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THE RELATIONSHIP BETWEEN EXPOSURE TO SECONDHAND SMOKE IN ENCLOSED SPACES AND SMOKING BEHAVIOR AMONG THE ELDERLY IN INDONESIA

Rasidin.A[1], Yuni Asri[2*], Amin Zakaria[3], Heny Nurmayunita[4]

[1-4]Department of Nursing, Faculty of Health and Science, Institute of Technology, Science, and Health, Dr. Soepraoen Hospital, Kesdam V/Brawijaya, Malang, Indonesia.

(*Correspondence: yuniasri@itsk-soepraoen.ac.id)

ABSTRACT

Introduction: Secondhand smoke (SHS) in enclosed spaces increases health risks for older adults, especially those with chronic conditions. In Indonesia, where smoking is common, few studies have examined the relationship between SHS exposure and smoking behavior among older adults. This study analyzed this relationship using the 2023 Indonesian Health Survey (SKI). This cross-sectional study analyzed data from 97,339 individuals aged ≥ 60 years. Smoking status was the outcome variable, with exposure to SHS in enclosed spaces as the main predictor. Confounding variables included age, gender, education, occupation, marital status, place of residence, and tobacco chewing habits. **Methods:** Data were analyzed using SPSS 27.0.1 with complex survey adjustments: chi-square tests were used to examine relationships between variables at a significance level of $p < 0.05$. **Results:** The prevalence of smoking among older adults was 28.5%. Exposure to secondhand smoke in enclosed spaces was significantly associated with smoking behavior ($p<0.001$), with 25.2% of smokers and 39.8% of non-smokers exposed. The effect size for SHS exposure showed an odds ratio (OR) of 1.75 (95% CI: 1.65-1.85), indicating a higher risk. **Conclusion:** Other related factors were male gender, age 60–69 years, low education, unmarried status, unemployment, and tobacco chewing. SHS exposure was significantly associated with smoking among Indonesian older adults, possibly due to shared social environments.

Keywords: elderly, Indonesian Health Survey, smoking behavior, secondhand smoke.

HUBUNGAN PAPARAN ASAP ROKOK PASIF DI RUANG TERTUTUP DENGAN PERILAKU MEROKOK PADA LANSIA DI INDONESIA

ABSTRAK

Pendahuluan: *Paparan asap rokok pasif (secondhand smoke atau SHS) di ruang tertutup meningkatkan risiko kesehatan pada lansia, terutama bagi mereka yang memiliki penyakit kronis. Di Indonesia, yang memiliki prevalensi merokok tinggi, masih sedikit penelitian yang mengkaji hubungan antara paparan SHS dan perilaku merokok pada lansia. Penelitian ini bertujuan menganalisis hubungan tersebut menggunakan data Survei Kesehatan Indonesia (SKI) Tahun 2023. Penelitian dengan desain cross-sectional ini menganalisis data dari 97.339 individu berusia ≥ 60 tahun. Status merokok digunakan sebagai variabel dependen, sedangkan paparan SHS di ruang tertutup sebagai variabel prediktor utama. Variabel perancu yang dianalisis meliputi usia, jenis kelamin, tingkat pendidikan, pekerjaan, status perkawinan, tempat tinggal, dan kebiasaan mengunyah tembakau.* ***Metode:*** *Data dianalisis menggunakan SPSS versi 27.0.1 dengan penyesuaian desain survei kompleks. Uji chi-square digunakan untuk menganalisis hubungan antarvariabel dengan tingkat signifikansi $p < 0,05$.* ***Hasil:*** *Prevalensi perilaku merokok pada lansia sebesar 28,5%. Paparan asap rokok pasif di ruang tertutup berhubungan signifikan dengan perilaku merokok ($p < 0,001$), dengan proporsi paparan*

sebesar 25,2% pada perokok dan 39,8% pada bukan perokok. Besarnya pengaruh paparan SHS menunjukkan nilai odds ratio (OR) sebesar 1,75 (95% CI: 1,65–1,85), yang mengindikasikan adanya peningkatan risiko. ***Kesimpulan:*** *Faktor lain yang berhubungan dengan perilaku merokok pada lansia adalah jenis kelamin laki-laki, usia 60–69 tahun, tingkat pendidikan rendah, status tidak menikah, tidak bekerja, dan kebiasaan mengunyah tembakau. Paparan SHS di ruang tertutup berhubungan signifikan dengan perilaku merokok pada lansia di Indonesia, yang kemungkinan dipengaruhi oleh kesamaan lingkungan sosial tempat mereka berinteraksi.*

