

## MEDIATION EFFECT OF FATIGUE WORKLOAD CONSEQUENTIAL HOSPITAL NURSES PERFORMANCE

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### ABSTRACT

Nurses' activity tends to perform repetitive it is susceptible to fatigue occurrence. This study aims to determine the workload effect, body mass index, work duration of fatigue and its impact on nurse's performance. Quantitative research with cross sectional method. The research sample used proportional stratified random sampling method with 123 respondents to see the workload effect, Body Mass Index (BMI) and work duration to fatigue and its impact on nurse's performance. Data were analyzed by path analysis. The results showed that the variable workload does not affect to fatigue ( $p = 0.834$ ), variable workload affects the performance ( $p = 0.010$ ), the variable BMI does not affect to fatigue ( $p = 0.595$ ), the variable BMI does not affect the performance ( $p = 0.312$ ), work duration variable effects to fatigue ( $p = 0.012$ ), work duration variable does not affect the performance ( $p = 0.34$ ), the fatigue variable does not affect the performance ( $p = 0.634$ ). The results of path analysis showed the workload effect on fatigue and its impact on the hospitalization nurse's performance amount 0,001 the effect of body mass index to fatigue and its impact on the hospitalization nurse's performance amount 0,002 work duration influences on fatigue and its impact on the hospitalization nurse's performance amount 0.009. The conclusion is the fatigue variable not intervening variable or mediating influence on the performance of nurse's workload.

**Keywords:** Workload, BMI, Fatigue, Nurse Performance.

### INTRODUCTION

Nurses' often experience various patient complaints, complex work, and demands for tasks to be achieved, repetitive activities, and relationships with coworkers. This vulnerable condition makes nurses easily experience work fatigue. Nurses are vital human resources in hospital services that help medical doctors in carrying out tasks, assist in emergency matters, provide nursing services for sick, injured, physical and mental disabilities, consistently provide safe patient care, monitor patient safety, and prevent and report on patient hazards and other health service needs (ILO, 2019; Drake & Steege, 2016).

The Indonesian National Nurses Association (PPNI) stated that the number of nurses in Indonesia in April 2017 was 359,339 nurses, consisting of 29% (103,013 people) male nurses and 71% (256,326 people) female nurses (Ministry of Health, 2017). Regulation of the Minister of Health of Republic of Indonesia Number 56 of 2014 states that the ratio of nurses in hospitals should ideally be the same as the number of beds. The ratio of nurses in hospitals in handling patients is a minimum of 1: 1 and a maximum of 1: 2 (Ahmad, 2015). Staffing data at the RSUD Dr. M. Haulussy the number of nurses in the inpatient room numbered 189 nurses and is divided

into 3 shifts, with working hours of each shift namely the morning shift starting at 08.00-14.00, the afternoon shift starts from 2:00 to 20:00 and the night shift starts from 8:00 a.m. to 8:00 p.m.

Different nurse workloads even though they are in the inpatient room. Neurology, surgical, and internal inpatient rooms lack nurses, the average nurse at Dr. M. Haulussy handles 3-5 patients. On the day and night shift there are only 3 (three) nurses on duty, sometimes there are serious patients who need observation or intensive care so that the nurse is overwhelmed, plus the nurse must face all complaints from the patient's family. If the patient in the treatment room is full, then one team of two to three nurses (day and night shifts) can handle 10-26 patients, especially in neurological halls that really need patience in treating patients such as stroke patients. Nurses tend to do repetitive activities and are prone to work fatigue, plus a higher workload of nurses because of the ratio of nurses' needs to the number of patients (number of beds) that cannot be fulfilled.

The high workload and complexity of the work of nurses will be increasingly heavy borne by nurses and can cause a feeling of complaints of pain, fatigue, and emotions of nurses who are not as expected. PPNI revealed that as many as 50.9% of Indonesian nurses who work often experience dizziness, fatigue, lack of friendliness, lack of rest due to too high workloads and inadequate income (Pongoh, 2015). Workload, fatigue has an influence on the performance of nurses, so that it can increase work stress which ultimately will lead to patient safety (Aini, 2014). Fatigue is related to nurse performance due to the high demands of work, which is often experienced by individuals in situations where they must serve the needs of many people (Kurniawati & Solikhah, 2012). Personal factors such as gender, anthropometry or body mass index, work duration or length of work are also risk factors for fatigue (Kang, 2016; Ribeiro et al., 2017).

