Global Health & Medicine. 2025; 7(6):444-448.

DOI: 10.35772/ghm.2025.01112

Prevalence and risk factors of tuberculosis among slum dwellers and unhoused individuals in Ho Chi Minh City, Vietnam: Insights from a pilot study

Khuat Thi Hai Oanh[1], Nguyen Thuy Linh[1], Masami Fujita[2], Lam Ngoc Thuy[1], Nguyen Hong Phuc[1], Kieu Thi Mai Huong[1], Le Tuan Anh[1], Pham Thi Ngoc Mai[1], Hitoshi Murakami[2,3,*]

[1] Center for Supporting Community Development Initiative (SCDI), Hanoi, Vietnam;
[2] Bureau of Global Health Cooperation, Japan Institute for Health Security, Tokyo, Japan;
[3] School of Tropical Medicine and Global Health, Nagasaki University, Nagasaki, Japan.

Abstract: Tuberculosis is reported as highly prevalent among slum dwellers and unhoused individuals worldwide. We conducted a study to estimate the prevalence of tuberculosis among slum dwellers and unhoused individuals in Ho Chi Minh City, Vietnam, and identified risk factors. An interview and chest X-ray screening of 367 slum dwellers and 32 unhoused individuals was conducted with sputum GeneXpert for X-ray-positive participants. The prevalence of bacteriologically confirmed tuberculosis was 1,504 per 100,000 population (1,362 among slum dwellers and 3,125 among unhoused individuals), and that of interview and chest X-ray positive status was 4,511 per 100,000 population (4,087 among slum dwellers and 9,375 among unhoused individuals). The above data represent 5.4- and 4.1-fold higher prevalence, respectively, compared to the general adult population of Vietnam based on point estimates. Interview and chest X-ray positive status was significantly associated with being 60 years or older (adjusted odds ratio = 5.039, $p = 0.005$) and having a monthly income below the median (adjusted odds ratio = 4.305, $p = 0.037$). The estimated high tuberculosis prevalences among the participants call for the need for systematic screening for tuberculosis disease among these populations.

***Keywords*:** tuberculosis, unstable housing, urban health, urban slum, slum dwellers, homelessness

1. Introduction

Ho Chi Minh City, Vietnam's largest city, had an estimated population of 9,543,600 in 2024 (*1*). Accelerated population growth has generated significant challenges for social welfare policy, most notably in the provision of adequate urban housing to address immediate housing demand (*2*). Around 2004, slums were estimated to comprise roughly 15% of the city's housing population. In 2024, over 2,350 unhoused (homeless) individuals were relocated to Social Protection Centers (*3*). This number is likely underestimated because it does not account for those who escaped relocation.

Tuberculosis has been reported as highly prevalent, particularly among slum dwellers and unhoused individuals worldwide. Systematic reviews have estimated tuberculosis prevalence among slum dwellers to be 3,150 per 100,000 population, with a pooled odds ratio for smear-positive tuberculosis incidence of 2.96 compared to national figures (*4,5*). Reviews focusing on unhoused individuals reported tuberculosis prevalence ranging from 2,600 to 7,700 per 100,000 (*6,7*). These figures far exceed the reported prevalence of 119–1,159 per 100,000 among the general population aged over 15 years in 22 high-burden countries in Asia and Africa during 2007–2016 (*8*).

We conducted a study with two objectives: *i*) to estimate the prevalence of tuberculosis disease among slum dwellers and unhoused individuals in Ho Chi Minh City who received services by Center for Supporting Community Development Initiative (SCDI), a Vietnam-based non-governmental organization (NGO); and *ii*) to identify risk factors associated with tuberculosis disease.

2. Study design

2.1. Participants

A cross-sectional survey was conducted among slum dwellers residing in 13 slum sites in Ho Chi Minh City,

served by the SCDI, and unhoused individuals in Ho Chi Minh City who received services through SCDI's outreach or drop-in programs and were aged 18 years or older. The survey took place from November 2023 to April 2024. The 13 slum sites were located across ten wards in four of the city's 16 urban districts. These sites included specific alleys, areas around hostels, and settlements of waste recyclers. Unhoused individuals were defined as those who had slept in locations other than a permanent home, including public spaces such as sidewalks, bus stations, under bridges, and parks, as well as workplaces, hammock cafés, and internet cafés within the past 30 days.