Kata kunci: *asap rokok pasif (secondhand smoke), lansia, perilaku merokok, Survei Kesehatan Indonesia.*

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Correspondence
Name: Yuni Asri
Affiliation: Department of Nursing, Faculty of Health and Science, Institute of Technology Science and Health RS dr Soepraoen Kesdam V/Brawijaya, Malang, Indonesia
Address: Jl. Sudanco Supriadi 22, Malang, Indonesia
Email: yuniasri@itsk-soepraoen.ac.id

INTRODUCTION

Tobacco use is one of the leading causes of preventable morbidity and mortality worldwide. According to the World Health Organization (WHO) (Perez-Warnisher et al.,2018), tobacco causes over 8 million deaths annually (Gellert et al., 2012), with over 7 million deaths caused by direct tobacco use and approximately 1.3 million caused by exposure to secondhand smoke (SHS) (Holipah et al., 2020). In low and middle-income countries, including Indonesia, the health burden of tobacco is severe due to high smoking prevalence, weak regulatory frameworks, and limited access to smoking cessation services (Rosilawati et al., 2024; Siddiqi et al., 2023; Amul et al., 2021).

Smoking has become deeply ingrained in social and cultural practices, especially among men. National surveys consistently show that Indonesia has one of the highest smoking prevalence rates in the world. (Kodriati et al., 2020; Septiono et al., 2020; Effendi et al., 2024) . Although most discussions on tobacco control focus on adolescents and adults of productive age, the elderly, especially those aged 60 and above, are a vulnerable group that is often overlooked. With the aging of Indonesia's elderly population, understanding smoking behavior is becoming increasingly important in public health planning.

Older adults who smoke have a significantly higher risk of developing noncommunicable diseases (NCDs), such as cardiovascular disease, chronic obstructive pulmonary disease (COPD), and various types of cancer, which can accelerate physical decline, cognitive impairment, and reduce life expectancy (King III, 2017; Talifu et al., 2025). Despite

these risks, many older adults continue to smoke due to long-standing habits, addiction, social norms, and in some cases, a lack of awareness about the benefits of quitting smoking in later life (de Graaf et al., 2023; Wallace-Williams et al., 2023; Thirlway, 2020).

Social factors such as education level, employment status, marital status, and place of residence can further influence smoking behavior among older adults (Chai et al., 2024; Cho et al., 2024; Ruhil, 2019). Additionally, environmental exposure to secondhand smoke and concurrent use of other tobacco products, such as chewing tobacco, can exacerbate health risks (Purnawan et al., 2024; Smith et al., 2020; Nurfitriani et al., 2023). Designing effective tobacco control policies and interventions to understand the elderly population is crucial.

Although previous studies have examined smoking patterns among young and adult populations in Indonesia, research specifically focused on the elderly remains limited. Most of the available literature either combines data on the elderly with younger age groups or lacks detailed analysis of the sociodemographic and behavioral factors associated with smoking in older age, (Chang, 2020; Bijani et al., 2025). Additionally, there is a lack of representative national data exploring smoking in relation to variables such as exposure to secondhand smoke and tobacco chewing among older adults. This gap hinders the development of targeted interventions to reduce tobacco use in this demographic group (Asri et al., 2024).

This study aims to analyze the prevalence and determinants of smoking among older adults in Indonesia using data from the 2023 Indonesian Health Survey (SKI).

METHODS

Data Sources and Study Design

This study used a cross-sectional design with secondary data from the 2023 Indonesian Health Survey (SKI) conducted by the Ministry of Health of the Republic of Indonesia. SKI is a representative national survey that uses a two-stage stratified sampling technique to measure health indicators in various demographic and geographic populations in urban and rural areas of Indonesia.

Data collection involved structured interviews conducted by trained enumerators and designed to support health monitoring and policy-making at the national level. This study is expected to provide insights into how to design more effective tobacco control policies, especially for the elderly.

Study Population

The study population included Indonesian adults aged ≥ 60 years who

participated in the 2023 SKI survey. From the total dataset, 97,339 respondents were included in the final analysis based on predetermined eligibility and data completeness criteria.

