PUBLIC HEALTH

POOR SLEEP QUALITY SIGNIFICANTLY CONTRIBUTES TO THE OCCURRENCE OF MULTIMORBIDITY IN OLDER ADULT POPULATION

Ardhya Ridha Prananda Siagian Putri[1], Erlin Listiyaningsih[1], Helda Khusun[2]

[1] *Universitas Muhammadiyah Prof. DR. Hamka, Jakarta, Indonesia*

[2] *Universitas Muhammadiyah Prof. DR. Hamka; SEAMEO Regional Center for Food and Nutrition (RECFON), Jakarta, Indonesia*

Citation: Putri ARPS, Listiyaningsih E, Khusun H. Poor sleep quality significantly contributes to the occurrence of multimorbidity in older adult population. Arch Pub Health 2025; 17 (2). 54-69.

doi.org/10.3889/aph.2025.6552

Key words: multimorbidity; older adults; predictors; quality of life; sleep quality

***Correspondence:**

Erlin Listiyaningsih, Universitas Muhammadiyah Prof. DR. HAMKA, Jakarta, Indonesia.

E-mail: erlin.soedarmo@uhamka.ac.id

Received: 20-Jun-2025; **Revised:** 22-Sep-2025; **Accepted:** 30-Sep-2025; **Published:** 30-dec-2025

Copyright: ©2025. Ardhya Ridha Prananda Siagian Putri, Erlin Listiyaningsih, Helda Khusun. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

Competing Interests: The author have declared that no competing interests

Abstract

The demographic condition of the aging population in Indonesia is accompanied by an increased risk of mortality and morbidity, which is exacerbated by multimorbidity, defined as the existence of two or more chronic diseases in older adults. This has a wide impact on their health, including physical and psychological effects on the family as well as significant economic impact on the government due to the soaring health insurance expenditures. This study aimed to discover multimorbidity-related factors, such as socio-demographic characteristics, behavior, and social environment. This research is an observational analysis with a case-control study design and purposive sampling technique comprising 75 cases and 75 controls. Data were taken using a questionnaire with interview techniques and analyzed by multiple logistic regression. The multivariate analysis showed seven variables significantly related to multimorbidity: physical activity (p = 0.016), BMI (p = 0.020), age (p = 0.011), family history (p = 0.005), smoking status (p = 0.012), sleep quality (p = 0.017), and social interaction (p = 0.007). The sleep quality variable had the most significant effect on the incidence of multimorbidity in older adults, with OR= 8.445. Education for behavior change needs to focus on behavioral factors that can be altered, such as improving sleep quality accompanied by increased physical activity, quitting smoking, maintaining an ideal weight, and encouraging older adults to be active in social activities to enhance their quality of life.

ЈАВНО ЗДРАВЈЕ

ЛОШИОТ КВАЛИТЕТ НА СПИЕЊЕ ЗНАЧИТЕЛНО ПРИДОНЕСУВА ЗА ПОЈАВА НА МУЛТИМОРБИДИТЕТ КАЈ ПОСТАРАТА ПОПУЛАЦИЈА

Ардја Рида Прананда Сиагијан Путри[1], Ерлин Листијанингсих[1], Хелда Кусун[2]

[1] *Универзитет Мухамадијах Проф. ДР. Хамка, Џакарта, Индонезија*

[2] *Универзитет Мухамадијах Проф. ДР. Хамка; SEAMEO Регионален центар за храна и исхрана (RECFON), Џакарта, Индонезија*

Цитирање: Путри АРПС, Листијанингсих Е, Кусун Х. Лошиот квалитет на спиење значително придонесува за појава на мултиморбидитет кај постарата популација. Арх Ј Здравје 2025;17 (2) 54-69.

doi.org/10.3889/aph.2025.6552

Клучни зборови: мултиморбидитет; постари возрасни; предиктори; квалитет на живот; квалитет на спиење.

***Кореспонденција:**

Ерлин Листијанингсих, Универзитет Мухамадијах Проф. ДР. ХАМКА, Џакарта, Индонезија.

Е-пошта: erlin.soedarmo@uhamka.ac.id

Примено: 20-јун-2025; **Ревидирано:** 22-сеп-2025; **Прифатено:** 30-сеп-2025; **Објавено:** 30-дек-2025

Печатарски права: ©2025 Ардја Рида Прананда Сиагијан Путри, Ерлин Листијанингсих, Хелда Кусун. Оваа статија е со отворен пристап дистрибуирана под условите на нелокализирана лиценца, која овозможува неограничена употреба, дистрибуција и репродукција на било кој медиум, доколку се цитираа ториганалниот(ите) автор(и) и изворот.

Конкурентски интереси: Авторот изјавува дека нема конкурентски интереси.

Извадок

Демографската состојба на старите лица во Индонезија е придружена со зголемен ризик од морталитет и морбидитет, дополнително влошена од мултиморбидитет, односно постоењето на две или повеќе хронични заболувања кај постарите возрасни лица. Тоа има големо влијание врз здравјето на постарите возрасни лица, вклучувајќи ги физичките и психолошките ефекти врз семејството, како и економското влијание врз владата поради зголемените средства за здравствено осигурување. Целта на оваа студија беше да се откријат факторите поврзани со мултиморбидитет, како што се социодемографските карактеристики, однесувањето и социјалната средина. Материјали и методи: Беше спроведена еден вид опсервациона студија која вклучуваше примерок од 75 испитаници - случаи и 75 испитаници – контролни лица. Податоците беа земени со помош на прашалник и интервју со испитаниците, а потоа анализирани со повеќекратна логистичка регресија. Мултиваријантната анализа покажа дека седум варијабли беа значајно поврзани со мултиморбидитетот: физичка активност (p = 0,016), BMI (p = 0,020), возраст (p = 0,011), семејна историја (p = 0,005), статус на пушење (p = 0,012), квалитет на спиење (p = 0,017) и социјална интеракција (p = 0,007). Квалитетот на спиењето имаше најзначаен ефект врз инциденцијата на мултиморбидитет кај постарите возрасни лица, со OR = 8,445. Интервенциите треба да се фокусираат на факторите на однесување што можат да се променат, како што се подобрување на квалитетот на спиењето придружено со зголемена физичка активност, откажување од пушење, одржување идеална тежина и охрабрување на постарите возрасни лица да бидат активни во општествените активности за да го подобрат квалитетот на својот живот.

