Intervening Variables of Human Errors in Iranian Public Hospitals

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Abstract: Patient safety and the prevention of medical errors have become the focus of most healthcare providers. This study aimed to determine intervening variables of human errors in Iranian public hospitals. The data were collected via researcher-made questionnaire with the reliability coefficient 0.98. The questionnaire was scored by five point Likert Scale. Rotation method of Varimax with Kaiser Normalization was used via Factor analysis. The results of the study showed factor of healthcare provider explained 7.81 percent of total variance. It had twelve intervening variables affect medical errors in Iranian public hospitals. The most factor loadings (0.718) was related "Inadequate ability of healthcare provider to decision making accurately and timely" and the Least factor loadings (0.53) was related "Inadequate awareness/consciousness of health care providers (consume alcohol, Drowsiness)". The findings of this study revealed the systemic approach must be replaced in hospitals setting to ensure the provision of patient safety and showed the most important causes for the avoidance of the culture of blame.
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1. Introduction

The larger numbers of patients are seriously harmed as a result of adverse events despite the best intentions of dedicated, hard-working health-care providers. One of the most commonly cited causes of medical errors and adverse events is human error (Busse and Johnson, 1999; Cooper et al., 1978; Leape, 1994; Pelletier, 2001; Wilson et al., 1995; Kathleen L, 2006).Human error is routinely blamed for accidents in the air, on the railways, in complex surgery and in healthcare generally. (cook, Woods and Miller,1998). When an error or adverse event occurred in a hospital setting, the most common reaction was to blame a person (Woodhouse et al., 2004;cook, Woods and Miller,1998).However, most error eventually passes through the hands of a care provider. Even when the primary cause of harm is system failure, there is usually a human standing at the bedside. The human factor of medical error is the most tangible, the most visible, and the most disturbing (cosby,2003). Healthcare services are also human activity systems (Behara and Valentine,2001). The delivery of safe, high-quality health care has always been a goal of physicians, nurses and other health-care professionals. Indeed, students in medical and nursing schools have long been taught Florence Nightingale's dictum (also attributed, with some debate, to Hippocrates, or the Hippocratic Oath): "first, do no harm" (Nightingale , 1863). Patient safety teaching needs to convey an understanding of the causes of adverse events and help develop skills to deal with error in healthcare settings. Graduates need to know how to reduce the occurrence of errors and also what to do when they make errors, when they witness an error or when they are told that someone else has made an error(patey et al.;2007). The level of attention paid to the problem of medical errors has accelerated markedly in recent years, with research and discussion leading to a number of improvement initiatives in both the public and private sectors. Many physicians, nurses, pharmacists, rehabilitation therapists, and other types of health care providers may carry out these activities. Each provider has a vital role in patient care. Thus, the hospital has the highest level of accountability to ensure that each of these practitioners is qualified to provide safe and effective care and treatment to patients. So recognize the intervening variables of healthcare provider errors are a necessary step toward improving patient safety and reducing medical errors. The aim of this study was to identify the Intervening Variables of Human Errors in Iranian Public Hospitals.

2. Methods

This research was done in 2009-2010. Population included 684 process owners (12-person teams) in 57 public university hospitals of Tehran province (N = 684) including (24 non-teaching hospitals and 33 teaching hospitals) were active. The sample size was 396 persons selected by classified random sampling. The data were collected by a self-made questionnaire. Items to be included in the questionnaire were identified from literature review, focus group discussion, to ensure cultural adaptability of the literature in the Iranian healthcare setting. Focus group discussion was held in public hospitals, involving doctors, nurses, allied health staff and managers. Focus group discussion was prompted using items from the literature about patient safety. Content validity and construct validity were assured with expert judgment. The questionnaire was pilot tested for clarity on 36 process owners who were physicians, nurses and have experience of executive management. Analysis of the pilot data led to minor changes in the final survey instrument. Changes included modified wording of several questions to improve clarity as the removal of questions to maximize the internal consistency of the instrument. The reliability of the questionnaire was determined using Cronbach's alpha with the reliability coefficient 0.98. The constructs tested for internal consistency using Cronbach's alpha correlation. Correlations of the constructs were high, ranging from $r=0.81$ to $r=0.98$. The final questionnaire comprised 145 questions, which measured responses to one dependent variable, 7 demographic questions. Responses were scored 5 for extremely agree and one for extremely disagree.

