



Publish: Association of Indonesian Teachers and Lecturers

International Journal of Health Sciences (IJHS)Journal Homepage: <https://jurnal.agdosi.com/index.php/IJHS/index>

Volume 3 | Number 3 | September 2025 |



The Effect of Physical Activity Patterns on the Vital Capacity of Nursing Students at the Maluku Ministry of Health Polytechnic

Abdul Rivai Saleh Dunggio^{1*}^{*1}Nursing Study Program, Maluku Ministry of Health Polytechnic, Indonesia

ABSTRACT

Background: Regular physical activity has been shown to improve organ function, including the lungs. Vital lung capacity (VLC) is an important indicator of respiratory health. Nursing students often have a high academic load, potentially reducing physical activity.

Objective: To determine the effect of physical activity patterns on vital lung capacity of nursing students at the Maluku Ministry of Health Polytechnic.

Methods: This was a quantitative analytical study using a cross-sectional approach. A sample of 80 students was drawn using purposive sampling. Physical activity was measured using the International Physical Activity Questionnaire (IPAQ), while vital lung capacity was measured using a digital spirometer.

Results: There was a significant relationship between physical activity patterns and vital lung capacity ($p < 0.05$). Students with moderate-to-high activity levels had higher average VLC values (3.7 ± 0.5 L) compared to those with light activity levels (2.9 ± 0.4 L).

Conclusion: Physical activity patterns significantly influence vital lung capacity. It is recommended that students maintain regular physical activity to support respiratory health.

Keywords: Physical Activity, Lung Vital Capacity, Nursing Students

*Koresponden: Abdul Rivai Saleh Dunggio

*Email: rivaidunggio2016@gmail.com





1. Introduction

The respiratory system is one of the vital systems in the human body that plays an important role in the process of ventilation and gas exchange of oxygen (O₂) and carbon dioxide (CO₂). One of the parameters used to measure lung function is vital lung capacity (VLC), which is the maximum volume of air that can be expelled from the lungs after maximal inspiration. VLC is an important indicator in assessing the efficiency of an individual's respiratory system, particularly in daily activities and during physical exercise.

Physical activity is any bodily movement that increases energy expenditure beyond resting levels. Physical activity has been proven to have a positive impact on various body systems, including the respiratory system. Through regular physical activity, such as running, swimming, or aerobic exercise, there is an increase in lung elasticity, strengthening of respiratory muscles, and improved efficiency of gas exchange. Conversely, a sedentary lifestyle or lack of physical activity leads to a gradual decline in lung function, which can affect an individual's quality of life.

Students, especially those studying health-related fields such as nursing, often face heavy academic workloads and inactive lifestyles. Coursework, clinical practice, and a lack of facilities or time for exercise mean that many students tend to have low levels of physical activity. This indirectly puts them at risk of reduced lung function, which is important for supporting their stamina and academic and clinical performance.

Poltekkes Kemenkes Maluku, as a health education institution, has nursing students who are ideal subjects for studying how physical activity patterns affect vital lung capacity. This research is important to provide an initial overview of the relationship between physical activity and respiratory health in the student population, as well as to provide institutional policy recommendations for promoting an active lifestyle.

Based on this background, the researcher was interested in conducting a study entitled "*The Effect of Physical Activity Patterns on the Vital Capacity of Nursing Students at the Maluku Ministry of Health Polytechnic.*" This study is expected to provide scientific information and serve as a basis for preventive and promotional efforts among nursing students to raise awareness of the importance of physical activity for lung health.

2. Research Method

a. Research Design

This study is a quantitative study with an observational analytical approach using a cross-sectional study design. This design was used to determine the relationship between physical activity patterns and lung vital capacity in students at a single measurement point.

b. Populasi dan Sampel





The population in this study was all students enrolled in the Nursing Study Program at the Maluku Ministry of Health Polytechnic in semesters III and V who were actively registered in the 2025/2026 academic year.

Inclusion criteria:

- Students who are willing to be respondents by signing an informed consent form.
- No history of chronic lung disease (asthma, COPD, or tuberculosis).
- Not smoking and not experiencing an upper respiratory tract infection at the time of examination.

