyze variables. To control potential confounding, multivariate analyses were conducted with the forward stepwise (Wald) method to determine the independent predictors of knowledge of attitude to and perception of medical errors. For each variable adjusted prevalence Odds Ratio (OR) and their 95% Confidence

Table 1. Different variables used in calculation of mean percent scores of knowledge and attitude of students for medical errors (perception score)

Perception Score		
Knowledge about the general concepts of Medical Errors (ME)	**Knowledge about preventive methods of Medical Errors (ME)**	**Students' attitude towards some concepts of Medical Errors (ME)**
1. Definition of ME	1. ME reduced by modifying procedures and protocols	1. I have the desire to prevent ME
2. Definition of malpractice	2. Some ME are unavoidable	2. I feel that ME are a big deal
3. Places of ME	3. Patient may assist in avoiding ME	3. I have the desire to carry out a lot of methods for prevention of ME
4. Forms of ME	4. ME reduced through health education of the patient	4. I have the desire to utilize and improve the reporting system for ME
5. Link of ME with malpractice	5. ME reduced through telling the health care providers all patients' medications	5. I have the desire to answer patient questions about disease condition
6. Link of ME with medical system	6. ME reduced through telling health care providers of the patient's allergies and adverse reactions	6. I have the desire to attach statements of possible errors everywhere
	7. ME reduced through understanding the indications, contraindications and side effects of medications	7. I agree with the fact that instruction on medical errors prevention should be given for every person receiving health care
	8. Double check from the pharmacy when the Rx is picked up reduce ME	8. I am pleased to revise the clear methods for ME claims
	9. Asking the physician what the treatment plan will be when the patient is discharged could reduce ME	
	10. Clear terms and extent of surgery to both the patient and the surgeon needed to avoid claimed ME	
	11. Presence of family physician is helpful in reduction of ME	

Intervals (CIs) were computed directly from the logistic regression analysis. Statistical significance was set at $p < 0.05$.

The mean percent scores for knowledge of general concepts of medical errors together with their preventive aspects and attitude for medical errors as well were calculated using the following formula:

Percent score =∑Scores of questions selected/ maximum possible score for these questions × 100

The answers to questions that were considered in calculation were scored (if binary question, it would be 0 for no and 1 for yes) and the actual answers for that questions were summated. Then, the maximum possible score that could be obtained for those questions was calculated.

Using the above formula, the score was calculated. To calculate the mean percent score, the mean value ± SD was multiplied by 100. The Variables that were used in calculation of mean percent scores of knowledge about general concepts, knowledge about preventive methods and attitude of students towards some concepts of medical errors were presented in Table 1. The summation of the three scores was considered as the total perception score (Table 1).

2.5 Ethical Considerations

The Ethical approval for the study was gained from Ibn Sina National College (ISNC) Research and Ethics Committee (IRRB-07-04082022) in accordance with the declaration of Helsinki for Human Studies[14]. Participation in the study was entirely voluntary and all participants were informed about the purpose of the study and their right to refuse or discontinue participation during the online survey. During data collection and throughout the research process, ethical behavior was maintained.

Table 2. Description of socio-demographic aspects of the studied students (n = 306)

Items		Curriculum-based patient safety course				Total		p-value
	No		Yes					
	N = 153	%	N = 153	%	N = 306	%		
Age	Mean (SD)	23.3 (1.67)		24.5 (2.43)		23.4 (1.98)		0.050
Gender	Male	52	34.0	63	41.2	115	37.6	0.043*
	Female	101	66.0	90	58.8	191	62.4	
Grade level	Preclinical	82	53.6	22	27.5	104	34.0	0.031*
	Clinical	71	46.4	111	72.5	202	66.0	
College	Private College	75	49.0	92	60.1	167	54.6	0.029*
	Governmental College	78	51.0	61	39.9	139	45.4	
Marital Status	Never married	132	86.3	122	79.7	254	83.0	0.041*
	Ever married	21	13.7	31	20.3	52	17.0	
Medical history	No chronic medical condition	146	95.4	144	94.1	290	94.8	0.529
	With chronic medical condition	7	4.6	9	5.9	16	5.2	
Surgical history	No history of previous operations	131	85.6	129	84.3	260	85.0	0.431
	With history of previous surgical operations	22	14.4	24	15.7	46	15.0	
Previous admission to hospital	No	94	61.4	103	67.3	197	64.4	0.267
	Yes	59	38.6	50	32.7	109	35.6	
History of previous exposure to medical errors	No	111	72.5	109	71.2	220	71.9	0.356
	Yes	42	27.5	44	28.8	86	28.1	

*p-value significant at < 0.05

3. Results

The total number of enrolled students was 306; 50% (153/306) had curriculum-based patient safety course and the other 50% (153/306) had not. Their mean age was 23.4 years (1.98), nearly two thirds were females (62.4%), 66.0% in enrolled in clinical years (p = 0.031). More than half (54.6%) were significantly enrolled to private medical college. The majority (83.0%) was significantly never married (p = 0.041). Less than one third (28.1%) previously exposed to medical errors (Table 2).

