

Effect of Ergonomic Levels on Text Neck Syndrome Among Students: A Correlational Study

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ABSTRACT

Introduction: Neck pain is a prevalent issue among students, exacerbated by prolonged and non-ergonomic smartphone and laptop use, especially during remote learning. **Method:** This study aims to examine the influence of ergonomic practices on text neck syndrome. The Neck Disability Index questionnaire assesses text neck syndrome (dependent variable), while the Rapid Upper Limb Assessment (RULA) evaluates ergonomic levels (independent variable). Employing an observational approach at Cililin 1 State Senior High School, West Java, the study involves 292 participants selected purposefully. **Results:** Ordinal linear regression analysis indicates a significant correlation ($p < 0.05$) between ergonomic levels and text neck syndrome. The obtained pseudo-R-Square value of 13.1% signifies that ergonomic factors account for 13.1% of the variability. The Wald value of 14.240 suggests a heightened risk of text neck syndrome by 14.240 with each unit increase in ergonomic level. **Conclusion:** In conclusion, this study underscores the substantial contribution of ergonomics (explaining 13.1% of variability) to the occurrence of text neck syndrome, as evidenced by the research outcomes.

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INTRODUCTION

Neck pain is a common health problem. According to (Genebra et al., 2017) the prevalence of neck pain in the world ranges from 16.7% to 75.1%, while in Indonesia, the prevalence of neck pain ranges from 11.9% (Badan Penelitian dan Pengembangan Kesehatan, 2018). Neck pain usually occurs in adults. However, since Covid 19 occurred, the Ministry of Education and Culture of the Indonesian government issued an online learning policy from 24 March 2022 to 13 September 2021 (Menteri Pendidikan dan Kebudayaan Republik Indonesia, 2020). The demand for service fulfillment to students requires students to carry out learning activities online using laptops or smartphones for a long enough duration that it can potentially cause musculoskeletal disorders (Aljinović et al., 2022; Dzuria, 2021).

Some high school students complain of neck pain after online learning with a learning duration of more than 6 hours every five days a week. It is suspected that the ergonomic position factor during online learning is the cause. Neck pain has many causative factors,

including ergonomics (poor working position, strenuous activity, inappropriate body posture, and repetitive movements), individual (age, body mass index, and musculoskeletal problems), Habits (level of activity, physical and unhealthy lifestyle) (Genebra et al., 2017; Wijaya, 2019).

During online learning, many students use smartphones and computers continuously in non-ergonomic positions for long periods. This triggers neck pain known as "text neck syndrome." According to David D, et al. (2021) "Text neck syndrome" is a disease caused by cervical bone regeneration which is caused by repeated pressure when flexing the cervical bones for a long time (Sekaaram & Ani, 2017).

According to (David D, et al., 2021), In 44% of cases, neck pain is associated with pathological changes in the cervical bone structure in response to increased loads on the active and passive structures of the cervical spine and in the long term can cause text neck syndrome due to There are many factors that influence the occurrence of text neck syndrome, so it is concluded that this study will examine the effect of the level of ergonomics on text neck syndrome in high school students who study using online methods during the COVID-19 pandemic (Rizqiansyah et al., 2017).

LITERATURE REVIEW

Text neck syndrome is a condition of neck pain that is caused by looking down and bending too often when using a cell-phone or other electronics for a long time which results in injury to the neck (Dewantari et al., 2021; Neupane et al., 2017).

The instrument used to measure text neck syndrome is the neck disability index. NDI is a special questionnaire that discusses the degree of injury and handicap caused by neck pain or limitations of neck movement in daily activities, such as self-care, lifting, reading, headaches, concentration, driving, sleep, work, and recreation. Neck disability index using an ordinal ratio scale with an interpretation of 0-20% indicating mild disability; 20-40% stated moderate disability; 40-60% stated severe disability; 60-80% stated paralyzed; 80-100% = ~ (Hartman et al., 2023; Vernon, 2014).

