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Behavioral and Anthropometric Predictors of Noncommunicable Diseases Among Older Adults: The Dominance of Smoking and Central Obesity

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ABSTRACT

The escalating burden of Noncommunicable Diseases (NCDs) poses a significant public health challenge in low- and middle-income countries, including Indonesia. In the Rancakalong Health Center area, Sumedang, hypertension prevalence among older adults has reached a critical 56.8%. This study aimed to identify and delineate the risk profiles of community-based NCDs—specifically a reported history of hypertension, diabetes mellitus, or dyslipidemia—among the older population. A cross-sectional study was conducted using a total sampling technique, involving 711 older adults. Data were collected using the validated Modified NCD Screening Form, covering lifestyle parameters, anthropometry, and clinical history. Independent predictors were identified using multivariate logistic regression analysis. The prevalence of NCD history among subjects was 57.9%. The multivariate model identified smoking habits as the strongest predictor (OR=3.49; 95% CI: 2.35–5.18; p<0.001). Other significant risk factors included infrequent vegetable/fruit consumption (OR=1.79; p<0.001), high-salt/fat intake (OR=2.12; p<0.001), overweight and obesity (OR=1.82–3.00; p=0.003), and increased abdominal circumference (OR=2.46; p<0.001). Conversely, low to moderate physical activity showed a protective effect (OR: 0.58 and 0.40; p<0.001), while alcohol consumption was not statistically significant (p=0.823). These findings underscore the urgency of evidence-based public health interventions at the primary care level. Shifting the focus toward lifestyle modifications is essential to mitigate NCD risks and enhance the quality of life for older adults in community settings.

Keywords: Noncommunicable Diseases; Aged; Risk Factors; Community Health Nursing; Lifestyle.

INTRODUCTION

Indonesia's aging population has increased significantly, with the older adult population projected to reach nearly 20% by 2045. Older adults face complex health challenges, including a high prevalence of Noncommunicable diseases (NCDs), multimorbidity, frailty, functional limitations, and mental health problems [1]This heightened vulnerability is fundamentally explained by the Accumulation of Risk Theory, which posits that long-term exposure to behavioral risks intersects with biological senescence. As individuals age, cellular aging mechanisms such as increased oxidative stress and reduced homeostatic capacity make older adults more susceptible to the deleterious effects of chronic inflammation and metabolic disturbances resulting from poor lifestyle choices. In Indonesia, this vulnerability is reflected in epidemiological data: the prevalence of frailty among older people reached 26.8%, while the prevalence of prefrailty was 55.5%. Multimorbidity was found in 24.9% of older adults, with hypertension being the most common disease. Furthermore, functional limitations and dependency increased, especially among the poorly educated and unmarried. [2]. The demographic transition in Indonesia has resulted in an ageing population, placing an increasingly complex health burden on the older adult group. In this context, Noncommunicable Diseases (NCDs) have transformed into the most pressing public health challenge, globally accounting for about 74% of total deaths, with the majority (82%) of premature deaths occurring in low-income countries and medium-sized enterprises, including Indonesia. [3]. Currently, Indonesia faces a "double burden of disease." [4] where the mortality trend has shifted predominantly toward NCDs, accounting for approximately 74% of total deaths [5]

National epidemiological data from the 2024 Indonesian Health Survey (SKI) underscores the urgency, reporting that hypertension prevalence in the population aged 60 and above has reached 56.8% [6]Indicates that this population faces a cumulative set of risks requiring integrated prevention and control strategies. Theoretically, NCDs are triggered by modifiable clusters of risk factors, in line with the WHO STEPwise Approach to NCD Surveillance framework, which emphasizes the importance of monitoring behavior (smoking, diet, physical activity) and biological parameters (blood pressure, anthropometry)[7]

