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# Sociodemographic and Health Insurance Ownership Related to Tuberculosis in Elderly: An Analysis of Indonesia Health Survey

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**ABSTRACT**

**Introduction:** Tuberculosis (TB) continues to be a significant public health issue globally, with Indonesia being one of the nation's experiencing the highest TB burden in the world. The purpose of this study is to analyze the sociodemographic factors and health insurance ownership associated with the incidence of tuberculosis (TB) among the elderly in Indonesia.

**Methods:** This study used secondary data from the 2023 Indonesia Health Survey (SKI), focusing on elderly individuals (≥60 years). A total of 97,339 participants were included after applying inclusion criteria. The dependent variable was the self-reported diagnosis of tuberculosis (TB), and independent variables included age, sex, marital status, education, occupation, health insurance, place of residence, and family status. Data were analyzed with univariate, bivariate (Chi-square), and multivariate (binary logistic regression) analyses.

**Results:** The study found that 0.57% of older adults self-reported the tuberculosis diagnosis. The significant associations between tuberculosis diagnosis and variables such as sex, marital status, education, occupation, health insurance, place of residence, and family status, with women, higher education levels, certain occupations, health insurance coverage, urban living, and being head of the household being less likely to report TB, while age showed no significant association. The binary logistic regression revealed that factors such as sex, education, occupation, health insurance, and family status significantly influence the likelihood of TB diagnosis, with females, higher education levels, certain occupations, no health insurance, and being a spouse showing reduced odds of being diagnosed with TB.

**Conclusion:** This study found that tuberculosis (TB) among older persons was significantly associated with several sociodemographic factors, including sex, education level, occupation, health insurance ownership, and family status. Female older adults and those with higher education levels were less likely to be diagnosed with TB. Similarly, those who were employed, especially as private employees, entrepreneurs, or farmers, and those without health insurance had lower odds of TB. It is suggested to improve TB prevention and treatment strategies for older adults, with a particular emphasis on gender, education, employment, and health insurance access.

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## INTRODUCTION

Tuberculosis (TB) remains a major public health challenge globally, including in Indonesia, which ranks among the countries with the highest TB burden worldwide (1–3). Indonesia is among the top three countries with the highest number of TB cases, following India and China (4). Despite longstanding national TB control programs, the prevalence of the disease remains high, particularly among vulnerable groups such as the elderly (5).

The elderly population (aged ≥60 years) is at higher risk for TB due to age-related decline in immune function, the presence of comorbidities such as diabetes mellitus, and limited access to healthcare services (6,7). Additionally, TB symptoms in older adults are often atypical and may be masked by other chronic conditions, leading to delays in diagnosis and treatment (8,9). Therefore, understanding the factors contributing to TB incidence in the elderly is crucial for designing targeted and effective public health interventions (10).

Sociodemographic factors such as educational level, socioeconomic status, gender, and place of residence have been shown to influence TB occurrence across different age groups (11,12). Older adults with lower education or those living in remote or rural areas tend to have limited knowledge about TB and face barriers in accessing healthcare services, which increases their risk of exposure and delays in treatment (13). These factors also influence health-seeking behavior and treatment adherence, which are critical in TB control (14).

Health insurance ownership plays a vital role in determining access to and continuity of healthcare. In Indonesia, the National Health Insurance system (Jaminan Kesehatan Nasional/JKN) aims to improve healthcare coverage, particularly for vulnerable populations such as the elderly (15). However, not all elderly individuals are enrolled in or actively utilize JKN services. Research examining the role of health insurance ownership in reducing TB risk among the elderly remains limited, highlighting the need for further investigation to inform evidence-based policy development (16).

Although numerous studies have identified general risk factors for TB, few have specifically explored the relationship between sociodemographic characteristics and health insurance ownership in relation to TB among the elderly in Indonesia. Existing studies tend to focus on younger, working-age populations or emphasize clinical aspects, often neglecting the broader socioeconomic context that may influence vulnerability and healthcare access. This research gap underscores the importance of conducting a nationally representative analysis to gain a comprehensive understanding and support the formulation of equitable and effective TB control policies for the elderly population. The purpose of this study is to analyze the sociodemographic factors and health insurance ownership associated with the incidence of tuberculosis (TB) among the elderly in Indonesia.