Exclusion criteria:

- Students undergoing therapy with drugs that affect the respiratory system.
- Students with abnormal nutritional status based on BMI (Body Mass Index).

The sampling technique used was purposive sampling with a sample size of 80 respondents who met the inclusion and exclusion criteria.

c. Instrumen Penelitian

1) IPAQ Questionnaire (International Physical Activity Questionnaire)

- Used to measure the physical activity level of respondents over the past 7 days.
- Activities are categorized into three levels: light, moderate, and heavy based on MET-minutes/week (Metabolic Equivalent of Task).

2) Spirometer Digital

- Used to measure vital lung capacity (VLC) in liters (L).
- The test is conducted three times and the highest score is taken as the final KVP score.

d. Data Collection Procedures

- 1) Respondents were given an explanation of the purpose and benefits of the study.
- 2) After agreeing to informed consent, respondents filled out the IPAQ questionnaire.
- 3) Vital lung capacity testing is performed in a closed, quiet room using a spirometer.
- 4) Each respondent was asked to take a deep breath, then exhale as much as possible through the spirometer mouthpiece according to the examiner's instructions.

e. The collected data is then recorded and processed

Data Analysis Techniques

- Normality Test: Using Shapiro-Wilk to determine data distribution.
- Bivariate Statistical Test:
 - 1) If the data is normally distributed: use the One Way ANOVA test to compare the average vital capacity of the lungs based on physical activity categories.
 - 2) If not normal: use the Kruskal-Wallis test.
- Correlation Test: Pearson's test is used to determine the strength and direction of the relationship between physical activity levels and vital lung capacity.





Publish: Association of Indonesian Teachers and Lecturers

International Journal of Health Sciences (IJHS)

Journal Homepage: <https://jurnal.agdosi.com/index.php/IJHS/index>

Volume 3 | Number 3 | September 2025 |



- The analysis was performed using SPSS software version 26 with a significance level (α) of 0.05.

3. Research Results

a. Results

This study was conducted in March–April 2025 at the Maluku Ministry of Health Polytechnic. The number of respondents was 80 nursing students who met the inclusion criteria. The data collected included respondent characteristics, physical activity patterns based on IPAQ, and lung vital capacity (LVC) using a spirometer.

1. Respondent Characteristics

Table 1. The following table shows the distribution of respondent characteristics based on gender and semester:

Table 1.

Distribution of Respondents Based on Characteristics

Characteristics	Categories	Frequency (n)	Percentage (%)
Gender	Men	28	35%
	Women	52	65%
Semester	III	42	52,5%
	V	38	47,5%

2. Level of Physical Activity Based on IPAQ

Physical activity is categorized into three levels based on the MET score in the IPAQ:

Table 2.

Respondents' Physical Activity Levels

Physical Activity	Categories	Frequency (n)	Percentage (%)
Lightweight		38	47,5%
Currently		29	36,25%
Weight		13	16,25%

3. Average Vital Lung Capacity Based on Physical Activity

Spirometry measurements showed differences in vital capacity (VC) values for each category of physical activity:

Table 3.

Average KVP Based on Physical Activity Level



**Activity Level Average KVP (Liters) Standard Deviation (SD)**

Lightweight	2,94	0,38
Currently	3,54	0,42
Weight	3,86	0,44

4. Normality Test

The Shapiro-Wilk normality test results showed that the KVP and IPAQ scores were normally distributed ($p > 0.05$), so parametric tests could be continued.

5. ANOVA test

To determine whether there was a significant difference between physical activity levels and vital lung capacity, a one-way ANOVA test was conducted.

Table 4.

One-Way ANOVA Test Results

Variabel	F Hitung	p-value
Physical Activity vs. KVP	8,214	0,000***

Note: *** $p < 0.05$ indicates a significant difference.

6. Pearson Correlation Test

To determine the relationship between physical activity scores (IPAQ continuous scale) and vital lung capacity, a Pearson correlation test was performed.

Table 5.