A recent literature review confirms that high-risk behaviors are the main determinants of NCDs in Indonesia. A systematic review in the past five years shows that dietary intake high in salt/fat, physical inactivity, and smoking habits are significant predictors of increased prevalence of NCDs such as cardiovascular disease and diabetes among Asian seniors, including those in Indonesia [8] . Consumption of fatty foods more than three times per week significantly increased the risk of NCDs (OR: 1.05), while intensive physical activity lowered the risk

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of NCDs (OR: 0.77). The prevalence of risky behaviors such as smoking, excessive sugar/salt/fat consumption, and lack of physical activity remained high across different age groups [9]. However, despite recognition of this high risk, essential gaps remain in detailed NCD risk profile data at the primary health care community level. A specific, up-to-date risk profile is crucial so that the Health Center, as the main gateway to services, can design a precise, targeted intervention program and the physical activities to be carried out. [10]While standard screening tools exist, the use of a Modified NCD Screening instrument in this study represents the "state of the art" in community-based surveillance. This modified tool offers superior sensitivity by integrating specific lifestyle parameters with anthropometric markers tailored to the Indonesian elderly context, enabling more granular identification of risk clusters that standard protocols often overlook.

A significant research gap remains despite awareness of these global risks. No comprehensive NCD risk profile exists for the Rancakalong Health Center work area. Existing studies do not use a modified screening-based approach with multivariate analysis to find dominant factors. NCDs cause nearly 60% of deaths. High-risk behaviors are common. This study aims to identify the main factors associated with NCD history in older adults here, using a modified screening tool and multivariate analysis. It will assess smoking, low physical activity, poor diet, and anthropometric status (BMI and central obesity) as potential risk factors. [11]

Most data in this region are limited to descriptive statistics and do not examine the magnitude of associations between behavioral clusters and disease history. A specific, current risk profile is crucial for Health Centers to design precise interventions. This study identifies the main risk factors for NCDs in older adults, including smoking, physical activity, diet, and anthropometric factors (BMI and central obesity). The main goal is to compile a comprehensive community-based NCD risk profile for older adults in the area of the Rancakalong Health Center, Sumedang. This will determine the dominance and magnitude of associations between behavioral risks, especially smoking, and lifestyle behaviors and NCD history in older adults using results from Modified NCD screening.

MATERIALS AND METHODS

Methodology

a. Study Design
This study employed a descriptive, quantitative cross-sectional design to evaluate Noncommunicable Disease (NCD) risk factors and disease history among older adults. This design facilitates the simultaneous identification of prevalence and associations between variables within a specific timeframe.[12]. The study was conducted between May and June 2025 across 12 villages within the Rancakalong Health Center's working area in Sumedang Regency, West Java.

b. Subject Recruitment
All individuals aged 60 or older in the local elderly health database residing in Rancakalong for at least 6 months were screened. Those physically and mentally able to participate in interviews were included. Individuals with advanced cognitive impairment, preventing accurate self-reporting, or with incomplete screening data (missing >10% of variables) were excluded. Ultimately, 711 respondents met the analysis criteria.

c. Sampling Technique
Participants were selected using a total sampling technique, involving all eligible older adults who participated during the research implementation period.

Materials And Procedures

a. Instruments
Data were collected using the Modified NCD Screening Form (SMD–PTM), adapted from Indonesian Ministry of Health guidelines.[13] Five experts in community nursing and epidemiology reviewed the modifications to ensure cultural and clinical relevance. Psychometric evaluation yielded a Content Validity Index of 0.91 and a Cronbach's Alpha of 0.84, indicating high reliability.

b. Procedures and Variable Categorization
Trained health cadres and clinical staff first conducted structured interviews, followed by physical examinations. They sequentially recorded blood pressure, height, weight, and abdominal circumference. The primary outcome, "NCD History," was defined as a prior diagnosis of hypertension, diabetes mellitus, or dyslipidemia, confirmed by triangulation of self-reported history, official medical records (Health Passports), and current screening results (blood pressure ≥140/90 mmHg or random blood glucose ≥200 mg/dL). Smoking habits were categorized into Non-Smoker (Never/Quit) and Active Smoker. Dietary patterns were assessed by the frequency of salt, fat, and sugar intake (frequent: >3 times/week). Anthropometric status followed WHO Asia-Pacific guidelines: Body Mass Index (BMI)

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for obesity (≥25 kg/m²) and central obesity (abdominal circumference >90 cm for men and >80 cm for women)

Ethical Considerations

The research received ethical approval from the Health Research Ethics Committee of the Health Polytechnic of the Ministry of Health, Tasikmalaya (No. DP.04.03/F.XXVI.20/KEPK/385/2024).

