ORIGINAL ARTICLE

THE MEASUREMENT OF NURSES' MENTAL WORKLOAD USING NASA-TLX METHOD (A CASE STUDY)

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ABSTRACT

Nurse is a profession that has a quite high workload. It can be seen from how often they should encounter situations which compel them to undergo precisely right decision in saving patients' lives. Various environmental conditions increase the frustration rate of the nurses, such as noise of the crowds and medical equipment, as well as smell of medicines and wounds at once. Moreover, demands from the patients' family make it even tougher for them. Therefore, this study aims to measure the mental workload of the nurses at Intensive Care Unit (ICU) and emergency unit (IGD) in the Hospital ZA based on their years of service. The study was conducted using the method of NASA-TLX (National Aeronautics and Space Administration – Task Load Index). It measured the workload in six dimensions: Mental Demand (MD), Physical Demand (PD), Temporal Demand (TD), Own Performance (P), Effort (EF), and Frustration Rate (FR). The results of the study show that the average value of the nurses' workload at ICU and IGD is in the category very high (respectively 80 and 83) for the nurses with 0-3 years of service, and the most contributing factor for both the primary groups is the effort (EF).

***Keywords**: Mental workload, NASA-TLX, nurse, healthcare*

INTRODUCTION

In the efforts to manage healthcare services, hospital is one of the health organisations obliged to optimally provide healthcare to the patients. The performance of the organisation in providing services to the patients can be measured both medically and non-medically. Among the professions in hospital, nurse is one of the most crucial entities in providing healthcare. Besides, nurse also plays important role in hospital due to its mass in number.

Nurse is a profession that has a close relationship with persons, families, and societies. In order to fulfill their expectations, nurse needs to possess healing effect on patients. The high demands spotted on nurses trigger unnoticed mental workload on the process they accomplish their tasks. The mental workload highly influences the nurses' performances, and accordingly gives impact on patients' level of satisfaction. Among the daily mental workload faced by nurses are: making a right decision to save patients' lives, coming at helpless patients, dealing with patients and their families from varied background, confronting high demand and complaints from the families, and not to forget accomplishing every single task from their superiors such as doctors. Besides, environmental conditions such as noise of the crowds and medical equipment, as well as smell of medicines and wounds at once worsen the circumstances in which the nurse should be dealt with. This study will therefore specifically elaborate the mental workload circumstances on nurses in two significant hospital departments: emergency unit and intensive care unit.

Emergency Unit (IGD) is the first ward for the patients with major health problems or life-threatening conditions when they present at the hospital without prior notice. The nurses at IGD are the ones who should be prepared to work tenaciously under higher pressure than other units. The patients' arrival at IGD is extremely unpredictable with various conditions so that the nurses should be always on stand-by position.

Intensive Care Unit (ICU) is a unit in the hospital that is supported with medical staff and sophisticated technology to observe the patients, providing therapy, as well as treating the patients in acute and critical conditions. High workload is considered one of the major concerns in healthcare provider, including ICU[1]. Poor design of mental workload could lead to bad impacts such as fatigue, carelessness, out of focus, and boredom in performing a task. Thus, measuring workload levels is required in order to sort out the causes that can lead to unacceptable performances[2].

One of the methods used to analyse mental workload is National Aeronautics and Space

Administration Task Load Index or abbreviated as NASA TLX. This method uses a questionnaire developed from required subjective measurement that is easily applied. It can identify the fundamental sources of the mental workload. There are six workload dimensions addressed by NASA TLX: mental demand, physical demand, temporal demand, performance, effort, and frustration level[3]. Therefore, this study aims to measure the mental workload on nurses in ICU and IGD at Hospital ZA.

LITERATURE OVERVIEW

Healthcare Industry. Hospital as a healthcare provider holds a fundamental role in the industry. It is demanded to offer the best quality of service to treat and even save patients' lives. Due to that high expectation, it is supposed to possess service excellence not only in terms of employing the states of the art facilities but also the qualified workers who would serve the best to the patients as the primary clients of the business.

The employees in the hospital encompass a broad variety of occupations in different categories such as financial and management, service, office and administrations, as well as the health service itself[4]. Those multidisciplinary workers are grouped into diverse teams with specific task and workload. Working in a complex environment such as healthcare industry demands the employees to anticipate any unpredictable circumstances which might highly influence their performances in serving the patients.

Ergonomics and Mental Workload. Basic principles on ergonomics have addressed certain points related to human factors, including the design work systems and mental workload. The implementation of ergonomics standard is expected to support better performances by the human resources through optimal working circumstances[5]. A decent working condition covers both the clean environment and stable mental workload of the employees.

Mental workload is a fundamental aspect that is highly related to ergonomics and human factors. It is believed that there is no universal standard on how to precisely define what mental workload is[6]. However, the concept of mental workload has been specifically related to efficiency, contentment, comfort, and safety in the working environment[7]. Measuring mental workload is required in order to avoid and anticipate fatigue as the after-effect of the over-workload which can influence the performance. There are three different approaches in estimating mental workload: procedural, subjective, and physiological[8]. This study measured mental workload perceived by nurses with the subjective method using NASA-TLX.

