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Analysis of Ergonomic Risk Factors Related to Low Back Pain and Tension Neck Syndrome Complaints in Nurses at Maria Walanda Maramis Regional General Hospital, North Minahasa Regency

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ABSTRACT

Ergonomic issues have a significant impact on health services, especially on nursing services. Various types of nursing work are done manually. Ergonomic risk factors include physical conditions (work posture, physical workload), psychosocial and individual (age, gender and Body Mass Index) (NIOSH, 2024). The purpose of this study was to analyze ergonomic risk factors for complaints of Low Back Pain and Tension Neck Syndrome in nurses at Maria Walanda Maramis Hospital, North Minahasa Regency.

This study is a quantitative study with an observational research type, namely analytical using a cross-sectional study design (a cross-sectional study conducted at the Maria Walanda Maramis Regional General Hospital, North Minahasa Regency. Data analysis was carried out using univariate which explains the frequency distribution of research variables, bivariate analysis using the Spearman Rank and Chi-Square tests and multivariate analysis using the Multiple Logistic Regression test.

The results of this study indicate that 130 nurses became respondents, where the average age of respondents was 31 years and most of them were female (75.4%). Low Back Pain complaints at low and moderate risk levels were experienced by 65 respondents (50%) each, and Tension Neck Syndrome complaints at low risk levels were 60 respondents (46.2%) and high risk levels were 70 respondents (53.8%). There is a relationship between Low Back Pain and gender (p=0.015), Body Mass Index (p<0.001), work posture (p<0.001), workload (p=0.015), and psychosocial (p<0.001) and there is no relationship between age and Low Back Pain (p=0.391). There is a relationship between Tension Neck Syndrome with, gender (p=0.018), Body Mass Index (p<0.001), work posture (p<0.001), workload (p=0.032), psychosocial (p<0.001) and there is no relationship between age and Tension Neck Syndrome (p=0.455). The results of the multivariate analysis showed that there was a relationship between Low Back Pain with Body Mass Index (p=0.002), work posture (p<0.001), workload (p= 0.180), psychosocial (p= 0.001) where work posture is the most dominant among all variables with an Exp(B) value of 13.912, meaning respondents with poor work posture are 13.9 times more at risk of experiencing Low Back Pain. And there is a relationship between Tension Neck Syndrome with Body Mass Index (p = 0.007) and psychosocial (p = 0.000) where the psychosocial variable is the most dominant variable with an Exp (B) value of 6.267 which means that respondents with poor psychosocial are 6.2 times more at risk of experiencing Tension Neck Syndrome.

The conclusion of this study is that age, gender, Body Mass Index, work posture, workload and psychosocial are important factors that have a relationship with complaints of Low Back Pain and Tension Neck Syndrome. Especially the dominant factor that affects Low Back Pain is work posture and the dominant variable that affects Tension Neck Syndrome is psychosocial.

Introduction

Ergonomics issues have a significant impact on health services, especially nursing services. Various types of work are done by nurses manually, causing various complaints of health problems such as musculoskeletal disorders. Complaints of musculoskeletal disorders reached 99,550 (16.6%) in 2021-2022 with the number of health workers with MSDs being 36,680 cases (16.4%) (National Safety Council of BLS Data, 2022). As many as 17% suffer from musculoskeletal disorders in the upper limbs or neck and 41% (195,000 cases) have low back pain (Labour Force Statistics, 2023).

The World Health Organization (WHO) (2022) reports that about 1.71 billion people worldwide have musculoskeletal disorders, including low back pain with 570 million cases and neck pain with 222 million cases. Low Back Pain is the most common musculoskeletal disorder among nurses, with a prevalence ranging from 33-90.1%, followed by neck pain with a prevalence of 12-52%. In the Southeast Asia region, there are 369 million complaints of Low Back Pain. According to Global Burden Disease (2021), there were 1,720,000 complaints of neck pain and stiffness in Southeast Asia in 2020.

The prevalence of low back pain disease in Indonesia that has been diagnosed by health workers is 11.9%. Based on diagnosis or symptoms, which is 24.7%, and subjective complaints of low back pain were obtained in 83.3% of workers. The prevalence of nurses in Indonesia with Low Back Pain according to Ecological Models in the study of Astuti et al (2022) is 57%. The prevalence of Tension Neck Syndrome globally was around 27.0 per 1000 population in 2019. In 2020, complaints of pain and stiffness in the neck to shoulders affected 203 million people. This prevalence rate standardized by age globally is estimated at 2450 (1960-3040) per 100,000 population (Global Health Data, 2021).