Ergonomics is a science that studies humans and work relationships, covering all aspects and space. In this case, the ergonomic position in sitting is based on RULA analysis, namely, the upright neck position does not bend, and the upright waist position does not bend (Middlesworth, 1989; Rizqiansyah et al., 2017).

The instrument used to measure ergonomics is the rapid upper limb assessment (RULA). RULA is a measurement tool for evaluating individual workers against ergonomic risk factors associated with upper extremity Musculoskeletal Disorder (MSD). Taking into account the biomechanics, load, and posture of the worker and the demands of work. Rapid upper limb assessment (RULA) uses an ordinal ratio scale with an interpretation of 1-2 = negligible risk; no change needed; 3-4 = low risk. Need changes if necessary; 5-6 = moderate risk, needs immediate change; 6+ = very high risk, needs change now (Dewantari et al., 2021; Kurniawidjaja et al., 2014; Middlesworth, 1989).

METHOD

The design used is an observational study with a correlational approach. This research was conducted to obtain data on factors or variables that are interrelated with other variables whose structure and nature are more complicated or complex. This type of research is used to determine the effect between the level of ergonomics and text neck syndrome in high school students.

The research variables consist of two variables. Dependent variable or dependent variable: text neck syndrome. Independent variable or independent variable: level of ergonomics. The sampling technique in this study was purposive sampling with a cluster sampling approach. The clusters in this study were high school students in grades 10,11, and 12 consisting of 1200 students. Using calculations through the OpenEpi platform. So the number of samples in this study was 292 students who were divided into 3 clusters, 97 class 10 cluster students, 97 class 11 cluster students, 98 class 12 cluster students. Inclusion criteria and exclusion criteria are in Table 1.

Table 1. Inclusion criteria and exclusion criteria

No	Inclusion Criteria	Exclusion Criteria
1	Respondents are active students	Respondents have musculoskeletal disorders
2	15-20 years old	Not willing to be a research respondent
3	Respondents take part in online learning for at least one semester	

Univariate analysis aims to explain or describe the characteristics of each research variable. The presentation of the data used is descriptive statistics to describe the parameters of each variable. These parameters include the mean (mean, median, mode) and dispersion values (variance, standard deviation, range). They also measured the total score to add to the characteristics of the data.

Bivariate analysis was performed on two variables to find the contribution of the relationship. The researcher used an ordinal linear regression statistical test because the data were not normally distributed with a significance level of 0.05, with the results of the statistical test of information fitting and goodness of fit models to show whether the model was fit or not, pseudo-R -Square to explain the ability of the independent variable (ergonomics) in explaining the dependent variable (text neck syndrome), parameter estimates function to test hypotheses and test of parallel lines to show whether data parameters are the same or not. In this study, the following hypotheses were developed:

H0 : There is no contribution of ergonomic level to text neck syndrome in high school students.

Ha : There is an ergonomic level contribution to text neck syndrome in high school students.

Ethical clearance is used to ensure that research meets the principles of respecting human dignity, the principle of doing good that is beneficial and not harmful, and the principle of justice. Data collection was carried out based on the consent of the respondents through informed consent. This study was approved by the Tk Hospital Research Ethics Committee. II 04.05.01 dr. Soedjono has received an Ethical Eligibility Letter with No. 183/EC/I/2023.

RESULT AND DISCUSSION

The research begins with collecting data on the characteristics of the research sample. The data was obtained through the results of the neck disability index questionnaire and ergonomic examination through video on a sample of respondents who had met the inclusion and exclusion criteria. 100% of the allocated respondents succeeded in following the entire research process. Characteristics of the data are in Table 2. Based on primary data sources in table 2, it was found that the neck disability index examination results obtained an average value of 16.94; the mid value is 16, and the value often appears as 10. The rapid upper limb assessment examination obtained an average value of 6.75, a mid-value of 7,

and the most frequent value is 7. All data were found not normally distributed to test for differences using an ordinal linear regression test.

