Study and ranking the impact of nurse's job stress on patients safety using Analytic Hierarchy Process (AHP)

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Abstract:

Considering staff's physical and mental health as far as paying attention to production and efficiency of an organization is one of the characteristic of a healthy organization. Since health staffs working in hospitals are facing high physical and psychological events that affect their stress and fatigue levels which consequently results in their potential adverse effects in patient care. This study was conducted to examine the effects of nurse's job stress on patient safety utilizing AHP (analytic hierarchy process). The study was carried out in three hospitals affiliated to Islamic Azad University-Tehran Medical Branch during August to December 2016. A questionnaire was prepared and its validity and reliability was proved. A statistical population consisting of 90 nurses were randomly selected and responded to 53 questions. A group of Experts including three headmasters and hospital managers determined their criteria including cost, time and organizational regulations for preferred top choice based on AHP (Analytic Hierarchy Process) to implement in order to reduce job stress. The results demonstrated that participation in planning and decision-making were the most stressful factors followed by security and career prospects, welfare and staff's support and justice.

Keywords:

Job stress, patient safety, AHP

1. Introduction

Although stress stretched from fact to legendry in the history but nowadays, it is clear that in the era of change and transformation, stress or tension is an acute problem in today's organizations that endangers the mental and physical health of workforces that leads to a heavy expense for organizations [1].

From 1960s onwards, job has been of special stand in people's life. Job is an exciting challenge for individuals however; it can be regarded as a major source of stress in people's life. Stress is one of the most attractive areas for academic researchers in recent years so that the last century has been called the Age of Stress [6].

However, French and colleagues reported that stress is not a bad phenomenon. The word stress can be neutral and it's good and bad effects could be considered to be in a form of benign and malignant stress concepts. They proposed a model that indicated the optimal range of stress that had a positive impact on performance [7].

One of the characteristic of a healthy organization is that staff's physical and mental health is equally interested in organization management as much as productivity. Consider a society that although its organizations have reached the desired level of production, utilizing different ways and neglecting human dimensions of work place, but the staff of these organizations are nervous, sad, unhappy, aggressive, pessimistic and waiting for an opportunity to show their mental distress with low performance and spreading destructive rumors [2].

One of the main reasons for stress in life is job. Job's stress is much broader than physical or financial pressure [3]. Health workers or HCWs (Health Care Worker) working in hospitals are facing high physical and psychological complications that affect their Fatigue and stress levels

which result in potential consequences in patient care [8].

General perception is that errors occur and committing a mistake is a normal human behavior. What all agree on is that people should be more accurate, have safe behavior and be responsible.

Patient safety, avoiding, preventing and reducing adverse outcomes or patient harm are resulting from medical care process. In other words, if the patient suffered severe complications during hospital stay that had no connection to his referral to hospital or an error that occurs in medical and care process that causes harm to patients, therefore patient's safety is not provided. Thus, the issue of patient safety in health centers and the impact of stressors in nurses' society on patient health and safety was a subject that required review and scientific research.

Research studies have demonstrated that, on average, about 10 percent of all admissions to various degrees (Including error injection, patients falling out of the bed, cross contamination and infection from one patient to another, surgery on a wrong patient or organ, patient health threat due to lack of access to equipment and medicine in appropriate time ...) are harmed and it has been estimated that up to 75% of these errors are preventable [4]. Wrong medicine injection and drug usage miscalculation are among errors occurred in medical and health centers that cause damage to millions of people annually worldwide.

Furthermore, the process of determining baby's identity could be mentioned of which about 26% of babies admitted to the neonatal intensive care unit at a risk of being mistaken- displacement- with other babies in the same sector and in every working day. The cause of this error arises from the fact that about 34 percent of babies have common surname, about 9.7% of them have similar and alike surname pronunciation and 44 percent have similar admission number. So babies are at a risk of displacement. The possible impact of the aforementioned and similar problems is due to the lack of motivation rule and presence of stress factors in healthcare personnel that results in patients' health threats.