Nurses are the most health workers and have been in the hospital for the longest time so they have the risk of being exposed to occupational hazards. Patient transfer and patient mobilization are jobs that nurses do by spending as much as 20% of their time. If nurses make a mistake in position or are not ergonomic, they can experience musculoskeletal disorders (Luthfiyah, 2022)

Ergonomic risk factors include physical (posture, physical workload), psychosocial and individual (age, gender and Body Mass Index) (NIOSH, 2024). When ignoring ergonomic conditions at work, nurses will become unproductive, impacting nurses, namely welfare, quality of life, and loss of work and income (Patrianingrum et al, 2021).

Nurses have a potential of more than 25% to experience MSDs in the lower limbs and back as well as neck (Jacquier-Bret and Gorce, 2023). The study, conducted by Kasih (2023) and Tuğran and Savci (2023), in nurses was evaluated at a very high risk of the incidence of Low Back Pain and neck pain.

A preliminary study conducted by nurses at the Maria Walanda Maramis Regional General Hospital in October 2024 said that there was a phenomenon or incidence of complaints of Low Back Pain and Tension Neck Syndrome in nurses at the hospital. The results of the observations obtained in addition to performing nursing actions, the nurses also performed tasks such as lifting, pushing, opening oxygen cylinders with a tube height of 150cm and a weight of approximately 56kg. The absence of evacuators in the hospital requires nurses to take action to encourage patients alone because the implementing nurse who carries out shifts in the room is 2 people. Nurses also perform the task of inputting patient data using computer devices because there are no administrative officers in the room, especially the inpatient room.

Based on the description above, the author is interested in conducting a study on "Analysis of Ergonomic Risk Factors related to Low Back Pain and Tension Neck Syndrome Complaints in Nurses at the Maria Walanda Maramis Regional General Hospital, North Minahasa Regency".

Research methods

This research is a quantitative research with a type of research, namely observational analysis using a cross sectional study research design. This research was conducted on nurses at the Maria Walanda Maramis Regional General Hospital, North Minahasa Regency which was carried out in March-April 2025. Data collection can be divided into two types, namely: 1) Primary Data, which is data taken directly by the author from the respondents through a questionnaire to be shared. 2) Secondary data, namely supporting data in the form of the number of nurses obtained from the Maria Walanda Maramis Regional General Hospital, North Minahasa Regency. This study uses a type of data analysis, namely:

a. Univariate Analysis, Univariate analysis aims to describe the characteristics of respondents, and each of the variables of ergonomic risk factors, namely work posture, workload, age, gender, Body Mass Index, psychosocial and complaints of Low Back Pain and Tension Neck Syndrome.
b. Bivariate Analysis, Bivariate analysis was conducted to examine the relationship between each independent variable (work posture, workload, age, gender, and Body Mass Index, psychosocial) with dependent variables (Low Back Pain and Tension Neck Syndrome complaints). To prove the existence of a significant relationship and measure the strength and direction of the relationship between independent variables (age, Body Mass Index, work posture, workload and psychosocial) with the dependent variable, Spearman rank analysis was used and to prove the existence of a significant relationship between independent variables with nominal data scale using chi-square

test. Decision making is related or not related with a confidence level of 95% (α = 0.05).

c. Multivariate Analysis, The next stage is to conduct a multivariate analysis together with independent variables (age, gender, Body Mass Index, work posture, workload and psychosocial) that are valid in the multivariate model, namely independent variables that have a p-value <0.25 in the bivariate analysis. If there is an independent variable that has a p-value> 0.25, then the variable is considered insignificant and is not included in the model. Multivariate analysis uses the multiple logistic regression method with a significant value to see the dominant independent variables that influence the dependent variable and the Exp(B) value to see how much risk the independent variable has of affecting the dependent variable.

Results and Discussion

Result

Table 1. Frequency Distribution of Nurse Characteristics and Ergonomic Risk Factors at Maria Walanda Maramis Regional General Hospital, North Minahasa Regency

Risk Factors (n=130)	Frequency n (%)	Mean (SD)
Individual Characteristics		
Age		31,04 (4,890)
20-24 years	8 (6,2)	
25-29 years	52 (40)	
30-34 years	36 (27,7)	
35-39 years	28 (21,5)	
40-44 years	6 (4,6)	
Gender		
Male	32 (24,6)	
Female	98 (75,4)	
Body Mass Indeks		24,74 (2,603)
Normal	61 (46,9)	
Overweight	36 (27,7)	
Obesity	33 (25,4)	
Work Posture		
Low	55 (42,3)	
Medium	66 (50,8)	
High	9 (6,9)	
Workload		
Low	118 (90,8)	
Medium	12 (9,2)	
Psychosocial		
Low	32 (24,6)	
Medium	42 (32,3)	
High	56 (43,1)	
Low Back Pain Distribution		
Low	65 (50)	
Medium	65 (50)	
Tension Neck Syndrome Distribution		
Low	60 (46,2)	
Medium	70 (53,8)	

a. Characteristics of participants

Overall, there were 130 nurses at Maria Walanda Maramis Hospital, North Minahasa Regency who participated in this study. The majority of participants were female 98 (75.4%), aged 25-29 years 52 (40%), had a normal Body Mass Index 61 (46.9%).