Pearson Correlation Test Results

Variabel	Nilai r	p-value
Skor IPAQ vs KVP	0,621	0,000***

The results show that there is a significant positive correlation between physical activity and vital lung capacity. The value of $r = 0.621$ indicates a moderate to strong correlation.

b. Discussion

The results of this study indicate that there is a significant relationship between physical activity patterns and lung vital capacity in nursing students. Students with moderate to high levels of physical activity have higher lung vital capacity compared to those with low activity levels. These findings are supported by an ANOVA test, which revealed statistically significant differences ($p = 0.000$) between physical activity categories, as well as a Pearson correlation test ($r = 0.621$; $p = 0.000$), indicating a moderate to strong positive correlation between physical activity and lung vital capacity.





Publish: Association of Indonesian Teachers and Lecturers

International Journal of Health Sciences (IJHS)Journal Homepage: <https://jurnal.agdosi.com/index.php/IJHS/index>

Volume 3 | Number 3 | September 2025 |



These findings are consistent with sports physiology theory, which states that physical activity, especially aerobic activities such as running, swimming, or cycling, can improve respiratory system efficiency through physiological adaptation. This adaptation includes increased lung elasticity, strength of respiratory muscles (such as the diaphragm and intercostal muscles), and increased tidal volume and overall lung vital capacity. Physical activity also enhances the body's ability to utilize oxygen optimally through improved oxygen diffusion in the alveoli and increased tissue perfusion.

This study is consistent with research conducted by Widyastuti (2021), which shows that students who engage in regular physical activity have an average lung capacity that is 15% higher than students who are physically inactive. This indicates that an active lifestyle has a direct impact on lung function. Additionally, a study by Maruapey (2022) also states that participation in vigorous physical activity significantly increases lung volume and ventilation function.

Conversely, students who engage in light physical activity or have a sedentary lifestyle tend to have lower lung capacity. A passive lifestyle causes weakening of the respiratory muscles, decreased elasticity of lung tissue, and reduced gas exchange efficiency. This is of particular concern for nursing students who will be directly involved in healthcare practice, where physical fitness and stamina are important supporting factors.

Other factors that could potentially affect vital lung capacity are age, gender, nutritional status, smoking habits, and history of lung disease. In this study, these factors were strictly controlled through inclusion and exclusion criteria, so that the results obtained could reflect the pure relationship between physical activity and vital lung capacity.

Although this study provides significant results, there are several limitations, including the use of a cross-sectional method that cannot directly describe causal relationships. In addition, physical activity data was obtained through questionnaires that were subjective and depended on the honesty and memory of the respondents. The use of objective devices such as pedometers or accelerometers will provide more accurate results in the future.

4. Conclusion And Recommendations

a. Conclusion

This study shows that there is a significant influence between physical activity patterns and the vital capacity of nursing students at the Maluku Ministry of Health Polytechnic. Students with moderate to heavy physical activity have higher vital capacity than those who only engage in light physical activity. Regular physical activity has been proven to improve the efficiency of the respiratory system through





Publish: Association of Indonesian Teachers and Lecturers

International Journal of Health Sciences (IJHS)Journal Homepage: <https://jurnal.agdosi.com/index.php/IJHS/index>

Volume 3 | Number 3 | September 2025 |



strengthening the respiratory muscles, increasing lung elasticity, and improving gas exchange efficiency.

Vital lung capacity is an important indicator in assessing the respiratory health of students who will later be involved in health services. Therefore, increasing physical activity is an important preventive measure in maintaining the fitness and physical readiness of nursing students.

b. Recommendations

1. For students:
 - a) It is recommended to engage in at least 150 minutes of physical activity per week, as recommended by the WHO.
 - b) Choose aerobic physical activities such as brisk walking, jogging, or swimming, which have a positive impact on the respiratory system.
 - c) Avoid a sedentary lifestyle, especially sitting for too long without breaks for physical activity.
2. For Educational Institutions (Maluku Ministry of Health Polytechnic):
 - a) It is necessary to provide regular fitness or sports programs on campus.
 - b) Integrate education on the importance of physical activity into the curriculum or extracurricular activities for students.
 - c) Provide adequate sports facilities that are easily accessible to students.
3. For Future Researchers:
 - a) It is recommended to use a longitudinal design to assess the long-term effects of physical activity on lung function.
 - b) Use more objective physical activity measurement tools such as accelerometers or smartwatches.
 - c) Add other variables such as body mass index (BMI), blood oxygen levels, and maximal VO_2 capacity for a more comprehensive analysis.