The survey questionnaire was administered to 408 process owners in each of 34 public hospitals (There were 20 teaching hospitals and 14 non-teaching hospitals in the sample).Finally 398 questionnaires were completed.

The data were analyzed using SPSS Version17. Exploratory factor analysis was used to determine the number and nature of factors describing the covariance structure of data.

3. Results

396 process owners' including 217 females and 179 males participated in this study. They all had a degree from B.S. through Ph.D. (170 B.S. , 39 M.S.,71M.D. and 116 Ph.D.). They had experience included (7% with a range of 1 to 5 yr ,14% with a range of 5 to 10 yr, 27% with a range of 10 to 15 yr , 28% with a range of 15 to 20 yr, 11% with a range of 20 to 25 yr, 13% with a range of 25 to 30 yr).

The result of KMO test for all the factors was 0.952, which is acceptable for factor analysis (Jae-On Kim, Mueller CW., 1985)

Table1. KMO and Bartlett's Testa

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.952
Bartlett's Test of Sphericity	Approx. Chi-Square	44104.622
	df	10440
	Sig.	.000

a. Based on correlations

Table 2 illustrates process owner in Iranian public hospital only could identify 69.995% factors affecting medical errors. They believed that healthcare providers affect medical errors only 7.81% and the causes of 62.182% medical errors related to the other factors.

Table2. Total variance explained related to healthcare provider and the others factors

factor	Initial Eigen values		
	Total	%of variance	Cumulative%
healthcare provider	48.985	33.783	33.783
The others			36.212
Total			69.995
factor	Extraction Sums of Squared loadings		
	Total	%of variance	Cumulative%
healthcare provider	48.985	33.783	33.783
The others			36.212
Total			69.995
factor	Rotation Sums of Squared loadings		
	Total	%of variance	Cumulative%
healthcare provider	11.334	7.816	7.816
The others			62.182
Total			69.995

Twelve intervening variables as shown in figure1, whose factor loadings (absolute value) on this factor are relatively large among all the factors, are identified to interpret it. The priorities of key intervening variables considered.
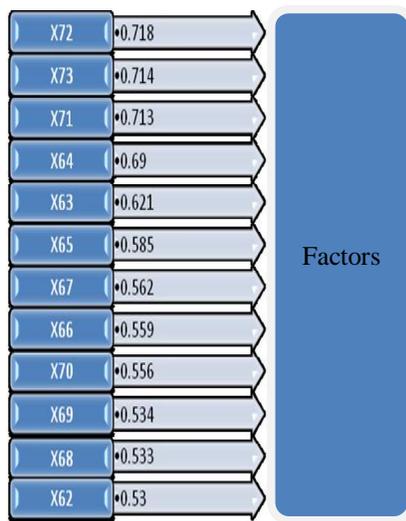
Figure1. Factor loadings (absolute value) on the factor of healthcare provider

The names and description of intervening variables affecting healthcare provider errors in Iranian public hospitals are:

X72: Ability of healthcare provider to decision making accurately and timely

X73: Effective patient assessment (correct diagnosis) with healthcare provider

X71: Awareness of healthcare provider about potential risk point

X64: Skills or the ability to act promptly and timely interventions of healthcare providers

X63: Knowledge of healthcare provider

X65: Experience of healthcare provider

X67: Psychological characteristics of healthcare provider (e.g. concentration of thought, attention, and tranquility)

X66: Physical characteristics of healthcare provider (fatigue, hunger, thirst, disease)

X70: Ethical and legal responsibility and accountability of health care provider to its patients and community

X69: Emotional barriers and motivations of healthcare provider

X68: Healthcare provider use of consultation and specialists

X62: Awareness/consciousness of health care providers (not to consume alcohol, not to work drowsily)

4. Discussion

Based on the results of the present research, the most significant intervening variables of human errors in Iranian public hospitals are 'Inadequate ability to decision making accurately and timely', 'Ineffective patient assessment (Incorrect diagnosis)', 'Inadequate awareness about potential risk point', 'Inadequate skill or ability to intervene promptly and timely', 'Inadequate knowledge', 'Inadequate experience', 'Psychological characteristics', 'Physical characteristics', 'Ethical and legal responsibility and accountability to patients and community', 'Emotional barriers and motivations', 'don't use of consultation and specialists', 'Inadequate awareness/consciousness'.

These finding are similar to the findings of the research titled "Work system design for patient safety: the SEIPS model" carried out by Carayon et al. in 2006. They showed that 'Education', 'skill', 'knowledge', 'Motivation and needs', 'Physical characteristics', 'Psychological characteristics' were elements of person component in their model.