Table 2. Univariate Analysis

INSPECTION	N	F	Percentage	Mean ± STDEV	Range	Median	Varian	Mode
Text neck syndrome	292			16.94 ± 9.50	68	16	90.24	10
Ergonomics	292			6.75 ± 0.46	1	7	0.21	7
Low Risk	292	1	0.3					
Moderate Risk	292	70	24					
High Risk	292	221	75.7					
Age	292			16.49 ± 0.96	5	16.5	0.92	17
15-16 Years	292	146	50					
17-18 Years	292	144	49.3					
19-20 Years	292	2	0.6					
Gender	292							
Man	292	102	34.9					
Woman	292	190	65.1					
Device Usage Time (Hours)	292			4.85 ± 1.48	5	6	2.17	6

Based on the results of the ordinal linear regression statistical test (Table 3.), the results of the fitting information model were $P < 0.05$, which means that the research model is fit or can be continued; goodness of fit pearson and deviance $P > 0.05$, which means the model is fit; pseudo R-Square value of cox and snell $0.057 = 5.7\%$, Nagelkerke $0.074 = 7.4\%$ means that the ergonomics variable can explain the text neck syndrome variable by 5.7% and 7.4% and 86.9% others are other factors which affect text neck syndrome; parameter estimates the significance of $0.000 = P < 0.05$ means H_0 is rejected so that there is a contribution to the ergonomic level of text neck syndrome, a Wald value of 14.240 means that ergonomics influences 14.240 to the occurrence of text neck syndrome; Test of parallel lines $P > 0.05$ means that the resulting model has the same parameters, meaning that the two variables have indicators that can explain the cause and effect of the independent and dependent variables.

Based on the statistical test results, the results obtained were $P < 0.05$, which means that H_0 was rejected so that there was an ergonomic contribution to the incidence of text neck syndrome, and a pseudo-R-Square value of 13.1% was obtained, which meant that the ergonomics factor was able to explain the text neck syndrome variable by 13.1%. Moreover, the other 86.9% are other factors that influence text neck syndrome. This happens because most students during the learning process sit down and are in a position that is not ergonomic so that the neck is burdened due to static cervical flexion. Based on the results of univariate data processing, it is obtained that the data that most often appears in the ergonomics aspect is at a value of 7; this value has cervical flexion of more than 10 degrees. So that it can cause changes in the cervical spine, cervical curve, ligaments, muscles, and tendons in the cervix, which can lead to pain and changes in posture of the cervical or neck towards the front or kyphosis (David et al., 2021; Neupane et al., 2017).

Based on research of (David et al., 2021; Neupane et al., 2017), the weight of the neck and head for adults is almost 5 kg in a neutral position. If you lower your head by 15

degrees, the weight will double, around 12 kg, and increase to 18.14 kg at 30 and 22.33kg at 45 degrees. Repeated flexion movements carried out for a sufficiently long duration can cause repetitive stress injuries due to overactive or overused muscle work in the neck, known as text-neck syndrome (Sulfandi et al., 2020).

Table 3. Bivariate Analysis

	Wald	R Square	Significance	Conclusion	
One Sample				Data	Not
<i>Kolmogorov</i>			0.000	Normal	
<i>Smirnov Test</i>				Distributed	
Model Fitting					
Information			0.000	Fit Models	
Goodness Of Fit					
<i>Pearson</i>			0.494	Fit Models	
<i>Deviance</i>			0.350	Fit Models	
Pseudo R-Square					
<i>Cox and snell</i>		0.057			
<i>Nagelkerke</i>		0.074			
Parameter					
Estimates	14.240		0.000	<i>H0 is rejected</i>	
Test Of Parallel				Same	
Lines			0.350	Parameters	

The overuse condition found in text neck syndrome occurs due to repeated microtrauma in the body's anatomical structures, such as the neuromusculoskeletal system (bones, tendons, joints, and muscles). This occurs because the body's tissues fail to adapt; bones, tendons, joints, and muscles have adaptability through the process of remodeling to the pressures or constraints faced by the network, such as gravity, load, and activity. However, if the body cannot adjust to the remodeling process, the tissue will be stressed, leading to musculoskeletal injuries. Text neck syndrome usually occurs in jobs that spend a long time in non-ergonomic positions, especially the neck, both in standing and sitting conditions, such as office workers, artisans "batik", students, or students who spend much time in static positions (Vorgelegt, 2016; Waibel et al., 2016).

