Original Article

Role of Organizational Culture and Implementing the Critical Success Factors Resulting in Reduced Medical Errors from the Viewpoint of Nurses

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ABSTRACT

Background and Aim: A set of management practices called critical success factors and organizational culture can lead to a misplaced program for reaching a goal in the hospital. The incidence of medical errors, one of the most important issues influenced by multiple factors, undermines the quality of healthcare provision and satisfaction and increases costs. Considering that medical errors constitute 44,000-98,000 of the annual deaths in the United States and the lack of reliable statistics in Iran, we aimed to examine the roles of organizational culture and critical success factors in reducing medical errors.

Materials and Methods: This applied cross-sectional study was performed among the staff of hospitals affiliated with Arak University of Medical Sciences, Arak, Iran. A 44-item questionnaire was used to collect the data. The questionnaire was designed based on the studies by McFadden, Cameron, and Quinn, and Gowen, and Tallon, the validity and reliability of which were confirmed in this study. Descriptive (frequency distribution) and inferential statistics (ANOVA, two-sample-test, and linear regression) were employed to analyze the data in SPSS, version.

Ethical Considerations: The informed consent was obtained from participants after explaining the research aims and the participants were assured about the confidentiality of information.

Findings: Most of the respondents were women (58.1%) and within the 30-40 years age group (52.5%). Further, 50.4% of the participants had a Bachelor's degree. Two main hypotheses and 10 sub-hypotheses were tested and partially accepted. Our results suggested that staff participation, error report, cultural change, education and training, statistical reports, system redesign, collaborative culture, hierarchical culture, mission culture, compatibility culture, and implementation of critical success factors can contribute to reducing errors.

Conclusion: Hospital managers must try to encourage the development and maintenance of a culture that emphasizes interpersonal relationships, development of human resources, mentoring co-workers, teamwork and participation, trust, and commitment. To this end, hospital managers should recognize the role of organizational maturity in reducing medical errors and encourage employees to develop organizational culture and increase organizational maturity.

Introduction

In the past, it was assumed that medical errors and the associated complications exist in any hospital and are a part of patient safety and quality of healthcare provision. This issue has captured attention since the publication of the first report by a medical institute in the United States in 2000. In this report, side events were defined as "the damage caused by medical management and not any

underlying diseases or the disease condition". Afterward, a medical error was regarded as a failure of a planned action that should have been completed. Errors can be complications in performance, methods, system, or services[1].

Medical errors are one of the common causes of mortality in the United States. Complications have been observed in 2.9–3.7% of 33 million hospitalized patients, and in the United States, 44000–98000 individuals annually die due to medical errors[2]. According to the reports by the World Health Organization (WHO), 50–70% of such damages are preventable and occur due to general problems in the healthcare system[3]. The European Union data also show that medical errors are a significant problem for healthcare systems, occurring in 8–12% of all hospitalizations[4]. In Iran, there are no reliable statistics on the incidence rate of these errors. However, experts believe that due to structural shortcomings in the national healthcare system and the lack of an efficient error reporting system the error rate has been underestimated[5].

Studies of other scholars also indicated that medical errors have negative effects on organizational performance. In a study by Tucker (2004), it was demonstrated that human errors have a significant impact on hospital financial performance. In that study, he noted that in a 204-bed hospital with 75% occupancy, human errors could lead to a loss of 51.000–27.000.000 dollars[6]. Tucker concluded that in addition to added costs, errors lead to patient dissatisfaction and diminished quality of care.

Mamadou categorized medical errors into two categories of skill- and knowledge-related errors (i.e., errors associated with the implementation of clinical skills and diagnostic errors) and process errors (i.e., treatment, communication, payment, and management processes)[8].

It is no surprise that the common causes of medical errors and mishaps are human errors. The stock has shown that the majority of mishaps are rooted in the complicated chain of events, which collectively lead to errors. This type of error is known as systematic error. Therefore, the prime principle of organizational reliability for implementing programs is organizational culture, which promotes safety[9].

Hospitals all over the country are developing error reduction systems to help decrease medical errors and side effects. Hospitals are evolving from various aspects, and to implement developmental programs, a roadmap or a list of important factors could be employed to control and reduce medical errors.