b. Frequency Distribution of Risk Factors

Respondents who have a work posture with a medium risk level are 66 or 50.8% and a high risk level of 9 or 6.9%. Respondents with a light workload of 118 people or 90.8% are the largest distribution. Respondents with a high psychosocial category are the largest distribution 56 respondents or 43.1% and psychosocial with a low category of 32 or 24.6%

Table 2. Relationship of Ergonomic Risk Factors with Low Back Pain in Nurses

Variables	Low Back Pain (n = 130)		r	p-value
	Low	Medium		
Age			0,076	0,391
Gender				0,015
Male	10 (31,3)	22 (68,8)		
Female	55 (56,1)	43 (43,9)		
Body Mass Indeks			0,358	<0,001
Work Posture			0,593	<0,001
Low	46 (83,6)	9 (16,4)		
Medium	19 (28,8)	47 (71,2)		
High	0	9 (100)		
Workload			0,213	0,015
Low	63 (53,4)	55 (46,6)		
Medium	2 (16,7)	10 (83,3)		
Psychosocial			0,393	<0,001
Low	23 (71,9)	9 (28,1)		
Medium	27 (64,3)	15 (35,7)		
High	15 (26,8)	41 (73,2)		

c. Ergonomic Risk Factors Associated with Low Back Pain Complaints

Table 1 shows the relationship between ergonomic risk factors and complaints of low back pain in nurses at Maria Walanda Maramis Hospital, North Minahasa Regency. Gender: p=0.015, Body Mass Index: p<0.001, r=0,358; work posture: p<0.001, r=0,593; workload: p=0.015, r=0,213; psychosocial: p<0.001, r=0,393. Age risk factors are not related to back pain with p=0.391, r=0,076.

Table 3. Relationship of Ergonomic Risk Factors with Tension Neck Syndrome in Nurses

Variables	Tension Neck Syndrome (n = 130)		r	p-value
	Low	Medium		
Age			0,066	0,455
Gender				0,018
Male	9 (28,1)	23 (71,9)		
Female	51 (52)	47 (48)		
Body Mass Indeks			0,358	<0,001
Work Posture			0,593	<0,001
Low	44 (80)	11 (20)		
Medium	16 (24,2)	35 (75,8)		
High	0	9 (100)		
Workload			0,189	0,032

Low	58 (49,2)	60 (50,8)		
Medium	2 (16,7)	10 (83,3)		
Psychosocial			0,336	<0,001
Low	21 (65,6)	11 (34,4)		
Medium	25 (59,5)	17 (40,5)		
High	14 (25)	42 (75)		

d. Ergonomic Risk Factors Associated with Tension Neck Syndrome Complaints
Table 2 shows the relationship between ergonomic risk factors and complaints of back pain in nurses at Maria Walanda Maramis Hospital, North Minahasa Regency. Gender: p=0.018, Body Mass Index: p<0.001, r= 0,358; work posture: p<0.001, r=0,593; workload: p=0.032, r=0,189; psychosocial: p<0.001, r=0,336. Age risk factors are not related to back pain with p=0.455, r=0,066.

Table 4. Logistic Regression Test Result

Risk Factors	Sig	Exp(B)	95% CI for Exp(B)	
			Lower	Upper
Low Back Pain				
Body Mass Index	0,002	2,697	1,443	5,041
Work Posture	0,000	13,912	5,199	37,227
Psychosocial	0,001	2,731	1,495	4,989
Tension Neck Syndrome				
Body Mass Index	0,008	2,165	1,226	3,822
Psychosocial	0,000	6,267	2,786	14,098

e. Logistic Regression for Dependent Variables Low Back Pain and Tension Neck Syndrome
Table 4 presents the final logistic regression model confirming the dominant factors related to low back pain and tension neck syndrome. The multivariate results confirm that the most dominant variable affecting complaints of Low Back Pain in nurses at Maria Walanda Maramis Hospital, North Minahasa Regency is work posture, with an Exp(B) value of 13.912 which means that respondents with poor work posture are 13.9 times more at risk of experiencing Low Back Pain. The most dominant variable affecting Tension Neck Syndrome complaints in nurses at Maria Walanda Maramis Hospital, North Minahasa Regency is psychosocial, with an Exp(B) value of 6.267, which means that respondents with poor psychosocial are 6.2 times more at risk of developing Tension Neck Syndrome.

Discussion

Relationship of Age, Gender, Body Mass Index, Work Posture, Workload and Psychosocial with Low Back Pain Complaints

1. The Relationship of Age with Low Back Pain Complaints

This study used the Spearman Rank test on 130 respondents and with a p-value of 0.391 which means there is no relationship between age and low back pain, with a correlation coefficient value (r count) of 0.076 meaning it has a very weak correlation strength with a positive relationship direction where the older the age, the higher the

low back pain complaints tend to be.

