Applied Medical Informatics
Original Research Vol. 26, No. 2/2010, pp: 63 - 72

Direct and Indirect Employee Questionnaires for Assessing Patient Safety in Saudi Hospitals

Khalid S. AL-SALEH* and Mohamed Z. RAMADAN

Industrial Engineering Department, King Saud University, P.O.Box 800, Riyadh, 11421, Saudi Arabia.
E-mail(s): kalsaleh@ksu.edu.sa; ramadan1@ksu.edu.sa

* Author to whom correspondence should be addressed: Tel.:+966-554268086; Fax: +966-1-4673505.

Received: March 2010 /Accepted: 10 June 2010 / Published online: 14 June 2010

Abstract

Aim: This paper provides information on the reliability and validity of direct and indirect employee questionnaires developed in a study of patient safety that examines the impact of human engineering intervention on both direct and indirect employees. *Method:* This paper describes the employee questionnaires, which survey various elements of the work system (e.g., heavy workload, inexperience/lack education, staffing issues, fatigue, inadequate technology, distractions, lack of vigilance, lack of adherence to medical administration policies, time constraints, and patient safety climate), the care process, and employee outcomes (e.g., job satisfaction, stress, perceived quality and safety of care provided). Data from a sample of 932 direct staff members and 99 indirect members were used to examine reliability, convergent validity, and predictive validity. *Results:* The two groups were different on three of the four groups of variables: measures of employee training and education, measures of reactions to medical errors occurred, and measures of participation to decision making related to medical errors. Managers had more positive perceptions of medical staff participation to decision making than medical staff believe. Medical staff was more satisfied with their job and reported significant fewer errors than manager staff claimed. Finally, managers felt that they offered significantly sufficient training programs to the medical staff than medical staff believed. *Conclusion:* The results provided evidence for the reliability and validity of the study's employee questionnaires

Keywords: Health care; Medical staff; Patients; Reliability and validity.

Introduction

The objective of this research was to examine the impact of human factors intervention on the work system, employee and organizational outcomes, and safety of patient care [1]. Sixteen hospitals in the Kingdom in Saudi Arabia cooperatively participated in the study. In the course of this research study, all employees working in the sixteen hospitals were asked to voluntarily respond to direct and indirect employee questionnaires, designed to assess patient safety from the viewpoint of the employees [2]. In this paper, the steps used to develop the content, reliability, and validity of the survey are described [3, 4].

There is a conceptual framework underlying the structure of the direct and indirect employees' questionnaires. In the model of work system and patient safety, this study integrated structure-

process-outcome framework [5] and the work system model [6, 7]. The work system of the organization affects the care process [8], and the means of caring for and managing the patient (the care process) affects patient safety (patient outcome), employee and organizational outcomes [9,10].

The aim of the study was to determine the agreement in point of view between managers and employees towards employee training and education policy, their reactions to medical errors that were occurred, and their participation to decision making related to medical errors.

Material and Method

The employee questionnaires in this study asked about various elements of the work system (e.g., workload, inexperience/lack education, staffing issues, fatigue, technology, distractions, lack of vigilance to medical administration policies, time constraint, and patient safety climates), the care process, and employee outcomes (e.g., job satisfaction, stress, and safety of care provided).

Study Setting

In 2008, representatives of the sixteen hospitals discussed a joint research effort aimed at addressing safety issues at their respective and combined hospitals. Through open-ended questionnaires, medical, nursing, technical as direct service providers, and clerical staffs as indirect service providers were asked to identify quality and safety issues at their hospitals, as well as working conditions issues that either interfered with or facilitated their ability to perform their jobs [11, 12].

From the information collected with the initial direct and indirect employees' questionnaires, the research team agreed that each group of employees could choose its own specific technique, but that any technique should address human factors issues. The interventions were evaluated using two data collection instruments: direct employee and indirect employee questionnaires. Data were collected from the sixteen hospitals during the first year of the research.

Sample Size

Direct employees (physicians, nurses, and other technical) and indirect employees (administrative personnel) from the sixteen hospitals were asked to complete the questionnaires. A total of 2500 questionnaires were distributed to the medical care staffs; 932 direct employees and 99 indirect employees participated, yielding an overall response rate of 41 percent.