Data Analysis

Data were analyzed using SPSS, with age, gender, and education level as control covariates in the multivariate model to mitigate potential confounding bias. The multivariate logistic regression procedure was executed in two primary stages: an initial bivariate selection to identify variables with $p < 0.25$ as model candidates, followed by a backward stepwise elimination method to determine the most parsimonious and accurate model. Model assumptions, including the absence of multicollinearity as confirmed by Variance Inflation Factor (VIF) values < 10, were rigorously verified to ensure statistical stability. The findings are reported as Odds Ratios (OR) with 95% Confidence Intervals (CI), with statistical significance set at $p < 0.05$.

RESULT

Characteristics of Research Subjects

Of the 711 older adults who participated, the majority were aged 60–70 years (66.4%) and female (53.9%). Socio-economic profiles showed a dominance of basic education (45.1%) and farming (36.6%). Regarding participants who were excluded (n=0), most were excluded due to incomplete cognitive screening or physical inability to complete anthropometric measurements, which may introduce a slight healthy-user bias.

Prevalence of NCD History

The screening revealed that 57.9% (n=412) of subjects had a confirmed history of NCDs (defined as a history of at least one condition: hypertension, diabetes mellitus, or dyslipidemia, verified via medical records and screening)

Table 1. Distribution of Subject Research Variables

Variabel	Category	n	(%)
History of PTM	Yes	412	57.9
	No	299	42.1
Smoking Habits	Active Smoker	204	28.7
	Non-Smoker (Never/Quit)	507	71.3
Alcohol Consumption	Yes	25	3.5
	No	686	96.5
Physical Activity	Very Low (Never)	418	58.8
	Low (1–2 times/week)	273	38.4
	Moderate–High (≥3 times/week)	20	2.8
Consumption of Vegetables/Fruits	Rarely/Never	148	20.8
	3–4 times a week	155	21.8
	Every day	408	57.4
Eat High in Salt/Fat	Rarely/Never	68	9.6
	Sometimes	457	64.3
	Often	186	26.1
Body Mass Index (BMI)	Normal /underweight	555	78,0
	Overweight	87	12.2
	Obesity	69	9.7
Abdominal Circumference	Risk (>90 cm/Male, >80 cm/Female)	63	8.9
	No Risk	648	91.1

Table 1 shows the distribution of characteristics among study subjects (N=711) by NCD history, behavioral risk factors, and anthropometric status. Most participants (57.9%, n=412) had a history of NCDs, and 42.1% (n=299) did not. Of the subjects, 28.7% (n=204) were smokers (moderate or never), while 71.3% (n=507) did not smoke or had quit. Only 3.5% (n=25) reported alcohol consumption. In physical activity, 58.8% (n=418) were in the very low category (never), 38.4% (n=273) in the low category (1-2 times/week), and only 2.8% (n=20)

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reported moderate-to-high activity (3 times/week). For vegetable/fruit consumption, 57.4% (n=408) consumed daily, and 20.8% (n=148) consumed infrequently or not at all. Regarding high-salt/fat foods, 64.3% (n=457) reported occasional consumption, 26.1% (n=186) frequent, and 9.6% (n=68) rarely or never.

According to anthropometric data, the majority of subjects had a Body Mass Index (BMI) in the standard category (64.1%, n=456). Proportions of overweight and obese subjects were 12.2% (n=87) and 9.7% (n=69), respectively. Additionally, 13.9% (n=99) of subjects were classified as underweight. Abdominal circumference measurements showed that most subjects (91.1%, n=648) were not at risk, while 8.9% (n=63) exceeded the risk threshold (abdominal circumference >90 cm for men and >80 cm for women).