## METHOD

### Study Design

This study utilized secondary data from the 2023 Indonesia Health Survey (*Survei Kesehatan Indonesia/SKI*), a nationally representative cross-sectional survey designed to capture health status, behaviors, and socio-demographic conditions across Indonesia at a single point in time. The cross-sectional design allows for the examination of disease prevalence and associated factors across diverse geographic and socio-economic groups simultaneously, providing essential input for national and regional health policy development.

### Setting

Indonesian Health Survey data were collected through structured household interviews conducted by trained enumerators from August to the first week of October 2023. Respondents were selected through multi-stage stratified random sampling, ensuring national representativeness that includes both urban and rural populations.

### Sample/Participants

From the total 1,191,692 individuals interviewed in the 2023 survey, this study specifically focused on older adults aged 60 years and above. After applying the inclusion criteria—respondents aged ≥60 years and having complete data on all relevant variables—a total of 97,339 elderly individuals were included in the analysis. Respondents with missing data on key variables were excluded.

### Instruments

The instrument used in this study is based on secondary data obtained from the 2023 Indonesian Health Survey (SKI), which includes information on health status, sociodemographic factors, and socioeconomic conditions of the respondents. The dependent variable in this study is the self-reported tuberculosis (TB) diagnosis by healthcare provider with the question "*In the past 12 months, has [NAME] been diagnosed with pulmonary tuberculosis (TB) / 'lung spots' by a doctor?".* This variable is used to identify the prevalence of TB among the elderly in Indonesia. The independent variables analyzed include age group, sex, marital status, educational level, occupation, health insurance ownership, place of residence, and family status. Age groups are divided into three categories: elderly (60-74 years), old age (75-90 years), and very old (over 90 years), to examine differences in TB prevalence across these subgroups. Sex is categorized into male and female to assess whether there are gender differences in TB prevalence. Marital status is categorized into never married, married, divorced (living), and divorced (death), to explore the relationship between marital status and TB occurrence. Educational level is divided into five categories: no education, primary education, secondary education, higher education, and university, to evaluate whether educational level influences TB prevalence. Occupation is categorized into formal sector (civil servants and private employees) and informal sector (self-employed, farmers, fishermen, drivers, etc.), to assess the relationship between occupation and TB occurrence. The health insurance variable is categorized into BPJS PBI/Jamkesda, BPJS non-PBI, private insurance, or no insurance, to investigate how insurance affects TB diagnosis in the elderly. In addition, place of residence is divided into urban and rural areas to examine the differences in TB prevalence based on access to healthcare services, while family status is categorized into head of household, spouse, children/in-laws, and other relatives, to assess the influence of family roles on TB diagnosis. All these variables are measured based on data from the 2023 Indonesian Health Survey, categorized for the analysis of sociodemographic factors that influence TB occurrence in the elderly.

### Data Analysis

The data were analyzed using STATA version 18. Univariate analysis was performed to describe the frequency and percentage of each variable. Bivariate analysis using the Chi-square test was conducted to identify associations between independent variables and TB diagnosis. Finally, multivariate analysis was performed using binary logistic regression to determine the adjusted effect of each predictor on the likelihood of having TB. The level of significance was set at $p < 0.05$.

### Ethical Consideration

The original survey protocol was approved by the Ethics Committee of the Ministry of Health, Republic of Indonesia. In addition, the use of the secondary dataset in this study was granted permission by the Center for Data and Information Technology, Ministry of Health of Indonesia, under the data usage approval letter No. FRM/SMKI-PUSDATIN/70/0385/2025.

## RESULTS

The results in this study consists of univariate, bivariate, and multivariate analysis. The univariate analysis results are described in the Table 1 below. It revealed that there was 0.57 % of the older persons in the study have diagnosed TB. According to the age group, the majority of them were in aged elderly (60 to 74 years old) which was 85.07%, following by old age for 75 to 90 (14.26%), and very old older than 90 (0.67%). The proportion between male and female is not huge different which female were 51.04%. The higher percentage of marital status were married (68.37%). The educational level revealed that the higher percentage were those finished primary school (42.00%). In terms of occupation, the higher percentage was showed for farmer (34.71%), followed by unemployed (31.84%). Health insurance ownership found more than half of older persons joined the survey were holding BPJS PBI (*Badan Penyelenggara Jaminan Kesehatan Penerima Bantuan Iuran / Health Insurance Administering Body for Contribution Assistance Recipients*) which 55.82%. More than half of them were residence in urban area (54.11%) and the head of household (64.81%).

