Research Article

Factors associated with vulnerability of patients to medical errors

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ABSTRACT

Background: Patient safety has been an important concern among quality conscious health-care providers. Patients undergoing hospitalization are vulnerable to harms from various errors during patient care process. The vulnerability may differ from patient to patient depending on certain patient-specific factors. **Objective:** The objective of the study is to examine the association of certain patient-specific factors with occurrence of medical errors. **Materials and Methods:** The study used a case–control study design under which patients who faced one or more medical error were taken as cases and those who did not faced any medical errors used as controls. The data constitute of 109 cases and 236 controls over the period of the past 1 year. Five different patient's factors; age, gender, literacy, income, and language inability were analyzed for their association with the occurrence of medical error. The Statistical Package for the Social Sciences version 16 was used to calculate odds ratio (OR) with confidence interval (C.I.) of 95% and $P = 0.05$. **Results:** It was found that old age patients, illiterate patients, and patients with language inability had a significant higher odd of suffering a medical error. The OR of old age patient is 1.22–1.83 (95% C.I., $P = 0.001$) in comparison to patients who are <60 years. The OR of illiterate patient is 1.75–3.12 (95% C.I., $P < 0.001$) in comparison to those who are not illiterate and the OR of patients with language problem is 2.32–8.83 (95% C.I., $P < 0.001$) in comparison with patients with no language problem. The OR of economically backward and gender (male and female) patients was not found to be significant. **Conclusion:** The study concludes that illiteracy, old age, and language problem when present in patient increase their vulnerability to suffer a medical error.

KEY WORDS: Vulnerable Patients; Patient Safety; Health-care Hazards; Medical Errors

INTRODUCTION

Several studies and data over the past 15 years have revealed significantly high levels of preventable medical errors causing harm to patients. Medical errors are estimated to result in about between 44,000 and 98,000 preventable deaths and 1,000,000 excess injuries each year in the U.S. hospitals.[1] Medication errors are among the most common medical mistakes, harming at least 1.5 million people every year.[2] Nearly 400,000 preventable drug-related injuries occur each year in hospitals, 800,000 in long-term care settings, and roughly 530,000 among Medicare recipients in outpatient clinics. The report stated that these are likely to be conservative estimates.[2] About 7,000 people were estimated to die each year from medication errors – about 16% more deaths than the number attributable to work-related injuries (6000 deaths).[3] Medication administration errors account for 34% of all medical errors and identified as one of the important reasons for patients' morbidity and mortality.[4]

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IOM defines patient safety as "the prevention of harm to patients."[5] It emphasizes on having a system that prevents errors, improves from the learning of past errors and involving health-care providers, patients, and hospitals in a culture of safety.[5,6] Errors leading to hazards can happen due to several reasons. Overwork, miscommunication, forgetfulness, lack of

training, etc., could all contribute to the occurrence of error. The study by Hirkani and Yogi[7] found that sleep deprivation severely reduces finger dexterity of resident doctor which can cause harm to patient while conducting procedures.

Even though high incidence of avoidable patient harm has been evidenced, there has been a perceived difficulty in identifying and measuring adverse patient events and level of patient safety. An analysis of incidence among Medicare beneficiaries highlighted the difficulty of determining what events should be considered in an adverse event incidence rate and how those events should be identified and defined.[8] Measuring patient safety has mostly been limited to counting of adverse events or near misses, and even in that gross underreporting has been observed. Adverse events in hospitals may be 10 times greater than previously measured.[9] "Global trigger tool" shows that adverse events in hospitals may be 10 times greater than previously measured.[10] There has been some framework and methods put forward for measuring patient safety, but almost all are based on actual occurrence of events.[11] The factors that contribute to the vulnerability of patient to medical error are also not known well. Kaur *et al*.[12] reported various factors, gender, education, financial independence, and family support that determines the quality of life of aged person. Similar factors may have effect on the vulnerability of patients getting treated in a hospital.

Purpose of the Study

Adding to the problem of patient safety, there is a lack of mechanism to identify patients who are vulnerable to medical errors. Since any good patient safety program in hospital should focus on prevention rather than taking corrective actions later, knowing what factors in a patient increases his/her vulnerability to suffer a medical error will be helpful in taking preventive actions on vulnerable patients ultimately leading to better patient safety. This paper attempts at describing the factors that are associated with the vulnerability of a patient to suffer a medical error.

MATERIALS AND METHODS

Study Design

The study was designed as a case–control study with cases being the patients on who suffered one or more medical error during their hospitalization and controls are the patients on whom no medical errors were reported. The patient's factors were compared between cases and controls to determine odds of facing medical error in case of each factor.

- Study variable: Following variables were studied
- Dependent variable: Occurrence of medical error
- Independent variables: Following patient-specific factors were taken as independent variable – Gender (female), old age, illiterate, economically weaker, and language limitation.