Fatigue is the body's defense mechanism to prevent damage and can recover after a break. Fatigue has different conditions for each individual, depending on the decrease in efficiency, work capacity, and endurance. This condition is most vulnerable to someone with a high workload activity (Tarwaka, 2014). Work exhaustion is characterized by feeling tired, feeling reluctant or lazy, weakening activity and imbalance in body condition, if it happens continuously to nurses every day it will result in chronic fatigue (Suma'mur, 2009). Chronic fatigue syndrome can cause absenteeism, which is an increase in short-term absenteeism due to the need for more rest or an increased rate of illness. Exhaustion of work has an impact on decreasing nurse performance so that many complaints of patient dissatisfaction with the services provided by the hospital. According to the ILO, every year two million workers die from workplace accidents by fatigue. Study at the hospital by the American Nurses Association (ANA), Institute of Medicine for 745 nurses found 65% of nurses experienced acute fatigue and 50% experienced chronic fatigue.

Chronic fatigue syndrome can cause absenteeism, which is an increase in short-term absenteeism due to the need for more rest or an increased rate of illness. Exhaustion of work has an impact on decreasing nurse performance so that many complaints of patient dissatisfaction with the services provided by the hospital. According to the ILO, every year two million workers die from workplace accidents by fatigue. Study at the hospital by the American Nurses Association (ANA), Institute of Medicine for 745 nurses found 65% of nurses experienced acute fatigue and 50% experienced chronic fatigue. These fatigue causes adverse events in patients, including falls, medication errors, and deaths and the consequences of individual nurses, such as decreasing the quality of decision making, increasing work injuries,

decreased performance, poor health, and job dissatisfaction (Steege & Dykstra, 2016). This study aims to determine the mediating effect of work fatigue on the effect of workload, body mass index, duration of work the impact on the performance of nurses in Dr.M.Haulussy Hospital Ambon.

## METHODOLOGY

The study was conducted at the Regional General Hospital (RSUD) Dr. M. Haulussy Ambon which is a type B state hospital that also provides services and accommodates referral services from district / city hospitals (type C). The number of nurses in this hospital exceeds the number of ratios determined by Republic of Indonesia Minister of Health Regulation No. 56 of 2014, namely the ratio of nurses in hospitals in handling patients is a minimum of 1: 1 and a maximum of 1: 2. The average nurse handles 3-5 patients, on the day and night shift there are only 3 nurses working. This research was conducted for 1 month from March to April 2019. This study was a quantitative observational study with cross-sectional study, which measures the influence of workload, BMI, work duration, and fatigue on nurses' performance in the span of time. the same without giving treatment or intervention.

Sampling used proportional stratified random sampling method to determine the sample of 13 inpatient rooms so that 123 respondents from 178 nurses used the slovin formula for calculating the sample size working on 3 shifts with working hours of each shift namely the morning shift starting at 08.00 -14.00, the afternoon shift starts at 14.00-20.00 and the night shift starts at 8:00 a.m. to 8:00 a.m. Data collected was assisted by several enumerators who had been trained to fill out questionnaires, conduct interviews, and measure height, weight, and calculate the body mass index of nurses, while measuring fatigue using a reaction timer assisted by Ambon K3 large hall. Fatigue was measured using a reaction timer, BMI was measured using weight scales to measure body weight, while height was measured using microtoise, workload was measured using the NASA-TLX method (National Aeronautics and Space Administration Task Load Index), namely weighting and giving procedures multidimensional score (mental demands, physical demands, temporal demands, own performance, effort, and frustration).

The data in this study were analyzed using SPSS 24. Variable work duration, workload, Body Mass Index (BMI), fatigue, and performance were described to see frequency, and average values, to see the simultaneous effect of workload, Body Mass Index (BMI), work duration, and fatigue on nurse performance were used multiple linear regression.