The results of this study are in line with research conducted by Wahyuliyanti et al (2023) which showed that there was no significant relationship between age and low back pain complaints in nurses at the Indonesian Christian University Hospital, East Jakarta with a p-value of 0.74.

Nurses at Maria Walanda Maramis Regional General Hospital are mostly aged 25-29 years who may have good endurance, but if the non-ergonomic work pattern continues, low back pain complaints can still occur. In the 35-39 age category, the results showed that 20 respondents or 71.4% experienced Low Back Pain complaints at a moderate level. Older or younger nurses did not consistently show higher or lower levels of low back pain complaints..

Researchers assume that although it is generally assumed that the risk of musculoskeletal disorders increases with age due to the natural degenerative processes of bones and joints, specific work environments such as hospital rooms may have other risk factors that are more dominant and affect all age groups equally. Nurses' work involves a variety of physical activities such as lifting patients, pushing stretchers, bending, and standing for long periods, which are universal ergonomic risk factors regardless of age.

2. Sex with Low Back Pain

Based on the data from the study results, it can be proven that gender has a significant relationship with the incidence of low back pain. This condition can occur because the muscles in women are smaller in size and have strength that is only two-thirds (60%) of men's muscles, especially in the muscles of the arms, back and legs (Sugathot et al, 2022). With the natural conditions that occur between women and men, it is very natural that the female gender has a higher level of risk of developing musculoskeletal disorders compared to men, this especially happens in women who are of productive age. Thus, it can be concluded that gender has a significant relationship with the incidence of low back pain.

The results of data calculation in this study using the chi square test, the results were obtained that there was a relationship between sex and the incidence of low back pain because the significance value showed 0.015 ($p < 0.05$). Gender is related to low back pain complaints because the physical strength of women's bodies is on average 2/3 of that of men, in addition to low back pain complaints often occur in women because women experience biological cycles such as menstruation, pregnancy, and postpartum pain.

Researchers assume that in addition to biological differences, psychosocial factors and how men and women process and express pain also contribute to differences in the prevalence of Low Back Pain. Many female nurses carry a double burden as both nurses and as homemakers/family caregivers. To prevent the occurrence of low back pain complaints on the gender factor, it is very necessary to control nurses, especially those who are female. Before starting work, you should stretch first, detect low back pain complaints early and get enough rest and increase

back sports activities.

3. The Relationship of Body Mass Index with Low Back Pain

Body Mass Index is significantly related to the incidence of low back pain. This condition can occur with an increasing body mass index, it will affect the increase in waist circumference, so that when viewed from a biomechanical point of view, this condition will cause an excess load on the intervertebral disc which will cause a change in the curve in the spine so that it can put pressure on the back muscles which are forced to withstand excess weight so that it will limit body movements in the upper part, shortening muscles and tissues and reducing flexibility, self-mobility and increasing the risk of pain, strains, and sprains (Sari et al, 2023).

The results of this study showed a p-value <0.001, which means there is a relationship between Body Mass Index and Low Back Pain complaints, and a correlation coefficient value (r count) of 0.593 was obtained, meaning it has a moderate correlation strength, with a positive relationship direction where the more unergonomic the nurse's work posture (bad work posture), the more likely the nurse is to experience an increase in low back pain complaints. Respondents as many as 63.6% in the obesity category experienced moderate risk Low Back Pain complaints.

Researchers assume that increased mechanical loads during work activities, namely lifting and moving patients, in nurses with a Body Mass Index above normal values will carry a greater body load when performing tasks that require physical strength. BMI above normal values can disrupt posture and is exacerbated when nurses have to bend or reach for patients, placing excess stress on the lower back structure.

Addressing BMI issues through lifestyle interventions, combined with good ergonomic practices and safe work technique training, increasing muscle endurance around the lumbar region in the face of continuous and repetitive spinal activities are important strategies to reduce the prevalence and severity of Low Back Pain.

4. The Relationship of Work Posture to Low Back Pain

This study shows the results of the Spearman Rank test with a p-value <0.001 (p <0.05) which means that there is a relationship between work posture and low back pain, and the correlation coefficient value (r count) of 0.593 is obtained, meaning that it has a moderate correlation strength, with a positive relationship direction where the more unergonomic the work posture (bad work posture) of the nurse, the more likely the nurse is to experience an increase in low back pain complaints.

An ergonomic working posture is a good working posture. Ergonomics itself is the alignment between employees, work styles and the environment. An unergonomic work posture occurs when nurses force their body positions which causes muscle fatigue faster and indirectly can lead to an extra workload. The consequences that will arise if you do not apply ergonomic body positions will cause tension in the muscles and the appearance of pain in certain parts of the body such as the lower back (Kasih, 2023).

