

# **Fatigue factors of work system in accident and emergency department (literature review)**

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**Abstract.** Nurse workers, especially in accident and emergency room department, have the highest levels of fatigue compared to other hospital staff. Nurses experience fatigue, stress, frequent dizziness, unable to rest because the workload is too high and takes too much time and low salary without adequate incentives. Fatigue cannot be underestimated because it affects the effectiveness, productivity and safety of workers in general. High levels of fatigue can cause workers to concentrate and focus when working and increase the risk of workplace accidents caused by human error. Based on the conditions and impacts above, further research is needed on the analysis of work systems to reduce nurse fatigue with the macro ergonomic approach of the Systems Engineering Initiative for Patient Safety (SEIPS) model in hospitals based on observations and interviews of nurses and hospital management. This is because that the causes of fatigue nurses are not only seen in one aspect. The factors influence the work system of nurses in hospitals are identified of the physical work environmental aspect, responsibilities and duties of workers aspect, equipment and technology used aspect, company organization aspect and personal nurses aspect. This research was conducted at one hospital in the city of Medan by using 83 respondents from the nurses and 7 respondents from the hospital.

## **1. Introduction**

Occupational health is a public health application in a place (company, factory, office, etc.) and being a patient in public health is workers and the community around the company [1]. From an ergonomic point of view, each workload received by a person must be appropriate or balanced of the physical, cognitive and limitations of human ability to accept the workload [2]. Any work of any kind job requires muscle strength or thought is a workload for all the people do the work. Due to workloads are too heavy or weak physical abilities, it can result in a worker suffering from work-related disorders or diseases. All postures are not natural in working; such as attitudes to reach goods exceed the hand reach must be avoided. Symptoms of fatigue are experienced by employees when working is monotonous and repetitive. Occupational fatigue is often interpreted as a process of decreasing efficiency and reduced physical strength or endurance to continue the activities must be done [3].

Occupational fatigue is a condition which a decrease in work efficiency, skills and resulted by feelings of fatigue or boredom to continue activities or work. Fatigue cannot be underestimated because it affects the effectiveness, productivity, and safety of workers in general. High levels of workload cause workers to concentrate and focus when working and increase the risk of workplace accidents caused by human error [4].

Fatigue condition usually results from physical and spiritual disorders, stress, and overworks. That is why fatigue is also explained as the inability to maintain and preserve the required or expected stamina and energy or the lack of energy in the working capacity. Working with fatigue is even equated to alcoholism [5] [6]. One profession that has a high level of fatigue is a nurse at the hospital. Hospital nurses who provide patient care service often experience temporal demand and heavier workload due to the shortage of staff and potential overtime. Nurses encounter nonstandard work schedules, long work hours and circadian adjustment to night shift which is physically, mentally and emotionally strenuous [7]. The nursing profession is among those jobs in which the staff works in various work shifts. Individuals who work in the night shift in circulating rounds are exposed to lack of sleep<sup>6</sup> which is associated with increasing fatigue. The consequences of fatigue include reduced memory, reduced reaction time, decreased speed of information processing, irritability, endangering of problem solving and critical thinking, slipping in paying attention to details, decreased concentration, judgment, and motivation. Also, regarding the point that fatigue is associated with serious damage to the nursing staff including muscular-skeletal and cardiovascular damages, etc on the whole fatigue may lead to reduced output, dissatisfaction, absence from work, increased sick leave, and high turnover of the personnel enhancing the decision for leaving the occupation [8].

One method used in analyzing work fatigue problems due to fatigue is the macro ergonomic approach. Macro ergonomic is concerned with factors in the technological subsystem, subsystem personnel, external environment, and their interactions as their impact on work system design. The goal of work system design optimization in terms of its sociotechnical system characteristics is to obtain harmonized work systems fully [9]. The macro ergonomics approach aims to better understand and overcome the factors contributes to and/or prevents fatigue in the work system of nurses in hospitals. One of the macro ergonomics approaches is the Systems Engineering Initiative for Patient Safety (SEIPS) model. The SEIPS model was specifically developed to deal with patient and nurse safety. This model explains five components for the structure of work systems, namely person (person), organization, task or workload, work environment, and equipment and technology to pursue balance in the work system of hospital nurses by increasing positive factors when there are several negative factors cannot accept redesign or system intervention [10].