## RESULTS AND DISCUSSION

Table 1. Distribution of Respondents by Workspace at Dr. M. Haulussy Ambon in 2019

<i>Work duration</i>	<i>Respondents</i>	
	<i>N</i>	<i>%</i>
<i>ICU</i>	7	5,7
<i>ICCU</i>	7	5,7
<i>Pavilion</i>	12	9,8
<i>Women's Surgery</i>	10	8,1
<i>ENT</i>	5	4,1
<i>Gender Skin</i>	3	2,4
<i>Cendrawasih</i>	10	8,1
<i>Childhood</i>	11	8,9
<i>Intern Woman</i>	13	10,6
<i>Lungs</i>	10	8,1
<i>Internal Man</i>	14	11,4
<i>Male Surgery</i>	10	8,1
<i>Neurology</i>	11	8,9
<i>Total</i>	123	100

Source: Primary Data, 2019

Table 1. shows the characteristics of nurses who were sampled in this study, the nurses who came mostly from male internal spaces were as many as 14 (11.4%) nurses and the least came from the genital skin room by 3 (2.4%) nurse person.

Table 2. Relationship between Workload, BMI, work duration, Fatigue with Performance at Dr. RSUD M. Haulussy Ambon in 2019

<i>Independent variables</i>	<i>Performance</i>				<i>Total</i>	
	<i>Less</i>		<i>Good</i>			
	<i>N</i>	<i>%</i>	<i>n</i>	<i>%</i>	<i>n</i>	<i>%</i>
<i>Workload</i>						
<i>Weight</i>	30	50,8	29	49,2	59	100
<i>Light</i>	12	21,9	52	42,1	64	100
<i>BMI</i>						
<i>Abnormal</i>	15	35,7	27	64,3	42	100
<i>Normal</i>	27	33,3	54	66,7	81	100
<i>Work duration</i>						
<i>Not eligible</i>	35	33,7	69	66,3	104	100
<i>Qualify</i>	7	35,8	12	63,2	19	100
<i>Fatigue</i>						
<i>Tired</i>	40	33,9	78	66,1	118	100
<i>Not tired</i>	2	40,0	3	60,0	5	100
<i>Total</i>	42	34,1	81	65,9	123	100

Source: Primary Data, 2019

Table 2. shows the distribution of nurses according to workload, nurses who experience a heavy workload of 59 (48%) nurses, and a light workload of 64 (52%) nurses. Nurse distribution according to BMI, showed nurses who had abnormal BMI as many as 42 (34.1%) nurses, and normal BMI as many as 81 (65.9%) nurses. Distribution of nurses according to work duration,

nurses who did not meet the requirements were 104 (84.6%) nurses and those who met the requirements were 19 (15.4%) nurses. Distribution of nurses according to fatigue, showed nurses who had fatigue with fatigue category as many as 118 (95.9%) nurses, and as many as 5 (4.1%) nurses were not tired. Distribution of nurses according to performance, shows respondents who have poor performance as many as 42 (34.1%) nurses, and good performance as many as 81 (65.9%) nurses.

Figure 1. Research conceptual framework

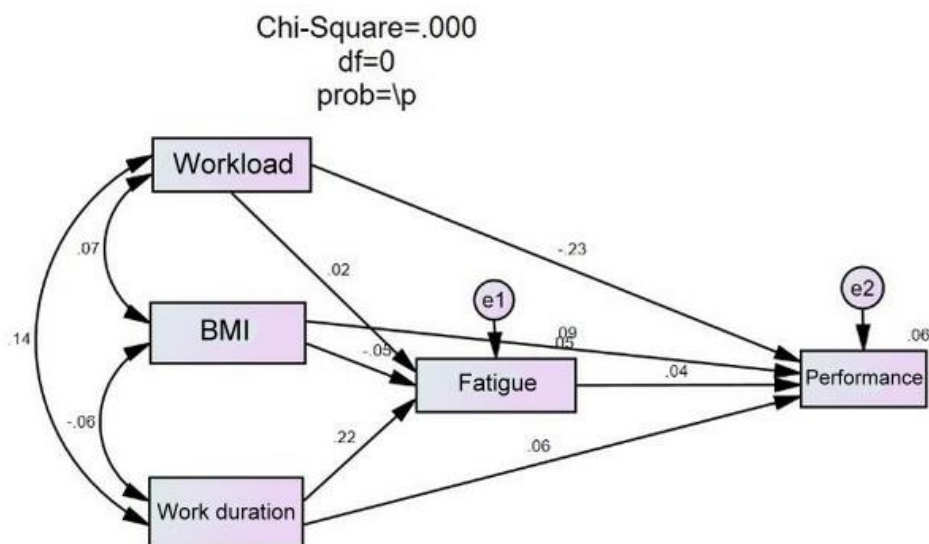


Table 3. Effect of Path Analysis Coefficients and Relation to the Direct and Indirect Effect Research Hypotheses