According to the results of previous investigations and studies, conditions such as stressful environment and job's stress can influence employees including nurses' physical and psychological health and may have an impact on patient safety. This increases the potential for errors (including the risk of transmission of infection from the hospital to the patient, wrong drug injection error, etc.) and reduces the quality of care and treatment services.

During the survey on the safety status of patients in three hospitals over the past year, 17 cases of patients falling out of bed, 4 cases of pathology samples loss, 25 cases of wrong medication prescription errors, two cases of wrong medication injection, three cases of wrong vaccine injection to infants, more than 10 cases of discharge with personal willingness because of dissatisfaction of hospital health care services, two cases of baby displacement due to the lack of precision in correct identifying the patients and also 32 cases of bedsores have been reported and registered.

According to the proven effect of job's stress on patient safety, it was attempted to determine and rank the leading causes of job's stress and the importance level of each of them on patient's safety.

This study examined the effects of nurses' job stress on patient safety based on AHP hierarchical analysis. Checking this subject would reduce costs, increase satisfaction among customers and will lead to a healthy society. It seems that occupational stress parameters affect the quality of patient safety that according to

health and medical care organizations standards including modification costs, recovery time and coherence with organization's rules and regulations using hierarchical analysis, AHP meant to determine the best options to improve patient safety and reduce occupational stress.

In 2005, a research by Tanya entitled occupational stress in nursing cycle (Confirmation of organizational and environmental conditions and job's characteristics) was done that determined the relationship between job's stress and nursing care and the results showed that motivation in increasing the income and reducing shifts can increase the quality of health care [9].

In 2012, Alavi-Arjmand and colleagues made a survey and published an article entitled the effect of stress management on job's stress and work-life conflict amongst two 91-member groups of Martyr Lavassani's hospital nurses in Tehran. Collecting data, completing demographic information questionnaire, work-life conflict and job's stress by both groups and stress management training courses for one of the groups and further questionnaires completion by both groups was conducted. The results of this research demonstrate that intervention through stress management skills training reduced job's stress and nurses work life conflict [4].

In 2015 a cross-sectional study by Gabriel Jones entitled the prediction of occupational stress and fatigue in nurses' population working in the intensive care unit and nursing assistants was studied in France. The results showed that health care workers (HCWs) were exposed to conditions such as stressful environment and work transposition and alteration. These two factors can affect their physical and mental health and employees' health may have an adverse effect on patient safety and thus increasing the potential for errors and risk of infection transmission of infection from the hospital to the patient [10].

In studies done in the past, it has been proven that job's stress is present in different treatment groups. Some studies have also proven that occupational stress factors such as poor sleep, personnel's income and mental status can affect their duties performance and ultimately patient safety. Nowadays, there are new ways to improve the processes that the best corrective method could be selected from a number of options and according to organization's criteria. In this study all options that are involved in job's stress were assessed and prioritized. Based on phase analysis, the best option will be proposed for reducing stress and improving patient safety.

It is hoped that by accomplishing this research and identifying important leading factors of stress including training and job's duties introduction, principles of respect and business communication, participation in planning and decision-making, providing welfare and staff support, Justice, security and motivation we are able to take small steps towards dealing with these factors in the estimated profession of nursing so patients are encountered with the lowest risk of human errors.

1. Materials and Methods

The considered research examines the effects of nurse's job's stress on patient safety based on the AHP hierarchical analysis utilizing descriptive method. The population consisted of 90 nurses working in Bu-Ali, Amir-Almomenin and Javahery hospitals affiliated to medical Branch of Tehran Islamic Azad University that were selected randomly. This study started from August 2016 and ended in December 2016.