Research using the literature review method conducted by Surotinoyo, et al (2021) on tailors in Indonesia obtained the results of six articles that had been reviewed

with a cross-sectional study design. Five studies had a relationship between work position and musculoskeletal complaints and one article with the result that there was no relationship between work position and musculoskeletal in tailors. In general, it is seen that work position has a significant association with musculoskeletal complaints in tailors in Indonesia. This is because tailors have the same work position continuously, causing musculoskeletal complaints. In the results obtained for Musculoskeletal Complaints, many complaints were obtained based on the type of musculoskeletal complaints, namely neck pain, low back pain and also back pain.

The results of this study show that as many as 47 or 71.2% of respondents have a moderate working posture with complaints of Low Back Pain of medium risk. The relationship between work posture and complaints of low back pain in nurses at the Maria Walanda Maramis Regional General Hospital is very strong, because nurses are often involved in various physical activities that require a certain work posture, such as bending over when performing nursing actions, sitting for a long time at the administration table, or standing for a long time while providing services.

Researchers assume that if the posture while working is not maintained properly and does not pay attention to ergonomic factors, it can cause excessive pressure on the lower back, muscles, ligaments which can ultimately trigger low back pain complaints. By using the RULA (Rapid Upper Limb Assessment) method, implementing ergonomic principles, providing appropriate education, and encouraging healthy work habits, hospitals can identify risky work postures and make changes to prevent musculoskeletal injuries.

5. The Relationship of Workload to Low Back Pain

The results of the Spearman Rank test in this study showed a p-value of 0.015 ($p < 0.05$) which means that there is a relationship between workload and low back pain complaints, and a correlation coefficient value (r count) of 0.393 was obtained, meaning that it has a weak correlation strength, with a positive relationship direction where the higher the level of psychosocial problems experienced by nurses, the more likely nurses are to experience an increase in low back pain complaints. The results of this study are in line with previous research conducted by Sanhaji and Cusmari (2023) which showed a p-value of 0.015 ($p < 0.05$) which means that there is a relationship between workload and low back pain complaints in nurses at Haji Hospital Jakarta.

Low back pain can occur in nurses due to various factors, one of which is workload. According to researchers from the results of the research that has been conducted, nurses at the Maria Walanda Maramis Regional General Hospital have the majority of workload in the light category as many as 63 respondents or 53.4% with low back pain complaints, but it can also be seen that nurses who experience moderate low back pain complaints in the medium workload category as many as 10 respondents or (83.3%). This shows that the heavier the workload, the greater the chance of low back pain complaints.

Researchers assume that the high and low workload measured through pulse oximetry to measure Heart Rate is felt by individuals according to their capacity and

ability after performing nursing actions. An increase in heart rate can be an indicator of physiological stress experienced by the body, including stress due to excessive workload. Excessive workload can cause physiological stress, which can increase heart rate. This physiological stress can also cause muscle tension, including back muscles, which can cause lower back pain.

6. Psychosocial Relationship with Low Back Pain

This study shows the results of the Spearman Rank test with the results of a relationship between psychosocial and low back pain complaints with a p-value of <0.001 (p <0.05), and a correlation coefficient value (r count) of 0.393 is obtained, meaning it has a weak correlation strength, with a positive relationship direction where the higher the level of psychosocial problems experienced by nurses, the more likely nurses are to experience an increase in low back pain complaints.

Work imbalance, lack of appreciation and effort in excess work, and lack of job satisfaction are psychosocial factors that are significantly associated with low back pain in the group of nurses at the Maria Walanda Maramis Regional General Hospital. According to Jradi (2020) in his research, low job satisfaction was significantly related to low back pain in nurses in 16 hospitals throughout Riyadh, Saudi Arabia. According to him, the underlying reasons for low job satisfaction, work imbalance, lack of appreciation as a psychosocial factor in developing countries include lack of job security, inappropriate salaries, fewer benefits, poor working conditions, lack of promotion, poor communication between employees, lack of control over work, poor leadership behavior, work stress, and poor mental and physical status.

The phenomenon of stress in the workplace, mediating factors, and how psychosocial factors relate to nurse health still need to be explored. According to researchers, nurses can continue to work despite a lack of job satisfaction, and stressful working conditions. Excessive stress conditions will adversely affect the ability of nurses to relate to their environment normally. Lack of rewards, imbalances in work, and excessive effort in work were shown to be associated with low back pain in this study. An effective work strategy through a balanced division of tasks, increased nurse discipline, reward and increased physical resilience and nurse skills are needed to improve the work demands of nurses.

Relationship of Age, Gender, Body Mass Index, Work Posture, Workload and Psychosocial with Tension Neck Syndrome Complaints

1. Age Relationship with Tension Neck Syndrome

The results of the Spearman Rank test showed a p-value of 0.455 (p> 0.05). This means that there is no relationship between age and tension neck syndrome, and the correlation coefficient value (r count) of 0.066 is obtained, meaning that it has a very weak correlation strength, with a positive relationship direction where the older the age, the higher the complaints of tension neck syndrome.

