



Strategic of Implementation of Ergonomic Positions for Nurses in Healthcare Department with SAST and AHP Methods in Qatar

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Performing ergonomic positions in nursing care both directly and indirectly is very fundamental. However, it need the strategy to implement ergonomic positions for the nurses. Aims of research to determine strategies that can be applied by the Healthcare Department Management in the application of ergonomic positions for nurses in Qatar.

Methods: Data analysis using SAST (Strategic Assumption Surfacing and Testing) and AHP (Analytic Hierarchy Process) for prioritized the criteria and alternative.

Result: SAST analysis shows all assumptions that appear contained in quadrant I (Certain Planning Region), Process to affect working conditions assumptions with values 5.3 - 5.3 (Certainty – Important) are considered as definite and important in apply an ergonomic strategy. In the AHP analysis, Top Down with a value of 0.345 as the most priority choice for criteria level, and Ergonomic Committee Effectiveness being the choice with the highest value 0.231 in alternative level. Both strategies being selected in carrying out an ergonomic position strategy.

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Conclusions: In the AHP method, Process to affect working condition has been choose as certainty and important strategy to be implemented. In the SAST method, to achieve the goal, Top Down selected in criteria level and Ergonomic committee effectiveness in the alternative level.

Keywords: Ergonomic strategy; SAST; AHP.

1. INTRODUCTION

Healthcare workers often use inappropriate bodily mechanisms such as making sudden movements, reaching for devices that are out of reach of the body, and or doing work that requires excessive posture. Repeated work or repetition can cause problems in the musculoskeletal if not done ergonomically. Activities such as lifting a patient from one bed to another, from an ambulance to a bed in the emergency room or vice versa, activities to insert IV cannula, giving injection, perform cardiac pulmonary resuscitation, examine vital signs to patients and others, are all activities that are at risk of causing problems with the musculoskeletal system.

The use of ergonomic positions in performing nursing actions both directly and indirectly is very fundamental for health workers because the activities carried out are very risky for the emergence of musculoskeletal health problems. The existence of a musculoskeletal case at the study site encouraged the author to conduct research under the title Strategy of Implementing Ergonomic Position in Nurses in the Healthcare Department, Company "X" in Qatar.

Ergonomics comes from two Greek words: *ergon* and *nomos*: *ergon* means work and *nomos* means rules, rules, or principles. The definition of ergonomics is the science of designing a job to be appropriate or in accordance with the workers, rather than forcing the physical workers to match the work [1]. Ergonomics is the study of interaction between humans and other elements in a system, as well as professions that practice theories, principles, data, and methods in design to optimize systems to suit human needs and skills [2].

Thus, ergonomics is a science that has rules that study, design and apply interactions between the muscle strength of the worker's body and the environment and equipment used by workers so as to increase and optimize the effectiveness of work and be able to prevent or minimize the occurrence of diseases caused by work.

The function of ergonomics is work quickly completed, has a smaller risk of accidents, efficient time, risk of illness due to small work and so forth. While the benefits obtained are [2]:

1. Work increases, as speed, accuracy, safety and reduce energy while working.
2. Reducing time, training and education costs.
3. Optimizing the use of human resources through improving the skills needed.
4. Reducing time wasted.
5. Increase employee comfort at work.

The objectives of ergonomics in general are [2]:

1. To improve physical and mental well-being by preventing injuries and occupational diseases, reducing physical and mental workload, and seeking work promotion and satisfaction.
2. To improve social welfare through increasing social contact, managing and coordinating appropriately and increasing social security during the period of productive age and after earning.
3. To create a rational balance between various aspects such as economic, technical, anthropological and cultural aspects of each work system carried out so as to create high quality work and quality of life.

There are several recommendations that companies are required to comply with and meet the standards issued by the agency. Some examples to control the hazard include [3]:

- Use a device to lift and reposition heavy objects to limit force exertion.
- Reduce the weight of a load to limit force exertion.
- Establish systems so workers are rotated away from the task to minimize the duration of continual exertion, repetitive motions, and awkward postures.
- Staff "floaters" to provide periodic breaks between schedule break.
- Use padding to reduce direct contact with hard, sharp, or vibrating surfaces.

