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Screening Tuberculosis in Social Welfare Residents

Detección de tuberculosis en residentes de bienestar social

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SUMMARY

Introduction: *The incidence of tuberculosis among the socially disadvantaged is widespread. This analysis study aims to detect active tuberculosis systematically, prevent cross-transmission in the community, and refer and manage patients with tuberculosis.* **Methods:** *The type of analysis used is multivariate analysis.* **Results:** *Twenty-nine cases were confirmed as tuberculosis, resulting in a prevalence of 164 cases per 1 060 000 individuals; 19 of these 29 cases showed inactive tuberculosis on CXR. Body mass index (BMI) was negatively correlated with Tuberculosis. Subjects with suggested TB and individuals requiring observation had significantly higher aORs (18.29; 95 % CI, 5.28 to 63.41; p<0.001 and 10.07; 95 % CI, 3.44 to 29.46; p<0.001, respectively) compared to individuals with inactive TB.* **Conclusion:** *Low BMI can be considered a factor significantly associated with Tuberculosis in street dwellers.*

Keywords: *Social untouchability, tuberculosis, screening, chest X-ray.*

RESUMEN

Introducción: *La incidencia de tuberculosis en personas socialmente desfavorecidas es muy común. El propósito de este estudio de análisis es la detección temprana de tuberculosis activa, la prevención de la transmisión cruzada en la comunidad y la derivación y tratamiento de pacientes con tuberculosis de forma sistemática.* **Métodos:** *El tipo de análisis utilizado es multivariable.* **Resultados:** *Se confirmaron 29 casos de tuberculosis, lo que resultó en una prevalencia de 164 casos por 1 060 000 personas; 19 de estos 29 casos mostraron tuberculosis inactiva en la radiografía de tórax. El índice de masa corporal (IMC) se correlacionó negativamente con la tuberculosis. Los sujetos con sospecha de tuberculosis y los que requirieron*

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observación presentaron ORa significativamente más altos (18,29; IC del 95 %: 5,28 a 63,41; p < 0,001 y 10,07; IC del 95 %: 3,44 a 29,46; p < 0,001, respectivamente) en comparación con los individuos con tuberculosis inactiva. **Conclusión:** *Un IMC bajo puede considerarse un factor significativamente asociado con la tuberculosis en personas en situación de calle.*

Palabras clave: *Intocabilidad social, tuberculosis, detección, radiografía de tórax.*

INTRODUCTION

The incidence of tuberculosis in Indonesia is reported to be 1 060 000 in 2024, and high-risk groups, including the socially disadvantaged, prisoners, and immigrants, are the targets of active case finding for prevention and early diagnosis in the Third National Strategic Plan for Tuberculosis Control (1,2). The socially disadvantaged population has a high prevalence of Tuberculosis due to poor hygiene, alcohol abuse, and drug use. Therefore, many countries have established guidelines for Tuberculosis screening using chest X-ray (CXR), tuberculin skin test, and excretion test to detect active and latent Tuberculosis in vulnerable groups based on the burden of Tuberculosis (3,4).

The Law on the Welfare of the Socially Disabled in Indonesia defines the socially disadvantaged as individuals who live without a permanent residence for a considerable period or people who use socially disadvantaged facilities such as side counselling canters, temporary shelters for the socially disadvantaged, rehabilitation/care/self-support facilities for the socially disadvantaged, or general support centers for the socially disadvantaged. The socially disadvantaged population can be categorized as street socially disadvantaged, facility workers, undocumented foreigners, socially disadvantaged people in facilities, and bedroom users. According to the Socially Disadvantaged Survey 2023, the composition of the population that did not visit the hospital was 37.5 % street socially disadvantaged people, 3.1 % socially disadvantaged people in facilities, and 9.1 %-bedroom users. This indicates that the socially disadvantaged population's access to health services is limited. The World Health Organization (WHO), after the End Tuberculosis 2023 strategy, recommends Tuberculosis screening for at-risk groups who may have low access to medical care, including the socially disadvantaged, and the integrated patient management of pillar I strategy emphasizes the importance of early diagnosis in high-risk groups. In addition, any proposed screening strategy should use early diagnosis methods and allow for effective treatment and follow-up to maintain case management (5-7). However, reports on the current status of Tuberculosis among the socially disadvantaged are very few, although one study investigated directly observed therapy and showed poor treatment adherence in Indonesia. Active case finding is a provider-initiated strategy to detect and treat patients with Tuberculosis who would not otherwise receive prompt medical care. In contrast, passive case findings are based on the voluntary presentation of patients to healthcare providers. Active case finding programs screen large populations to identify active TB cases, usually by CXR. However, due to the context of the health system and availability of resources, there are concerns regarding the accuracy of TB detection, differential diagnosis from inactive TB, rapid sequential diagnosis and treatment, and economic and social consequences. Although the specificity of CXR is low (46 % to 89 %) (8,9), which depends on quality web-based remote interpretation from a digitalized portable instrument (10,11) CXR can provide sufficient data for TB screening, followed by additional diagnostics, such as sputum acid-fast bacilli (AFB) staining and culture. This study reports on the TB epidemic in the socially disadvantaged compared to the general population and investigates factors associated with TB, as suggested and confirmed on CXR.