Work fatigue problems have been solved in previous studies. The research has been conducted in North Sumatra relates to these nurses, namely the influence of stress and leadership on the nurses performance in the general hospital in Pematangsiantar. Problems cause stress in work include the absence of a balance between nurses and patients in this case the quantity of beds as a comparison, and nurses feel exhausted, the long duration can be the cause of the emergence of stress experienced at work. The results of regression analysis indicates that the coefficient of determination ( $R^2$ ) is equal to 0,429, means that the independent variables (stress and leadership) together have an influence of 42,9% on nurse performance when the remaining 57,1% is influenced by other variables not examined [11]. Other studies on fatigue problems were also carried out by Shucisnigdha, et al. The study was conducted using fatigue alarms to improve operator performance. This study was focused on one Intensive Care Unit (ICU) with the presence of unit clerks and a second monitor for patients from other medical floors. Physiological measures can be used along with mental workload and affects to produce a complementary definition of alarm fatigue [12].

Based on the research that has been done before, this study uses a macro approach in analyzing the fatigue factors of nurses at Accident and Emergency Department.

## 2. Methodology

This study is conducted at one of the hospitals in the Medan city where the object examined in this study is the work system of nurses in hospitals. The study begins with observations to observe and see the condition of the company directly. From the results of observations, it is determined the formulation of the problem in accordance with the conditions occur in the company and the research objectives can be applied. The research objectives determined are a solution to existing problems. Furthermore, the data collection as the input in conducting this research. The data needed is in the form of questionnaires data. The questionnaire is a quantity of written questions are used to obtain information from the respondent in the sense of reports about the person, or things. In research, the use of questionnaires is a very important thing in data collection. The main purpose of making a questionnaire is to obtain information is relevant to the goal by fillment in the question by the researcher towards the chosen respondents. Carayon (2001) has set five stages to develop a questionnaire survey, namely:

1. Conceptualization

Determine what concepts will be measured between the elements of the work system that will be evaluated and the output elements that will be evaluated.

2. Operationalization

Determine the goals to be achieved from the survey and how to match between the concepts used and the objectives to be achieved

3. Source of Questionnaire

Determine the type of survey questionnaire that is used as a reference for research

4. Making of Questionnaire

Reviewing the form of questionnaires, the rating scale of measurement and the question items determination, how to fill out questionnaires and etc.

5. Initial testing of the questionnaire who is the respondent will participate in this initial test, and determine the objectives of the initial testing (checking the clarity of the question items, the format and duration of questionnaire fillment).

The questionnaires are distributed to nurses and hospital management. The nurse is the operator with the highest level of fatigue. The management provides a work description. The scale used in the assessment of the questionnaire is the Likert scale. Likert scale is a psychometric scale is commonly used in questionnaires and is the scale most widely used in research in the form of surveys. The name of this scale is taken from the name Rensis Likert, who published a report explaining its use. When responding to questions on a Likert scale, respondents determine their level of agreement with a statement by choosing one of the available options. Likert scale is used to measure attitudes, opinions and perceptions of a person or group of people about social phenomena.