Definitions

For identifying the independent variables in a patient, the following definitions have been used,

- Old age: Person with age 60 years or above as per the Government of India's "National policy on older patients."[13]
- Illiterate: As defined by the United Nations Educational, Scientific and Cultural Organization,[14] "ability to identify, understand, interpret, create, communicate, compute, and use printed and written materials associated with varying contexts. Literacy involves a continuum of learning in enabling individuals to achieve their goals, to develop their knowledge and potential, and to participate fully in their community and wider society."
- Economically weak: A person belonging to a family with the total income of <Rs. 4.5 lacs annually, as per the definition of Government of India for Economically Weaker Section.[15]
- Language inability: A working definition of language inability was taken as "A person who lacks ability to communicate in Hindi, Gujarati, or English language." This was taken as most of the staff in the hospital cannot communicate in any language other than the stated three.

Sampling

The sample constitutes of a total of 345 patients' medical files with 109 cases and 236 controls. All samples were taken from the preceding 1 year of the study. The cases constitute of all patients for whom one or more medical errors were reported. For control, 235 patients' medical files were selected using stratified random sampling. The stratification was done on the basis of independent variables and the proportion of each independent variable in the control sample was matched to the proportion in cases.

Inclusion Criteria

- Patients treated as inpatient department patients in secondary specialties, with 2–7 days of hospitalization
- Patients discharge date was within the past 1 year
- Patients admitted in general ward category.

Exclusion Criteria

Patients were excluded from sample selection, for both cases and controls, to avoid any unwanted heterogeneity from the sample,

- Below 18 years of age (to avoid the effect of care/caution rendered by the parent/guardian)
- Treated under any superspecialty, such as Cardiac, Onco, Neuro
- 50% or more of the length of stay in intensive care setting
- Patient with physical or mental disability.

Data Collection

For each sample, the data on gender, age, literacy status, income, and ability to communicate in Hindi/English/Gujarati were obtained. The data were used to classify them into various independent variables using the definitions stated above. The data on gender, age, and income were obtained from registration form of the patient, while the data on literacy status and language ability were obtained from nursing assessment form.

Data of the occurrence of medical errors in patients were obtained from the "incident reporting form" of the hospital. The hospital, as a part of its patient safety program, has a system, whereby any adverse patient incident was recorded by the nursing staff which is used for analysis and taking corrective/preventive actions. The form identifies the patient who suffered medical error and the description of error.

Ethical Clearance

The study proposal was reviewed and approved by the Institutional Ethics Committee of the hospital and ethical clearance was given. The study was non-interventional and identity of individual patient and the health-care staff who provided care has been kept confidential.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences version 16.0. Descriptive statistics were used to describe the medical error data and samples under cases and controls. For determining the effect of factors on medical errors occurrence, odds ratio (OR) of facing medical error when a dependent variable is present was calculated. The OR range at 95% confidence interval (C.I.) and $P < 0.05$ was used to determine the significance of OR.

RESULTS

The proportion of patients who suffered medical error during the study period was 1.7%. A total of 109 medical errors cases were observed, which are described in Table 1. The frequency of the occurrence of types of medical errors is shown in Figure 1. The presence of study variables into cases and controls is given in Table 2.

The association of each patient's factor with occurrence of medical error was assessed. The odd of medical error occurrence in patients where a factor under study was present in comparison to the patients in whom that factor was not present was determined. The OR was calculated at 95% confidence interval and corresponding p-value was used to interpret the finding.

It was found that old age patients, illiterate patients, and patients with language inability had a significant higher odd of suffering a medical error. The OR of old age patient is 1.22–1.83 (95% C.I., $P = 0.001$) in comparison to patients who are <60 years. The OR of illiterate patient is 1.75–3.12 (95% C.I., $P < 0.001$) in comparison to those who are not illiterate and the OR of patients with language problem is 2.32–8.83 (95% C.I., $P < 0.001$) in comparison with patients with no language problem. The OR of economically backward and gender (male and female) patients was not found to be significant. Table 3 describes the association and OR of each factor under the study.