Introduction

The increasing life expectancy is a sign of the success of development in Indonesia, and it presents new challenges in the form of a growing elderly population, which has become a global trend experienced by many countries in the world, including Indonesia. The number of the world's population aged 60 years and older is expected to increase from 1.4 billion in 2020 to 2.1 billion by 2050.[1]

The growing elderly population is directly proportional to increased health risks, considering the decline in bodily functions that accompanies older adults. Based on data from the 2023 Health Statistics Profile, older adults are most vulnerable to health problems. A total of 41.49% of older adults experienced health complaints during the 2021-2023 period, which had implications for a decline in the quality of life, reflected in the proportion of 19.72% of older adults who experienced difficulties in carrying out daily activities.[2]

This condition is exacerbated by multimorbidity, which is simultaneous appearance of various chronic or acute diseases and medical conditions in one person.[3] Literature studies indicate that the prevalence of multimorbidity in older adults ranges from 30.7% to 57%.[4] Globally, the highest prevalence of multimorbidity has been found in South America (50.1%), while the lowest prevalence was observed in Africa (28.2%).[5]

Although data related to multimorbidity studies in Indonesia is still limited, the latest study by Mathias et al. in 2021 showed that respondents aged 50 years and older in Indonesia had a multimorbidity prevalence of 22% based on data from the Indonesia Family Life Survey (IFLS) in 2014.6 In addition, a study by Nurinayah et al. in Bandung found that 166 older adults or 40.9% suffered from multimorbidity.[7]

The high prevalence of multimorbidity in the elderly has consequences in the form of a higher risk of death, greater need for health services with large costs, a decrease in productivity, and a low quality of life.[5,6]

The low quality of life after the onset of a disease will affect the level of independence in caring for oneself, the low ability to meet physiological needs and adjust to lifestyle changes as well as the low level of medication adherence.[8] This condition also burdens families and caregivers because older adults tend to depend on getting help in carrying out daily activities.

The government also feels a large impact related to the loss of Indonesia's National Health Insurance system, known as BPJS program due to the high cost of handling chronic diseases. More than 43% of Indonesia's National Health Insurance (BPJS) users who go to the hospital are identified with chronic multimorbidity.[9]

Non-communicable diseases account for around 60% of the total expenditure on health insurance programs in Indonesia.[6] The synergistic effects of multimorbidity create an urgent need for wider access to specialist services for more in-depth biomedical examinations, appropriate treatment, and comprehensive care.[10]

Based on the Indonesian National Socio-Economic Survey, according to the type of health expenditure, the largest proportion is used for

medical or curative service costs, accounting for approximately 68.15% of the total monthly health expenditure. In comparison, the cost of preventive services is around 17.54% of the total health expenditure for a month and the rest is used for drug costs of 14.32%.2 Therefore, the BPJS program is not currently able to fully finance (100%) the treatment of chronic diseases.

Factors that have been confirmed to affect the high risk of suffering from multimorbidity are female gender, old age, high socioeconomic level, overweight, family history of non-communicable disease, older adults who are married, including widows/widowers, unemployed individuals, and those who live in urban areas.[11–13] The high prevalence of multimorbidity events is also due to behavioral risk factors such as lack of fresh fruit consumption, smoking and alcohol consumption, poor sleep quality, lack of physical activity and low medication adherence.[14,15]

The health profile of the Pancoran Mas Community Health Center in 2022 showed that only about 42% of the total 9,216 elderly population had taken part in health screenings.16 This figure indicates a considerable number of older adults whose diseases have not been detected. In addition, a preliminary study found that 9 out of 15 older adults experienced multimorbidity. However, there is no accurate data on the prevalence of multimorbidity in older adults in the region, an obstacle to better health service planning.

A data gap regarding multimorbidity in older adults in Indonesia, especially in the Pancoran Mas Community Health Center area is a strong basis for researchers to conduct further studies. This study aimed to uncover the risk factors associated with multimorbidity in older adults so that it can be the foundation for developing more effective interventions.

Materials and methods

This is an observational analytical study with a case-control design. It was conducted in the working area of the Pancoran Mas Community Health Center in Depok City, which covers 2 (two) sub-districts - Depok Sub-district and Pancoran Mas Sub-district, and was conducted in June 2024. The population included were older adults aged 60 years and above who had been recorded as having received treatment in the Pancoran Mas Community Health Center working area during the research period. Meanwhile, respondents were divided into case groups, and controls were taken from elderly patients who came for treatment in the working area of the Pancoran Mas Community Health Center during the research period. The case group comprised older adults who suffered from multimorbidity based on the disease diagnosis made by a physician within the previous 6 months, while the control group included older adults who did not suffer from multimorbidity, either being disease-free or having only one type of disease.

The study samples were taken using purposive sampling. A total of 150 respondents consisted of 75 people in the case group and 75 people in the control group. The number of samples was calculated using the two-proportional difference hypothesis formula to detect differences in exposure in cases with multimor-

bidity and non-multimorbidity. Data was collected using face-to-face interviews and questionnaires for 20-25 minutes.