The result of study done by West et al.(2009) about " Association of resident fatigue and distress with perceived medical errors" showed that among internal medicine residents, higher levels of fatigue and distress are independently associated with self-perceived medical errors. This paper had the similar results about physical characteristics such as fatigue and disease affect to human errors. Numerous reports have implicated fatigue and sleepiness as contributors to medical errors (Kohn, Corrigan, Donaldson; 1999, AHRQ; 2009, Lockley et al; 2007).

Helmreich and Musson(2003) in their research have found that lack of proficiency (training issue) or alertness(fatigue issue)are Individual (Physician) factors that increase probability of medical errors.

Kumar and Steinbach used implementing the six sigma DMAIC cycle and developing cause-and-effect diagram in their research and showed that the causes of anesthesia errors were poorly trained people, poor anesthesia-related experience, poor familiarity with surgical procedure, poor familiarity anesthetic method, lack of skilled assistance or supervision, fatigue, haste, carelessness, negligence, restriction of visual field, emergency case, inadequate communication with team or laboratory personnel, methods. That paper had the similar results. It showed that preventable medical errors may occur because of doctors and nurses lack of experience.

Consequently, a physician or nurse during their residency should not be allowed to be in charge of a task until he or she has assisted an experienced physician/nurse for a certain amount of time with that specific task. The number of training-on-the-job hours a hospital staff member has achieved should be

recorded. Before achieving the minimum amount of experience, a staff member should only be allowed to assist experienced staff. Medical errors caused by physician or nurse fatigue can be easily eliminated through the implementation of maximum working limits. In order to prevent medical errors that result from haste, understaffing must be resolved. There are cases, such emergencies, where haste is inevitable. However, many situations where haste occurs can be prevented, since many errors resulting from haste have their source in understaffing. Therefore, quotas must be implemented that determine how many hospital staff members are required for a certain number of patients (Kumar and Steinbach, 2008).

Also Krueger (1994) has found substance abuse, and emotional distress can all adversely affect performance of health care provider.

In this study, clinical skills such as 'Inadequate ability to decision making accurately and timely', 'Ineffective patient assessment (Incorrect diagnosis)' are the highly loaded variables on factor of human error. Failures of judgment and decision making are led to the incorrect diagnosis.

Medical and other health information is essential for making correct decisions about which patient needs can be met by the health care organization; the efficient flow of services to the patient; and the appropriate transfer or discharge or the patient to his or her home or another care setting. This information may be in paper or electronic form or a combination of the two.

Diagnostic failures accounted for the majority of the adverse events in EDs reported by the Harvard Practice Study, and most were judged as negligent (leap; 1991). A number of authors have described the diagnostic process and where it can go wrong. (Graber, Gordon and Franklin ;2002, Kuhn;2002, Elstein and Schwarz ;2002, Kovacs and Croskerry ;1999).Diagnosis is always an interaction between the patient and the doctor or other professional, who are both influenced by the system in which they work (Vincent, 2006). Furthermore, a number of individual characteristics and the role they might play in terms of work practices that affect patient safety have been studied. The individual characteristics most likely to affect safety are low risk perception, sensation seeking, Type A behavior (aggressive, competitive and impatient),high self esteem, psychological ill health, and attitudes concerning safety (Firth-Cozens, Cording, Ginsburg, 2003).We cannot change the human condition, we can change the con-ditions under which humans work (reason, 2000).
So, we can control these intervening variables by corrective action to ameliorate deficiencies identified following competency testing.

Conclusion

In Iran healthcare provider is identified at the sharp end of errors but the individual is not the only cause. Multiple factors affect the patient safety. They may only affect care indirectly. For the provision of patient safety requires spreading systematic approach. This approach helps to identify other factors affecting medical errors and lead to develop comprehensive and systematic management based on safety and quality. This approach leads to proactive rather than reactive risk management. Developing this approach need to attract the participation of all stakeholders. To reduce medical errors the hospital must constantly evaluate (measure) its performance and use that information to identify ways in which it can improve. This self-evaluation must be planned and ongoing and should focus on systems and processes, not solely on individual performance. To be successful, the hospital leadership must ensure that the climate does not allow focus on "who is to blame."Appropriate educating for healthcare provider such as national and international conferences; ongoing professional education and development; Training of staff can help.

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