Employee Questionnaires

The first questionnaire was aimed at medical members dealing directly with the patients. The questionnaire contained 65 questions about what medical staffs feel are the biggest contributors to medical errors, their attitudes regarding compliance with the national safety standards goals and suggestions for improving the system. Demographic questions were included for the purpose of data analysis.

The second questionnaire was aimed at managers controlling and monitoring medical members. The questionnaire contained 62 questions about the biggest contributors to medical errors and how to reduce or eliminate those errors from the systems.

The survey instrument was adapted from five researches [13-17]. The survey included personal demographic information such as age, ethnic background, gender, marital status, other individuals to help in the home, dependents in the home, age of dependents, highest level of staff's education, years of experience, employment status (full time or part time), number of hours per shift, hours worked per week, length of time on night shift, untreated sleep disorders, diagnosed metabolic diseases, hours slept in the last 24 hours, hours worked in the past two days, number of patient related errors and description of the error, and number of occupational related errors and description of the occupational error.

Other items in the survey included: whether or not the medical staff had ever attended educational sessions about recognizing or reporting medical errors; if the medical staff could recall if error disclosure was discussed in medical setting orientation; questions about the internal culture

of the work environment and reporting policies of various departments; the number of medical errors reports made by the medical personnel in the past; how and to whom those errors were reported; the reasons for reporting or for failure to report; attitudes about potential interventions for increasing error reports, and recommendations do medical staff have for reducing medical errors or reducing compliance [18,19].

Patient related errors were described as any omitted treatment, medication error, near medication error, errors in transmission of doctors' orders, errors in documentation, and omission of an intervention that is needed [20, 21]. The entire questionnaire required 10-15 minutes to be completed. A patient related error referred to any accident or injury to the patient, adverse drug event, improper transfusion techniques, falls, bums, pressure ulcers, mistaken identity, failure to change a dressing, missed treatments, or missed medication. Other errors included staff having a musculoskeletal injury or exposure to blood born pathogens or infectious diseases, accident, or injury over the past two shifts.

The indirect employee questionnaire included a total of 62 questions covering the following domains:

- Recruitment and selection processes: 3 questions on utilizing procedures for capture experience and well educated personnel.
- Staffing level and power: 2 questions on utilizing the power of medical personnel.
- Continuous education and training programs: 7 questions on utilizing the medical personnel for increasing their skills periodically.
- Performance appraisal: 5 questions on utilizing a problem-solving approach and others for annual performance appraisal.
- Compensation, promotion, and job security: 4 questions on eligibility for performance-based bonuses.
- Work systems and patient safety climate: 5 questions on quality of care, injures to patients, patient satisfaction, medical errors, and patient or family complaints.
- Participation to decision making: 2 questions on quality assurance and patient safety.
- Cooperation among staff team: 9 questions on behavior of medical staff with each other at heavy workload, absent, willing to help, help orient new people, suggesting improvement.
- Decisions to prevent errors occurrence: 3 questions on identifying wrong activities, potential negative consequences action, putting procedures to prevent errors.
- Reaction to errors happened: 9 questions on supervisor written-up, asked to take an educational class, disciplined by a higher board, nothing happened.
- Data describing the clinic: 10 questions on number of beds, average patient length of stay, average number of patient to medical staff ratio, number of medical errors occurred, and average age of medical staff in the clinic.

Study Procedures

As the study subjects were drawn from sixteen hospitals with varying case mixes, types of employees, and a range of physical settings (i.e., in-hospital setting, free-standing clinics, and clinics in close proximity to the hospital), several data collection procedures were used for each site.

The survey questionnaire was originally formatted in Microsoft Word (version 2003; http//:www.microsoft.com). Upon completion of the project presentation and discussion, the investigators explained and distributed the employee questionnaire to all medical staff or managers. Attendance was taken at each site's staff meeting, and questionnaires were left for absent employees to complete. The units' managers explained and distributed questionnaires to the absent employees at a later time. An institutional review board-required cover letter and information sheet, explaining the research project, accompanied each questionnaire. All staff were given work time to complete and return the questionnaires. Completed questionnaires were retrieved from each site's locked drop box twice weekly by a research assistant or were placed in self-addressed sealed envelopes and returned to the principal investigator at King Saud university mail. Table 1 provides information on the source of the questions, the number of questions for each concept, and examples of the questions.