This study shows that there is no relationship between age and complaints of tension neck syndrome. In line with the results of this study, where nurses in the age category of 25-29 years are the category with the most complaints of low and moderate

tension neck syndrome, namely 26 respondents (50%). Heavy work carried out by young nurses and having good endurance including frequent bending, standing for long periods, and other nursing actions can be factors in the occurrence of complaints of tension neck syndrome.

Researchers assume that neck and shoulder muscles tend to weaken and lose flexibility with age. Weak muscles are less able to support the head in an ergonomic position, forcing other muscles to work harder and become tense. Decreased flexibility also makes nurses more susceptible to injury when making sudden neck movements or maintaining static positions. But it is also important to note that younger nurses who frequently use unergonomic postures have the same or even higher risk than older nurses who have performed their work according to good ergonomic principles. The work environment of nurses is often characterized by busy schedules, long working hours, and high physical demands. Therefore, prevention and intervention approaches should focus more on improving working conditions, implementing proper ergonomics, stress management, and ongoing education for all nurses, regardless of their age.

2. Sex Relationship with Tension Neck Syndrome

This study showed the results of the Chi-square test with a p-value of 0.018 ($p < 0.05$) which means that there is a relationship between sex and complaints of tension neck syndrome in nurses. The results of this study are in line with a study conducted by Heidari et al (2019) which showed a p-value of 0.001 in complaints of neck pain and discomfort and a p-value of 0.02 in complaints of shoulder pain where $p < 0.05$ which means that there is a relationship between sex and tension neck syndrome in nurses in Iran.

Research shows that changes in levels of this hormone can improve the perception of pain. Estrogen is known to modulate the pain response through its effects on neurotransmitters and the central nervous system (Khusna et al, 2022). Research shows that women's pain threshold is lower than that of men, which may explain the high prevalence of neck pain among women (Ichsanti et al, 2023).

Researchers assume that the relationship between gender and Tension Neck Syndrome in nurses is an interaction between biological, psychosocial, and work environment factors. Although all nurses are at risk, female nurses tend to be more susceptible to TNS due to lower muscle strength, hormonal influences, different pain thresholds, and the dual burden of personal and professional life. By recognizing these differences and implementing appropriate prevention and intervention strategies, hospitals can significantly reduce the prevalence and impact of Tension Neck Syndrome, ensuring that female nurses can continue to provide high-quality care with optimal health and comfort.

3. The Relationship of Body Mass Index with Tension Neck Syndrome

The results of this study showed a p-value <0.001 ($p < 0.05$) which means that there is

a relationship between Body Mass Index and complaints of tension neck syndrome in nurses. This means that there is a relationship between Body Mass Index and tension neck syndrome, and a correlation coefficient value (r count) of 0.320 was obtained, meaning that it has a weak correlation strength, with a positive relationship direction where the higher the Body Mass Index value. In line with research conducted by Chaiklieng (2021), the factor that correlates significantly with complaints of tension neck syndrome is Body Mass Index with a p-value of 0.044 (p <0.05).

The results of this study showed that as many as 22 or 66.7% of respondents with Body Mass Index in the obesity category experienced complaints of Tension Neck Syndrome at medium risk. Research by Citko et al (2024) showed that 153 respondents (47.22%) were associated with complaints of tension neck syndrome with a p-value of 0.001.

Researchers assume that nurses with Body Mass Index above normal values, especially those with Obese Category BMI with central obesity or a pot belly, can affect overall body posture. High BMI can limit flexibility and range of motion in the shoulder and neck joints. These limitations can make it difficult for nurses to achieve an ergonomic working position. As a result, nurses force their neck and shoulders into uncomfortable or tense positions while performing tasks, which worsens Tension Neck Syndrome. Therefore, a holistic approach that includes weight management, workplace ergonomic interventions, and physical exercise programs that focus on strengthening and flexibility is essential to prevent and manage Tension Neck Syndrome in nurses.

4. The Relationship of Work Posture with Tension Neck Syndrome

The results of the study with the Spearman Rank test showed a p-value <0.001 (p <0.05) which means that there is a relationship between work posture and complaints of tension neck syndrome in nurses. This means that there is a relationship between work posture and tension neck syndrome, and a correlation coefficient value (r count) of 0.564 is obtained, meaning that it has a moderate correlation strength, with a positive relationship direction where the more unergonomic the nurse's work posture (bad work posture), the more likely the nurse is to experience an increase in complaints of tension neck syndrome. This study is in line with research conducted by Rumangun et al (2024) on nurses at Cendrawasih Dobo Hospital with a p-value of 0.000 which means that there is a relationship between work posture and neck and shoulder pain in nurses.