**Table 1.** The general characteristics of the older persons

| Variables = 97,339 | Frequency | Percentage |
|---|---|---|
| **Have diagnosed TB** | | |
| No | 96,782 | 99.43 |
| Yes | 557 | 0.57 |
| **Age group** | | |
| Elderly | 82,808 | 85.07 |
| Old age | 13,876 | 14.26 |
| Very old | 655 | 0.67 |
| **Sex** | | |
| Male | 47,662 | 48.96 |
| Female | 49,677 | 51.04 |
| **Marital status** | | |
| Unmarried | 1,222 | 1.26 |
| Married | 66,554 | 68.37 |
| Divorced (life) | 2,096 | 2.15 |
| Divorced (death) | 27,467 | 28.22 |
| **Educational level** | | |
| None | 11,722 | 12.04 |
| Not finished primary school | 14,260 | 14.65 |
| Primary school | 40,880 | 42.00 |
| Secondary higher school | 10,431 | 10.72 |
| High school | 13,188 | 13.55 |
| Diploma | 2,961 | 3.04 |
| University | 3,897 | 4.00 |
| **Occupation** | | |
| Unemployed | 30,991 | 31.84 |
| Student | 338 | 0.35 |
| Government officer | 3,459 | 3.55 |
| Private employee | 1,972 | 2.03 |
| Entrepreneur | 10,589 | 10.88 |
| Farmer | 33,783 | 34.71 |
| Fisherman | 1,358 | 1.40 |
| Driver, etc | 5,011 | 5.15 |
| Others | 9,838 | 10.11 |
| **Health insurance** | | |
| BPJS PBI/Jamkesda | 54,336 | 55.82 |
| BPJS non PBI | 21,226 | 21.81 |
| Private insurance | 1,577 | 1.62 |
| None | 20,200 | 20.75 |
| **Place of residence** | | |
| Urban | 52,671 | 54.11 |
| Rural | 44,668 | 45.89 |
| **Status in family** | | |
| Head | 63,087 | 64.81 |
| Wife/husband | 22,602 | 23.22 |
| Child/child in law, grand child | 10,443 | 10.73 |
| Driver, housekeeper, other relatives | 1,207 | 1.24 |

Table 2 below showed the bivariate analysis of correlation between each predictors and TB case among older persons using the Chi-square test. The findings revealed that sex, marital status, educational level, occupation, health insurance, place of residence, and status in family are significantly associated with TB case. However, the variable of age group was not found significantly associated with TB case.