Table 1. Description of the variables

Concept	No of questions	Ref	Example of question
Indirect questionnaire			
Recruitment and selection processes	3	[17]	We utilize an extensive selection procedure to hire new medical member.
Staffing level and power	2	[17]	We have enough medical members to provide high quality patient care.
Continuous education and training programs	7	[17]	We regularly supplement formal training sessions with informal discussion on the unit.
Performance appraisal	5	[17]	Raises and promotions are closely tied to performance appraisal.
Compensation, promotion, and job security.	4	[17]	We provide incentives for suggestions to improve unit operations.
Work systems and patient safety climate.	5	[17]	How good is the quality of care?
Participation to decision making.	2	[17]	How often medical members are participated in forming patient safety measures?
Cooperation among staff team.	9	[17]	Medical members help others who have heavy workloads.
Decisions to prevent of errors occurring.	3	[17]	The equipment you work with is... ... modern / outdated
Access to supplies	3	[17]	We spend time identifying activities we do not want to go wrong.
Reaction to errors happened	9	[15]	We talk about mistakes and ways to learn from them.
Data describing the clinic	10	[15]	How many beds are in the unit?
Direct questionnaire			
Demographic information	17	[16]	How long have you worked in the unit(s) you identified above?
Education and training	5	[14]	Have you ever participated in formal education and training regarding the reporting of medical errors?
Work systems	9	[15]	Heavy workload
Participation to decision making.	2	[17]	How often medical members are participated in forming patient safety measures?
Ways of reducing medical errors	7	[15]	Reminders to check the patient's ID against the patient's lists or records.
Web-based training participation	3	[15]	The program is interactive.
Factors caused medical errors	Open	[22]	
Reactions to medical errors occurred	6	[15]	Required to take an educational and training class.
Circumstances not to report medical errors.	5	[16]	Error is quickly identified and corrected.
Circumstances to report medical errors.	2	[16]	Harm occurred to the patient.
Data describing the clinic	10	[15]	How many beds are in the unit?

Data Analysis

This paper reports data on reliability and validity for the measures of work system, reaction to medical errors occurred, participation to decision making, education and training, and perceived performance. Cronbach's alpha scores were used to assess the reliability of scales [22]. For convergent validity, answers from direct and indirect medical staff to various scales and questions among two job categories were compared. In order to evaluate predictive validity, the relationship between measures of the work system and the measures of patient safety climate were examined. This analysis was based on a correlation analysis and a series of stepwise regression analysis. All analyses were performed with SPSS (version 16.0; http//:www.spss.com).

Results

The results showed that, in general, the models fit the data well, although not always optimally. Results of the analysis of the variables had adequate range, and the Cronbach's alpha scores of most

scales were satisfactory (above 0.7) values. The scales of recruitment and selection process, web-based training participation, reactions to medical errors occurred, participation to decision making, and circumstances to report medical errors had Cronbach's alpha scores of .6 or above, as shown in Table 2.

Table 2. Basic statistics of the variable

Scale	No. of items	Mean (SD)	Range	Cronbach's alpha score	Coding (meaning of high score)
Indirect questionnaire					
Recruitment and selection processes	3	5.595 (1.45)	4.8-6.3	0.595	High level of selection process
Staffing level and power	2	3.842 (1.75)	3.8-3.9	0.846	High level of staff power
Continuous education and training programs	7	4.255 (1.69)	3.9-4.8	0.917	High level of training provided
Performance appraisal	5	4.747 (1.75)	4.2-5.2	0.742	High level of performance feedback
Compensation, promotion, and job security.	4	4.788 (1.71)	4.4-5.1	0.722	High incentives
Work systems and patient safety climate.	5	3.898 (1.90)	2.9-4.9	0.881	High patient injuries
Participation to decision making.	2	4.775 (1.62)	4.6-5.0	0.841	Little cooperation problems
Cooperation among staff team.	9	4.982 (1.38)	4.8-5.1	0.912	Little negative actions
Decisions to prevent of errors occurring.	3	5.092 (1.42)	5.0-5.3	0.871	High opportunity to suggest improve.
Reaction to errors happened	9	4.978 (1.44)	4.4-5.2	0.821	
Data describing the clinic	10	N/A	N/A	N/A	N/A
Direct questionnaire					
Demographic information	17	N/A	N/A	N/A	N/A
Education and training	5	2.099 (0.52)	1.8-2.7	0.644	High educated
Work systems	9	3.779 (0.81)	3.6-4.1	0.758	Low technology, vigilance,…
Ways of reducing medical errors	7	4.004 (0.11)	3.9-4.2	0.810	High processing
Web-based training participation	3	3.664 (0.21)	3.4-3.8	0.598	High participation
Factors caused medical errors	open	N/A	N/A	N/A	N/A
Reactions to medical errors occurred	6	1.865 (0.05)	1.8-1.9	0.618	Low response
Participation to decision making	5	1.857 (0.04)	1.8-1.9	0.642	High participation
Circumstances to report medical errors.	2	2.096 (1.1)	1.1-4.9	0.635	Good circumstances
Data describing the clinic	10	N/A	N/A	N/A	N/A