The reduction of medical errors using management methods such as the application of the Six Sigma process, critical success factors, and high-reliability organization (HRO) theory has been considered by experts. In the HRO theory, culture and safety are taken into account. Two cultural characteristics, which support high organizational reliability, especially within the realm of patient safety, are cultural flexibility and a tendency towards learning. According to the HRO theory, flexibility is an important cultural characteristic in enhancing safety and curtailing medical errors[10].

In the HRO theory, after the participation of beneficiaries, emphasis is placed on safety culture as a crucial element for decreasing medical errors. Establishing organizational trust is key to increasing error reports. The third important factor in reducing errors in the free discussion of errors. A well-known quality improvement method in the field of medical care is holding weekly error discussion sessions.

The fourth factor is the collection and statistical analysis of the error data. Data collection is not sufficient; quantitative methods must be used to systematically analyze the data. The other factor is education, which increases knowledge about patient care and declines cognitive failures, except human errors. According to the HRO theory, sustained and extensive training can lead to high levels of safety and reliability.

The final effective error reduction factor is the redesign of the system or process. Therefore, key factors for success are positively correlated with better outcomes of reduced error[11]. Cultural orientation has been taken into account to evaluate the possible relationship between organizational culture and implementing the key factors for success, which might be related to the mentioned factors. In short, collective and developmental culture is compatible and associated with a series of key success factors. With regards to a competitive value, it is suggested that flexibility orientation is most likely to be related to implementing the key success factors[9].

In this study, applying the HRO theory, we considered a series of management methods entitled critical success factors (CSFs), which are directly related to organizational culture, as the management approaches reducing medical errors. CSFs are characteristics, conditions, and/or variables that can significantly affect the success of an organization,

with the stipulation that variables be stored, maintained, or managed properly[7].

Seven CSFs proposed by McFadden et al. (2004) include the participation of all beneficiaries, cultural change, blame-free error reporting, free discussion of errors, statistical analysis of errors, educational planning, and system redesign, which could reduce the probability of medical errors or range of medical errors. In the model by McFadden, these factors are regarded as the fundamental elements of the error reduction system. Therefore, this study aimed to evaluate the role of organizational culture and the implementation of SCFs in reducing medical errors.

Ethical Considerations

The informed consent was obtained from participants after explaining the research aims and the participants were assured about the confidentiality of information.

Materials and Methods

This applied cross-sectional study was carried out among all the nursing staff (n=986 individuals) of Valiasr, Amiralmomenin, Taleghani, and Ayatollah Khansari hospitals of Arak, Iran. To calculate the standard sample size, we used Cochran's sample size formula. In line with relevant studies, the value of the normal variable corresponding to the intended confidence level for the 95% confidence interval was equal to 1.96, the standard deviation was equal to 0.5, and the permissible error value was equal to 0.05. In total, 278 subjects were selected, and after the distribution of 300 questionnaires using the stratified sampling method, 284 questionnaires were collected .

The required data were collected using a questionnaire that contained 44 items on the role of organizational culture and implementation of CSFs in the results of reduced medical errors. The study was conducted in the hospitals affiliated with Arak University of Medical Sciences, Arak, Iran. This questionnaire consisted of two sections: the first section was about demographic characteristics and the second part was related to the components of CSF (24 items), for which the McFadden questionnaire was used (12). In addition, the Cameron and Quinn questionnaire (13) was employed to evaluate organizational culture (15 items), and the items on the results of reduced error (n=4) were extracted from the questionnaire by Gowen and Tallon[14].

The items were rated using a 5-point Likert scale (from 1 to 5). The reliability of the questionnaire was determined at Cronbach's alpha of 0.864, which was computed using SPSS. In addition, two methods were used to evaluate the validity of the questionnaire. In the first stage, the views of experts were used to evaluate the validity of the questionnaire and establish content validity. In the second stage, the confirmatory factor analysis method was applied to assess the validity of the questionnaire.

To analyze the data, descriptive (frequency distribution) and inferential statistics (i.e., analysis of variance, skewness, and kurtosis test) were used to evaluate the fitness of the collected data in terms of normality. In addition, linear regression and Watson's camera statistics were utilized to assess the linear relationship between variables.