**Table 2.** Result of chi square analysis each variable with TB diagnosed

| Variables = 97,339 | Have diagnosed TB | | Total | Chi2 and p-value |
|---|---|---|---|---|
| | No (%) | Yes (%) | | |
| **Age group** | | | | 0.9852 |
| Elderly | 99.42 | 0.58 | 82,808 | |
| Old age | 99.48 | 0.52 | 13,876 | |
| Very old | 99.54 | 0.46 | 655 | |
| **Sex** | | | | 72.6413*** |
| Male | 99.22 | 0.78 | 47,662 | |
| Female | 99.63 | 0.37 | 49,677 | |
| **Marital status** | | | | 17.9843*** |
| Unmarried | 99.43 | 0.57 | 1,222 | |
| Married | 99.39 | 0.61 | 66,554 | |
| Divorced (life) | 98.95 | 1.05 | 2,096 | |
| Divorced (death) | 99.56 | 0.44 | 27,467 | |
| **Educational level** | | | | 28.3225*** |
| None | 99 | 0.67 | 11,722 | |
| Not finished primary school | 99.28 | 0.72 | 14,260 | |
| Primary school | 99 | 0.60 | 40,880 | |
| Secondary higher school | 99 | 0.57 | 10,431 | |
| High school | 100 | 0.42 | 13,188 | |
| Diploma | 100 | 0.34 | 2,961 | |
| University | 100 | 0.15 | 3,897 | |
| **Occupation** | | | | 33.6996*** |
| Unemployed | 99.48 | 0.52 | 30,991 | |
| Student | 98.82 | 1.18 | 338 | |
| Government officer | 99.74 | 0.26 | 3,459 | |
| Private employee | 99.8 | 0.20 | 1,972 | |
| Entrepreneur | 99.52 | 0.48 | 10,589 | |
| Farmer | 99.31 | 0.69 | 33,783 | |
| Fisherman | 98.82 | 1.18 | 1,358 | |
| Driver, etc | 99.38 | 0.62 | 5,011 | |
| Others | 99.51 | 0.49 | 9,838 | |
| **Health insurance** | | | | 18.818*** |
| BPJS PBI/Jamkesda | 99.34 | 0.66 | 54,336 | |
| BPJS non PBI | 99.51 | 0.49 | 21,226 | |
| Private insurance | 99.24 | 0.76 | 1,577 | |
| None | 99.58 | 0.42 | 20,200 | |
| **Place of residence** | | | | 9.1115** |
| Urban | 99.49 | 0.51 | 52,671 | |
| Rural | 99.35 | 0.65 | 44,668 | |
| **Status in family** | | | | 36.6011*** |
| Head | 99.33 | 0.67 | 63,087 | |
| Wife/husband | 99.67 | 0.33 | 22,602 | |
| Child/child in law, grand child | 99.53 | 0.47 | 10,443 | |
| Driver, housekeeper, other relatives | 99.25 | 0.75 | 1,207 | |

Note: *p-value <0.05, **p-value<0.01, ***p-value<0.001

The findings of binary logistic regression in this study revealed that some variables are significantly had effect on TB case after adjusted with other independent variables. In terms of sex, compared to male elderly, female ones is less likely to be diagnosed TB with 55% lower odds. The educational level was found significant for some points, compared to those without any educational background, those finished high school, diploma, and university were less likely to be diagnosed by TB with 49%, 58%, and 82% lower odds, respectively. After adjusted to other independent variables, compared to those unemployed, those worked in private employee, entrepreneur, farmer, and

driver were found less likely to be diagnosed for TB with 75%, 42%, 31%, and 40% lower odds, respectively. The health insurance ownership revealed that compared to those are holding the BPJS PBI/Jamkesda, those with none health insurance was found less likely to be diagnosed for TB with 39% lowering the odds. Additionally, the status in the household found significantly affect the TB case, compared to head of households, those who are wife or husband were significantly reducing the odds by 31%. According to model building, the Pseudo R2 revealed that the independent variables in this model are explaining the 2.70% the association with TB diagnosis. The rest of the variables are not included in this study.