Figure 1 illustrates that there was a significant difference in opinion between those who had curriculum-based patient safety and those who had not regarding incidence and management of medical errors when comparing private and governmental hospitals (p = 0,019, 0.006 respectively) (Figure 1).

There was significant difference between those who had curriculum-based patient safety and those who had not for all scores namely, knowledge of general concepts (p = 0.025), knowledge of preventive methods (p = 0.000), attitude towards some aspects of medical errors (p = 0.000) and total perception of medical errors (p = 0.031) (Table 3).

College type (OR = -3.8, p = 0.000), curriculum-based patient safety course (OR = 4.2, p = 0.000) and history of previous exposure to medical errors (OR = 2.9, p = 0.035) were predictors for the level of student perception towards medical errors (Table 4).

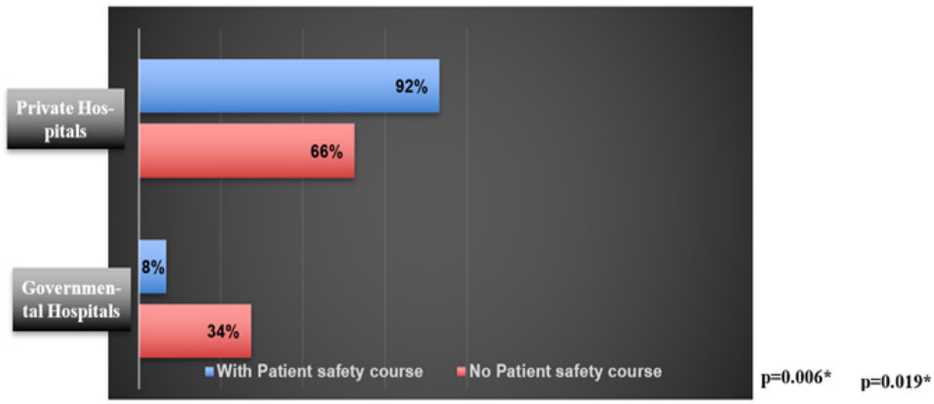

Figure 1. Students' opinion regarding difference in incidence and management of medical errors between private and governmental hospitals.

Table 3. Distribution of total percent scores knowledge and attitude of students towards medical errors by state of curriculum-based patient safety course (n = 306)

	Curriculum based patient safety course		Total	p-value
	No	Yes		
Total percent score for knowledge about the general concepts of ME Mean (SD)	57.6 (5.91)	79.8 (4.66)	68.7 (4.98)	0.025*
Total percent score for knowledge about preventive methods of ME Mean (SD)	59.3 (4.74)	81.9 (3.27)	70.6 (3.89)	0.000*
Total percent score of attitudes towards some concepts of ME Mean (SD)	46.8 (6.67)	76.5 (4.81)	61.7(5.73)	0.000*
Total percent score of perception of students towards ME Mean (SD)	54.6 (5.83)	79.4 (4.61)	67.0 (4.89)	0.031*
*p-value significant at less than 0.05 level ME: Medical errors				

Table 4. Multivariate logistic regression analysis of predictors for students' perception of medical errors

	OR	95% CI for OR	p-value
Constant	1.3		0.001*
Marital status (ever married)	1.7	1.2-3.9	0.043*
Gender(females)	2.1	1.9-6.4	0.051
College(governmental)	-3.8	-2.6-6.7	0.000*
Curriculum based patient safety course	4.2	3.6-8.9	0.000*
History of previous exposure to medical errors	2.9	2.5-8.3	0.035*
Previous admission to hospital	3.1	1.5-7.7	0.053

Dependent variable encoding: negative = 0, positive = 1, R2 = 0.786. CI-confidence interval; ME- medical errors; OR- odds ratio.
*P-value is significant if P < 0.05

4. Discussion

The current study aimed to determine the knowledge pattern, attitude of medical students towards medical errors and predictors for their perception among medical students in Jeddah city, KSA.

Students during their clinical years exposed to hospital working environment and medical practice and obviously discover any malpractice or negligence performed by other health care workers. In this clinical training phase, they are mainly observers criticizing everything and compare it with the standards that they study. Also, they may discover some forms and causes of medical malpractice that could not be categorized[15].

The current study illustrated that most of medical students who got a patient safety course (including medical errors) were enrolled in private medical college. The private medical education is a growing phenomenon in many countries all over the world. This may be attributed to both shortage of physicians' number together with increasing demand to qualified medical personnel with population growth[16].

Mostly in Saudi Arabia, the private education has to modify and improve its curriculum continuously based on the updated international standards, the clients' needs, work employer and healthcare system standards. So, inclusion and implementation of solely course will be a mandatory process in addition with integrated patient safety related topics in different courses, modules, and clinical rotations. This patient safety course will assist the students in developing fundamental knowledge about medical errors upon which they will build throughout their academic and professional lives.

The World Health Organization (WHO) is currently leading a global effort to broaden medical error and patient safety education, principles and approaches, resulting in a future healthcare workforce who is prepared to provide patient-centered care anywhere in the world. Since 2011, it has been developing a multi-professional patient safety curriculum guide, as well as a health systems approach with global concern[17].