In order to examine convergent validity, answers to the various measures across the two job categories of medical personnel and manager staff were compared. A discrimination analysis showed that the two groups were different on three of the four groups of variables: measures of employee training and education (Wilks' lambda = 0.89, $p < 0.004$), measures of reactions to medical errors occurred (Wilks' lambda = 0.606, $p < 0.0001$), and measures of participation to decision making related to medical errors (Wilks' lambda = 0.82, $p < 0.0001$). However, measure of work system between answers of medical personnel and manager staff was not significantly different, as shown in Figure 1.

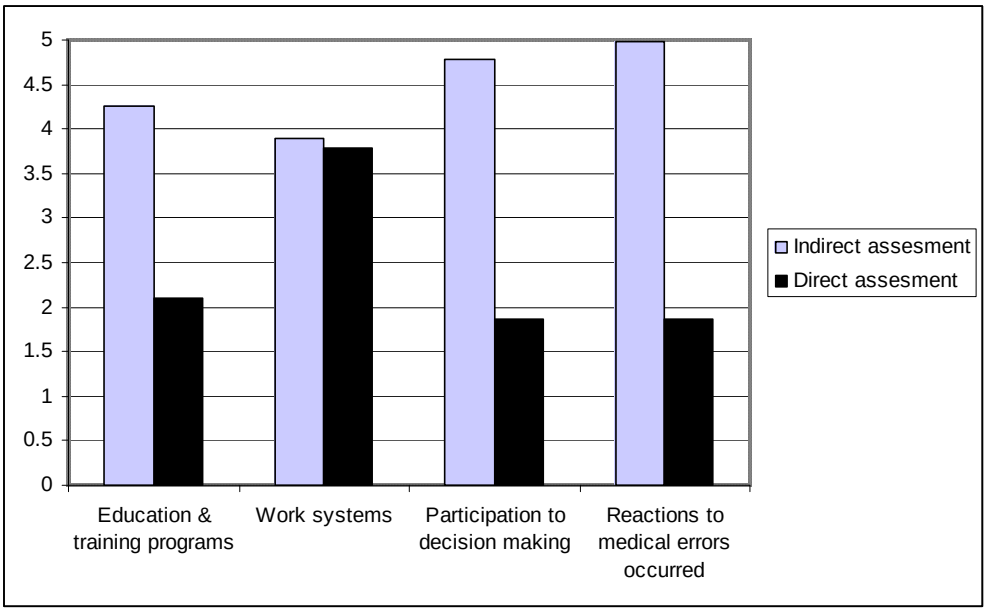

Figure 1. Comparison of two categories (medical staff and manager staff)

For the measures of work system, all measures except the measure of staff workload displayed agreements between the two job categories. However, for the measures of participation to decision making, all measures displayed differences between the two job categories. In general, managers had more positive perceptions of medical staff participation to decision making than medical staff believe. As for reactions to medical errors, univariate tests were statistically significant for discussing the potential negative consequences of medical errors ($p < 0.05$) and approached significance for how we could have prevented errors ($p < 0.01$). Medical staff were more satisfied with their job and reported significant fewer errors than manager staff claimed ($p < 0.001$). For the measures of continuous educational and training programs, all measures displayed differences between the two job categories. Managers felt that they offered significantly sufficient training programs to the medical staff than medical staff believed ($p < 0.05$).