Research variable	Direct Effect			Indirect Effect
	Estimate	Nilai p	Conclusion	Estimate
Workload → fatigue	0,019	0,834	Not significant	0,019
BMI → fatigue	-0,047	0,595	Not significant	-0,047
Work duration → Fatigue	0,223	0,012	Significant	0,223
Workload → Performance	-0,028	0,010	Significant	-0,028
Work duration → Performance	0,061	0,501	Not significant	0,061
Fatigue → Performance	0,043	0,634	Not significant	0,043
BMI → Performance	0,089	0,312	Not significant	0,089

Source: Primary Data, 2019

The results showed that workload variables had no effect on fatigue ( $p = 0.834$ ), workload variables had an effect on performance ( $p = 0.010$ ), BMI variables had no effect on fatigue ( $p = 0.595$ ), BMI variables did not affect performance ( $p = 0.312$ ), variable work duration has an effect on fatigue ( $p = 0.012$ ), duration of work variable is not affected by performance ( $p = 0.34$ ), fatigue variable has no effect on performance ( $p = 0.634$ ). The results of the path analysis showed the effect of workload on fatigue and the impact on the performance of inpatient nurses was 0.001, the effect of the body mass index on fatigue and its impact on the performance of inpatient nurses was 0.002, the effect of Work duration on fatigue and its impact on nurses' inpatient performance amounting to 0.009.

Workload has no effect on fatigue due to the number of nurses who have a light workload experiencing fatigue, half the number of nurses who are respondents. Fatigue is characterized by a tired sensation, decreased motivation, morale, and even doing repetitive work so that it appears bored. Fatigue can occur at home or other activities outside of housework and workload outside of other nursing duties.

The fatigue experienced by respondents is fatigue caused by the characteristics of the nurse itself, for example gender factors where women feel fatigued faster than men. This agrees with Madadzadeh et al., (2018), which states that women have more fatigue than men, which can be caused by physiological and mental differences between women and men, as well as the social status and dual duties of housewives and employee for women. Monitoring carried out during conducting research shows that the existence of breeding carried out by the nursing field is routinely carried out every day before the nurse performs his duties.

This long duration of 1-2 hours is the complaint of nurses feeling tired before work, but this does not become an obstacle in improving the performance of nurses in serving patients, the arrangement of work with a team sharing system that applies to each inpatient room is one strategy in the division of workload, where the team is divided into 2 namely team 1 and team 2, for example in one team there are nurses who do not enter then the work can be done by friends in one team. This is in line with Steege & Dykstra (2016), stating that teamwork is one way to prevent and overcome Nurse fatigue, where teamwork can help nurse interpersonal problems.

The Body Mass Index (BMI) is a simple tool or way to monitor the nutritional status of adults, especially those related to underweight and overweight. To monitor the body mass index of an adult, a weight scale and height gauge are used. The use of BMI is only for adults aged > 18 years (Oesman & Simanjuntak, 2011). The results of measurements and calculations related to body mass index on respondents showed the largest percentage with a normal BMI more than respondents with abnormal BMI, so that the body mass index does not affect the variables of work fatigue.

Nurses who experience fatigue are experienced by nurses with normal nutrition categories. This is influenced by individual characteristic factors that can cause fatigue, such as respondents with normal BMI but who are over 40 years old or with a long working period (> 5 years). In addition, respondents had experienced fatigue before they worked that day so there was no relationship between nutritional status and work fatigue. This result is in line with the research conducted by Ningsih (2018), but different from the research conducted by Mahardika et al. (2017), that there is a relationship between nutritional status (BMI) and work fatigue in tube filling workers at the LPG Depot at PT Pertamina (Persero) Kota Makassar.

The duration of work in this study is the work time performed by nurses every working day. Duration of work can affect workers both positively and negatively. The positive influence is that if the work period meets the predetermined requirements, namely 6-8 hours / day, the work or condition of the worker can be maintained. Conversely, negative effects can arise if the length of work does not meet the requirements of more than 8 hours / day or 40 hours / week, it will affect the condition of workers who will feel fatigue. The results showed that respondents who had longer working hours did not meet the requirements more than respondents who had long working hours fulfilled the requirements, so that the duration of work had an influence on fatigue. This shows that the higher the duration of work, the more fatigue increases.