NASA-TLX. NASA – Task Load Index is one of the most common methods with rating scale used to subjectively measure mental workload in healthcare sector[9]. NASA – TLX is a bipolar rating scale used to quickly yet subjectively measure mental workload based on six different dimensions: mental demand (MD), physical demand (PD), temporal demand (TD), own performance (P), effort (EF), and frustration (FR). The dimension with the highest score is the most significant factor that influences the mental workload[10]. Fig. 1 described the rating scale of each dimension started from very low to very high. Meanwhile, Table 1 shows the category of the average weighted workload (WWL) that indicates the intensity of the perceived mental workload.

Table 1: Weighted Workload (WWL) Category[11]

Score	Category
0 – 9	Very Low
10 – 29	Low
30 – 49	Medium
50 – 79	High
80 – 100	Very High

METHODOLOGY

Object of Research. The research was conducted in the Hospital ZA, Banda Aceh, Indonesia. Using proportional stratified random sampling, the samples on this study were 59 nurses at Intensive Care Unit (ICU) and Emergency Unit (IGD) based on their years of service. The duration of service was categorised into four groups: 0-3 years, 3-5 years, 5-10 years, and >10 years.

Research Variables. There were two main variables in this study: dependent and independent variables. Dependent variable was the mental workload of the nurses, and the independent ones were the six different dimensions from NASA-TLX method: mental demand, physical demand, temporal demand, performance, effort, and frustration rate.

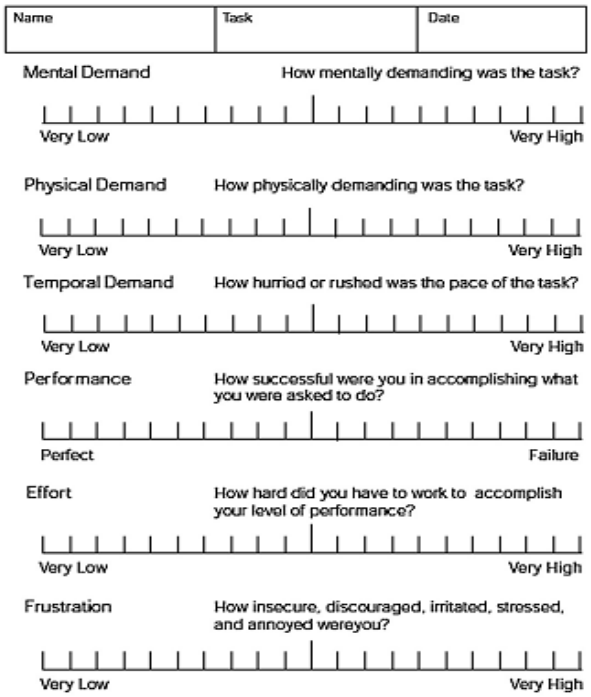

Figure 1: NASA-TLX Scale[11]

Research Data. This study used both primary and secondary data. The primary data was collected using NASA-TLX questionnaire in which the nurses rated their workload in the hospital. The secondary data was the supporting data about the nurses such as the number of nurses at ICU and IGD and their years of service in the hospital.

RESULTS

Scoring the Workload. The nurses as the respondents score each dimension of the perceived workload in their working place. The results responded by the nurses at ICU and IGD are tabulated in table 2 and 3 respectively.

Table 2: Average Workload Dimension by the Nurses at ICU

Years of Service	MD	PD	TD	P	EF	FR
0-3 years	193	270	257	213	273	0
3-5 years	180	236	238	196	210	84
5-10 years	201	209	226	216	246	40
>10 years	214	229	203	220	263	15

Table 3: Average Workload Dimension by the Nurses at IGD

Years of Service	MD	PD	TD	P	EF	FR
0-3 years	256	179	221	36	424	122
3-5 years	193	205	214	234	243	55
5-10 years	203	227	240	215	220	60
>10 years	220	192	200	202	157s	43

The tables indicate the highest rate of mental workload both at ICU and IGD is on the effort dimension, with the range from 243 to 424. In addition, Fig. 2 and 3 respectively shows the graphical views of the results in those tables. The figures clearly visualise the rate of each workload dimension perceived by the nurses at ICU and IGD.