Specialization in the field of ergonomics includes [4]:

1. **Physical ergonomics:** relating to the anatomy of the human body, anthropometry, physiological and biomechanical characteristics related to physical activity. Topics that are relevant to physical ergonomics include: work posture, material transfer, repetitive movements, MSDs, workplace layout, safety and health.
2. **Cognitive ergonomic:** relating to human mental processes, including therein; perception, memory, and reaction, as a result of human interaction with the use of system elements. Topics relevant to cognitive ergonomics are; workload, decision making, performance, human computer interaction, human reliability, and work stress.
3. **Organizational ergonomics:** relating to the optimization of the sociotechnical system, including organizational structure, policies, and processes. Topics relevant to organizational ergonomics include; communication, human resources, work design, work time design, teamwork, participation design, ergonomic community, organizational culture, virtual organization, etc.
4. **Environmental ergonomics:** related to lighting, temperature, noise and vibration. Topics relevant to environmental ergonomics include; workspace design, acoustic systems, etc.

There are several risk factors carried out by health workers in their daily work where not doing an ergonomic position can increase the risk of injury to musculoskeletal injuries. They make a list of correct and incorrect ways of performing ergonomic positions for nurses in moving patients from one place to another [5].

To conduct the ergonomics positions programs for nurses in place and has sustainability, it need strategy to implement, the author use soft system methodology to find the best strategy, those are SAST (Strategic Assumption Surfacing and Testing) and AHP (Analytic Hierarchy Process).

2. METHODS

Type of the research were used qualitative research, conducted a priority scale on the

strategy using the soft of system methodology method with the SAST (Strategic Assumption Surfacing and Testing) model approach and do the determination of priority assumptions with the AHP (Analytic Hierarchy Process) model approach using panel of experts. In this study, 3 experts were participated in SAST and 5 experts were participated in AHP.

SAST is a method used to identify strategic assumptions regarding what needs to be considered in designing a strategic policy or in making strategic planning [6].

Steps for using Strategy Assumption Surface and Testing, those are determine the complex problems to be conveyed, choose related experts, arrange the questionnaire, discuss with experts to get answers or input, tabulate expert answers for later grouping, express in the graph, interpret according to the results obtained [6].

The SAST questionnaire filled up by 3 experts, tabulated the data and make the Cartesians quadrant by Microsoft excel 2016.

AHP is a method of decision making based on compound criteria and AHP is based on expert judgment [6]. AHP is a non-linear framework that brings both thoughts, namely deductive and inductive without using syllogism [7]. In using the AHP model in problem solving, one needs a hierarchy or network structure to display the problem. This AHP method can be used to determine measurements on both things, physical and social domain.

From the several existing hierarchical models, one of the hierarchical models is a hierarchy with three levels, which consists of goals, criteria and alternatives [7]. The next step is to compile a combined matrix, gather all the considerations made from the results of the comparison, then enter the values obtained from discussions with experts to select components in the criteria and alternatives, then the results are synthesized as priorities for vector weighting. Vectors are entered into the expert choice to get the results. From the results of the expert choice, it will be known which is best selected in the category of criteria and alternatives, which are believed to be able to be applied in achieving goals. The final step evaluates inconsistencies for the entire hierarchy by looking at a consistency ratio of 10% or less. The value of the consistency ratio is very important to know how good the consistency

is produced from discussions with experts so that the results are optimal.

The AHP method involves five experts, those were representing from managerial to supervisors at the study site. Each expert filled up a questionnaire, then the results of the questionnaire were analyzed using Expert Choice 11 software. The level of expertise was measured by looking at the Consistency ratio (CR), which is a CR value of less than 10% or 0.10 [6].

3. RESULT AND DISCUSSION

Reported from the results of the study that there were a total of 944 workers who had accidents resulting in time-loss from 23,742 workers. The number of accidents as much as 83% are musculoskeletal cases. For direct treatment of patients, the highest causes that cause musculoskeletal injuries are inappropriate positions of 25% and forced positions as much as 23%, for the activities of health workers indirectly in handling patients are forced positions as much as 25%, incidents of slipping or fell as much as 22%. Direct patient handling activities account for 60% of total musculoskeletal injuries and activities that do not pertain to patient handling as much as 55% of musculoskeletal injuries are caused by equipment handling activities in hospitals or clinics [8].

Assess physical activities of nurses and working facilities, REBA (rapid entire body assessment) were used to performed observation in identify high risk activities. They discovered that dominant causes of low back pain were bending and patient –lifting and suggested to provide adjustable facilities, providing SOPs, and educating the nurses [9].