Predictive validity was examined by conducting a correlation analysis between measures of work system and continuous education and training programs and the measures of patient care and quality of service, as shown in Table 3.

A series of stepwise regression analyses were also conducted with each of the measures of work system and continuous education and training programs as the dependent variables, and the 5 measures of patient care as independent variables, as shown in Table 4.

The measures of work system & continuous education and training programs predicted a significant amount of variance of technology provided (5.9%), standardized hand-off report (6.5%), well stocked medications (3.4%), reminders to check the patient's ID (5.1%), and direct observation/audits (5.6%). The measures of work system & continuous education and training programs that were the most consistent predictors of patient care were inadequate technology, heavy workload, inexperience / lack of education, distractions, staff issues, and training regarding preventing medical errors.

Table 3. Correlation and regression analyses between measures of work system and providing continuous education and training programs (independent variables) and occurring medical errors (dependent variables) based on indirect survey.

Work system & continuous education and training programs	Patient care		Quality of service		
	Injuries to patients	Patient or family complaints	Patient satisfaction	Quality assurance	Patient safety
CORRELATION ANALYSIS					
Providing training program to new staff	0.142	-0.147	0.435***	0.300**	0.364***
An extensive orientation to hospital procedures	0.175	-0.040	0.360***	0.220*	0.267**
Providing training in communication and interpersonal skills	0.162	-0.045	0.357***	0.192	0.262**
Providing training on a new piece of equipment is introduced in the unit.	0.105	-0.203*	0.286**	-0.059	0.275**
Staffing power	0.289**	-0.017	0.086	0.253*	0.114
Enough staff to provide high quality of patient care	-0.253**	-0.008	0.178	0.105	0.171
Coordination effectiveness	0.084	-0.297***	0.285***	0.149	0.223*
Participation to decision making	0.056	-0.003	0.178	0.156	0.228*
STEPWISE REGRESSION ANALYSIS					
Adjusted R^2	7.4%*	7.9%*	18%**	10.9%*	12.3%**
Significant predictors (beta-coefficients)	Enough staff (-0.325)	Coordination effectiveness (-0.403)	Providing training program to new staff (0.380)	Providing training program (0.337)	Providing training program (0.312)
				Staffing power (0.205)	

*$p<0.05$, **$p<0.01$, ***$p<0.001$

Table 4. Correlation and regression analyses between measures of work system and providing continuous education and training programs (independent variables) and occurring medical errors (dependent variables) based on direct survey

Work system & continuous education and training programs	Patient care				
	Technology provided	Standardized hand-off report	Well stocked medications	Reminders to check the patient's ID	Direct observations / audits
CORRELATION ANALYSIS					
Education degree	0.112**	-0.004	0.031	0.008	0.013
An extensive training regarding preventing medical errors	0.175***	0.067	0.004	-0.039	-0.030
Inexperience or lack of education	0.058	0.204***	0.148***	0.124***	0.121***
Inadequate technology	0.200***	0.200***	0.148***	0.104***	0.054
Lack of vigilance	0.187***	0.223***	0.094**	0.112**	0.000
Fatigue	0.123***	-0.008	0.030	0.059	0.028
Heavy workload	0.110***	0.126***	0.178	0.058	0.197***
Time constraints	0.112**	0.063	0.053	0.073*	0.009
Lack of adherence to medical administration policies	0.167***	0.146***	0.087*	0.069*	0.130***
Staffing issues	0.188***	0.100***	0.111**	0.183***	0.048
Distractions	0.134***	0.084*	0.109**	0.113**	0.103***

*$p<0.05$, **$p<0.01$, ***$p<0.001$

Table 4. (continuation)

STEPWISE REGRESSION ANALYSIS					
Adjusted R^2	5.9%*	6.5%*	3.4%**	5.1%*	5.6%**
Significant predictors (beta-coefficients)	Inadequate technology (0.114)	Heavy workload (0.117)	Inexperience or lack of education (0.084)	Staffing issues (0.162)	Heavy workload (0.150)
	Staffing issues (0.104)	Inexperience or lack of education (0.090)	Staffing issues (0.089)	Inexperience or lack of education (0.087)	Distractions (0.072)
	Training regarding preventing medical errors (0.126)				

Discussion

A questionnaire approach was used in order to collect structured, quantitative information on the work system & continuous education and training programs and various outcomes (e.g., medical errors, type of technology provided, standardized hand-off report, well stocked medications, reminders to check the patient's ID, and direct observations / audits). The data presented provide evidence for the reliability and validity of direct and indirect employee questionnaires used in this research. The Cronbach's alpha scores for all the scales except six were above 0.70, which demonstrates acceptable reliability [23]. Six scales had Cronbach's alpha scores of 0.6 or above, close to the 0.70 limit.