The field visit of the aforementioned hospitals environment was conducted at the beginning of the study to get a detailed reconnaissance. Thus, in the first stage the physical space of the three

hospitals were visited and specifications such as room dimensions, color, buildings condition, etc. were recorded. Then, a review of the harmful physical and chemical factors in the work environment in aforementioned three hospitals was made. Thus, lighting, noise, air quality and ventilation systems, heat stress, radiation exposure as well as its spatial location were recorded. In the third stage, staff welfare status in three hospitals, including rest rooms, feeding system, cultural programs and sports, health and hygienic status ... were checked and viewpoints were recorded. In the fourth stage, staffs were accurately identified so in order to increase the sampling accuracy, appropriate numbers of all questionnaire parameters were sampled. At last, complaints and criticisms in the past year were studied after the permission of the three hospitals heads. Furthermore, attention was paid to do sampling randomly rather than selective. The remarkable point in field visits performance was selected so that interviews and answers of hospital nurses could be expressed in three hospitals experts meeting for determining involved criteria. Then, based on questionnaires and according to the accomplished identification, comparative analysis was carried out and samples according to age, gender, work experience, type of employment were classified.

Also for more accurate sampling, parameters such as type of work shift, spouse employment status, housing status and educational level were also considered.

After performing field visits, including 15 stages (five in each hospital), 30 samples were selected from each hospital. Since there were no equal ratio and distribution between male and female nurses', gender was considered in the sampling.

Questionnaires and their data extraction were utilized for data collection. For data extraction, SPSS was utilized.

Questionnaires were completed using SPSS software analysis and statistical data were prepared.

Then a group of experts consisting of six people (the head of the hospital, deputy director of development and resources in three monitored hospitals) announced their criteria including cost of process modification, improvement recovery time and coherence with organization's rules and regulations for implementing corrective measures in six major parameters including education and acquaintance with the career tasks, the regulations of respect and job relationships, participation in decision-making and decision-taking, staff support and welfare as well as job security and motive.

Weighting and pair comparison of the criteria

Criteria and options were compared using AHP. The first level of hierarchy is composed of main criteria. Expert’s questionnaire deals with the priorities of each of the major criteria based on the pair comparison of major criteria. Therefore, criteria should be compared in pairs based on our goal. In order to do this, experts compared the criteria in pairs. The matrix had diameter 1 with the upper triangle as the mirror of the lower one. The matrix relative priority of criteria is observed in Table 3.1.

Table 3.1 the matrix relative priority of criteria.

Criteria	Expense	Time	Organizational regulations
Expense	1	3	5
Time	1.3	1	1.3
Organizational regulations	1.5	3	1
Total	1.53	7	6.33

Then, the normal matrix with norm 1 with columnar accumulation 1 was drawn and row averaging was conducted (Table 2.3).

Table 2.3 Normal matrix and row averaging

	Expense	Time	Organizational regulation	Eigen vector
Expense	0.65	0.43	0.79	0.62
Time	0.21	0.14	0.05	0.13
Organizational regulation	0.14	0.43	0.16	0.25
Total	1	1	1	1

When the weight of each criterion was determined, the choices were compared in pairs based on each criterion. The average stress index was obtained based on the results and analysis of job stress questionnaires' (Table 3.3).

Table 3.3 Average job stress index

No.	Stress parameter	Stress index
1	Job security and motives	48.934
2	Staff support and welfare	45.451
3	Justice	45.26
4	Participation in planning and decision taking	45.023
5	Education and reconnaissance with job task	33.045
6	Respect and relationship	26.489

As it is observed in the table 3.3, stress index has the maximum values in the rows 1 to 4. Then, it is better to select the best options based on the organization criteria for its modification and corrective action.

In order to do this, the following options were utilized for evaluation, considering the results of the questionnaires:

A: Job security and motives

B: Staff support and welfare

C: Justice

D: Participation in planning and decision taking

Then, pair comparison matrix was drawn for all options based on the three criteria i.e. expense, time and organizational regulations. Furthermore, normalization was utilized for the determination of priorities which was obtained based on the weight normalization of each option based on the desired criterion.