The dependent variable in this study was multimorbidity, while the independent variable included three aspects - sociodemographic characteristics (age, gender, family history, occupation, marital status and body mass index), behavioral factors (smoking status, sleep quality, physical activity and risky diet), and social environmental factors (family support, living arrangement and social interaction). Multimorbidity was assessed based on respondents' self-reports identifying several chronic diseases among elderly individuals diagnosed by a physician within the last 6 months, without additional examinations conducted by the researcher. Ten chronic diseases were the focus of the research: hypertension, diabetes mellitus, gastroenteritis, hypercholesterolemia, arthritis, coronary heart disease (CHD), asthma, chronic obstructive pulmonary disease (COPD), stroke and depression.

Sleep quality variables were measured using a leaned questionnaire, Pittsburgh Sleep Quality Index (PSQI), and the physical activity variable was measured using a questionnaire, Physical Activity Scale for the Elderly (PASE). Next, the data were analyzed by chi-square and multiple logistic regression tests with a significance level of $p = 0.05$ and a confidence level of 95% CI. Data were presented in both tabular and narrative form. The study was approved by the Medical and Health Research Ethics Commission, University of Muhammadiyah Prof. DR. Hamka, with the number KEPKK/FK/054/04/2024.

Results

Sociodemographic characteristics are shown in Table 1. The study results showed that the majority of respondents were aged 60-69 (63.3%); there were 70.7% of females, 56.7% had no family history of illness, 62.7% were unemployed), 53.3% were married, and 52% had an abnormal BMI.

Table 1: Sociodemographic characteristics of the study population

Characteristics	n = 150	%
Age		
≥ 70 years	55	36.7
60-69 years old	95	63.3
Gender		
Woman	106	70.7
Man	44	29.3
Family History		
Yes	65	43.3
No	85	56.7
Work		
Not Working	94	62.7

Work	56	37.3
Marital Status		
Single/Divorce/Widow/Widower	70	46.7
Married	80	53.3
Body Mass Index (BMI)		
Abnormal	78	52
Normal	72	48

Source: Primary Data, 2024

The prevalence of 10 chronic NCDs is shown in Table 2. Older adults who were affected by multimorbidity had 2 to 6 types of diseases, with the most frequent co-occurrence being 4 and 5 types of diseases (16%). The top three chronic NCDs experienced by most respondents were hypertension (68.7%), diabetes mellitus (43.3%) and gastroenteritis (39.3%). The combination of hypertension and arthritis was most commonly found in older adults studied. However, about 48.7% of respondents presented with a single chronic disease, and 1.3% reported no specific chronic disease.

Table 2: Prevalence of chronic NCDs in older adults

Chronic NCDs	n	%
Hypertension	103	68.7
Diabetes Mellitus	65	43.3
Gastroenteritis	59	393
Hypercholesterolemia	58	38.7
Arthritis	56	37.3
Coronary Heart Disease (CHD)	32	21.3
Asthma	11	7.3
Chronic obstructive pulmonary disease	5	3.3
Stroke	4	2.7
Depression	3	2
Number of Chronic Diseases		
0	2	1.3
1	73	48.7
2	4	2.7
3	13	8.7
4	24	16
5	24	16

*NCD= Non-Communicable Diseases
Source: Primary Data, 2024

Table 3 shows that the majority of older adults with multimorbidity were aged ≥70 years (52%), female (80%), had a family history (61.3%), were unemployed (74.7%), had no partner (single, divorced, widow/ widower) (57.3%), had abnormal BMI (68%), smoked (58.7%), had poor sleep quality (64%), inadequate physical activity (93.3%), risky diet (89.3%), poor family support (84%), lived with family (76%) and had poor social interaction (57.3%).

Furthermore, Table 3 shows that factors related to multimorbidity included age ($p < 0.001$), gender ($p = 0.020$), family history ($p < 0.001$), occupation ($p = 0.004$), marital status ($p = 0.014$), body mass index (BMI) ($p < 0.001$), physical activity ($p < 0.001$), smoking status ($p = 0.003$), sleep quality ($p = 0.009$), risky diet ($p < 0.001$), family support ($p = 0.006$), and social interaction ($p < 0.001$). However, no significant relationship was found between living arrangements and multimorbidity in older adults.

Table 3: Relationship between multimorbidity and sociodemographic, behavioral and social environment characteristics

Variable	Multimorbidity				Total		p-value	cOR value (95%CI)
	Yes		No					
	n	%	n	%	n	%		
Age								
≥ 70 years	39	52	16	21.3	55	36.7	< 0.001	3.995 (1.955 – 8.161)
60-69 years old	36	48	59	78.7	95	63.3		
Gender								
Woman	60	80	46	61.3	106	70.7	0.020	2.522 (1.213 – 5.244)
Man	15	20	29	38.7	44	29.3		
Family History								
Yes	46	61.3	19	25.3	65	43.3	< 0.001	4.675 (2.327 – 9.393)
No	29	38.7	56	74.7	85	56.7		
Work								
Not Working	56	74.7	38	50.7	94	62.7	0.004	2.870 (1.440 – 5.720)
Work	19	25.3	37	49.3	56	37.3		
Marital Status								
Single/Divorce/Widow/ Widower	43	57.3	27	36	70	46.7	0.014	2.389 (1.238 – 4.608)
Married	32	42.7	48	64	80	53.3		
Body Mass Index (BMI)								
Abnormal	51	68	27	36	78	52	< 0.001	3.778 (1.921 – 7.431)
Normal	24	32	48	64	72	48		
Smoking Status								
Yes	44	58.7	25	33.3	69	46	0.003	2.839 (1.460 – 5.518)
No	31	41.3	50	66.7	81	54		
Sleep Quality								
Poor	48	64	31	41.3	79	52.7	0.009	2.523 (1.306 – 4.874)
Good	27	36	44	58.7	71	47.3		