The Relationship of Risk Factors with NCD History

The results of the Chi-square test showed a statistically significant association between six of the seven risk factors studied and a history of NCDs ($P < 0.05$). Only alcohol consumption showed no significant association. As shown in Table 2 below:

Table 2. Relationship of Risk Factors with NCD History

Independent Variables	PTM History (Yes) n(%)	PTM History (No) n(%)	P-value
Smoke			<0.001
Active Smoker	158 (77.5)	46 (22.5)	
Non-Smoker (Never/Quit)	254 (50.1)	253 (49.9)	
Physical Activity			<0.001
Very Low	285 (68.2)	133 (31.8)	
Low	120 (44.0)	153 (56.0)	
Medium–High	7 (35.0)	13 (65.0)	
Consumption of Vegetables/Fruits			0.008
Rarely/Never	101 (68.2)	47 (31.8)	
3–4 times a week	78 (50.3)	77 (49.7)	
Every day	233 (57.1)	175 (42.9)	
Eat High in Salt/Fat			0.005
Rare/Never	125 (67.2)	61 (32.8)	
Occasional/Rare	287 (54.5)	243 (45.5)	
Body Mass Index (BMI)			0.002
Obesity	51 (73.9)	18 (26.1)	
Normal/Underweight	304 (54.8)	250 (45.2)	
Abdominal Circumference			0.002
Risk	47 (74.6)	16 (25.4)	
No Risk	365 (56.3)	283 (43.7)	

Table 2 shows the results of a bivariate analysis using the *Chi-square* Test to examine the link between independent risk factors and a history of Noncommunicable Diseases (NCDs) among the subjects. Most tested risk factors were significantly associated with NCD history ($p < 0.05$). Smoking habits showed a very strong association with NCD history ($p < 0.001$). Subjects who smoked ("Yes") had a much higher proportion with NCD history (77.5%, n=158) than those who did not smoke or had quit ("No") (50.1%, n=254). A very significant relationship was found between physical activity levels and a history of NCDs ($p < 0.00$). The very low physical activity group had the highest proportion of NCD history (68.2%, n=285). This proportion decreased with increasing physical activity. Subjects with moderate-high physical activity showed the lowest proportion of NCD history (35.0%, n=7). Consumption of vegetables and fruits was significantly associated with a history of NCDs (p=0.008). Subjects who rarely or never consumed vegetables/fruits had the highest proportion of NCD history (68.2%, n=101). In the daily consuming group, the proportion was lower (57.1%, n=233) than in the infrequent group but higher than in the 3-4 times weekly group (50.3%, n=78). There was also a significant association between the frequency of consumption of high-salt/high-fat foods and a history of NCDs (p=0.005). Subjects who frequently ate foods high in salt/fat had a higher proportion with a history of NCDs (67.2%, n=125) than the occasional or rare group (54.5%, n=287). Anthropometric Status (BMI and Abdominal Circumference): Body Mass Index (BMI) status was significantly associated with NCD history (p=0.004). The highest proportion of NCD history was found in the obese group (73.9%, n=51), followed by the *overweight* group (65.5%, n=57). The normal/*underweight group* had the lowest proportion (54.8%, n=304). Similarly, abdominal circumference in the risk category was significantly associated with a history of NCDs (p=0.002). Subjects with abdominal circumference at risk had a much higher proportion of NCD history (74.6%, n=47) than those who were not at

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risk (56.3%, n=365). Taken together, these bivariate analysis results indicate that smoking habits, low physical activity, infrequent consumption of vegetables/fruits, frequent consumption of foods high in salt/fat, and obesity and abdominal circumference at risk are factors significantly associated with an increased probability of NCD history in this subject population.