The results of the study conducted by Faizin (2008), showed that there was a relationship between the Work duration of nurses to the performance of nurses at the Pandan Arang General Hospital in Boyolali Regency and in line with Frely et al., (2017), research that there is a relationship between the Work duration of the driver and work fatigue. Nurses almost every day extend the duration of work for about 1-3 hours. Even nurses often complain of feeling tired. This happens because there is a Circardium rhythm (natural state of the body) that is disturbed such as sleep, readiness to work, which should rest because work that requires work, the process in the body is forced to work, this will increase lactic acid in the body and cause fatigue work. Therefore it is necessary to have good time management so that nurses can rest to restore health.

The percentage of nurses who reported fatigue and intention to leave work increased gradually with increasing shift length. Nurses feel dissatisfied with work because they work long hours, 8-9 hours and 12-13 hours. Ineffective staffing and scheduling processes are a concern among nurses and have the potential to have an impact on increasing levels of fatigue (Dempsey & Reilly, 2016).

Decree of the Minister of Administrative Reform Number: KEP / 75 / M.PAN / 7/2004, Workload is a number of work targets or target results that must be achieved in a certain time unit. Workload standards according to Kepmenkes RI Number 81 / MENKES / SK / I / 2004 concerning guidelines for Health Human Resource planning at the Provincial, Regency or City level and Hospitals are the number of units of time (or numbers) needed to complete health service activities by health personnel in accordance with the standards of their profession. The results of the study were 123 respondents in Dr.M Hospital. Haulussy Ambon shows that half of the respondents have a light workload, so the results of the statistical analysis show that there is an effect of workload on performance. This is influenced by external factors, such as a comfortable physical environment, good relationships between nurses, demands from hospitals that require hospital nurses to always provide quality nursing care services, and supervision from the head of the room makes nurses continue to improve the quality of nursing services.

In addition, the most important is the influence of internal factors or the condition of the nurse itself, which means high ability and hard work from the nurse in carrying out his responsibilities. This research is in line with the research conducted by Manuho et al. (2015), at RSUP Prof. Dr. R. D. Kandou Manado shows that there is a relationship between workload and nurse performance in providing nursing care. Observations show that nurses in the inpatient room have a minimum workload, meaning that patients can do their own personal hygiene, bathe and change clothes, eat and drink. Nevertheless, the patient is monitored when doing ambulation or movement. Fluctuations in nurse workload occur at certain times, so sometimes the burden is very light and other times the load can be high.

The body mass index has no effect on performance. The results of this study are not in accordance with the theory that nutritional status has a positive correlation with human physical quality. The better a person's nutritional status, the better his physical quality will be. Resilience and the ability of the body to do work with adequate performance will be more owned by individuals with good nutritional status. In order to be able to carry out their work, a workforce does not only provide healthy and nutritious food with sufficient caloric value according to the type of work, but also requires good physical fitness. Although physically the workforce is healthy, with adequate nutritional intake, but if it is not fresh and fit, the workforce will become tired quickly in carrying out their work (Montano, et al., 2014).

The results showed that there was no effect of body mass index on performance. This is because nurses with normal or abnormal BMI remain a demand from the hospital that requires hospital nurses to always provide quality nursing care services to patients and the most important is the influence of internal factors or the condition of the nurses themselves, their commitment to the nursing profession itself, the ability and hard work of nurses in carrying out their responsibilities. This statement agrees with Hayes, et al., (2010), which states that nurse support is one of the most important factors that improve working conditions and improve the quality of care.

The work duration a person usually counts for a day for 6-8 hours or 40-50 hours a week. Remaining time in one day (14-16 hours) is used for social life, rest and others. Every individual has a time limit at work. This time limit is expected to maintain efficiency, effectiveness and performance optimally in order to complete the work well (Suma'mur, 2009). The results showed that respondents with a work duration  $\geq 8$  hours (did not meet the requirements) more and most had good performance compared to respondents with long working hours to meet the requirements, so there was no influence on the work duration on performance. Observations in the field show that sometimes nurses work more than hours / day. This is due to the high ability and hard work of the nurses in carrying out their responsibilities so that the nurses try to complete their tasks within the allotted time. This is confirmed by Hayes et al., (2010), which states that nurse support is one of the most important factors that improve working conditions, reduce emotional fatigue and motivate nurses to improve the quality of care.