Findings

In total, 284 of the nursing staff of the understudy hospitals were enrolled. The majority of the participants were within the age range of 30–40 years (52.5%). In addition, 58.1% of the participants were female, 50.4% had a Bachelor's degree, and 37% had less than 10 years of work experience (Table 1).

Table 1. Demographic characteristics of the nursing staff in the understudy hospitals

Variable		Frequency	Percentage	Variable		Frequency	Percentage
	Less than 30 years	62	21.8		Less than 10 years	105	37
	30-40 years	149	52.5		10-15 years	77	*27.1*
	40-50 years	56	19.7	**Work experience**	15-20 years	52	18.3
Age	More than 50 years	8	2.8		More than 20 years	42	14.8
	Without response	9	3.2		Without response	8	2.8
	Diploma	39	13.7		Male	113	39.8
	Associate degree	46	16.2		Female	165	58.1
Level of education	Bachelor's degree	143	50.4	**Gender**	Without response	6	2.1
	MSc and higher	52	*18.3*		Total	284	100%

As shown in Table 2, the standard error of skewness and kurtosis coefficients were within the range of -2 and +2 for all of the mentioned variables, indicating the normal distribution of the data. Considering the normal distribution of the collected data, parametric tests were used for statistical analysis. Based on the obtained results, a test of means of the two populations for the research variables was run based on gender.

In the t-test, the significance level was higher than 0.05 for all the variables (participation of the staff, error report, cultural change, education, statistical report, redesign of the system, cooperative culture, hierarchical culture, mission culture, compatibility culture, and effects of error reduction). Therefore, the hypothesis of equality of response means in the male and female groups was not rejected, and it was determined that no significant difference exists between these two groups in terms of response to the presented indicators.

Based on the results of ANOVA, the significance level was above the 0.05 error level for all the studied variables based on age. In other words, no significant difference was observed among different age groups in terms of the mean scores of the variables. According to the components of education and work experience, no statistically significant difference was found between mean levels of education and work experience in terms of response to these variables.

Given the fact that Watson's camera was within the range of 1.5–2.5 for all of the presented hypotheses, the error independence restriction has been observed and a linear regression test can be applied. In addition, the significance level of F was equal to 0.000 for all of the proposed hypotheses, which was below the error level of 0.05. Therefore, it can be concluded that a linear relationship exists between the raised variables in each hypothesis.

Table 2. Results of evaluation of the normal distribution of the data

Variables	N	Skewness	Standard error of skewness	Kurtosis	Standard error of kurtosis
Participation of the staff	284	-0.015	0.145	0.526	0.288
Statistical analysis of error	284	0.286	0.145	0.426	0.288
Cultural transformation	284	-0.017	0.145	0.143	0.288
Education	284	0.314	0.145	-0.406	0.288
Blame-free statistical report of error	284	-0.373	0.145	0.103	0.288
Redesign of the system	284	0.255	0.145	1.058	0.288
Cooperative culture	284	0.948	0.145	2.647	0.288
Hierarchical culture	284	1.323	0.145	2.308	0.288
Mission culture	284	0.120	0.145	0.293	0.288
Compatibility culture	284	0.079	0.145	-0.219	0.288
Results of error reduction	284	0.034	0.145	0.149	0.288

In terms of the claim of the researcher about the main hypotheses, given the fact that the level of significance was equal to 0.000 for the effect of the implementation of CSFs on results of error reduction and below 0.05 error, it could be stated that implementation of CSFs had a significant effect

on the results of error reduction at the confidence level of 95%. On the other hand, the beta regression coefficient was equal to 0.530, which is indicative of a positive relationship between the implementation of CSFs and results of error reduction in hospitals affiliated to Arak University

of Medical Sciences, hence confirming the mentioned hypothesis .

Moreover, the value of the coefficient of determination was equal to 0.281, which reveals that 28.1% of changes in the variable of results of error reduction were determined through the variable of implementation of CSFs. Given the fact that the level of significance for the evaluation of the effect of organizational culture on results of error reduction was equal to 0.000 and below 0.05 error, it could be claimed that cultural organization had a positive impact on the result of error reduction at the confidence level of 95% .