Multivariate Analysis (Independent Predictor of PTM History)

Multivariate logistic regression, incorporating six significant variables identified in bivariate analysis, confirmed that three risk factors were the strongest independent predictors of NCD history.

Table 3. Predictors of NCD History

Independent Variables	B	S.E	P-value	OR	95% CI
Smoking (Ref: No)	1.24	0.20	<0.001	3.49	2.35–5.18
Eating high in salt/fat (ref: rare/never)	0.75	0.19	<0.001	2.12	1.45–3.09
BMI (Ref: Normal/Underweight)	1.10	0.35	0.002	3.00	1.51–5.95

Table 3 presents results from a multivariate logistic regression analysis to identify the strongest independent risk factors for Noncommunicable Diseases (NCDs). The analysis confirmed three factors as independent predictors of NCD history (alpha < 0.05). Smoking is a highly significant predictor (p < 0.001). Smokers had 3.49 times higher odds (95% IK: 2.35-5.18) of NCD history than non-smokers, after adjusting for other variables. Frequent consumption of high-salt/high-fat foods was also associated with a history of NCDs (p < 0.001). Those who often ate salty/fatty foods had 2.12 times higher odds (95% IK: 1.45-3.09) than those who rarely or never did. Obesity was the second-strongest predictor (p = 0.002), with 3.00 times the odds (95% IK: 1.51-5.95) compared with normal/underweight individuals. Being overweight also increased risk (p = 0.003; odds ratio: 1.82, 95% CI: 1.23-2.68). Multivariate results confirm smoking and obesity as the most powerful predictors of higher NCD risk. Physical activity (low to moderate-high) is a significant protective factor. All relationships are independent after model adjustment.

DISCUSSION

This study explicitly affirms the substantial epidemiological burden of Noncommunicable Diseases (NCDs) among older adults in the Rancakalong Health Center area; notably, 57.9% of subjects reported a confirmed history of chronic disease. Although multivariate analysis identified smoking habits as the strongest independent predictor, raising NCD risk by 3.49-fold, other significant contributors—obesity (OR=3.00), central obesity (OR=2.46), high salt/fat intake (OR=2.12), and infrequent eating high in salt/fat (OR=1.79) — also played substantial roles. In contrast, engaging in physical activity produced a robust protective effect, reducing the odds of NCDs by 40% to 60%. These findings reflect morbidity trends in Indonesia and other LMICs, where older adults are most affected. The high risk from smoking (OR=3.49) matches large-scale Asian cohort studies linking tobacco use to faster vascular aging and higher rates of myocardial infarction. This study also shows the protective effect of physical activity (OR=0.40 for moderate-to-high levels), supporting global evidence that regular exercise improves insulin sensitivity and blood pressure in older populations. The high NCD risk in older adults stems from biological aging and accumulated behavioral risks. Smoking is a key factor, driving oxidative stress and inflammation, and exceeding other clinical risks in promoting metabolic syndrome among Asian seniors. Central obesity, a strong predictor here, shows visceral fat accumulation—a marker of insulin resistance and a major contributor to NCDs. The wide confidence interval for obesity (95% CI: 1.51–5.95) likely reflects heterogeneous metabolic health within the obese subgroup, but the risk remains statistically significant. These results reinforce *the need to prioritize older adults as a primary focus of* national NCD control strategies in Indonesia and similar countries. [14]

The latest findings confirm that the increase in NCD (Noncommunicable disease) morbidity in Indonesia reflects a similar trend in lower-middle-income countries (LMICs), where older adults are the most affected group.[15] The prevalence of multiple NCDs rises with age, putting older adults at higher risk for heart disease, diabetes, hypertension, and related complications. A panel study in Indonesia finds that those with more than three NCDs have greater risks of hospitalization, catastrophic health costs, and less productivity. Identifying clusters of behavioral risks through community screening shows that NCD morbidity results from risky behaviors. [16] . Older adults are highly susceptible to Noncommunicable diseases because the body's functions undergo continuous degenerative processes. [17,18]. Crucially, multivariate logistic regression analysis established smoking habits as the most dominant independent predictors. Smoking significantly increased the chances of subjects having a history of NCDs by nearly 3.5 times compared to individuals who did not smoke or had quit. This high magnitude of risk implies that tobacco consumption is not only a risk factor; rather, it is the primary catalyst that accelerates the pathological processes of cardiovascular, metabolic, and respiratory diseases in older adults. [19] This evidence is consistent with research in older adults in Asia that has repeatedly shown a strong association between smoking,