It is highly important that medical students learn the domains of patient safety and healthcare improvement with the core concepts of the quality and safety of healthcare provision in one separate course[18]. This course can be developed based on WHO curriculum guide and include topics related to (what is patient safety, human factors and patient safety, understanding systems and effect of complexity on patient care, learning from errors and prevent harm, using quality improvement model to improve health care, patient safety and invasive procedures, and medication errors, etc)[17].

This study found that 28.8% of those who had history of exposure to patient safety course had a more positive attitude toward medical errors, inspiring the next generation of health-care professionals to embark on a lifelong quest to provide their patients with the highest quality and safest care possible. Theoretical knowledge about patient safety, the causes and types of medical errors forces medical students to be more vigilant to any medical practice or intervention he receives. He will be able to distinguish between cause and effect[19].

Medical students who had patient safety course had significant different perspectives regarding incidence and management of medical errors between private and governmental hospitals. Medical errors cause serious problems for patients in terms of increasing mortality and hospital cost. One study found a significant variation in the reported rates of medical errors in different hospitals in Saudi Arabia; with higher incidence than reported in other studies[20,21].

This variation may be due to underreporting of malpractice which may be accompanied by unusual presentation and causation. A new strategy including computerized notification system is needed to be developed including all hospitals weather private or governmental allowing adding these unusual causes and presentation to solve this discrepancy in incidence and management of medical errors between both health sectors[21].

The healthcare system in Saudi Arabia had CBAHI which is a nationally recognized accreditation organization. Its mandate is to accredit all Saudi healthcare facilities. Its goal was to ensure safety measures within the healthcare system and its mission was to promote quality and safety by assisting healthcare facilities in maintaining continuous compliance with accreditation standards[22]. CBAHI implemented Essential Safety Requirements (ESR) to enhance patient safety throughout the Saudi Arabia. ESR is considered as a set of 20 national hospital standards. They are regarded as the fundamental conditions that must be met to ensure patient safety inside all healthcare system and facilities[22]. Hospitals will not be granted accreditation unless they prove full compliance with ESR. ESR is regarded as the Kingdom's National Patient Safety Objectives. So, all undergraduate medical education curriculum in Saudi Arabia should provide the health professional students with the basic knowledge about medical errors, patient safety and quality of healthcare system. The current study proved that students who had patient safety course significantly had higher total percent scores for knowledge about general concepts and preventive methods, attitude and perception towards medical errors.

As our work is matching other previous study which proved that the curriculum-based patient safety course has a great impact on modifying the knowledge and behavior towards medical errors[23]. The higher level of knowledge and attitude will affect the prevalence and types of medical errors. It also will improve self-reporting of any malpractice and increase the tendency to find more practical preventive methods. Students getting this course will have a great capability as future physicians and healthcare developers to create new strategies to prevent and control medical errors and they can easily emerge inside the complex healthcare system.

5. Conclusion

Medical errors are among the main concepts to be known in any patient safety course to reach high quality healthcare services. Understanding risks in the complex processes of healthcare necessitates knowledge of errors and "near misses". We can learn from patient safety curriculum how to close safety gaps, reduce morbidity and mortality and improve healthcare quality. This study determined the knowledge pattern of medical students about medical errors. Measure the attitude of medical students towards medical errors and identify predictors affecting their perception of medical errors. Most of medical students who had patient safety course had significant different perspectives regarding incidence and management of medical errors between private and governmental hospitals.

6. Recommendations

- Medical error is the responsibility of everyone in the healthcare facility. So, this study strongly recommends the presence of a sole course guided by the WHO curriculum about medication errors and patient safety with more stress on real errors related cases to help students learn from these situations.
- Repetition of this study work at a national level by surveying the number of medical schools in Saudi Arabia that implemented a sole course on patient safety and check the availability of interprofessional Education strategy which will improve health profession training and prepare practitioners to provide effective patient-centered collaborative care.
- Measure the graduates' effectiveness in healthcare practices at different private and governmental sectors following patient safety concepts with measuring the medical errors percentage incidence.

7. Study Limitations

The data collection method (an online questionnaire rather than a community-based survey) and sampling technique (a voluntary response sample) both limit the generalizability of the results.

8. Contribution

Manal Ibrahim Hanafi Mahmoud hypothesized the study, supervised the study procedures, contributed to data analysis and interpretation and drafted the first manuscript. Hala Mohammed M. Aljahdali, Abdulrahman Ali A. Bukhari, Ahmad Mohammad A. Bayazeed, Sultan Mohammed D. Algarni designed the survey, helped with data acquisition and the first draft of the overall manuscript. Asmaa Abdel Nasser and Mohamed Elsayed Saifalyazal shared in reviewing the literature and introduction, methodology and discussion sections. Both Manal Ibrahim Hanafi Mahmoud and Asmaa Abdel Nasser had made the essential contributions, critically reviewed and approved the final copy of manuscript.

9. Conflict of Interest

The authors declare that they do not have any conflicts of interest.

10. Funding

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11. References

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