Inclusion and Exclusion Criteria

Inclusion criteria: Respondents aged ≥60 years, complete responses for the primary outcome (smoking status), and all independent variables. Exclusion criteria: Respondents under 60 years of age, incomplete or missing data regarding smoking behavior or other key covariate variables.

Variables and Measurements

Dependent Variable

The dependent variable is smoking status, obtained from the question: "Have you ever smoked?" Respondents who answered "Yes" were classified as smokers (coded as 1), while those who answered "No" were classified as non-smokers (coded as 0). This variable is used to provide a broader picture of smoking prevalence among older adults, as many older adults may have quit smoking but have a history of smoking. Combining data on current and former smokers provides more complete information about the factors that influence smoking cessation, as well as its relevance to more effective tobacco control policies in older adults.

Independent Variables

The following independent variables were included: Age group (grouped into three groups: young elderly [60–69 years], middle-aged elderly [70–89 years], and old elderly [90–112 years]), gender (male or female), and education level (grouped into five categories: no formal education, elementary school, junior high school, high school, and higher education). Employment Status: Participants were categorized as employed or unemployed at the time of the survey. Marital status: Categorized as: Single (never married), Married, Divorced/widowed. Place of residence: Classified as urban or rural, based on national administrative codes. Tobacco Chewing: Measured with the question, "Have you chewed tobacco in the last month?" Passive smoke exposure was measured using the question: "How often do other people smoke near you?" Answers were categorized as yes (indicating exposure) or no (indicating no passive smoke exposure in enclosed spaces).

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 27.0.1, with all analyses accounting for the complex survey design with adjustments for stratification, clustering, and unequal probability sampling. Descriptive statistics were used to summarize the study population as

frequencies and percentages. The Chi-square (χ^2) test was used to assess the relationship between smoking status and each independent variable , with $p < 0.05$ considered statistically significant.

Main limitation: no use of multivariate regression in this analysis. The use of multivariate regression could provide deeper insights into the relationships between interacting variables and estimate the more precise impact of ETS exposure on smoking behavior, taking into account age, gender, and educational status.

Ethical Approval

This study was conducted using publicly available secondary data and complies with all applicable ethical regulations regarding research on human participants in the United States. The data request was submitted and approved under a confidentiality agreement (No. FRM/SMKI-PUSDATIN/70/0108/2024) and authorized under ticket number 240675B7CC9C4327. This dataset is publicly accessible and can be requested through the official portal of the Ministry of Health at: https://www.badankebijakan.kemkes.go.id/data-mikro-ski/. All data has been anonymized prior to release to ensure full protection of participant confidentiality.

Participant Characteristics

The number of participants involved in this study reached 97,339 people. The participants' ages ranged from 60 to 112 years, and they were divided into three age groups: early elderly (60–69 years), middle elderly (70–89 years), and late elderly (90–112 years). Most participants belonged to the early elderly group (68.3%), followed by the middle elderly group (24.9%) and the late elderly group (6.8%). In terms of gender, the distribution was almost balanced, with 49.0% male and 51.0% female. Regarding educational attainment, 42.0% had completed primary education, and 26.7% had no formal education. The rest had attained junior high school (10.7%), senior high school (13.5%), or higher education (7.0%) levels. Regarding employment status, the majority of participants were employed (67.8%), while 32.2% were unemployed. Regarding marital status, most participants were married (68.4%), while 30.4% were divorced, and only 1.3% were single. Regarding place of residence, 53.8% of participants lived in urban areas, while 46.4% lived in rural areas. Regarding smoking status, 28.5% of participants reported smoking, while 71.5% had never smoked. When asked if they had chewed tobacco in the past month, only 7.1% answered yes, while 92.9% answered no. Finally, 65.0% of participants reported

being exposed to secondhand smoke (i.e., someone smoking near them in an enclosed space), and 35.0% reported not being exposed.