This condition was exacerbated by the length of time the respondents were in an ergonomic position obtained from the results of univariate data processing; it was found that the longest and highest duration of the respondents was using a smartphone or computer for more than 5 hours per day. This condition can cause spasms, micro-trauma, or myofascial pain syndrome in the upper trapezius muscles if carried out continuously. It can irritate the nerves, causing pain and impaired mobility in the neck (Sulfandi et al., 2020). In line with research (Fathimahhayati et al., 2020), it was found that 82.14% of 155 respondents complained of musculoskeletal disorders, namely pain in the upper neck due to the use of smartphones and laptops that are not ergonomic and for a long time this has an impact on decreased productivity (Chen et al., 2018).

In a cross-sectional study (Yani et al., 2020) with a p value of less than 0.005 and r 0.229 means there is a relationship between the length of work and neck pain with a low degree of closeness of the relationship, so there are other factors that affect neck pain apart from the length of work. The longer the worker works in an ergonomic position, the greater the risk of neck pain (text neck syndrome) in workers. In the study (Yani et al., 2020), the respondents worked 8 hours a day in a static and non-ergonomic position with a 1-hour break duration during work. The higher the work period, the higher the risk of neck pain. Working more than 8 hours per day can cause decreased work productivity and lead to

fatigue, work accidents, and musculoskeletal disorders such as neck pain and changes in posture that tend to bend or kyphosis (Maulana et al., 2021). In the study (Sekaaram & Ani, 2017), it was found that 91.7% of research respondents experienced musculoskeletal disorders as a result of working longer than 12 hours per day.

Ergonomic position in sitting based on RULA analysis, namely the cervical upright position (range of motion 0 degrees) not bending down and the waist upright position (range of motion 0 degrees) not bending down, so that the cervical muscles are not burdened too much which leads to overuse, which causes text neck syndrome, because what if the cervical flexion is 15 degrees then the neck is burdened by 12 kg, if the flexion is 30 degrees then the neck is burdened by 22.33 kg, this is equivalent to putting 1 gallon of water on the neck, as a result the tissues in the neck, especially the cervical extensor muscles, upper trapezius, erector spinae, rhomboids, levator scapula, supraspinatus, and infraspinatus, ligaments, joints will experience stretching and overuse and in the long term will change the cervical vertebrae into kyphosis and pain in the neck due to the process of nociception from a chemical stimulus in the form of release of arachidonic acid by cells - muscle cells that are over active experience tension, mechanical stress, spasms, irritation, and result in local ischemia, which in turn triggers the production of prostaglandins, thromboxane monohydroxy fatty acids, and leukotrienes, encourages the progression of the release of pain activator complements such as histamine, serotonin, and bradykinin, which finally activates wide dynamic range neurons (WDRN) causing a sensation pain with precise localization. (Kurniawidjaja et al., 2014; Aicale et al., 2018 Rahma et al., 2022; Setiyowati & Hartati, 2022; Sulfandi et al., 2020).

In the end, this research still has limitations. Researchers have yet to monitor activities outside of learning hours, especially the utility of using gadgets or smartphones, hobbies, the long duration of using cell phones, and the high ratio of cell phones.

CONCLUSION

Based on the research results, the estimated parameter significance value is $0.000 = P < 0.05$, which means that H_0 is rejected so that there is an ergonomic level contribution to the occurrence of text neck syndrome, then a pseudo-R-Square value of 13.1% is obtained, which means that the ergonomics factor can explain the text neck syndrome variable. by 13.1%, and obtained a wald value of 14,240 which interprets every one increase in the ergonomics level will increase the risk of text neck syndrome by 14,240.

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