Nurses generally experience musculoskeletal complaints starting from habits that are carried out while working. As many as 35 or 75.8% of respondents at the Maria Walanda Maramis Regional General Hospital had a moderate posture with complaints of tension neck syndrome at a medium risk level. This happens because the posture when working is not ergonomic and causes parts of the body to move away from their natural position, such as the back that is too bent or the neck that is too up or down. Sitting for a long time can also cause complaints in the form of soreness and pain in the neck and shoulders.

Nurses, in addition to performing nursing actions, also perform room administration duties, so it requires a long time sitting in front of the computer which can make the neck and shoulders tense. According to researchers, posture at work has a significant influence on the appearance of neck and shoulder pain complaints. This complaint is often experienced by workers, including nurses with the wrong posture at work, especially if done repeatedly for a long period of time, it can cause muscle tension, blood flow disorders, and pressure on nerves in the neck and shoulder area. The accumulation of these conditions will eventually trigger the appearance of pain that can interfere with productivity and work quality. To reduce the risk of such complaints, it is important for nurses to acquire adequate knowledge about the correct working posture. In this case, socialization and training related to work ergonomics need to be provided to nurses to be able to apply the correct posture when carrying out daily tasks. Thus, the risk of injury due to incorrect work posture can be minimized.

5. The Relationship of Workload to Tension Neck Syndrome

The results of this study showed a p-value of 0.032 ($p < 0.05$) which means that there is a relationship between workload and complaints of tension neck syndrome. This means that there is a relationship between workload and tension neck syndrome, and a correlation coefficient value (r count) of 0.189 is obtained, meaning that it has a very weak correlation strength, with a positive relationship direction where even though there is a significant relationship, an increase in nurses' workload is only very weakly related to an increase in complaints of tension neck syndrome. In line with the research of Keskin et al (2024), there is a relationship between workload and pain in the neck and shoulders with a p-value <0.05, workload was found to be a 31.5% trigger for neck pain.

Tension neck syndrome can be triggered by many factors, one of which is workload. The height and low workload measured through pulse oximetry to measure the Heart Rate is felt by individuals according to their capacity and ability after performing nursing actions. According to researchers from the results of the research that has been conducted, nurses at the Maria Walanda Maramis Regional General Hospital have the majority of workload in the mild category as many as 60 respondents or 50.8% with complaints of tension neck syndrome of medium risk, but it can also be seen that nurses with a moderate workload have complaints of tension neck syndrome as many as 10 respondents or 83.3%. This shows that the heavier the workload, the greater the chance of tension neck syndrome complaints.

Researchers assume that nurses often maintain unergonomic neck and shoulder positions for long periods of time. When bathing, changing linens, or performing procedures at the patient's bedside, nurses often bend over with their heads down. This position drastically increases the load on the neck and shoulder muscles, causing tension. A safe and physically supportive working environment will not only improve the health and well-being of nurses, but will also ensure the sustainability of the nursing profession and improve the overall quality of patient care.

6. Psychosocial Relationship with Tension Neck Syndrome

This study shows results with a p-value <0.001, which means that there is a relationship between psychosocial and complaints of tension neck syndrome in nurses, and there is a relationship between psychosocial and tension neck syndrome, and a correlation coefficient value (r count) of 0.336 is obtained, meaning that it has a weak correlation strength, with a positive relationship direction where the higher the level of psychosocial problems experienced by nurses, the more likely nurses are to experience an increase in complaints of tension neck syndrome. In line with this study, Cezar-Vaz et al (2023) reported the results of their study that there was a relationship between psychosocial and complaints of neck pain within a period of 12 months in health workers with a p-value of 0.024 (p <0.05).

This study obtained psychosocial results in the high category that had the most moderate low back pain complaints, namely 42 respondents or 75%. Demands in the work environment are psychosocial risk factors that pose great challenges to nurses. Work-related psychological stress can lead to changes in a person's physiological functioning, such as an increased sensitivity to pain or muscle tension, which can increase a person's susceptibility to developing tension neck syndrome complaints.

Researchers assume that nurses operate in a fast-paced work environment, often dealing with urgent emergency situations, heavy patient workloads, and high expectations from patients, families, and management. These demands cause physiological responses to stress. This directly triggers chronic muscle tension, especially in the neck, shoulder, and upper back areas. Therefore, to effectively reduce the prevalence and impact of Tension Neck Syndrome, Hospitals must implement a comprehensive strategy that not only addresses the physical and ergonomic aspects of the job, but also prioritizes the mental and emotional well-being of nurses, creating a healthier, more supportive, and sustainable work environment.