The values obtained from calculations are called Eigenvector. Pair comparisons were made for the three criteria, so the priority of each option was calculated based on each criterion. Pair comparison matrix of the four stressors in nurses based on the expense criterion was shown in Table 3.4.

Table 3.4 pair comparison matrix based on the expense criterion

Expense	A	B	C	D
A	1	5	2	1.3
B	1.5	1	1.5	1.7
C	1.2	5	1	1.5
D	3	7	5	1

Expense	A	B	C	D	Eigenvector
A	0.21	0.28	0.24	0.2	0.23
B	0.04	0.05	0.03	0.09	0.05
C	0.11	0.28	0.12	0.12	0.16
D	0.64	0.39	0.61	0.59	0.56
Total	1	1	1	1	1

Pair comparison matrix of four stressor in nurses based on the time are shown in Table 3.5.

Table 3.5 pair comparison matrix based on the time criterion

Time	A	B	C	D
A	1	5	3	1.3
B	1.5	1	1.3	1.5
C	1.3	3	1	1.2
D	3	5	2	1

Time	A	B	C	D	Eigenvector
A	0.22	0.36	0.47	0.16	0.3
B	0.05	0.07	0.05	0.1	0.07
C	0.07	0.21	0.16	0.25	0.17
D	0.66	0.36	0.32	0.49	0.46
Total	1	1	1	1	1

Pair comparison matrix of four stressor in nurses based on the organizational regulations are shown in Table 3.6.

Organizational regulations	A	B	C	D
A	1	3	5	7
B	1.3	1	3	5
C	1.5	1.3	1	2
D	1.7	1.5	1.2	1

Organizatioanl regulations	A	B	C	D	Eigenvector
A	0.59	0.66	0.53	0.47	0.56
B	0.2	0.22	0.32	0.33	0.27
C	0.12	0.07	0.1	0.13	0.1
D	0.09	0.05	0.05	0.07	0.07
Total	1	1	1	1	1

It is necessary to multiply the weight of each criterion in its score and add them up to get the total score (Table 7.3).

Table 7.3 Determination of final priority of choices

	Expense	Time	Regulations
A	0.23	0.3	0.56
B	0.05	0.07	0.27
C	0.16	0.17	0.1
D	0.56	0.46	0.07
Weight	0.62	0.13	0.25

Results

Job stress is the most prevalent stressor, however, parameters outside of the job area may considerably play role in one's stress [11]. Lazarus and Levoilo considered emotions role important in job stress due to quick reaction to stressors [12]. Researches made by Giorgi et al., Pasadkov et al., Guilbola et al. demonstrate that heavy duty (both in quantity and time-bound intensity), low control (professional self-decisioning, wide decision), lack of support from heads and colleagues (difference among colleagues, managers and organization in general), ambiguity and contradictions (when staffs have ambiguous and conflicting duties in the organization), all are involved in stressors [13, 14].

The results of the research demonstrated that regarding organizational criteria (including confliction expenses, time span and accordance with the organizational regulations) for reducing job stress, participation factor in planning and decision were introduced as top choice in nurses' job stress. Furthermore, job security and motives, staff justice and welfare are among the lower rank stressors.

Final weight =Σ (weight of the choice with respect to the criteria×weight of the criteria)

$WA = (0.23 \times 0.62) + (0.3 \times 0.13) + (0.56 \times 0.25) = 0.322$

$WB = (0.05 \times 0.62) + (0.07 \times 0.13) + (0.27 \times 0.25) = 0.108$

$WC = (0.16 \times 0.62) + (0.17 \times 0.13) + (0.1 \times 0.25) = 0.146$

$WD = (0.56 \times 0.62) + (0.46 \times 0.13) + (0.07 \times 0.25) = 0.425$

$W_A=0.322$

$W_B=0.108$

$W_C=0.146$

$W_D=0.425$

$W_D > W_A > W_C > W_B$

W_D: participation in planning and decision

W_A: Job security and motivations

W_C: Justice

W_B: Staff support and welfare

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