A total of 1031 responses from north (i.e., 421 from medical staffs and 30 from medical managers = 451 responses), middle (i.e., 273 from medical staffs and 18 from medical managers = 291 responses) and south (i.e., 238 from medical staffs and 51 from managers = 289 responses) of the Kingdom's hospitals were collected.

The mean age of the direct employee providers was 36 years, with a range from 20 years to 64 years. 461 (49.5%) of the respondents were females and 463 (49.7%) were males. Eight responses out of 932 were identified neither male nor female. Eighty two had sleep deviation disorders where 22 had treated this disorder effectively; however, only 25 have had treated this disorder un-effectively. The rest have had untreated this disorder so far. The mean year of medical experience for all respondents was 7.3 years. Four-hundred and eleven (44.1%) of the participants had associate middle degrees in medical schools, 35.4% had bachelors' degrees, and about 19% had higher education in medicine. Over one-third of the medical staff (44.4%) worked 5 or fewer years in their units. More than half of the sample (50.4%) worked more than five years on their unit, and almost half (49.4%) of the medical personnel worked the night shift more than five years. The sample consisted of 67.7% married, 21.5% caring for aged parents at home, 6% caring for a sick child or other sick adult at home.

The mean age of the indirect employee providers was 40.8 years, with a range from 25 years to 59 years. 100% of the respondents were males. Four percent of the respondents were physicians. The rest of the sample included office personnel, and schedulers. The majority worked either 30–40 hours per week (41 percent) or more than 40 hours per week. Tenure with current employer was 9.6 years on average (standard deviation [SD] = 8.5 years), and the average number of years in current job was 8 (SD = 9.3 years). Ninety-six percent of respondents were Saudis.

Convergent validity was examined by comparing responses of the two job categories (direct and indirect staff) on four groups of variables, i.e., measures of employee training and education, measures of reactions to medical errors occurred, measures of work system, and measures of participation to decision making related to medical errors. Evidence was found of convergent validity for the measures of the work system. There were differences between the two job categories on the measures of education and training programs, participation to decision making, and reactions to medical errors occurred. The differences between direct and indirect medical staff on these measures actually demonstrates their differences in reporting information on the patient

care and safety of medical services provided by their clinics, as well as themselves. In general, managers reported more positive perceptions of those measures and higher quality of service care than direct medical staff.

In order to assess predictive validity, this research examined the relationships between the measures of work system and continuous education and training programs and the measures of patient care and quality of service. The measures of the work system explained a significant proportion of the variance for all measures of patient care. In particular, the measures of inadequate technology, heavy workload, inexperience / lack of education, distractions, staff issues, and training regarding preventing medical errors affecting patient safety were strong predictors of patient care and service.

Results showed that many of the measures of the work system and continuous education and training programs showed a statistically significant correlation with most measures of patient care and quality of service. Staffing power and staff to provide high quality of patient care showed a statistically significant correlation with injuries to patients. Providing training on a new piece of equipment and coordination effectiveness showed a statistically significant correlation with patient or family complaints. All measures of work system and continuous education and training programs, except staffing power, enough staff to provide high quality of patient care, and participation to decision making showed a statistically significantly correlation with patient satisfaction. Providing training on a new piece of equipment, an extensive orientation to hospital procedures, and staffing power showed a statistically significant correlation with quality assurance. All measures of work system and continuous education and training programs, except staffing power and enough staff to provide high quality of patient care showed a statistically significant correlation with patient safety.

Finally, the direct and indirect employee questionnaires provide a unique opportunity to hear from different health care providers. Information on the patient care and safety was collected. This research demonstrated how a structured method (i.e., the employee questionnaires) can be developed for assessing perceptions and opinions of medical service providers from hospitals around different territories in the kingdom.