Table 1: Types of medical errors observed

Type	Specific incidents reported
Medication error	Administration of wrong medicine, wrong dose, expired medicine, wrong rate of administration, allergic drugs
Accidents	Burns, falls, electric shock, hazardous materials spill on patient
Surgical errors	Wrong site incision, items left inside body, pre-operative checks not done
Others	Radio imaging of pregnant lady, names mismatch of laboratory sample or report, wrong diet, and others

Table 2: Profile of the sample patients

Description	*n*	Cases	Controls
Sample size	345	109	236
Mean (standard deviation) of age	47.3 (8.6) years	49.3 (7.3) years	46.9 (9.2) years
Males (%)	198 (57.4)	61 (56)	137 (58.1)
Females (%)	147 (42.6)	48 (44)	99 (41.9)
Old age patients (%)	116 (33.6)	55 (50.5)	61 (25.8)
Illiterate (%)	82 (23.8)	46 (42.2)	36 (15.3)
Economically backward (%)	184 (53.3)	50 (45.9)	134 (56.8)
Patients with language problems (%)	43 (12.5)	27 (24.8)	16 (6.8)

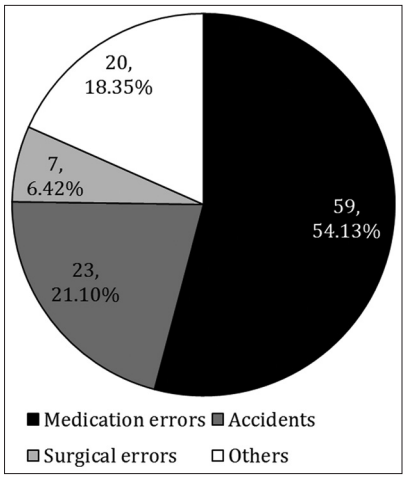

Figure 1: Frequency of the occurrence of medical errors by type

Table 3: Association of medical error occurrence and various patient's factors among the study participants

Variable	Cases (*n*=109) N (%)	Controls (*n*=236) N (%)	OR (95% CI)	*P* value
Female	48 (44.1)	99 (41.9)	0.58–1.45	0.73
Old aged	55 (50.5)	61 (25.8)	1.22–1.83	<0.001
Illiterate	46 (42.2)	36 (15.3)	1.75–3.12	<0.001
Economically backward	50 (45.9)	134 (56.8)	0.4–1.02	0.06
Language problem	30 (27.5)	13 (5.5)	2.32–8.83	<0.001

CI: Confidence interval

DISCUSSION

The study found significant difference in vulnerability to medical errors in case of some patient factors. For old patients (above 60 years of age), vulnerability to suffer a medical error is 1.22–1.83 times that of the patients who are not old. Illiterate patients are 1.75–3.12 times vulnerable compared to literate and patients with language problem are 2.32–8.83 times vulnerable compared to those who do not. Gender and economic status were not found to have any effect on the vulnerability.

While gender may influence the choice of treatment or how the health-care provider relates to the patient, it is not a significant factor as far as medical error occurrence is concerned. Theoretically also, there is no reason for a particular gender to have a different vulnerability to medical error. However, this finding cannot be implied for treatments which are gender specific, such as obstetrics and gynecology. In gender-specific medical interventions, there could be certain procedures or situations that can trigger an error. A similar finding was given by Cappell *et al.,*[16] in which they found not significant concerns of safety in females undergoing esophagogastroduodenoscopy. However, Goodman and Amurao[17] found higher risk of radiation hazard in female patients due to pregnancy. The finding by Yadav *et al.*[18] that knowledge about emergency contraception is very low among rural female, also indicates that some gender-specific vulnerability could be there.

In case of economic backwardness also, no specific reason can be specified for medical error occurrence. No other study could be found that associates economic backward patients with health-care safety concern. The illiteracy and patients with language inability had significant vulnerability of suffering medical error. This could be due to ineffective communication as illiterate patient may not be able to understand many written communication and the patient with language problem may not understand the message clearly. This finding is supported by the findings from other research work such as Kripalani *et al.,*[19] Dunsford,[20] and Brock *et. al.*[21] Old age patients' significant association with medical error occurrence can be explained with several reasons. Patients in old age suffer with many associated health problems such as dementia, delirium, and reduced physical capability. These limitations prevent the old patient to effectively safeguard himself/herself from any kind of medical errors. Old age patients are also much prone to incidents such as fall and drug reaction with minor fluctuations in dose. Kutluay *et al*.[22] had a similar finding with safety of elderly patient under epilepsy treatment.

The study sheds some light on how vulnerability of patients to medical error can differ from patients to patients. While most hospitals focus to improve their patient safety practices, identifying patients with factors associated with vulnerability can be an important safety step. The study is based on actual errors occurred during hospitalization, and hence, the findings can be relied upon. The study is, however, limited to one hospital and few factors. The study can be replicated in different hospital that will encompass much diverse patient group and many more factors can be included for studying the effect on vulnerability.

CONCLUSION

The study identifies certain patient-specific factors that are associated with increased odds of facing a medical error during hospitalization. Illiteracy, old age, and lack of language ability are found to be significantly associated with occurrence of medical error while gender and economic backwardness are not.

The hospitals focused on patient safety can consider these factors to identify patients who are highly vulnerable to face medical errors. Appropriate and focused preventive actions to these patients can increase the safety of such patients.

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