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increased lipid accumulation products, and Metabolic Syndrome, even surpassing the effects of obesity in some clinical conditions.[9].

Other behavioral risk clusters, including physical inactivity and improper dietary patterns, make significant contributions. Almost all participants reported very low levels of physical activity, and the regression results corroborated that an increase in the frequency of physical activity, even to 3–4 times per week, had a substantial protective effect on the history of NCDs (Odds Ratio [OR] = 0.40). Physiologically speaking, regular physical activity is effective in optimizing insulin sensitivity, lowering blood pressure, and improving lipid profiles, thereby mitigating the risk of NCDs [8]On the other hand, the habit of eating foods high in salt and/or fat multiplies the risk of NCDs by more than twofold. This reaffirms the urgency of nutrition interventions, especially in communities with limited nutritional literacy potential (estimated from the dominance of the subject's primary/junior secondary education background) [3]Anthropometric status, both measured through Body Mass Index (*overweight* to obesity) and high abdominal circumference (central obesity), is a strong independent predictor. Central obesity (at-risk abdominal circumference) clinically increases the probability of NCD history by up to 2.46 times. These findings are of high clinical relevance because central obesity specifically reflects visceral fat accumulation, a strong marker of metabolic dysfunction, insulin resistance, and systemic inflammation that underlie the etiology of NCDs [20]. Meskipun prevalensi obesitas sentral dalam sampel relatif rendah (8.9%), the high presence of these predictors suggests that this subgroup requires intensive screening and clinical intervention to prevent serious cardiovascular complications. (Papaioannou & Typas, 2015). Trends in NCDs in Indonesia and LMICs confirm that older people are a priority group in national control strategies. Strengthening primary services, risk surveillance, and the integration of elderly care are essential to reducing the burden of NCDs in the future.

The trend of NCDs in Indonesia confirms that older adults are a priority group in the national control strategy. Strengthening primary services, risk surveillance, and the integration of elderly care are essential to reducing the burden of NCDs in the future. Community-based NCD screening with modified instruments, such as those used in this study, has been shown to produce a comprehensive, immediately actionable risk profile. These results provide an empirical foundation for primary health care facilities (such as the Rancakalong Health Center) to transition from a generic approach to a precision health strategy by strengthening comprehensive programs. [22] A methodological limitation of this study is that the cross-sectional design precludes causal inference; however, the magnitude *of the Odds Ratio* obtained strongly indicates the priority of clinical intervention. Studies across various lower-middle-income countries show that community-based NCD screening with simple or modified instruments can effectively yield a comprehensive, immediately actionable risk profile.[23]. This approach facilitates early detection, identification of risk factors, health education, and referral of patients to primary services, as well as increasing public knowledge about NCDs[24] In Indonesia, programs such as Posbindu, integrated with health centers, have been proven to increase screening coverage, risk awareness, and the detection of new NCD cases. [25]Studies in Mexico and India have also shown that community-based screening can identify a large proportion of previously undetected high-risk individuals.[17]