The results showed that there were more nurses who experienced fatigue with better performance. This result was in line with Majore (2018), showing that of 9 respondents who were tired and had good performance there were 6 nurses (13.6%), while respondents with tired work fatigue and having poor performance totaling 3 nurses (6.8%)., so that there was no effect of fatigue on performance. This result is also in line with Macdonald & Stephenson's research (2006) stating that increasing fatigue does not always result in deteriorating performance. Nurses who experience fatigue with more good performance. This is influenced by individual characteristic factors that can cause fatigue, such as the age factor where the respondent is more than 40 years old or with a long working period ( $> 5$  years). Nurses tend to carry out walking and standing activities to control patients one by one so that complaints of fatigue but not reduce the services provided to patients. This shows that even though tired, the nurse still shows a sense of responsibility towards the task that has been given by showing quality nursing services for patients and the role of the head of the room as a direct supervisor in monitoring the performance of his staff.

The involvement of nurses with hospitals and professions or nursing organizations reduces fatigue and increases teamwork. The impact of the work results is seen from various things, namely clinically fewer hospital-acquired dissatisfaction conditions, operational quality of staff and efficiency, culturally positive work, environment and empowerment, and behavioral ability to connect with patients and colleagues (Dempsey & Reilly, 2016).

The results showed that around half a percent of the performance of nursing staff was presented at a good level. This may be due to the ongoing training and education program, adequate supervision and support from their head nurses. In line with this study, Al-Makhaita et al., (2014) who conducted research on nurses working in hospital care centers in East Saudi Arabia reported that almost half of the staff performance of the nurses studied were at a good level.



## CONCLUSION

Workload influences the performance of nurses, while BMI, work duration, and fatigue have no effect on nurse performance. Workload, BMI has no effect on fatigue, while the duration of work has an influence on fatigue. Fatigue does not have a mediating effect on workload that has consequential on nurse performance. Workload has an influence on nurses' performance due to physical environment, relationships between nurses, demands, abilities and hard work of nurses in carrying out their responsibilities that still need to be addressed by means of hospitals conducting nutritional surveys on nurses (body mass index assessment) and measurement of fatigue periodically, work time management so that nurses can take advantage of their work time does not exceed the provisions, and nurses are expected to often stretch a few minutes between work hours.

## REFERENCES

- Ahmed, M. F., Sleem, W. F., & Kassem, A. H. (2015). Effect of working Condition and Fatigue on Performance of Staff Nurses at Mansoura University Hospital. *Journal of Nursing and Health Science*, 4(3), 83-91.
- Aini, Q. (2014). The Influence of Workload and Work Stress to Patient Safety Attitude on Nurses. *Journal of Biology, Agriculture and Healthcare Vol*, 4, 93-102.
- Al-Makhaita, H. M., Sabra, A. A., & Hafez, A. S. (2014). Job performance among nurses working in two different health care levels, Eastern Saudi Arabia: a comparative study. *International Journal of Medical Science and Public Health*, 3(7), 832-837.
- Dempsey, C., & Reilly, B. (2016). Nurse engagement: What are the contributing factors for success. *OJIN: The Online Journal of Issues in Nursing*, 21(1).
- Drake, D. A., & Steege, L. M. B. (2016). Interpretation of hospital nurse fatigue using latent profile analysis. *Advances in Nursing Science*, 39(3), E1-E16.
- Faizin, A. (2008). Hubungan Tingkat Pendidikan dan Lama Kerja Perawat dengan Kinerja Perawat di RSUD Pandan Arang Kabupaten Boyolali. *Berita Ilmu Keperawatan*, 1(3), 137-142.
- Frely, A. N., Kawatu, P. A., & Maddusa, S. S. (2017). Hubungan Antara Umur Masa Kerja Dan Lama Kerja Dengan Kelelahan Kerja Pada Pengemudi Truk Tangki Di Terminal Bahan Bakar Minyak (Bbm) Pt Pertamina Bitung. *Media Kesehatan*, 9(3).
- Hayes, B., Bonner, A. N. N., & Pryor, J. (2010). Factors contributing to nurse job satisfaction in the acute hospital setting: a review of recent literature. *Journal of nursing management*, 18(7), 804-814.
- International Labour Organization. (2019). *International Hazard Datasheets on Occupation (HDO)*. Diakses 11 Februari 2019, Retrieved from <https://www.ilo.org>
- Kang, S. W. (2017). The use of body mechanics principle, clinical-practice fatigue, and practice satisfaction of nursing students. *NursingPlus Open*, 3, 6-10.
- Kurniawati, D., & Solikhah, S. (2012). Hubungan kelelahan kerja dengan kinerja perawat di bangsal rawat inap rumah sakit Islam Fatimah kabupaten Cilacap. *Kes Mas: Jurnal Fakultas Kesehatan Masyarakat Universitas Ahmad Daulan*, 6(2).
- Macdonald, W. A., & Stephenson, D. G. (2006). Effect of ADP on slow-twitch muscle fibres of the rat: implications for muscle fatigue. *The Journal of physiology*, 573(1), 187-198.
- Madadzadeh, M., Barati, H., & AhmadiAsour, A. (2018). The association between workload and job stress among nurses in Vasei hospital, Sabzevar city, Iran, in 2016. *Journal of Occupational Health and Epidemiology*, 7(2), 83-89.