Acknowledgements

This research was funded by King Abdel-Aziz for Science and Technology, Grant AT# 26-39 (Principal Investigator Khalid Al-Saleh). We would like to thank all the 16 hospitals staffs that participated in this study.

References

1. Wears R, Woloshynowych, M, Brown R, Vincent C. Reflective analysis of safety research in the hospital accident & emergency departments. Applied Ergonomics. 2010;41:695-700.
2. Garrido M, Gerhardus A, Rottingen J, Busse R. Developing health technology assessment to address health care system needs. Health Policy 2010;49:196-202.
3. Montague E. Validation of a trust in medical technology instrument. Applied Ergonomics. 2010;41:1-10.
4. O'Neil E. Four factors that guarantee health care change. Journal of Professional Nursing 2009;25(6):317-321.
5. Donabedian A. The quality of care. How can it be assessed? JAMA 1988;260(12):1743-8.
6. Smith MJ, Carayon-Sainfort P. A balance theory of job design for stress reduction. Intentional Journal of Industrial Ergonomics 1989;4:67-79.
7. Carayon P, Smith MJ. Work organization and ergonomics. Applied Ergonomics. 2000;31:649-662.
8. Mangano A. An analysis of the regional differences in health care utilization in Italy. Health & Place 2010; 16:301-308.

9. Carayon P, Alvarado CJ, Brennan P. Work system and patient safety. In: Luczak H, Zink KJ, editors. Human factors in organizational design and management VII. Santa Monica, CA: IEA Press. 2003;583-9.
10. Helfand M, Balshem H. AHRQ series Paper 2: Principles for developing guidance: AHRQ and the Effective Health-Care Program. Journal of Clinical Epidemiology 2010;63:484-490.
11. Nieva VF, Sorra J. Safety culture assessment: a tool for improving patient safety in healthcare organizationsQual Safe Health Care 2003;2:17-23.
12. Carayon P, Gurses AP, Hundt AS,. Performance obstacles and facilitators of healthcare providers. In: Korunka C and Hoffman P, editors, Change and quality in human service work. Vol. 4. Munchen, Germany: Hampp Publishers. 2005.
13. Hogan CA. Pediatric Patient Safety: Factors pediatric nurses identify as contributing to medication administration errors, Ph.D. Thesis, Nursing School, Loyola University, Chicago, Illinois, U.S.A. 2006.
14. Johnson, Arlene. The influence of sleep deprivation on performance and the occurrence of error in staff nurses who work the night shift, Ph.D. Thesis, University of Alabama at Birmingham, Alabama, U.S.A. 2006.
15. Huang YM. Project SECURE: Safety through Empowerment- Cultivating understanding to reduce errors, Education D. Thesis, Education Dept., University of California, Los Angeles, U.S.A. 2006.
16. Hohenhaus SM. Ethical Decision Making in Emergency Nursing Regarding Medical Error, M.Sc., Thesis, State University of New York, New York: Nw, U.S.A. 2005.
17. Vogus TJ. In search of mechanisms: How do HR practices affect organizational performance? Ph.D. dissertation, Business administration department, University of Michigan. 2004.
18. Bray B, Schwartz C, Weeks D, Kardong-Edgren S. Human patient simulation technology: perceptions from a multidisciplinary sample of health care educators. Clinical Simulation in Nursing 2009;5:e145-e150.
19. Bush M, Lederer A, Li X, Palmisano J, Rao S. The alignment of information systems with organizational objectives and strategies in health care. International Journal of Medical Informatics 2009; 78:446-456.
20. Benner P, Sheets V, Uris P, Malloch K, Schwed JD. Individual, practice, and system causes of errors in nursing, Journal of Nursing Administration 2002;32(10):509-523.
21. Rogers A, Hwang W, Scott L, Aiken L, Dinges D. The working hours of hospital staff nurses and patient safety. Health Affairs (Millwood) 2004;23:202-212.
22. Menachemi N, Shewchuk S, O'Connor S. Physicians' Perception of Medical Errors. Proceedings of Academy of Management, Health Care Management Division. 2002.
23. Nunnally JC. Psychometric theory. 2nd ed.; New York, NY: McGraw-Hill. 1978.