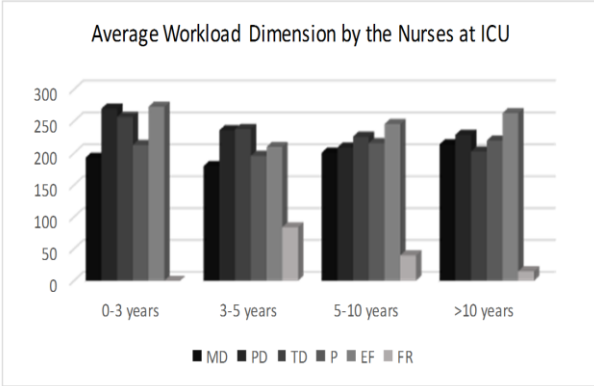

Figure 2: Average Workload Dimension by the Nurses at ICU

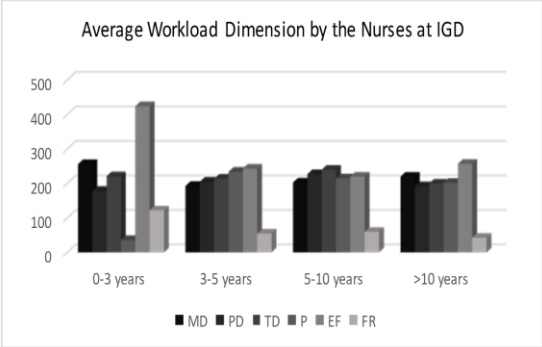

Figure 3: Average Workload Dimension by the Nurses at IGD

The Average Weighted Workload (WWL). The overall result is revealed in table 4 and visualized in Fig. 4 on average weighted workload perceived by both the nurses at ICU and IGD.

***Table 4**: Average WWL on the Nurses at ICU and IGD*

Years of Service	ICU	IGD	Category
0-3 years	80	83	Very High
3-5 years	76	76	High
5-10 years	76	78	High
>10 years	76	74	High

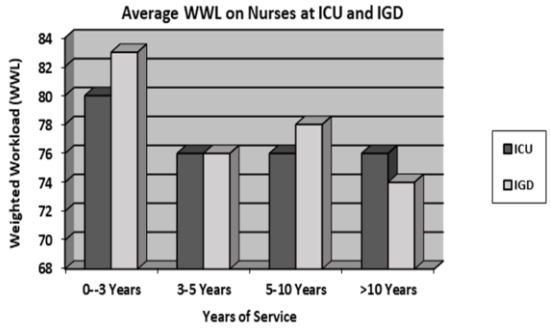

Figure 4: Average Weighted Workload (WWL) on the Nurses at ICU and IGD

The number in average of WWL reveals the category in which the rate of mental workload at ICU and IGD is grouped. It can clearly be seen that the highest rank of mental workload was faced by new nurses, similarly both at ICU and IGD.

DISCUSSION

The result in Fig. 2 reveals that the ICU nurses from 3 out of 4 years of service group has similar decision that the most dominant factor influencing their mental workload is the effort (EF) with the average over 230. It was in correlation with the condition that they were required to work intensely hard in order to monitor and provide intensive treatment to the patients, as well as accomplish each assigned task. Surprisingly, the frustration rate is very low in 0-3 years of service group. Perhaps other workload dimension they perceived leave no space for overthinking their working conditions. However, it is quite normal for the employees with the experience over ten years to have low frustration rate since they have adapted well with various pressuring circumstances in their unit and are able to hand over some of their tasks to their junior staffs.

Meanwhile, the nurses with the experience 3 – 5 years considered temporal demand (TD) as the most contributing factor on their fatigue circumstances. They perceived that they were in rush to save patients' lives in the unit. Another point of view shows that the physical demand (PD) perceived by the nurses with 0-3 years of service is higher than any other groups. It is relevant with the fact that the new employees might have a tendency to be treated as assistants assigned extra tasks and duties which are supposed to be carried out by their seniors.

Mostly similar to the ICU, Fig. 3 informs that the nurses at IGD also perceived the effort dimension highly influences their mental workload. Moreover, the nurses with 0-3 years of service considered effort as the dominant workload dimension with the average more than 400. It indicates that the new employees in the emergency department are required to commit extra effort in dealing with patients who need first aid or even with the unexpected critical patients. In addition, the new nurses still need to adjust themselves to various requests from the patients' family and most importantly to the new demanding working place.

In correlation with two previous results on workload dimension, the average WWL also exposes that the category 0-3 years of service suffers more intensive workload than the other groups. The scores are 80 and 83 respectively for ICU and IGD, which means that the workload is in the category very high[11] and needs further favourable adjustment especially from the decision makers to accommodate their complaints and troubles. The changes are required so that their performance mainly in serving the patients can be improved as well[5].

The other three groups are having the workload in the category high[11], with the lowest one is on the nurses in group >10 years of service. It is quite logical for as the time passing by, they have been well adjusted to the working environments and daily tasks in the unit. Moreover, the scope of duties assigned is also in the different level to their juniors in the category less than ten years of service.

CONCLUSION

This study in healthcare industry was conducted in order to identify the intensity of mental workload perceived by nurses in intensive care unit (ICU) and emergency unit (IGD) using NASA-TLX method. The samples were grouped based on their years of service. The findings reveal that the most dominant factor on mental workload for nurses both in ICU and IGD is effort (EF), while the least contributing one on nurses' fatigue circumstances is frustration rate (FR). Furthermore, the average weighted workload on the nurses at ICU and IGD with 0-3 years of service is in the category very high with the score respectively is 80 and 83. Meanwhile, the average WWL on the other three groups both at ICU and IGD is in the category high with the range 74 – 78. As a conclusion, the nurses in their first years of service tend to perceive higher intensity on mental workload.

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