Conducted a study in New Zealand, reported that there was an increase in the incidence of musculoskeletal injuries in nurses compared with office work where there was 10% in shoulder pain, 19% in knee pain and 16% in wrist pain [10].

The implementation of ergonomics programs in the workplace aims to prevent injury and prevent disease by eliminating or reducing exposure to the risk of developing MSDs.

There are three element models in implementing strategies for implementing ergonomics programs in health facilities that have been applied, the three elements are [11]:

1. Ergonomics Committee Effectiveness:

Management commitment, Supervisory support and participation, Worker support and participation, Employee Health Department and / or Occ. Med Participation and support, Committee Leadership, Training for committee members, Written plan with realistic goals and delegation of work, Performance evaluation.

2. Process to affect working conditions:

Hazard Identification, Evaluation of risk, Hazard control identification, Implementation approval and support, Funding for changes, Monitoring, and Evaluation.

3. Process to reduce lost time:

Case Management, Rehabilitation Program, Job descriptions with physical demands, Policy for job modifications to facilitate early return to work, Monitoring and evaluation

There are five critical elements for managing ergonomics programs, the five elements are [12]:

a. Target cause: Validation, knowing and measuring risk factors can provide the number of workers exposed to the risk of the emergence of MSDs in the workplace. This will provide an early warning system for employees to be able to anticipate and control the causes of MSDs.

b. Common goal: The general goal in the ergonomics program is to reduce the risk exposure to MSDs, this program provides a common goal for each employee.

c. Top down: Commitment, sponsorship, and resources by the top management or management are important to maintain the sustainability and effectiveness of the ergonomics program.

d. Familiar system: The success of an ergonomics program where the program is sustainable, a process that is aligned and is known for continuous improvement.

e. Regular check (Regular Check): This is a key element for maintaining an effective ergonomic process improvement, maintaining momentum and maintaining priorities among the ever-changing business challenges.

After determining the steps in managing a program, the next step is to find out what programs are related to the position of ergonomics.

The organization revealed that to establish and implement controls over the workplace are divided into three tiered hierarchies. Where these three levels are widely accepted as an intervention strategy to reduce, eliminate or control hazards in the workplace. The three levels are [13]:

a. Engineering controls: The approach taken is to prevent and control MSDs by designing work to take the capabilities and limitations of the workforce using engineering control.

For example: Changing materials or equipment as a tool, changing the design of the workplace environment that is adapted to the anthropology of the worker's body.

b. Administrative controls: Change the way things work or change management policies. At this level it does not eliminate the presence of Hazards in the workplace but is able to reduce the risk of MSDs.

For example: Reducing work duration or exposure, changing standard operating procedures, rotating workers to reduce physical fatigue, providing training on ergonomics.

c. Personal Protective Equipment (PPE): Personal protective equipment actually becomes a tool that is able to limit between workers and hazards.

This study aims to determine strategies that can be applied by the Healthcare Department Management in the application of ergonomic positions for nurses.

3.1 SAST (Strategic Assumption Surfacing and Testing)

In the discussion process with panel of experts will be directed to bring up some of the strategic assumptions needed in accordance with the object of the study by considering the 'Level of certainty' and 'Level of importance'.

Based on the findings or the results of discussions with these experts with a questionnaire model it came to weighting the assumptions based on the level of importance and level of certainty, then processed and tabulated, then a plot of importance and certainty of SAST will be obtained. Assumptions from each expert were synthesized, from the results of the synthesis obtained six strategy of

implementing the ergonomic program for nurses. The assumption is given weighting based on the level of importance and level of certainty. Result of judgement and opinions from the experts based on the level of importance and certainty is in Table 1.

The resulted grades for six strategies it showed in the Cartesian quadrant. The position of each strategies were positioned in the four quadrant according to each importance and certainty. An overview of the positions can be seen in Fig. 1.

The results of research conducted with the SAST approach, the strategies that have been analyzed almost have a value that is not much different and all strategies are in quadrant I, where quadrant I is a Certain Planning Region or quadrant with a value that is very certain and very important. The strategies with the highest value is the strategies E which is Process to affect working conditions with values 5.3-5.3(Certainty-Important). The strategies E is chosen to be the most optimal assumption because this strategy is considered the most optimal which is a stage with an ongoing process and has sustainability when applied in the ergonomics program.