Physical Activity								
Poor	70	93.3	34	45.3	104	69.3	< 0.001	16.882 (6.119 – 46.576)
Good	5	6.7	41	54.7	46	30.7		
Risky Diet								
Not Good	67	89.3	45	60	112	74.7	< 0.001	5.583 (2.347 – 13.281)
Good	8	10.7	30	40	38	25.3		
Family Support								
Not Good	63	84	47	62.7	110	73.3	0.006	3.128 (1.441 – 6.786)
Good	12	16	28	37.3	40	26.7		
Living Arrangement								
Living Alone	18	24	11	14.7	29	19.3	0.215	1.837 (0.801 – 4.216)
Living with Family	57	76	64	85.3	121	80.7		
Social Interaction								
Poor	43	57.3	13	17.3	56	37.3	< 0.001	6.409 (3.019 – 13.606)
Good	32	42.7	62	82.7	94	62.7		

*cOR = Crude Odds Ratio, Source: Primary Data, 2024

Table 4 presents logistic regression results for multimorbidity. Sociodemographic characteristics were included in modelling 1; it was found that family history was the most dominant risk factor, where the presence of family history with similar health conditions significantly increased the likelihood of a person being multimorbid 5 times (OR = 5.194; 95% CI = 2.259 - 11.94). Furthermore, individuals aged 70 years or older had a significantly higher risk of developing multimorbidity than those aged 60-69 years (OR = 3.667; 95% CI = 1.530 – 8.787). Similarly, individuals with an abnormal BMI had a significantly higher risk of developing multimorbidity than those with normal BMI (OR = 3.318; 95% CI = 1.469 - 7.494). Factors such as gender, occupation and marital status did not significantly affect model 1.

Behavioral factors in model 2 showed that, in addition to being physically inactive as the most influencing factor for multimorbidity (OR = 9.746; 95% CI = 3.346-28.385), other behavioral factors such as poor sleep quality (OR = 5.639; 95% CI = 1.951-16.300), smoking status (OR = 4.613; 95% CI = 1.588-13.400), and risky diet (OR = 4.493; 95% CI = 1.635-12.349) significantly contributed to the incidence of multimorbidity in older adults.

In model 3, social environmental factors were included in the analysis. The results showed that lack of family support and poor social interaction was significantly associated with an increased risk of multimorbidity by three times and six times, respectively, compared to older adults with good family support and social interaction (OR family support = 3.157; 95% CI = 1.348-7.397 and OR social interaction = 6.305; 95% CI = 2.875-13.828). The living arrangement factor was not significantly related.

In addition, model 4 combined sociodemographic, behavioral and social environment characteristic

factors that were analyzed simultaneously. Multivariate final modelling in model 5 showed that the variables related to multimorbidity were physical activity, BMI, age, family history, smoking status, sleep quality and social interaction. Sleep quality was the most dominant variable influencing multimorbidity (OR = 8.445; 95% CI 1.4 – 47.03).

Table 4: Multivariate regression analysis of factors associated with multimorbidity in older adults

Factors	Model 1		Model 2		Model 3		Model 4		Model 5	
	p	aOR (95% CI)	p	aOR (95% CI)	p	aOR (95% CI)	p	aOR (95% CI)	p	aOR (95% CI)
Sociodemographic Characteristics										
Older Age	0.004	3.667 (1.530 – 8.787)					0.016	4.709 (1.336 – 16.599)	0.011	4.958 (1.436- 17.117)
Gender (Woman)	0.119	1.969 (0.839 – 4.620)					0.217	2.666 (0.561 – 12.659)	0.195	2.769 (0.594 – 12.899)
Have a Family History	0.000	5.194 (2.259 – 11.94)					0.006	5.664 (1.665 – 19.271)	0.005	1.607 (0.431 – 5.991)
Not Working	0.122	1.971 (0.835 – 4.656)					0.707	1.261 (0.377 – 4.214)	/	/
Not Married	0.063	2.196 (0.958 – 5.031)					0.531	1.534 (0.402 – 5.848)	0.480	1.607 (0.431 – 5.991)
Abnormal BMI	0.004	3.318 (1.469 – 7.494)					0.019	4.161 (1.268 – 13.661)	0.020	4.057 (1.249 – 13.175)
Behavioral Factors										
Smoking			0.005	4.613 (1.588 – 13.40)			0.015	5.776 (1.413 – 23.607)	0.012	5.982 (1.477 – 24.230)
Poor Sleep Quality			0.001	5.639 (1.951 – 16.300)			0.017	8.503 (1.461 – 49.479)	0.017	8.445 (1.472 – 48.443)
Poor Physical Activity			0.000	9.746 (3.346 – 28.385)			0.019	4.906 (1.300 – 18.514)	0.016	5.085 (1.361 – 18.998)
Risky Diet			0.004	4.493 (1.635 – 12.349)			0.078	3.513 (0.871 – 14.174)	0.082	3.404 (0.855 – 13.553)
Social Environmental Factors										
No Family Support					0.008	3.157 (1.348 – 7.397)	0.356	1.906 (0.485 – 7.496)	0.324	1.979 (0.510 – 7.685)
Living Alone					0.629	1.269 (0.483 – 3.335)	0.166	3.483 (0.595 – 20.385)	0.182	3.231 (0.577 – 18.081)
Poor Social Interaction					0.000	6.305 (2.875 – 13.828)	0.007	4.972 (1.565 – 15.797)	0.007	4.788 (1.542 – 14.864)

Source : Primary Data, 2024, *aOR = Adjusted Odds Ratio, p = p-value.