2.2. Sampling

Local collaborators initially approached slum dwellers residing in 13 slum sites. The pre-visits were guided by the local collaborators' knowledge of adult individuals in the target slums to identify all eligible participants. Individuals who expressed willingness to participate were listed. A total of 460 slum dwellers were listed, and all were subsequently visited by the survey teams. As a result, 367 individuals ultimately participated, yielding a response rate of 79.8%. For the unhoused population, all individuals who were contacted by SCDI, either through outreach or drop-in services, and agreed to participate were included. In total, 399 individuals with unstable housing conditions were selected for the study, comprising 367 slum dwellers and 32 unhoused individuals.

2.3. Tuberculosis screening

Face-to-face interviews were conducted using a structured survey instrument to collect information on participants' sociodemographic and economic backgrounds, a cough lasting more than two weeks, and any history of tuberculosis treatment. Chest X-rays were conducted for all 399 participants. For individuals whose X-ray results were compatible with pulmonary tuberculosis, sputum samples were tested by the National Tuberculosis Program using the GeneXpert system to confirm the presence of tuberculosis bacteriologically.

Our tuberculosis screening endpoints and their definitions were as follows: *i*) bacteriologically confirmed tuberculosis cases defined as participants who had abnormal chest X-ray image suspected of pulmonary tuberculosis and were positive for tuberculosis in sputum GeneXpert; and *ii*) interview and chest X-ray positive status defined as participants who had a cough lasting for at least two weeks and/or any history of tuberculosis treatment plus abnormal chest X-ray image compatible with pulmonary tuberculosis.

2.4. Statistical analysis

We estimated the prevalence of both bacteriologically confirmed tuberculosis cases and interview and chest X-ray positive status. We explored bivariate associations between explanatory variables and both bacteriologically confirmed tuberculosis cases and interview and chest X-ray positive status. Chi-square tests were used for categorical variables, while *t*-tests were applied to continuous variables. We then constructed a multiple logistic regression model, with interview and chest X-ray positive status as the dependent variable, and the variables that showed significant associations in the bivariate analysis as independent variables.

Statistical significance was set at $p < 0.05$. Multiple logistic regression was not performed for bacteriologically confirmed cases due to the small number of positive cases ($n = 6$). Data analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 27 (IBM Corp., Armonk, NY, USA).

2.5. Ethical considerations

The study protocol, explanation document with the informed consent form, consent withdrawal form, and questionnaire were reviewed and approved by both the Ethics Independent Review Board (IRB) of the National Center for Global Health and Medicine (NCGM), currently the Japan Institute for Health Security (JIHS), on 9 July 2023 (approval number: NCGM-S-004698-00), and the IRB of the Institute for Social Development Studies (ISDS), Vietnam, on 28 September 2023. Written informed consent, including participants' signatures, was obtained from all participants before their participation in the study.

3. Key research findings

3.1. Estimation of tuberculosis prevalence

Table 1 presents the estimated prevalence of bacteriologically confirmed tuberculosis cases and interview and chest X-ray positive status, with a breakdown between slum dwellers and unhoused individuals. The prevalence of bacteriologically confirmed tuberculosis cases among all participants was estimated at 1,504 per 100,000 population — 1,362 among slum dwellers and 3,125 among unhoused individuals, and that of interview and chest X-ray positive status at 4,511 per 100,000 — 4,087 among slum dwellers and 9,375 among unhoused individuals. In point prevalence, unhoused individuals showed higher estimates in both categories; however, the wide 95% confidence intervals (CIs) indicated no significant difference between slum dwellers and unhoused individuals.

In Vietnam, the second national tuberculosis

prevalence survey was conducted in 2017–2018, targeting a general adult population of 61,763 individuals aged 15 years or older. The prevalence of bacteriologically confirmed tuberculosis cases was 280 per 100,000 population (95% CI: 241–325), and the prevalence of interview and chest X-ray positive status was 1,100 per 100,000 population (95% CI not available) in the national survey (*9*).

3.2. Associated risk factors of interview and chest X-ray positive status

Table 2 lists the explanatory variables statistically significantly associated with interview and chest X-ray positive status in bivariate and multivariate analyses. In bivariate analysis, old age (≥ 60 years), a monthly income below the median, receipt of cash or in-kind support during the past year, lack of an ID card, a history of incarceration in prison, a reform school, or a compulsory education center, police detention, and having chronic medical conditions requiring ongoing treatment were significantly associated ($p < 0.05$). In multivariate analysis, only old age of 60 years or older (adjusted odds ratio 5.04, $p = 0.005$) and a monthly income lower than the median (adjusted odds ratio 4.31, $p = 0.037$) remained significantly associated after adjusting for confounding.

3.3. Lessons learned from screening implementation

To effectively screen the population with precarious housing and social vulnerability, trust-building through the organization providing day-to-day support, compensating for opportunity costs, protecting privacy, and preventing psychological trauma were critically important.