3.2 AHP (Analytic Hierarchy Process)

The strategies obtained are six strategies, all of it included in quadrant one in SAST analysis. Those strategies are prioritized using analytic hierarchy process. The ultimate goal of this research is Strategic to Implement Ergonomic Positions for Nurses, in the criteria level consisted of five criteria, those are Target Cause, Common Goal, Top Down, Familiar System and Regular Check. In the hierarchy level alternative consisted of six alternatives, those are Engineering control, Administrative Control, Personal Protective Equipment, Ergonomic Committee Effectiveness, Process to affect working conditions and Process to reduce lost time.

Data obtained from the discussion and judgement of experts processed with expert choice 11 software, in the results of the analysis showed from highest up to the lowest values in each criteria and alternative level. The result of the analysis that appear can be seen in Fig. 2.

The result of analysis using expert choice software in AHP approach method showed that criteria level are Top Down (C3) becomes the highest value 0.345, in the second place Target

Table 1. Weighting result of the strategy

No	Assumptions	Certainty	Importance
A	Engineering control	4.6	5.6
B	Administrative Control	5.3	5
C	Personal Protective Equipment	5	5
D	Ergonomic Committee Effectiveness	4.6	6
E	Process to affect working conditions	5.3	5.3
F	Process to reduce lost time	4.6	5

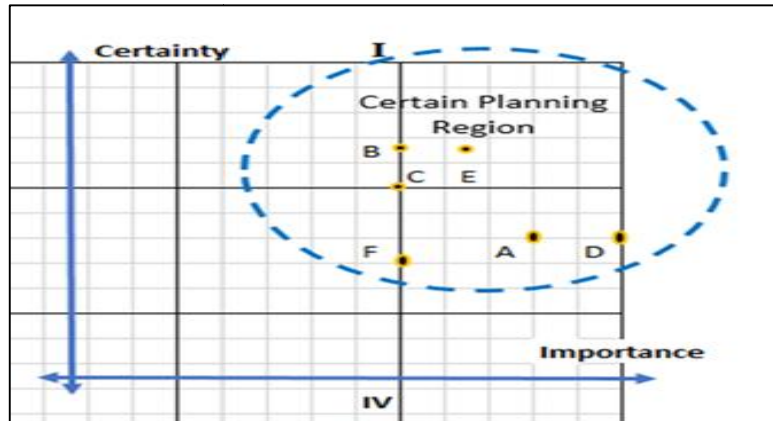


Fig. 1. SAST analysis of ergonomic positions for nurses

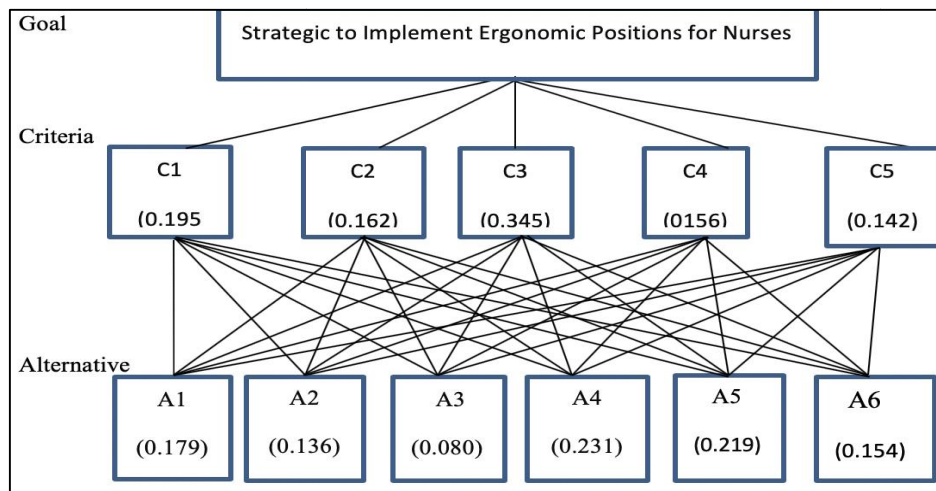


Fig. 2. AHP hierarchy result

Remarks: C1: Target Cause; C2: Common Goal; C3: Top Down; C4: Familiar System; C5: Regular Check; A1: Engineering Control; A2: Administrative Control; A3: Personal Protective Equipment; A4: Ergonomic Committee Effectiveness; A5: Process to Affect Working Conditions; A6: Process to Reduce Loss Time

Cause (C1) has value of 0.195, the third place selected Common Goal (C2) with a value 0.162, in the fourth place Familiar System (C4) with a value 0.156, and the last selected is Regular Check (C5) with a value 0.142. Analysis result from expert choice software can be seen in Fig. 3.