On the other hand, the beta regression coefficient was equal to 0.433, which indicates a positive association between organizational culture and results of error reduction in hospitals affiliated to Arak University of Medical Sciences, thereby confirming the hypothesis. Furthermore, the value of the coefficient of determination was equal to 0.188, which demonstrates that 18.8% of changes in the variable of results of error reduction were determined through organizational culture. Evaluation of results of sub-hypotheses indicated their effect on reduced medical errors (Table 3).

Table 2. Regression analysis results for the main- and sub- hypotheses

Hypotheses	Independent variable	Dependent variable	*Regression (β)coefficient*	Level of significance	Determination coefficient
Main hypothesis 1	Implementation of critical success factors	Results of error reduction	*0.530*	*0.000*	0.281
Sub-hypothesis 1	Participation of the staff	Results of error reduction	0.437	0.000	0.191
Sub-hypothesis 2	Statistical analysis of error	Results of error reduction	0.250	0.000	0.062
Sub-hypothesis 3	Cultural change	Results of error reduction	0.336	0.000	*0.113*
Sub-hypothesis 4	Education	Results of error reduction	*0.324*	0.000	0.105
Sub-hypothesis 5	Blame-free statistical report of error	Results of error reduction	0.381	0.000	0.145
Sub-hypothesis 6	Redesign of the system	Results of error reduction	0.170	0.004	0.029
Main hypothesis 2	Organizational culture	Results of error reduction	*0.433*	0.000	0.188
Sub-hypothesis 7	Cooperative culture	Results of error reduction	0.228	0.000	0.052
Sub-hypothesis 8	Hierarchical culture	Results of error reduction	*0.123*	0.039	0.015
Sub-hypothesis 9	Mission culture	Results of error reduction	0.416	0.000	0.173
Sub-hypothesis 10	Compatibility culture	Results of error reduction	0.204	0.001	0.042

Conclusions

According to the results of the present research, CSFs were mostly influenced by the staff participation level (β=0.437), and it could be stated that increased or decreased levels of staff participation led to improved or deteriorated error reduction results, respectively. When the staff can cooperate with other colleagues and managers, their level of productivity increases since in addition to foreseen and decreased possible errors, accurate and proper methods for service provision are adopted through consultation, leading to increased effectiveness.

In similar research by Sabri, the team participation factor was presented as one of the main four factors of CSFs of Six Sigma, that is, designing work improvement teams, mutual functional teams, self-control teams, and project-oriented teams can improve the key performance indicators.

It should be noted that one of the evaluated components regarding key performance indicators related to Six Sigma and CSFs in the present research was reduced costs, in which three dimensions of medical error reduction, error in processes, and reduced time off work or reduced duration of hospital stay were evaluated[15].

Results obtained by Stock et al. in 2007 also indicated that the highest level of correlation in CSFs is related to the participation of beneficiaries, which improved results.[9] Blame-free statistical error reporting (β=0.381) was regarded as the second effective factor for improved outcomes due to error reduction. The creation of this culture leads to error reporting without blaming anyone. By doing so, managers and heads of hospitals can determine the problem and cause of the error and provide solutions for the problems to improve work results. Eventually, reduced errors optimize performance and services.

Clinical audit and monitoring the performance of treatment professionals and presentation of blame-free statistical error reports as the critical requirements of policymakers and treatment experts can contribute to increased patient safety. Results of this hypothesis are also consistent with the results obtained by Stock et al. in 2007. However, the level of correlation was low[9].

According to Sabri, the presence of a reporting system to follow up on the root causes of errors and learn from such experiences seems necessary[15]. Non-punitive response to errors to prevent similar mistakes is a factor not accepted by the organizational culture of hospitals due to fear of blame and shame.

Education has always been taken into account in organizations and has been regarded as an effective factor for increased productivity of individuals. This is mainly because by increasing the skills of the staff, we enable them to perform their duties more efficiently and with fewer errors. Therefore, it could be concluded that the education of the staff improves their abilities and services in the organization and eventually contributes to the improvement of the organization.

According to the results of Sabri, education was regarded as the third factor at the level of significance of 5% and the test value of T=2.66. In addition, employee training has been evaluated as an independent factor, determining that employee training had a significant effect on improved performance[15]. Results of this hypothesis (β=0.324) are in congruence with those obtained by Stock et al. in 2007[9].