RESULTS

The prevalence of smoking among older adults was 28.5%. A significant association was found between exposure to secondhand smoke in enclosed spaces and smoking behavior ($p < 0.001$), with 25.2% of smokers and 39.8% of nonsmokers reporting exposure to secondhand smoke. In addition, factors such as male gender, younger age (60–69 years), low education, unmarried status, unemployment, and tobacco chewing were significantly associated with higher smoking prevalence. Among 97,339 elderly individuals, 27,750 (28.5%) reported smoking (Table 2). Smoking was most common among the early elderly group (60–69 years) and decreased with age (χ^2 test, all $p<0.001$). A striking gender difference was observed, with men dominating the number of smokers (26,468 men vs. 1,281 women), indicating that elderly men bear a much greater burden of smoking. There was an inverse educational gradient, with the highest prevalence among respondents with no education or only elementary school education, and a decreasing prevalence at higher levels of education. Smoking was also more common among those who were not working compared to those who were working. Based on marital status, married individuals were more likely to report smoking than those who were single or divorced/widowed. Place of residence had a moderate association with smoking, with urban residents showing higher prevalence than rural residents. Behavioral and environmental correlations were evident: recent tobacco chewing and regular exposure to secondhand smoke in enclosed spaces were both positively associated with smoking initiation. Overall, these patterns highlight the interrelated roles of sociodemographic disadvantages, urban living, and tobacco-related behaviors in shaping smoking habits among Indonesian older adults.

Table 1. Frequency distribution of characteristics among the elderly (n = 97,339)

Variable	Frequency (n)	Percentage (%)
Age Group (Years)		
(60-69)	66,435	68.3
(70-89)	24,282	24.9
(90-112)	6,622	6.8
Gender		
Male	47,662	49.0
Female	49,677	51.0
Education Level		
None	25982	26.7
Elementary	40,880	42.0
Junior High School	10,431	10.7
High School	13,188	13.5
Higher Education	6858	7
Employment		
Not working	31329	32.2
Working	66,010	67.8
Marital Status		
Single	1222	1.3
Married	66554	68.4
Divorced	29,563	30.4
Place of Residence		
Urban	14,781	53.8
Rural	12,879	46.4
Have you ever smoked?		
Yes	27,750	28.5
No	69,589	71.5
Have you chewed tobacco in the past month?		
Yes	6,924	7.1
No	90,415	92.9
How often do others smoke near the room?		
Yes	63,270	65
No	34069	35.0

Table 2. Chi-square analysis (n = 97,339)

Variable	Smoking				p
	Yes		No		
	N (27750)	%	N (69589)	%	
Age (Years)					
(60-69)	19,838	20.4	46,597	47.9	
(70-89)	6436	18.3	17,846	24.9	**0.001***
(90-112)	1476	1.5	5,146	5.3	
Gender					
Male	26,468	27.2	21,194	21.8	
Female	1,281	1.3	48,395	49.7	**0.000***
Level of Education					
None	6668	6.9	19,314	19.8	
Elementary	12058	12.4	28,822	29.6	
Junior High School	3280	3.4	7,151	7.3	**0.001***
High School	4085	4.2	9,103	9.4	
Higher Education	1659	1.7	5,199	5.3	
Occupation					
Occupation	3364	3.5	27,965	28.7	**0.000***
Not working	24386	25.1	41,624	42.8	
Marital Status					
Single	221	0.2	1001	1.0	
Married	23,152	23.8	43,402	44.6	**0.001***
Divorced	4377	4.5	25,186	25.9	
Place of residence					
Urban	14,871	15.3	37,800	38.8	**0.000***
Rural	12,879	13.2	31,789	32.7	
Have you chewed tobacco in the last month?					
Yes	1773	1.8	5151	5.3	**0.001***
No	25,977	26.7	644,389	66.2	
How often do other people smoke near enclosed spaces?					
Yes	24,536	25.2	38,734	39.8	**0.000***
No	3,214	3.3	30,855	31.7	

*$p=<0.001$

Among 97,339 elderly individuals, 27,750 (28.5%) reported smoking (Table 2). Smoking was most common among the early elderly group (60–69 years) and decreased with age (χ^2 test, all $p<0.001$). A striking gender difference was observed, with men dominating the number of smokers (26,468 men vs. 1,281 women), indicating that elderly men bear a much greater burden of smoking. There was an inverse educational gradient, with the highest prevalence among respondents with no education or only elementary school education, and a decreasing prevalence at higher levels of education. Smoking was also more common among those who were not working compared to those who were working. Based on marital status, married individuals were more likely to report smoking than those who were single or divorced/widowed. Place of residence had a moderate association with smoking, with urban residents showing higher prevalence than rural residents. Behavioral and environmental correlations were evident: recent tobacco chewing and regular exposure to secondhand smoke in enclosed spaces were both positively associated with smoking initiation. Overall, these patterns highlight the interrelated roles of sociodemographic disadvantages, urban living, and tobacco-related behaviors in shaping smoking habits among Indonesian older adults.