Logistic Regression Equation (Y) = a+b1x1 +b2x2+.....+bnxn

Multimorbidity = -24,630 +1,626 Poor Physical Activity + 1,400 Abnormal BMI + 1,601 Older Age + 1,789 Have a Family History + 2,134 Poor Sleep Quality + 1,566 Poor Social Interaction + 0.474 Not Married + 0.683 No Family Support + 1,018 Gender +1,173 Living Alone + 1,225 Risky Diet

Discussion

Pancoran Mas Community Health Center is an urban health center located in Depok City. It is very strategically located and closest to the center of Depok City, so it has become a community treatment center and has wide coverage, especially in providing health services for older adults. This study found that

older adults in Pancoran Mas Community Health Center work area in Depok City were mostly women, predominantly in the young elderly groups (60-69 years old) and lived with their family or a partner rather than alone.

This data is supported by the 2019 national data on sociodemographic conditions of the elderly population in Indonesia in general, where the proportion of female elderly (5%) was greater than that of male elderly (4.6%) so that the life expectancy of female elderly was higher than that of men. In addition, based on age groups, older adults in Indonesia were predominantly in the young elderly groups aged 60-69 years (63.82%) compared to the elderly group aged 70 years and above. Then, based on residence status, most older adults lived with their families, partners, children, and grandchildren (40.64%) compared to a smaller proportion who lived alone (9.38%).[17]

Based on the demographic structure, Indonesia is experiencing a transition period towards an aging population structure, which has caused a shift in disease patterns, marked by a decrease in cases of infectious diseases and an increase in cases of non-communicable diseases that require attention. The incidence of NCDs in 2017 accounted for 55.3% of the disease burden in older adult group in Indonesia.[9]

Then, national data from 2019 indicated that around 51.1% of older adults experienced health complaints, and 26.2% experienced illness.[17] This situation becomes even more concerning with the existence of several chronic diseases or multimorbidity in older adults.

In this study, hypertension was the most frequently reported disease related to multimorbidity, as it was often accompanied by one other chronic condition. The combination of hypertension with cardiovascular disease, stroke, digestive diseases, hyperlipidemia, diabetes, and arthritis is a common condition in multimorbidity.[18] Similar findings were reported in previous studies illustrating that older adults suffer from top three diseases - hypertension (45.2%), diabetes mellitus (32.2%), and arthritis (29.5%).[12]

The results of the final modeling of multiple logistic regression revealed that physical activity, BMI, age, family history, smoking status, sleep quality, and social interaction were related to multimorbidity. These results are similar to previous studies.[15]

Age was significantly associated with multimorbidity. Similar findings presented in other studies found a relationship between age factors and the incidence of multimorbidity ($p < 0.05$).[13,19,20] Individuals aged 70 years or older were at a higher risk of developing multimorbidity or experiencing two or more chronic conditions simultaneously (OR= 1.46; 95% CI =1.22 - 1.74).[14]

The increasing prevalence of multimorbidity goes hand in hand with the advancing age.[21] With a tendency to live longer, it means that individuals are more likely to develop chronic diseases due to prolonged exposure to risk factors such as an unhealthy lifestyle that accumulates over time and damages organs and body systems so that disease arises.[22]

However, the study by Pereira et al. (2023) shows that younger people also

experience a high prevalence of various health conditions.[20] Therefore, multimorbidity treatment should begin from younger age rather than focusing only on older adults.

Furthermore, the family history variable was significantly associated with multimorbidity (OR= 5.730; 95% CI: 1.688 – 19.442). In line with the findings of Chen et al. in 2022, family history is considered the most significant risk factor for multimorbidity (OR: 2.22; 95% CI: 1.73-2.86).[14] Individuals with a family history of hypertension and diabetes are at higher risk of suffering from similar diseases than those without a history of these diseases.[23] Family-inherited genetic factors can increase susceptibility to developing some chronic diseases and contribute to the existence of multimorbidities.[22]

This study also showed that the BMI variable was significantly related to multimorbidity (p-value =0.020; OR= 4.057; 95% CI: 1.249 – 13.175). This study's results align with previous research, which stated a positive relationship between BMI and multimorbidity (p-value < 0.05).24–26 An unhealthy lifestyle, reflected in high BMI outcomes, results in developing chronic conditions such as cardiovascular disease, diabetes, and respiratory problems.[22] Moreover, overweight is a common phenomenon in urban areas today, where unhealthy diets and lifestyles supported by easy access to processed foods and the lack of public spaces for exercise are the main driving factors for urban residents. So, overcoming BMI through lifestyle modifications such as dietary changes and increased physical activity can help prevent and manage chronic diseases.

Furthermore, smoking status was statistically significant in relation to multimorbidity, where elderly smokers were almost 6 times more likely to experience multimorbidity than non-smokers (OR= 5.982; 95% CI: 1.477 – 24.230). This is consistent with several other studies that reported a significant association between smoking status and the incidence of multimorbidity ($p < 0.001$).[20,27,28]

Smoking status is associated with a higher risk of multimorbidity, suggesting the negative impact of smoking on health because smoking weakens the immune system and inhibits the body's ability to heal and fight infections, making it more susceptible to developing multiple chronic diseases simultaneously.[28]

The results of this study indicated that the sleep quality variable was the most dominant variable that affected the incidence of multimorbidity (p-value of 0.017). Respondents who had poor sleep quality were 8.445 times more likely to experience multimorbidity than those who had good sleep quality (OR=8.445; 95% CI 1.472 – 48.443). Similar findings were reported by Xue et al. in their 2022 study in China, which showed that sleep quality was the most dominant factor influencing multimorbidity (OR = 2.445; 95% CI: 2.043–2.927).[29]