3.4. Limitations of this study

The present study has several limitations. First, because we used non-probability sampling without comprehensive sampling frames for both slum dwellers and unhoused individuals, we could not estimate the prevalence of tuberculosis in either group with precise statistical inference. Similarly, the associations between bacteriologically confirmed tuberculosis cases and interview and chest X-ray positive status and explanatory variables cannot be generalized for all slum dwellers and unhoused individuals in Ho Chi Minh City or other cities in Vietnam. Second, due to the limited sample size, the small number of bacteriologically confirmed tuberculosis cases precluded multivariable analysis for this gold-standard tuberculosis definition, and the wide 95% CI failed to demonstrate a statistically significant difference between our results

Table 1. Prevalence of bacteriologically confirmed tuberculosis cases and interview and chest X-ray positive status

Characteristics	Number of participants	Prevalence (per 100,000 population)	95% CI
Bacteriologically confirmed tuberculosis cases			
All participants	6/399	1,504	305–2,703
Slum dwellers	5/367	1,362	171–2,554
Unhoused people	1/32	3,125	-3,249–9,499
Interview and chest X-ray positive status			
All participants	18/399	4,511	2,466–6,557
Slum dwellers	15/367	4,087	2,052–6,122
Unhoused people	3/32	9,375	-1,302–20,052

Abbreviation: CI, confidence interval.

Table 2. Explanatory variables significantly associated with interview and chest X-ray positive status for tuberculosis

Explanatory variables	Bivariate analyses				Multivariate analyses			
	n	Chi^2	OR (95% CI)	*p*	*n*	Chi^2	OR (95% CI)	*p*
Old age (60 years or older)	52	16.41	6.13 (2.30–16.35)	0.000*	52	1.617	5.04 (1.62–15.67)	0.005*
Monthly income < median	153	11.05	6.52 (1.86–22.88)	0.003*	153	1.460	4.31 (1.09–16.94)	0.037*
Receipt of cash or in-kind support[a]	111	7.22	3.47 (1.33–9.02)	0.011*	-	-	-	-
Lack of ID card	47	8.43	4.15 (1.48–11.64)	0.007*	47	0.980	2.66 (0.81–8.73)	0.106
Ever been incarcerated[b]	25	8.07	4.86 (1.47–16.05)	0.010*	25	1.418	4.13 (0.91–18.67)	0.066
Ever been detained by police	30	5.61	3.80 (1.17–12.38)	0.027*	30	1.040	2.83 (0.66–12.07)	0.160
Have chronic condition requiring medication	79	4.33	2.73 (1.02–7.23)	0.045*	79	0.862	2.37 (0.80-6.99)	0.119

*$p < 0.05$. [a]Excluded from the multivariate regression model because it was not significant in the model constituted by all seven explanatory variables, and removal of it did not alter the regression coefficients (β) of the two significant variables by more than 15%, indicating that it is not an important confounder. [b]Ever been incarcerated in prison, reform school, or compulsory education centre. *Abbreviations*: ID, identification; *n*, number; OR, odds ratio; CI, confidence interval; AOR, adjusted odds ratio.

and those observed in the general population. Third, the study did not address several known risk factors, including smoking, alcohol use, illicit drug use, and malnutrition.

4. Challenges and strategies for tuberculosis screening among slum and unhoused communities

The estimated prevalence of bacteriologically confirmed tuberculosis cases and interview and chest X-ray positive status among our study participants were 5.4- and 4.1-fold higher than those among the general adult population of Vietnam, as estimated by the second national tuberculosis prevalence survey. Old age and poverty were identified as significant risk factors for interview and chest X-ray positive status.

These findings, combined with the aging of slum and unhoused populations in developing countries, including Vietnam, highlight the urgent need for systematic screening for tuberculosis disease among slum dwellers and unhoused individuals in Ho Chi Minh City as part of the End TB (Tuberculosis) Strategy of the World Health Organization (WHO), particularly given that Vietnam is one of the 39 high tuberculosis burden countries (*10*). Provider-initiated screening is particularly important for slum dwellers and unhoused individuals, who are often not reached through patient-initiated consultations because of their limited access to health services, even though they are not explicitly listed as risk groups in the WHO Handbook. Such screening is expected to improve individual outcomes and to reduce transmission and incidence at the population level (*11*).

Although older age and poverty were associated with increased tuberculosis risk, segmenting these populations by age and income is difficult; therefore, a population-based approach is recommended. Such efforts must also ensure the protection of these populations from stigmatization, discrimination, and harm (*11*). The lessons learned from implementing this study — including trust-building, compensating for opportunity costs, protecting privacy, and preventing psychological trauma — should be fully considered in the screening.