At the alternative level, highest value selected Ergonomic Committee Effectiveness (A4) with a value 0.231, in the second level of alternative chosen Process to affect working condition (A5) with a value 0.219, in the third place Engineering Control (A1) with a value 0.179 then in the fourth place selected Process to reduce

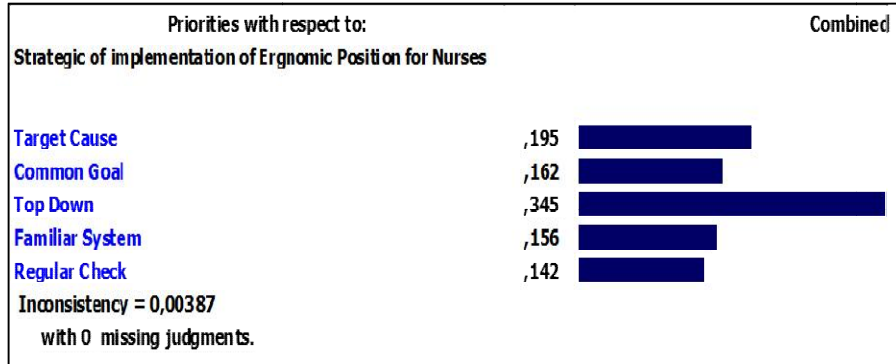


Fig. 3. Criteria strategy result of ergonomic positions for nurses

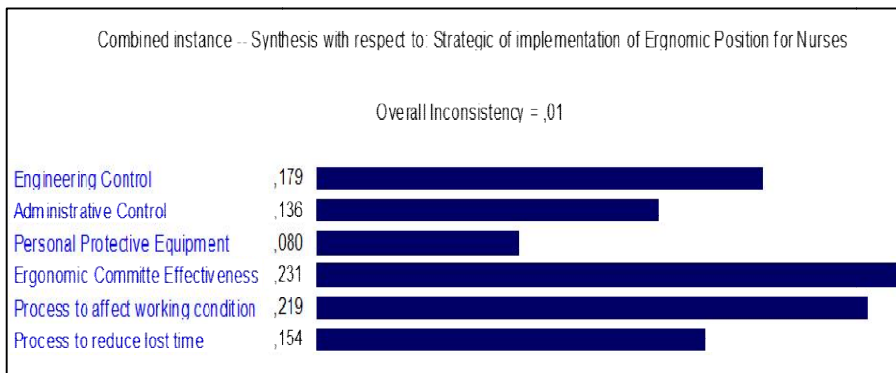


Fig. 4. Alternative strategy result of ergonomic position for nurses

lost time (A6) with a value 0.154, the fifth place selected Administrative Control (A2) with a value 0.136, the last place selected Personal Protective Equipment (A3) with a value 0.080.

Alternative analysis strategies result of ergonomic position for nurses can be seen in Fig. 4.

The result of the research on AHP method approach model concluded that the strategic ergonomic positions for nurses selected and recommended can be apply by Healthcare Department management are Top Down with a value 0.345 in criteria level and Ergonomic Committee Effectiveness with a value 0.231 in alternative level.

4. CONCLUSION

The results of research conducted with the SAST analysis, the strategies that have been analyzed are in quadrant I, where quadrant I is a Certain Planning Region or quadrant with a very certainty and very important. The Process to affect

working conditions (E) was selected to be the most optimal strategy with certainty value 5.3 and important value 5.3.

While the results of the analysis using the AHP approach method concluded that Top Down with a value of 0.345 suggested to be apply in the ergonomic position strategy with the highest selected criteria, and recommended alternative is the Ergonomic Committee Effectiveness with a value of 0.231. Those strategy selected by experts because considered the most optimal strategy which is a stage with an ongoing process and has sustainability when applied in the ergonomics program.

DISCLAMIER

The products used for this research are commonly and predominantly use products in our area of research. There is no conflict of interest between authors and the area of research and the research was not funded by the company rather it was funded by personal efforts of the authors.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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