Moreover, the study area is classified as the social status of urban communities with more crowded and busy social activities until late into the night. This may be one of the conditions that affect poor sleep quality among people in urban areas. Meanwhile, a study of regions with different population characteristics in rural areas in Tiongkok, showed that poor sleep quality significantly

affected multimorbidity (OR = 2.15; 95% CI: 1.59–2.92). Most rural residents are involved in agricultural activities daily, especially if there is busyness during the harvest season, which requires them to wake up early and stay up late, thus reducing sleep time and negatively impacting the health of older adults.[15]

Individuals with poor sleep quality had a 1.39 times higher risk of developing two chronic diseases, 1.56 times higher risk for three chronic diseases, and 2.36 times higher risk for four chronic diseases.[30] This shows that the more chronic diseases a person suffers, the higher the risk of sleep disorders. Older adults with sleep problems were 34% more likely to have a vascular-metabolic multimorbidity pattern, 62% more likely to have a cardiopulmonary pattern, 64% more likely to have a musculoskeletal multimorbidity pattern, and 88% more likely to have coexisting multimorbidity patterns.[31]

Studies on aging in Canada show that the risk of multimorbidity in both men and women of various age groups is higher in individuals who report poor sleep patterns in the form of too short or too long sleep duration, as well as dissatisfaction with sleep quality.[32] According to a study by Lin Yawen et al. in 2022, multimorbidity is more common in people with shorter (less than 7 hours) and longer (more than 9 hours) sleep duration at night while people with an ideal night's sleep duration of between 7 and 9 hours have a lower prevalence of multimorbidity.[33]

Poor sleep quality can trigger changes in autonomic activity, appetite regulation, and inflammation, all linked to chronic diseases.[30] Poor sleep quality negatively impacts happiness and quality of life because older adults who experience poor sleep quality are more susceptible to negative emotions, such as anxiety, depression, and the inability to cope with stress effectively.[13,34]

On the other hand, there is a reciprocal relationship that shows how sleep quality and a person's chronic condition can worsen each other. Multimorbidity also increases the risk of poor sleep quality; for example, individuals with multimorbidity who have to take a lot of medication, have the potential to experience negative side effects on their sleep duration.[30]

Furthermore, in diabetics, it can also cause sleep disorders such as excessive thirst and frequent urination at night, as well as hormonal system disorders that can cause difficulty sleeping. Lack of sleep can increase the risk of diabetes because it causes insulin resistance.[35] Therefore, good sleep management should be an integral part of the care of multimorbidity patients. By providing the right education and interventions, primary health care can help patients cope with sleep disorders and improve their overall quality of life.

This study also showed that physical activity was significantly associated with multimorbidity (OR= 5.085 95% CI: 1.361 – 18.998). Physical activity is effective in preventing and managing chronic diseases, as well as improving mental health and general quality of life.[36] The results of the study were in line with the explanation that there was a relationship between physical activity and the incidence of multimorbidity (p-value

< 0.05).[12,20,28] Older adults who have never been physically active are at a very high risk of multimorbidity, 3.82 times higher than those who are physically active.[12]

Multimorbidity and physical inactivity form a cycle that reinforces each other. Chronic diseases can lead to decreased physical activity; conversely, a lack of physical activity can worsen health conditions and increase the risk of developing diseases. This is evidenced by the results of studies in 46 low- and middle-income countries showing that older adults with multimorbidity have a 1.31 times higher risk of being physically inactive than healthy individuals. Conditions such as chronic pain due to arthritis can limit mobility and lead to sleep disturbances, which in turn can trigger depression and reduce motivation to exercise.[37]

The social and environmental factors associated with multimorbidity were social interactions indicated by values (p = 0.007) (OR= 4.788; 95% CI 1.542 – 14.864). Lack of participation in social activities was associated with an increased risk of developing multimorbidity (p = 0.003).[26]

Based on a study in the city of Makassar and a survey in 34 provinces in Indonesia, it was concluded that the involvement of older adults in social activities such as religious activities, social gatherings, and other social activities was still low due to declining physical conditions and a limited number of social activities in the environment where older adults lived.[38,39] Older adults who are active in socializing tend to be happier, healthier, and more independent because they can freely express their feelings and needs to others. Thus, older adults can be more independent and have a better quality of life.[40]

Limitation

The limitation of this study is using a case-control design, so recall bias is highly likely to occur. However, in this study, the recall conduct is general and does not require detailed information, so the condition of recall bias can be minimized. Furthermore, there is a limitation of data related to chronic diseases in the elderly that have not been fully registered in primary health facilities, so the prevalence of chronic diseases may be higher than in this study. This occurs because chronic disease patients are likely to visit health facilities in poor condition, thus being referred directly to secondary health services before reaching primary health facilities. Nevertheless, this study recommends that improving sleep quality must be accompanied by increasing physical activity, quitting smoking, maintaining an ideal weight, and encouraging older adults to participate in social activities. Primary health care providers must be more proactive in paying attention to sleep disorders in older adults. In addition, to maintain physical health and improve the quality of their sleep, older adults need to be motivated to be more active in doing regular exercise, especially multicomponent physical activity programs that include a combination of balance, strength, endurance, gait, and physical function training so that the quality of life of older adults can improve. Further research with broader scope and longitudinal methods is needed to better under-

stand the impact and patterns of multimorbidity in older people.

Conclusion

This study showed that the variables related to multimorbidity were physical activity, BMI, age, family history, smoking status, sleep quality, and social interaction. Sleep quality is the most dominant variable for the incidence of multimorbidity in older adults. Therefore, the target intervention needs to focus on factors that can still be changed and prevented, such as behavioral factors including sleep quality, physical activity, and smoking status. The implementation of the Chronic Disease Management Program (PROLANIS) needs to put a big emphasis on educating people about healthy behavior.