Dominant Ergonomic Risk Factors Affect Low Back Pain and Tension Neck Syndrome Complaints

This study was conducted multivariate analysis using multiple logistic regression tests to find out which independent variables had a dominant effect on dependent variables. Based on the Chi-Square test conducted in bivariate analysis, there were six independent variables (age, gender, Body Mass Index, work posture, workload and psychosocial) for the dependent variables Low Back Pain and Tension Neck Syndrome that were eligible for multiple logistic regression tests with a significant value of $p < 0.25$.

1. **Dominant Ergonomic Risk Factors Affect Low Back Pain Complaints**

   Based on the test in the second step, the following results were obtained: age value p = 0.001, work posture value p = 0.000, workload value p = 0.129 and psychosocial value p = 0.000. Based on these results, the third step of logistical regression was carried out by removing workload variables. The results of the third step of the double logistics regression test showed that the dominant independent variable had an effect on the dependent variable Low Back Pain, namely the work posture with a p-value of 0.000 and an Exp(B) value of 13.912, which means that

respondents with poor work posture were 13.9 times more at risk of experiencing Low Back Pain complaints.

The results of the statistical test using the Confidence Interval (CI) for Exp(B) value range or the range of differences that are tolerated using the 95% confidence level, so that the range of values between work posture and Low Back Pain in nurses at Maria Walanda Maramis Hospital, North Minahasa Regency, is 5.1 to 37.2. These results are in line with the study conducted by Febrianti et al (2024) which reported that the results of the work posture variable with a p-value of 0.001 had an effect on low back pain complaints with an Exp(B) value of 22.028. Doda et al (2020) in their study stated that the Exp(B) value of the work posture was 1.13 times the risk of experiencing Low Back Pain complaints with a Confidence Interval (CI) of 1.07 to 1.19 in Nurses in Emergency Departments at seven hospitals in Manado.

Researchers assume that Low Back Pain is a condition that not only causes physical suffering for nurses, but also contributes to work absence, decreased productivity, and potential high staff turnover. Although various risk factors such as age, gender, Body Mass Index (BMI), workload, and psychosocial have been identified, unergonomic work posture is the most dominant risk factor and has a direct impact on the occurrence of LBP in nurses. Poor work posture directly affects the biomechanics of the spine. Nurses are exposed to this high-risk posture repeatedly, every day, for years. Although it requires awareness and training, it is something that is within the control of nurses and can be intervened through education and provision of adequate ergonomic tools by the Hospital.

2. **Dominant Ergonomic Risk Factors Affect Tension Neck Syndrome Complaints**
   The results of the second stage of multiple logistic regression test showed that the dominant independent variable had an effect on the dependent variable of Tension Neck Syndrome, namely psychosocial with a p-value of 0.000 and an Exp(B) value of 6.267, which means that respondents with poor psychosocial were 6.2 times more at risk of developing Tension Neck Syndrome complaints. The results of the statistical test using the Confidence Interval (CI) for Exp(B) value or the range of difference values tolerated using the 95% confidence level, so that the range of values between psychosocial and Tension Neck Syndrome in nurses at Maria Walanda Maramis Hospital, North Minahasa Regency, was 2.7 to 14. In line with research conducted by Chaiklieng et al (2021) which reported that psychosocial factors have an Exp(B) value of 3.53 times the risk of experiencing neck pain complaints with a Confidence Interval (CI) of 1.65 to 7.58. And psychosocial factors had an Exp(B) value of 3.45 times the risk of developing shoulder pain complaints with a Confidence Interval (CI) of 1.79 to 6.66 in 240 emergency nurses from 10 regional hospitals in Northeastern Thailand.

Conclusion

After conducting a study on 130 respondents regarding "Analysis of Ergonomic Risk Factors related to Low Back Pain and Tension Neck Syndrome Complaints in Nurses at the Maria Walanda Maramis Regional General Hospital, North Minahasa Regency, it

can be concluded: This study shows that there is a significant relationship between age, gender, Body Mass Index, work posture, workload and psychosocial with complaints of low back pain complaints in nurses at the Maria Walanda Maramis Regional General Hospital. This study shows that there is a significant relationship between age, gender, Body Mass Index, work posture, workload and psychosocial with complaints of tension neck syndrome in nurses at the Maria Walanda Maramis Regional General Hospital, North Minahasa Regency. The risk factor for ergonomic work posture is the dominant factor affecting low back pain complaints and the psychosocial ergonomic risk factor is the dominant factor affecting tension neck syndrome complaints

Suggestions

It is expected that with this research at Maria Walanda Maramis Regional General Hospital in 2025, it can take appropriate further steps in an effort to manage nursing resources properly to prevent complaints of Low Back Pain and Tension Neck Syndrome in nurses by holding ergonomic training for nursing staff as well as early detection of complaints felt. In addition, it is hoped that the hospital will also facilitate physical activity or physical fitness training programs in the hospital, diet education, policies for placement of older nurses, rotation, and division of labor to ensure that nurses have done their work according to their proportions.

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