Multivariate logistic regression analysis emphatically confirms the role of several behavioral and anthropometric risk factors in exacerbating the burden of Noncommunicable Diseases (NCDs) among older people. The identification of independently operating risk factor clusters (Table 3) reinforces the view that approaches to managing NCDs should be comprehensive rather than focused on a single variable. The prominence of smoking as the leading independent predictor of NCD history in this study (OR=3.49) can be explained through several complex biological pathways that accelerate the ageing process in older adults. Recent evidence suggests that lifetime tobacco exposure in adults aged 50 and older is directly linked to accelerated epigenetic ageing clocks, such as GrimAge, PhenoAge, and DunedinPoAm38. These epigenetic modifications serve as a core biological mechanism that mediates the deleterious effects of smoking on cardiovascular diseases, hypertension, lung pathologies, and overall mortality in later life. [26]. Furthermore, the relationship between smoking and multimorbidity is driven by chronic systemic inflammation. Tobacco use triggers a persistent inflammatory response and is associated with shorter telomeres and higher biological age, which ultimately leads to frailty and homeostatic dysregulation. In the context of age-related diseases, smoking has been shown to disrupt vascular homeostasis through molecular pathways such as the Sema4D–PlexinB1 signalling axis. This activation impairs the interaction between immune cells (specifically CD8 T cells) and pericytes, thereby amplifying pathological processes like neovascularization and tissue fibrosis. These molecular insights offer a concrete explanation for the high prevalence of chronic conditions observed among older adult smokers in this study. [27]. [28]These findings are in line with the global consensus that smoking is a major contributor to morbidity and mortality caused by NCDs, especially cardiovascular and respiratory diseases. Large-scale cohort studies in Asian countries, including China and India, have consistently linked smoking to accelerated vascular aging, endothelial dysfunction, and an increased incidence of stroke or myocardial infarction in old age. The large *Odds Ratio* in this study indicates that smoking cessation interventions should be a top priority in community-based NCD prevention programs. Large-scale cohort studies in Asia, including China, India, and Southeast Asian countries, have consistently shown that smoking increases the risk of NCDs, especially cardiovascular disease, stroke, myocardial infarction, and chronic

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respiratory disease.[29]. The risk of death from all causes in smokers increased by 1.7–1.8 times, and the risk of death from lung cancer increased by almost 5 times.[29]. In older adults and elderly age groups, smoking accelerates vascular aging, causes endothelial dysfunction, systemic inflammation, and worsens atherogenesis.[30]. Studies in Korea and China show that the odds ratio of stroke and myocardial infarction in smokers ranges from 1.2 to 2.8, and increases with the duration and intensity of smoking.[31] The magnitude of the Odds Ratio (up to 3.5 times) confirms that smoking cessation interventions should be a top priority in community-based NCD prevention programs. An Asian meta-analysis study confirms that quitting smoking before the age of 40 lowers the risk of death to the equivalent of that of non-smokers. Smoking cessation interventions are effective in reducing the incidence of NCDs and premature death. Smoking is the strongest independent predictor of NCDs, with a very high risk of morbidity and mortality. Smoking cessation should be a top priority in NCD prevention strategies at the community and national levels.

Physical inactivity was a significant problem among the study population. Although the majority of subjects showed very low levels of activity (Table 2), the analysis showed that increasing the frequency of physical activity, even to low or moderate-high levels, had a significant protective effect, reducing the chance of NCD history by 40% to 60% (Table 3). This protective effect is consistent with the physiological principles of NCDs: regular physical exercise improves blood glucose regulation by increasing insulin sensitivity and reducing systolic and diastolic blood pressure. These results support the World Health Organization's (WHO) recommendation to promote physical activity as a "cure" for NCDs, especially in older people who are more likely to experience sarcopenia and decreased mobility. Associated with eating habits, frequent consumption of foods high in salt/fat has been shown to independently double the risk of NCD history (Table 3). This association is supported by substantial evidence linking high-salt diets with hypertension and high-saturated fat diets with dyslipidemia and atherosclerosis. In addition, infrequent consumption of fruits and vegetables significantly increases the risk of NCDs, reflecting reduced intake of fiber, antioxidants, and micronutrients essential for cardiovascular protection.