**Table 3.** The binary logistic regression of effect sociodemographic and health insurance ownership on TB case

| Variables = 97,339 | Adj Odds Ratio | 95% confidence interval | | p-value |
|---|---|---|---|---|
| **Age group** | | | | |
| Elderly | ref | | | |
| Old age | 0.79 | 0.61 | 1.03 | 0.077 |
| Very old | 0.67 | 0.21 | 2.12 | 0.499 |
| **Sex** | | | | |
| Male | ref | | | |
| Female | 0.45 | 0.34 | 0.60 | **0.000** |
| **Marital status** | | | | |
| Unmarried | ref | | | |
| Married | 1.11 | 0.49 | 2.50 | 0.804 |
| Divorced (life) | 2.07 | 0.84 | 5.06 | 0.113 |
| Divorced (death) | 0.90 | 0.40 | 2.03 | 0.797 |
| **Educational level** | | | | |
| None | ref | | | |
| Not finished primary school | 1.01 | 0.75 | 1.36 | 0.948 |
| Primary school | 0.83 | 0.64 | 1.08 | 0.161 |
| Secondary higher school | 0.74 | 0.52 | 1.04 | 0.085 |
| High school | 0.51 | 0.35 | 0.75 | **0.001** |
| Diploma | 0.42 | 0.21 | 0.84 | **0.015** |
| University | 0.18 | 0.08 | 0.43 | **0.000** |
| **Occupation** | | | | |
| Unemployed | ref | | | |
| Student | 1.96 | 0.72 | 5.34 | 0.189 |
| Government officer | 0.54 | 0.26 | 1.12 | 0.097 |
| Private employee | 0.25 | 0.09 | 0.67 | **0.006** |
| Entrepreneur | 0.58 | 0.41 | 0.82 | **0.002** |
| Farmer | 0.69 | 0.54 | 0.88 | **0.003** |
| Fisherman | 0.93 | 0.54 | 1.60 | 0.790 |
| Driver, etc | 0.60 | 0.40 | 0.91 | **0.016** |
| Others | 0.84 | 0.60 | 1.18 | 0.316 |
| **Health insurance** | | | | |
| BPJS PBI/Jamkesda | ref | | | |
| BPJS non PBI | 0.95 | 0.76 | 1.20 | 0.690 |
| Private insurance | 1.48 | 0.82 | 2.65 | 0.190 |
| None | 0.61 | 0.48 | 0.78 | **0.000** |
| **Place of residence** | | | | |
| Urban | ref | | | |
| Rural | 1.12 | 0.93 | 1.35 | 0.228 |
| **Status in family** | | | | |
| Head | ref | | | |
| Wife/husband | 0.69 | 0.48 | 0.99 | **0.042** |
| Child/child in law, grandchild | 0.83 | 0.60 | 1.14 | 0.238 |
| Driver, housekeeper, other relatives | 1.35 | 0.66 | 2.77 | 0.411 |
| _cons | 0.01 | 0.01 | 0.03 | 0.000 |

Note: *p-value <0.05, **p-value<0.01, ***p-value<0.001
Prob > chi2 = 0.0000, Log likelihood = 3338.7385, Pseudo R2 = 0.0270

## DISCUSSION

This study found that 0.57% of the elderly population were diagnosed with tuberculosis, a proportion that is relatively low but still concerning considering the vulnerability of this age group. The majority of respondents were in the younger elderly category (aged 60–74 years), consistent with national demographic data indicating that this subgroup constitutes the largest portion of the older adult population in Indonesia. Age has a significant contribution to the variation in tuberculosis incidence rates between genders (17). On the other hand, based on WHO reports that TB prevalence does not always exhibit strong gender disparities in older populations, although some studies have indicated a higher risk in males due to behavioral and occupational exposures (4,18–20).

The majority of elderly TB cases had only completed primary education supports previous research which noted that lower educational attainment is associated with reduced TB awareness and delayed treatment seeking (21). Furthermore, the dominance of farmers and unemployed individuals among the respondents reflects socioeconomic vulnerability, which has also been linked to higher TB risk (22). The fact that over half of the participants were covered under BPJS PBI indicates reasonable access to health services; however, this does not necessarily correlate with reduced TB incidence, which contradicts the findings of a previous study that reported that JKN membership improved early TB detection among the elderly (16). This highlights the need to examine not just insurance coverage, but also its effective utilization and quality of care accessed by older persons.

Several sociodemographic variables were significantly associated with tuberculosis among older adults, including gender, marital status, education level, occupation, health insurance coverage, residence, and household status. These findings reinforce the complexity of TB determinants in older adults. For example, male respondents had significantly higher TB prevalence than female respondents (0.78% vs. 0.37%), consistent with previous studies that have linked this difference to greater lifetime exposure to risky environments and behavioral factors among men (23). Similarly, lower education level was associated with higher TB prevalence. Limited education may reduce TB awareness and delay health-seeking behavior (24). Notably, Individuals using government-subsidized insurance schemes (BPJS PBI/Jamkesda) showed higher TB prevalence compared to those with private insurance or no insurance—an unexpected pattern that may reflect differences in health service access, utilization, or lack of diagnosis among the uninsured. Similarly, in Ghana, the national health insurance (NHIS) was found to be ineffective in reducing the financial burden on households affected by TB, suggesting that simply having insurance may not be enough to ensure effective TB care and protection from financial hardship (25). Place of residence also showed a significant association, with rural older adults having slightly higher rates of TB than urban residents, consistent with previous studies showing limited access to health services in rural areas (26). Interestingly, age group was not significantly associated with TB prevalence, suggesting that risk persists across all subgroups of older adults and may be more influenced by social and structural factors than age alone. These findings highlight the importance of addressing multiple interrelated vulnerabilities in TB prevention strategies for older adults.