References

1. Badan Pusat Statistik (BPS). Statistik Penduduk Lanjut Usia. 2022 [cited 2023 Nov 8].
2. Badan Pusat Statistik (BPS). Profil Statsitik Kesehatan 2023. Vol. 7. 2023.
3. Johnston MC, Crilly M, Black C, Prescott GJ, Mercer SW. Defining and measuring multimorbidity: A systematic review of systematic reviews. European Journal of Public Health. 2019; 29(1):182–9. https://doi.org/10.1093/eurpub/cky098
4. Melo LA de, Braga L de C, Leite FPP, Bittar BF, Oséas JM de F, Lima KC de. Factors associated with multimorbidity in the elderly: an integrative literature review. Revista Brasileira de Geriatria e Gerontologia. 2019;22(1). https://doi.org/10.1590/1981-22562019022.180154
5. Chowdhury SR, Chandra Das D, Sunna TC, Beyene J, Hossain A. Global and regional prevalence of multimorbidity in the adult population in community settings: A systematic review and meta-analysis. E Clinical Medicine. 2023 ;57:6–11. https://doi.org/10.1016/j.eclinm.2023.101860
6. Marthias T, Anindya K, Ng N, McPake B, Atun R, Arfyanto H, et al. Impact of non-communicable disease multimorbidity on health service use, catastrophic health expenditure and productivity loss in indonesia: A population-based panel data analysis study. BMJ Open. 2021;11(2). https://doi.org/10.1136/bmjopen-2020-041870
7. Nurinayah A, Nugraha S, Adawiyah AR. Hubungan Penyakit Kronis dan Multimorbiditas dengan Kekuatan Genggaman Lansia di Kota Bandung dan Kabupaten Bandung Tahun 2022. Jurnal Untuk Masyarakat Sehat (JUKMAS). 2022; 6(2):120–6. https://doi.org/10.52643/jukmas.v6i2.2473
8. Terzieva A, Stambolova I, Vasileva N. Quality of life and multimorbidity in elderly people. Innowacje w Pielęgniarstwie. 2024;9(2):41–8. https://doi.org/10.52643/jukmas.v6i2.2473
9. Husnayain A, Ekadinata N, Sulistiawan D, Su ECY. Multimorbidity patterns of chronic diseases among indonesians: insights from Indonesian National Health Insurance (INHI) Sample Data. International Journal Environmental Research and Public Health.

2020; 17(23):1–12. https://doi.org/10.3390/ijerph17238900

10. Tripp-Reimer T, Williams JK, Gardner SE, Rakel B, Herr K, McCarthy AM, et al. An integrated model of multimorbidity and symptom science. Nursing Outlook. 2020; 68(4):430–9. https://doi.org/10.1016/j.outlook.2020.03.003
11. Khan MR, Malik MA, Akhtar SN, Yadav S, Patel R. Multimorbidity and its associated risk factors among older adults in India. BMC Public Health. 2022;22(1). https://doi.org/10.1186/s12889-022-13181-1
12. La Foucade A, Davis G, Baboolal N, Bethelmie D, Laptiste C, Ali-Sisbane H, et al. The socio-economic determinants of multimorbidity among the elderly population in Trinidad And Tobago. PLoS One [Internet]. 2020;15(9):e0237307. https://doi.org/10.1371/journal.pone.0237307
13. Zhang C, Dong F, Zheng X, Xue Y, Xiao S, Shi L, et al. The impact of sleep quality on subjective well-being among older adults with multimorbidity: A moderated mediation model. Frontiers in Psychology. 2022;13. https://doi.org/10.3389/fpsyg.2022.813775
14. Chen Y, Shi L, Zheng X, Yang J, Xue Y, Xiao S, et al. Patterns and determinants of multimorbidity in older adults: Study in health-ecological perspective. International Journal Environmental Research and Public Health. 2022;19(16756):1–15. https://doi.org/10.3390/ijerph192416756
15. Zhang C, Xiao S, Shi L, Xue Y, Zheng X, Dong F, et al. Urban–rural differences in patterns and associated factors of multimorbidity among older adults in China: A cross-sectional study based on apriori algorithm and multinomial logistic regression. Frontiers in Public Health. 2021;9:1–10. https://doi.org/10.3389/fpubh.2021.707062
16. UPTD Puskesmas Pancoran Mas. Profil Kesehatan UPTD Puskesmas Pancoran Mas Tahun 2022. 2022.
17. TNP2K. Situasi Lansia di Indonesia dan Akses terhadap Program Perlindungan Sosial: Analisis Data Sekunder. Jakarta; 2020 Nov [cited 2024 Dec 30]. Available from: https://www.tnp2k.go.id/download/87694Laporan%20Studi%20Lansia%20-%20Analisis%20Data%20Sekunder.pdf
18. Griselda M, Alfian SD, Wicaksono IA, Wawruch M, Abdulah R. Findings from the Indonesian Family Life Survey on Patterns and Factors Associated with Multimorbidity. Scientific Reports. 2023;13(1). https://doi.org/10.1038/s41598-023-42603-2
19. Nguyen H, Chua KC, Dregan A, Vitoratou S, Bayes-Marin I, Olaya B, et al. Factors associated with multimorbidity patterns in older adults in England: Findings from the English Longitudinal Study of Aging (ELSA). Journal of Aging and Health. 2020;32(9):1120–32. https://doi.org/10.1177/0898264319891026
20. Pereira CC, Pedroso CF, Batista SRR, Guimarães RA. Prevalence and factors associated with multimorbidity in adults in Brazil, according to sex: A popula-

tion-based cross-sectional survey. Frontiers in Public Health. 2023;11(1193428). https://doi.org/10.3389/fpubh.2023.1193428