The fourth CSF affecting the outcomes of reduction of medical errors (β=0.336) is cultural transformation. Culture can direct the staff's attitudes, preventing them from breaching laws and regulations. As a result, through cultural change and making appropriate modifications, causes of errors and mistakes are curtailed and the staff can reduce the rate of possible errors through cooperation, hence guiding the organization toward higher performance efficiency. In a study by Stock et al. in 2007, cultural change had the highest correlation with the results related to error prevention knowledge.

The results obtained from studying the effect of organizational culture through cooperative culture (β=0.228), hierarchical culture (β=0.123), mission culture (β=0.416), and compatibility culture (β=0.204) on medical error results indicated that efforts of managers for the implementation of these dimensions within the required time can improve the performance of the organization due to reduced errors and stress and increased staff satisfaction.

Emphasis on mission culture while encouraging new resources, creating new challenges, committing the staff to innovation, and empowering them can be associated with increased risk-taking, innovation, and autonomy of the staff. Mission culture is applicable in hospitals that value employees, have a risk-seeking mission, and are accepting risks in providing state-of-the-art medical treatments.

Concerning the mentioned characteristics in mission culture, a positive relationship was observed between this culture and the results of reduced medical errors in the evaluated hospitals, which is indicative of the lack of tendency of the hospital's managers toward creativity and innovation. The lack of consistency of the results of this hypothesis with the results obtained by Stock et al. illustrates that the emphasis of a manager on mission culture might lead to increased errors and their associated consequences. In this regard, Stock has also expressed a negative association between these two variables[9].

Encouraging the medical staff to eliminate the unnecessary steps and reduce the use of invasive procedures while emphasizing the consideration of alternative views in solving problems and excluding redundant procedures are some factors expressed by compatibility culture. The results obtained by Stock revealed a positive relationship between self-control and higher patient safety. Given the emphasis on the participation of external beneficiaries by compatibility culture and the prominence of customer orientation and patient-centeredness based on TQM, implementing their views can lead to improved quality of performance, increased patient satisfaction, and decreased medical errors. Recommendation of teamwork and institutionalization of this culture in hospitals and synergy of duties can minimize errors and mistakes and help empower the staff.

The use of hierarchical culture along with cooperative culture for the tasks and duties that are repetitive and not previously determined or the staff do not know how to perform them and fear their consequences will create the opportunity to refer the tasks through hierarchical culture to the managers to use their help in adopting a suitable and accurate approach.

Results obtained by Kordnaich et al. (2014) also demonstrated a significant positive relationship between organizational transparency and the performance of an organization through the mediating organizational culture variable, which is in line with our findings[16].

In addition, George et al. (2009) concluded that cooperative and mission cultures had a positive association with the implementation of the quality improvement program in an organization[17]. The positive relationship between mission culture and the results of reduced medical errors (improved quality) in the study by George et al. is mainly because the effects of errors were only considered in the improvement of service quality. However, improved quality, patient satisfaction, and knowledge of the type of error, as well as decreased costs and frequency of errors were regarded as the outcomes of reduced medical errors in the study by Stock.

Results of the current study presented some of the inevitable consequences of medical errors. At first, some evidence was provided to demonstrate the significant role of organizational culture in the results of reduced medical errors. Through emphasizing the development of human resources, mutual commitment, and synergy of duties through participation, organizational culture plays a positive role in promoting the quality of performance, service provision, patient satisfaction, and knowledge and understanding of the nature of errors in the staff and decreasing costs. Considering the importance of implementing management methods known as CSFs in the results of medical error reduction, we suggest cooperation with doctors, nurses, and patients and the creation of a management culture based on the avoidance of traditional techniques, as well as shame and blame and use of a method by which the medical staff can freely report their errors in a blame-free environment. Moreover, the development of educational programs for the medical staff, holding group discussions, statistical analysis of error reports, and re-engineering and redesigning the system (e.g., equipment, technology, and processes) have been emphasized .

Changing the organizational culture and implementing CSFs depend on the system of values and behavioral criteria of the management and medical staff of a hospital. Hospital managers are recommended to evaluate the level of organizational maturity for the reduction of medical errors so that the staff is encouraged to develop organizational culture and increase the level of organizational maturity.

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Conflict of Interest Statement
The author declares that they have no conflicts of interest.

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