Multivariate analysis results through binary logistic regression showed that several sociodemographic and insurance-related variables were significantly associated with the likelihood of being diagnosed with TB among the elderly. Elderly women were found to have a 55% lower probability of being diagnosed with TB compared to men, supporting findings from previous studies linking higher TB prevalence among elderly men to behavioral risk factors and lifetime occupational exposure (27). Educational attainment also showed a strong protective effect; individuals with higher levels of education (high school and above) were significantly less likely to be diagnosed with TB. This trend is in line with studies emphasizing the role of education in improving TB awareness, health literacy, and health-seeking behavior (28). Interestingly, the occupational variable revealed that those who were employed-especially in the private sector, entrepreneurship, agriculture, and driving-had a significantly lower risk of TB compared to the unemployed, possibly reflecting better mobility, income, and access to care, although this finding contrasts with previous study linking certain labor-intensive occupations to increased TB risk due to exposure to poor environments (29).

Another important and somewhat unexpected finding was that older adults who did not holding the health insurance is reducing the self-reported TB diagnosis by 49%., which contradicts some previous studies that suggest that health insurance increases access to diagnostic services (30). This anomaly may reflect underdiagnosis or lower utilization of health services among the uninsured, rather than a true lower prevalence of TB. In addition, household status significantly influenced TB outcomes: individuals who were partners (husband/wife) rather than heads of

household were 31% less likely to be diagnosed with TB, possibly reflecting differences in household roles, exposures, or access to resources. However, it is important to note that the overall explanatory power of the model remained low (Pseudo $R^2 = 2.70\%$), indicating that while some associations were statistically significant, many other unmeasured variables likely contribute to TB risk among older adults. This highlights the need for more comprehensive models that incorporate environmental, behavioral, and biological factors in future research.

This study provides valuable insights into the sociodemographic and health insurance factors associated with tuberculosis (TB) among older adults in Indonesia; however, several limitations should be noted. The cross-sectional design limits the ability to infer causality. The use of secondary data restricts inclusion of behavioral, environmental, and clinical variables that may affect TB risk. Possible underreporting or misclassification of TB cases could also occur. Moreover, the low explanatory power of the model (Pseudo $R^2 = 2.70\%$) indicates that other unmeasured factors likely influence TB prevalence.

Future studies should use longitudinal designs to clarify causal relationships and include broader variables such as comorbidities, nutrition, and access to health care. Incorporating qualitative approaches could also provide deeper understanding of older adults' experiences with TB services. Expanding research to diverse regions would enhance the generalizability and relevance of findings for TB prevention among the elderly.

## CONCLUSION

In conclusion, this study highlights several key factors associated with the likelihood of self-reported tuberculosis (TB) diagnosis among the elderly in Indonesia. Female gender, higher levels of education, certain occupations were found to significantly reduce the odds of TB diagnosis. However, health insurance ownership was significantly associated with reducing the self-reported TB diagnosis. Conversely, being the head of a household increased the likelihood of being diagnosed with TB. These findings suggest that addressing socio-demographic disparities, improving access to healthcare, and promoting health education could play a crucial role in reducing TB prevalence among older adults in Indonesia. It is recommended to enhance targeted TB prevention and treatment efforts for elderly individuals, especially focusing on gender, education, occupation, and health insurance coverage.

## AUTHOR'S CONTRIBUTION STATEMENT

Lili Amaliah contributed to the conceptualization, data collection, analysis, and drafting of the manuscript. Oktia Woro Kasmini Handayani provided guidance on the study design, data interpretation, and critical revision of the manuscript for important intellectual content. Intan Zainafree assisted in data analysis, literature review, and manuscript editing. All authors have read and approved the final version of the manuscript.

## CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest associated with this research, and no financial or personal relationships have influenced the work reported in this manuscript.

## DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that generative AI and AI-assisted technologies, specifically ChatGPT (OpenAI), were utilized solely to improve the clarity, grammar, and readability of the manuscript. The authors take full responsibility for the content, interpretation, and conclusions presented in this paper.

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