- Mahardika, P. (2017). *Faktor Yang Berhubungan Dengan Kelelahan Kerja Pada Pekerja Pengisian Tabung Depot LPG PT. Pertamina (Persero) MOR VII Makassar Tahun 2017*. Thesis: Hasanuddin University
- Majore, C. E., Kalalo, F., & Bidjuni, H. (2018). Hubungan kelelahan kerja dengan kinerja perawat di instalasi rawat inap RSUD Pancaran Kasih GMIM Manado. *Jurnal Keperawatan*, 6(1).
- Manuho, E., Warouw, H., & Hamel, R. (2015). Hubungan Beban Kerja Dengan Kinerja Perawat Dalam Pemberian Asuhan Keperawatan Di Instalasi Rawat Inap C1 Rsup Prof. Dr. RD Kandou Manado. *Jurnal Keperawatan*, 3(2).
- Ministry of Health. (2017). *Situation of Nursing Workers in Indonesia*. Center for Data and Information of the Ministry of Health of the Republic of Indonesia. Accessed 11 February 2019, Retrieved from [www.pusdatin.kemkes.go.id](http://www.pusdatin.kemkes.go.id)
- Montano, D., Hoven, H., & Siegrist, J. (2014). Effects of organisational-level interventions at work on employees' health: a systematic review. *BMC public health*, 14(1), 135.
- Ningsih, S. N. P. (2018). Factors Relating To Work Fatigue In Locomotive Dipo Workers PT. Kereta Api Indonesia (Persero). *Journal of Industrial Hygiene and Occupational Health*, 3(1), 69-82.
- Oesman, T. I., & Simanjuntak, R. A. (2011). Hubungan Faktor Internal dan Eksternal Terhadap Kelelahan Kerja Melalui Subjective Self Rating Test. In *Proceeding 11th National Conference of Indonesian Ergonomics Society* (pp. 168-276).
- Pongoh, V. V., Warouw, H., & Hamel, R. (2015). Perbedaan Stres Kerja Antar Shift Perawat Di Ruang Gawat Darurat Medik Rsup Prof Dr. RD Kandou Manado. *Jurnal Keperawatan*, 3(2).
- Ribeiro, T., Serranheira, F., & Loureiro, H. (2017). Work related musculoskeletal disorders in primary health care nurses. *Applied Nursing Research*, 33, 72-77.
- Steege, L. M., & Dykstra, J. G. (2016). A macroergonomic perspective on fatigue and coping in the hospital nurse work system. *Applied ergonomics*, 54, 19-26.
- Suma'mur, P. K. (2009). Higiene perusahaan dan kesehatan kerja (HIPERKES). *Jakarta: Sagung Seto*, 116-32.
- Tarwaka. 2014. *Ergonomi industri Dasar-Dasar Pengetahuan Ergonomi dan Aplikasi Di Tempat Kerja*. Surakarta: Harapan Press.