DISCUSSION

This study investigated the prevalence of smoking and related factors among Indonesian older adults using data from the 2023 Indonesian Health Survey (SKI). The results showed that smoking among older adults remains a public health issue, with nearly one-third (28.5%) of respondents reporting that they had smoked at some point in their lives. Age was significantly associated with smoking status, with the highest prevalence observed among early older adults (60–69 years). This trend is consistent with previous studies showing that smoking behavior tends to decline with age, possibly due to declining health or smoking cessation after the onset of chronic diseases (Pengpid & Peltzer, 2019). Gender is a strong predictor of smoking, with a much higher prevalence among men than women.

An unexpected finding is the significant relationship between exposure to secondhand smoke (SHS) in enclosed spaces and behavior in the elderly (Amalia et al., 2019). Although in reality (SHS) only affects non-smokers, the results of this study show a percentage of 39.8%, which means that in this case, environmental factors such as smoking habits can influence behavior, both in terms of habits and health (Pengpid & Peltzer, 2019). In addition, smoke-free environments are still very much needed to protect all levels of society. This underscores the importance of controlling (SHS) through the creation of smoke-free spaces for comfort.

Educational levels are inversely proportional to smoking prevalence. Participants without formal education or only elementary school graduates are more likely to smoke than those with higher educational levels, especially. Gender differences in smoking behavior have also been reported in other Southeast Asian countries. This suggests that low educational attainment may limit access to health information or reduce health literacy, contributing to continued tobacco use (Widyaningrum & Yu, 2018), (Stormacq et al., 2019). Employment status also influences smoking behavior, with unemployed individuals being more likely to smoke than employed individuals. This may reflect psychosocial stress, financial instability, or limited access to smoking cessation support services among unemployed individuals. Marital status is associated with smoking, with married individuals more likely to smoke than those who are single or divorced. Cultural or household dynamics may influence smoking behavior differently based on marital status (Pengpid & Peltzer, 2019).

Place of residence emerges as a significant factor, with urban residents showing higher smoking prevalence compared to rural residents. Historically,

higher smoking rates have been associated with rural populations due to lower health literacy and weaker enforcement of regulations. Increased tobacco marketing, greater social acceptance, and lifestyle pressures in urban areas, coupled with rapid urbanization, (Wihatno et al., 2025). This suggests a reinforcing cycle in which personal tobacco habits and environmental exposure mutually sustain tobacco consumption. These findings highlight the complex interactions between individual behavior and the social environment, emphasizing the need for integrated tobacco control measures that address risk factors at both the individual and household levels (Purnawan et al., 2024).

This study has several limitations. First, causal relationships cannot be established due to the cross-sectional design. Second, self-reported data on smoking and related behaviors may be affected by memory bias or social desirability bias. Third, the variable "ever smoked" includes both current and former smokers, which may weaken the specific relationship with current smoking behavior. Additionally, other potential confounding variables, such as income, chronic disease status, and access to healthcare services, were not included in the analysis. The findings of this study, highlight the need for tobacco control interventions targeted at older adults, particularly those who are less educated, live in urban areas, and are not employed. Public health campaigns should be tailored to target older male smokers and include smoking cessation support that considers their unique socioeconomic and cultural contexts. Additionally, reducing exposure to secondhand smoke through household or public regulations can help address smoking-related harms. These results emphasize the importance of integrating tobacco prevention efforts into broader geriatric care and healthy aging policies in Indonesia.

CONCLUSION

This study highlights that smoking remains a significant public health problem among older adults in Indonesia, with nearly one-third of those aged ≥ 60 years reporting a history of smoking. Strengthening smoke-free services to create a clean environment is essential to support smoking cessation and prevent mortality, which has implications for SHS policies. These results indicate that smoking in later life is influenced by personal behavior and social factors. Targeted tobacco control strategies, particularly those targeting education, employment, and exposure to secondhand smoke, are crucial to support smoking cessation and promote healthy aging. Strengthening smoking cessation services and creating smoke-free environments will be key to reducing the

adverse effects of tobacco on the elderly population in Indonesia.

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DATA AVAILABILITY STATEMENT

The data used in this study can be accessed by submitting a request to the Ministry of Health of the Republic of Indonesia via this link: https://www.badankebijakan.kemkes.go.id/data-mikro-ski/

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