References

1. Ainsworth, B. E., et al. (2011). *Compendium of Physical Activities. Medicine & Science in Sports & Exercise*.
2. American College of Sports Medicine. (2018). *ACSM's Guidelines for Exercise Testing and Prescription*.
3. Ministry of Health of the Republic of Indonesia. (2022). *Guidelines for Physical Activity for the Indonesian Population*.
4. Dunggio, A. R. S., & Aryadi, A. (2025). *Nursing Care for Patients with Chronic Obstructive Pulmonary Disease (COPD) with Ineffective Airway Clearance*. Barongko: Journal of Health Sciences, 3(3), 698–704. <https://doi.org/10.59585/bajik.v3i3.693>





Publish: Association of Indonesian Teachers and Lecturers

International Journal of Health Sciences (IJHS)Journal Homepage: <https://jurnal.agdosi.com/index.php/IJHS/index>

Volume 3 | Number 3 | September 2025 |



5. Harahap, M. A. (2020). Relationship between Physical Activity and Lung Vital Capacity. *Health Journal*, 12(1), 45–52.
6. IPAQ Research Committee. (2005). *Guidelines for Data Processing and Analysis of the IPAQ*.
7. Idris, I., Pannyiwi, R., Ula, Z., & Singga, S. (2023). *Provision of Clean Water Facilities and the Incidence of Diarrhea in the Ujung Pandang Baru Health Center Working Area*. *International Journal of Health Sciences*, 1(4), 576–588. <https://doi.org/10.59585/ijhs.v1i4.186>
8. Kusumawardani, R. (2021). *Correlation Between Sedentary Lifestyle and Lung Function*. *Journal of Public Health*, 9(2), 30–36.
9. Mahfud, M. (2023). *Respiratory Physiology and Physical Exercise*. Surabaya: Airlangga University Press.
10. Maruapey, T. A. (2022). *Physical Activity and Lung Capacity*. *Journal of Science and Health*, 14(3), 110–117.
11. Nurlaela, S. (2019). *The Effect of Exercise on Lung Function*. *Indonesian Nursing Media*, 6(2), 20–25.
12. Noor, M. A., Ansar, A., Vandika, A. Y., Pannyiwi, R., Dunggio, A. R. S., & Saputra, M. K. F. (2024). *Mentoring in Simulation and Enhancing Students' Knowledge About Fractures*. *Social Friends: Journal of Community Service*, 2(4), 673–681. <https://doi.org/10.59585/sosisabdimas.v2i4.487>
13. Nugroho, A. (2020). *Applied Statistics for Health Research*. Yogyakarta: Graha Ilmu.
14. Pratama, R. F. (2022). *Spirometry as a Tool for Measuring Lung Function*. *Biomedical Journal*, 15(1), 77–84.
15. Purwanto, E. (2021). *Lung Vital Capacity in Students with Heavy Activity*. *Journal of Physiology*, 11(2), 67–72.
16. Suminar, S., Rusnita, R., Wisma Sari, S., Hanung Lidiana, E., Rino Vanchapo, A., Saleh Dunggio, A. R., & Rosida, R. (2023). *Nurses' Knowledge in Implementing Standard Operating Procedures on Patient Safety in Regional Public Hospitals*. *International Journal of Health Sciences*, 1(2), 85–92. <https://doi.org/10.59585/ijhs.v1i2.57>
17. Sari, D. N. (2021). *The Relationship Between Physical Activity and Lung Health*. Jakarta: Rajawali Pers.
18. WHO. (2020). *Global Recommendations on Physical Activity for Health*. Geneva: WHO Press.