**Table 1.**Likert Scale

Preference		Preference		Preference	
1	Very agree	1	Agree	1	Very Positive
2	Agree	2	Often	2	Positive
3	Doubt	3	Sometimes	3	Neutral
4	Disagree	4	Almost Never	4	Negative
5	Very disagree	5	Never	5	Very Negative

For the purposes of quantitative analysis, the answer is given a score, for example: very agree / agree / very positive given a score of 5, then agree / often / positively given a score of 4 and so on [13]. The Systems Engineering Initiative for Patient Safety (SEIPS) macro ergonomic approach carried out after questionnaires are distributed. Some of the things discussed in macro ergonomics are organizational structures, interactions between people in the organization and aspects of workers motivation. In other words, micro ergonomics only look at the level of work but macro ergonomics look at the level of work and also the level of the organization. Macro ergonomics has been known as a sub-discipline of ergonomics related to human, organizational and technological relations. Macro-ergonomics is something that is integrated because it includes knowledge, methods, and equipment from socio-engineering systems, industrial psychology, systems engineering, physical ergonomics, and ergonomics theory. In its implementation, macro ergonomics presents a valuable niche that none of these areas has ignored. As a science, macro ergonomics directs to develop an understanding of work systems, behavior, or personnel that interact with hardware or software in an internal physical environment, external environment, and organizational structure and processes to make it better.

### **3. Result and Discussion**

#### *3.1. Stages of Ergonomic Approach Using Systems Engineering Initiative for Patient Safety (SEIPS)*

In macro ergonomics application there are several stages, namely:

##### **1. Stage of Information Collection**

Information collection needed for making questionnaires about the work system and information about who the respondents will be involved in conducting direct observation in the hospital and conducting interviews with 7 respondents from the hospital management and 83 nurse respondents.

##### **2. Stage of Objective Determination**

Determine the goals to be achieved in the study and the benefits will be obtained for the company. The goal to be achieved is to determine the factors affect the nurse mistakes and how to overcome them.

##### **3. Stage of Implementation**

Determine when the survey will be conducted, the procedure to be used and the survey data collection method used by conducting an open questionnaire distribution based on a Likert scale.

##### **4. Stage of Analysis and Interpretation**

Data processing is done with statistical software to process, analyze and draw conclusions from survey data, then connect with the objectives to be achieved.

##### **5. Stage of Result Deliver**

Making reports on the results of the research conducted.

##### **6. Stage of follow-up action is the final stage of a research to make the next activity plan / action, for example the making of a recommendation work system improvement or implementation of the results of the research conducted.**

#### *3.2. Approach of Work System Design*

Each work system contains several or all work components, each interacting with each other. Ergonomics as both science and technology is always concerned with interfaces and interactions between operators and work components, and concentrates on the influence of

interactions on work system performance. In a relationship table or interaction between operators and work components can be seen in Table 1.

**Table 2.** Components of Work System

Component	Design Area	Consideration
Hardware	Design and layout of components	Process, equipment, access
Operator	Physical Characteristics of Skills	Body characteristics, strength, work capacity, posture, fatigue, and endurance.
	Recipient of information and process	The five senses (vision, hearing, etc.), attention, memory, etc.
	Individual and social characteristics	Age, gender, cultural background, ethnicity, skills, training, motivation, job satisfaction, and interest, saturation, behavior, etc.
Organization	Personnel / production organization	Work-rest time, work rotation, rotating work, interest, satisfaction, responsibility, social interaction, and others.

From the table above it can be concluded that the factors that influence nurse fatigue are physical work environmental aspect, responsibilities and duties of workers aspect, equipment and technology used aspect, company organization aspect and personal nurses aspect.

#### 4. Conclusion

Macro ergonomics has been known as a sub-discipline of ergonomics related to human, organizational and technological relations. This research was conducted at one hospital in Medan City by using 83 respondents from the nurses and 7 respondents from the hospital to determine the factors that influence of nurse fatigue. Analysis of work systems to reduce nurse fatigue with the macro ergonomic approach of the Systems Engineering Initiative for Patient Safety (SEIPS) model in hospitals based on the results of observations and interviews of nurses and hospital management. The factors that influence the work system of nurses in hospitals are identified both physical work environmental aspect, responsibilities and duties of workers aspect, equipment and technology used aspect, company organization aspect and personal nurses aspect.

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