21. Keomma K, Bousquat A, César CLG. Prevalence of multimorbidity in older adults in São Paulo, Brazil: A Study With ISA-Capital. Revista de Saude Publica. 2022;56(69). https://doi.org/10.11606/S1518-8787.2022056004252
22. Singh K, Patel SA, Biswas S, Shivashankar R, Kondal D, Ajay VS, et al. Multimorbidity in South Asian adults: Prevalence, risk factors and mortality. Journal of Public Health. 2019;41(1):80–9. https://doi.org/10.1093/pubmed/fdy017
23. Shi J, Guo Y, Li Z, Liang Z, Pan L, Yu Y, et al. Sociodemographic and behavioral influences on multimorbidity among adult residents of Northeastern China. BMC Public Health. 2022;22(1):1–12. https://doi.org/10.1186/s12889-022-12722-y
24. Aminisani N, Stephens C, Allen J, Alpass F, Shamshirgaran SM. Socio-demographic and lifestyle factors associated with multimorbidity in New Zealand. Epidemiology and Health. 2020;42:1–7. https://doi.org/10.4178/epih.e2020001
25. Bezerra de Souza DL, Oliveras-Fabregas A, Espelt A, Bosque-Prous M, de Camargo Cancela M, Teixidó-Compañó E, et al. Multimorbidity and its associated factors among adults aged 50 and over: A cross-sectional study in 17 European Countries. PLoS One. 2021;16(2):1–16. https://doi.org/10.1371/journal.pone.0246623
26. Lee TW, Chung J, Song K, Kim E. Incidence and predictors of multimorbidity among older adults in Korea: a 10-year cohort study. BMC Geriatrics. 2022;22(1). https://doi.org/10.1186/s12877-022-03250-w
27. Sinaga IOY, Barliana MI, Pradipta IS, Iskandarsyah A, Abdulah R, Alfian SD. Depression is associated with the increase risk of multimorbidity among the general population in Indonesia. Journal of Multidisciplinary Healthcare. 2022;15:1863–70. https://doi.org/10.2147/JMDH.S372712
28. Zou S, Wang Z, Bhura M, Zhang G, Tang K. Prevalence and associated socioeconomic factors of multimorbidity in 10 regions of China: An analysis of 0.5 million adults. Journal of Public Health (United Kingdom). 2022;44(1):36–50. https://doi.org/10.1093/pubmed/fdaa204
29. Xue B, Xue Y, Dong F, Zheng X, Shi L, Xiao S, et al. The impact of socioeconomic status and sleep quality on the prevalence of multimorbidity in older adults. Frontiers Public Health. 2022;10:1–9. https://doi.org/10.3389/fpubh.2022.959700
30. Wang X, Wang R, Zhang D. Bidirectional associations between sleep quality/duration and multimorbidity in middle-aged and older people chinese adults: A longitudinal study. BMC Public Health. 2024;24(1). https://doi.org/10.1186/s12889-024-17954-8
31. Idalino SCC, Canever JB, Cândido LM, Wagner KJP, de Souza Moreira B, Danielewicz AL, et al. Association between sleep prob-

lems and multimorbidity patterns in older adults. BMC Public Health. 2023;23(1):1–8. https://doi.org/10.1186/s12889-023-15965-5

32. Nicholson K, Rodrigues R, Anderson KK, Wilk P, Guaiana G, Stranges S. Relationship between sleep patterns and multimorbidity in the canadian longitudinal study on aging. European Journal of Public Health. 2019;29. https://doi.org/10.1093/eurpub/ckz185.416
33. Lin Y, Hu Y, Guo J, Chen M, Xu X, Wen Y, et al. Association between sleep and multimorbidity in chinese elderly: Results from the Chinese Longitudinal Healthy Longevity Survey (CLHLS). Sleep Medicine. 2022;98:1–8. https://doi.org/10.1016/j.sleep.2022.06.007
34. Lin H, Xiao S, Shi L, Zheng X, Xue Y, Yun Q, et al. Impact of multimorbidity on symptoms of depression, anxiety, and stress in older adults: Is there a sex difference? Frontiers in Psychology. 2021;12. https://doi.org/10.3389/fpsyg.2021.762310
35. Darraj A. The link between sleeping and type 2 diabetes: A systematic review. Cureus. 2023;15(11):1–10.https://doi.org/10.7759/cureus.48228
36. Kadambi S, Abdallah M, Loh KP. Multimorbidity, function, and cognition in aging. Clinics in Geriatric Medicine. 2020;36(4):569–84. https://doi.org/10.1016/j.cger.2020.06.002
37. Vancampfort D, Koyanagi A, Ward PB, Rosenbaum S, Schuch FB, Mugisha J, et al. Chronic physical conditions, multimorbidity and physical activity across 46 low and middle income countries. International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1). https://doi.org/10.1186/s12966-017-0463-5
38. Ginting L, Mulyani RWP, Muta'ali L. Mapping of the elderly in Indonesia based on their socio-economic characteristics and health profile. Sosio Informa. 2019;5(01):51–3. https://doi.org/10.33007/inf.v5i1.1664
39. Bernard, Dirawan GD, Nurlita. Social interactions and elderly quality of life in Makassar, South Sulawesi, Indonesia. IOSR Journal Of Humanities And Social Science (IOSR-JHSS). 2018;23(2):77–83. https://doi.org/10.9790/0837-2302107783
40. Fadhila D, Didi Kurniawan, Nauli FA. Hubungan Interaksi Sosial dengan Tingkat Kemandirian dalam Pemenuhan Activity ff Daily Living pada Lansia. Jurnal Vokasi Keperawatan (JVK). 2022 Dec 22;5(2):156–64. https://doi.org/10.33369/jvk.v5i2.23091