Given their precarious civil status, engagement of community actors — including civil society organizations such as SCDI — in collaboration with the National Tuberculosis Program, is crucial for identifying tuberculosis cases and ensuring their enrollment in community-based treatment in line with WHO recommendations, with appropriate follow-up and treatment adherence (*12,13*). An effective communication strategy is also essential to address the common perception among slum dwellers and unhoused individuals that public health services are slow and therefore inferior to private care.

In conclusion, when considered alongside the ongoing aging of slum and unhoused populations, our findings underscore urgent need for systematic tuberculosis screening among these groups in Ho Chi Minh City.

Acknowledgements

The authors gratefully acknowledge the contributions of two community organizations, namely Companions and My Hands, to planning and implementation of the survey. We also thank Professor Masayoshi Tarui and Mr. Masaki Inaba, who joined in the preliminary survey in Ho Chi Minh City, for their encouragement and inspiration.

Funding: This research was supported by research grant 22A03 from the National Center for Global Health and Medicine (NCGM), Japan, and the SCDI budget.

Conflict of Interest: The authors have no conflicts of interest to disclose.

References

1. National Statistics office, Vietnam. Statistical Yearbook of Viet Nam, 2023. *https://www.nso.gov.vn/en/default/2024/07/statistical-yearbook-of-2023/* (accessed October 10, 2025).
2. Tien HT. Housing inequality in relation to housing tenure: Evidence from Ho Chi Minh City. VNUHCM Journal of Economics – Law and Management. 2023;7:4191–4201.
3. Viet Nam News. HCM City brings homeless people to social support centres to reduce panhandling, petty crimes. *https://vietnamnews.vn/society/1663210/hcm-city-brings-homeless-people-to-social-support-centres-to-reduce-panhandling-petty-crimes.html?ut%E2%80%A6* (accessed October 10, 2025).
4. Litvinjenko S, Magwood O, Wu S, Wei X. Burden of tuberculosis among vulnerable populations worldwide: An overview of systematic reviews. Lancet Infect Dis. 2023; 3:1395-1407.
5. Noykhovich E, Mookherji S, Roess A. The risk of tuberculosis among populations living in slum settings: A systematic review and meta-analysis. J Urban Health. 2019; 96:262-275.
6. Gioseffi JR, Batista R, Brignol SM. Tuberculosis, vulnerabilities, and HIV in homeless persons: A systematic review. Rev Saude Publica. 2022; 56:43.
7. Beijer U, Wolf A, Fazel S. Prevalence of tuberculosis, hepatitis C virus, and HIV in homeless people: A systematic review and meta-analysis. Lancet Infect Dis. 2012; 12:859-870.
8. World Health Organization. National tuberculosis prevalence surveys 2007–2016. *https://iris.who.int/bitstream/handle/10665/341072/9789240022430-eng.pdf?sequence=1* (accessed October 10, 2025).
9. Nguyen HV, Tiemersma EW, Nguyen HB, *et al.* The second national tuberculosis prevalence survey in Vietnam. PLoS One. 2020; 15:e0232142.
10. World Health Organization. Global tuberculosis report 2024. *https://iris.who.int/bitstream/handle/10665/379339/9789240101531-eng.pdf?sequence=1* (accessed October 10, 2025).

11. World Health Organization. WHO operational handbook on tuberculosis. Module 2: Screening. Systematic screening for tuberculosis disease. *https://iris.who.int/bitstream/handle/10665/340256/9789240022614-eng.pdf?sequence=1* (accessed October 10, 2025).
12. World Health Organization. WHO consolidated guidelines on tuberculosis. Module 4: Treatment. Drug-susceptible tuberculosis treatment. *https://iris.who.int/bitstream/handle/10665/353829/9789240048126-eng.pdf?sequence=1* (accessed October 10, 2025).
13. World Health Organization. WHO consolidated guidelines on tuberculosis. Module 4: Treatment. Drug-resistant tuberculosis treatment. 2022 update. *https://iris.who.int/bitstream/handle/10665/365308/9789240063129-eng.pdf?sequence=1* (accessed October 10, 2025).

Received October 17, 2025; Revised December 9, 2025; Accepted December 15, 2025.

Released online in J-STAGE as advance publication December 18, 2025.

**Address correspondence to*:
Hitoshi Murakami, Bureau of Global Health Cooperation, Japan Institute for Health Security, 1-21-1 Toyama, Shinjuku-ku, Tokyo 162-8655, Japan.
E-mail: murakami.h@jihs.go.jp