These findings highlight the need for structured, tailored, culturally appropriate nutrition interventions. Central obesity status (measured by at-risk abdominal circumference) emerged as a strong anthropometric predictor, increasing the risk of NCDs by more than 2.4-fold (Table 3). Although the prevalence in the sample is relatively low (Table 2), the high magnitude of the risk indicates that visceral fat accumulation is a more accurate indicator of risk than Body Mass Index (BMI) in general, especially in Asian populations with lower risk thresholds. Central obesity is a direct clinical manifestation of metabolic syndrome, characterized by insulin resistance and pro-inflammatory conditions, which ultimately accelerate the development of NCDs. The importance of this central obesity shows the need for abdominal circumference screening as a priority diagnostic tool in primary health services.[32]Although the limitations of the cross-sectional design preclude causal inference, the magnitude of the Odds Ratio coefficient for smoking and central obesity provides a clear mandate for intervention. The results of this study provide empirical justification for transitioning from generic prevention programs to precision health strategies that prioritize reducing tobacco exposure and managing central obesity. This effort must be integrated into the existing CERDIK program to optimize the role of primary health facilities in intensive screening and education.

Based on the highest Odds Ratios found, the Rancakalong Health Center should prioritize "Eliminating Cigarette Smoke" (the 'E' in CERDIK) as the most urgent intervention. These results provide an empirical foundation for transitioning from generic health promotion to a precision health strategy. Integrate abdominal circumference measurements as a priority diagnostic tool in Posbindu to detect central obesity early, develop smoking cessation clinics, and community-based physical activity sessions specifically tailored for elderly mobility. Focus on reducing salt and fat intake, utilizing simple media appropriate for seniors with basic education backgrounds. The strength of this study lies in its use of a validated Modified NCD Screening instrument and total sampling, which provides a comprehensive and immediately actionable risk profile for the local community. However, several limitations must be acknowledged. First, the cross-sectional design precludes determining causal relationships between lifestyle factors and NCDs. Second, the "NCD History" variable relied in part on self-reports and medical records, which may introduce recall bias. Third, while we controlled for several factors, potential confounders such as genetic predisposition and psychological stress were not included in the multivariate model. Lastly, the wide confidence interval for obesity suggests that results for this specific subgroup should be interpreted with caution due to high variability in the data.[33]. Early Screening and Detection: This program encourages routine health check-ups (blood pressure, blood sugar, cholesterol) and detection of NCD risk factors in Posbindu, Puskesmas, and schools. Behavior Change: CERDIK has been proven to improve healthy living behaviors, such as quitting smoking, increasing physical activity, and improving diet. The CERDIK program has been proven effective in enhancing knowledge, behavior, and early detection of NCDs across various community groups. CERDIK is an essential foundation for health promotion and preventive strategies in Indonesia.

CONCLUSIONS AND SUGGESTIONS

The epidemiological burden of chronic diseases among older adults in the Rancakalong Health Center area is at a critical level, with 57.9% of participants having a verified history of Noncommunicable Diseases (NCDs). This

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study finds that NCD history is significantly associated with a cluster of modifiable lifestyle and biological factors, with smoking behavior emerging as the strongest independent predictor in the model (OR=3.49; 95% CI: 2.35–5.18), followed by obesity, high salt/fat intake, and central obesity. Consequently, primary care facilities must prioritize the "E" (Eliminate cigarette smoke) and "R" (Regular health checks) components of the CERDIK program, specifically targeting high-risk groups, such as active smokers with concurrent central obesity, through enhanced screening for abdominal circumference. Furthermore, the local Health Office should formulate and strictly enforce regulations regarding Smoke-Free Zones in public facilities frequented by older adults to mitigate the primary driver of community morbidity. For future research, it is recommended to transition from cross-sectional observations to a prospective cohort design to track the incidence of new NCDs and establish clear temporal sequences between behavioral risks and disease onset.

AUTHOR'S CONTRIBUTION STATEMENT

Dian Yuniar Syanti Rahayu: Conceptualization, Methodology
Supriadi: Project administration
Susi Susanti: Writing- Reviewing and Editing
Sugianto: Reviewing

CONFLICTS OF INTEREST

The authors disclose no conflicts of interest.

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