Research Methods

The study used a cross-sectional design and gathered information from patients with TB in Tuban Regency, Indonesia. The sample was recruited through cluster sampling to generalize the results. The sample size was calculated using the Slovin formula with a significance level of 0.05. Before being recruited, respondents were informed about the aim of this study and the procedure adopted for the survey. They were also asked for informed consent to participate in this study. Data for this study were collected using a questionnaire for each variable.

This study received ethical approval from the Ethics Committee of the Nursing Faculty of Universitas Airlangga Indonesia, with certificate number 2043-KEPK/ 2023. After receiving

explanations and research procedure instructions, all respondents voluntarily provided informed consent to participate. The research procedure adhered to the principles outlined in the Declaration of Helsinki for research involving human participants.

Data Analysis

The data obtained through the study were coded, entered, and verified using IBM SPSS Statistics for Mac version 27.0 (IBM Corp., Released) to increase the quality of data analysis. The categorical study, including child factor, health service factor, maternal factor, household factor, food safety factor, supplementary feeding factor, and early warning stunt, was described through descriptive statistics and analyzed using regression (12,13).

RESULT

The main objectives of this study were early detection of active TB, prevention of cross-transmission in the community, and systematic referral and management of patients with TB. National general health screening by age category ($p<0.005$). Twenty-nine cases were confirmed as Tuberculosis, resulting in a prevalence of 164 cases per 1 060 000 individuals; 19 of these 29 cases showed inactive Tuberculosis on CXR. Body mass index ($p=0.0478$) and CXR results ($p<0.001$) were significantly correlated with confirmed Tuberculosis based on multivariate analysis (Table 1).

In multivariable analysis to identify factors influencing confirmed Tuberculosis in street dwellers screening, no differences were found based on screening category, age, or respiratory symptoms ($p>0.05$).

Table 1. Distribution of Tuberculosis confirmed cases.

Type	Estimated	Actual	Gender	No %	Total
Total cases		7,913 (100.00)	13,382:4,531	29 (0.16)	164
Street social disadvantage	1.795	2036 (10.37)	1.949.188	10	545
Facility worker	NA	1309 (6.26)	849.460	1	90
Undocumented foreigner	NA	3877 (20.76)	2.659	4	109
Socially disabled people in facilities	7.561	6919 (37.37)	5137	3	45
Bedroom users	5.649	4672 (25.25)	3790	11	246

Table 2. Regression analysis between Body Mass Index (BMI) and Tuberculosis

Indicator	p-value	OR (CI)
Body Mass Index	0.0001	0.86 (0.73- 0.99)

Body mass index (BMI) was negatively correlated with Tuberculosis (aOR, 0.86; 95 % CI, 0.73 to 0.99) (Table 2). Subjects with suggested TB and individuals requiring observation had significantly higher aORs (18.29; 95 % CI, 5.28 to 63.41; $p<0.001$ and 10.07; 95 % CI, 3.44 to 29.46; $p<0.001$, respectively) compared to individuals with inactive TB. Therefore, low BMI can be considered a factor significantly associated with Tuberculosis in street dwellers.

Previous studies confirmed a significantly higher proportion of inactive TB in the confirmed TB group at 2 761 (24.6 %) compared to the control group at 3 072 (15.9 %; $p<0.0001$). Given recent advances in diagnostic technology, findings suggestive of

Tuberculosis on CXR can be determined using deep learning algorithms. However, for homeless individuals without permanent housing or financial means for diagnostic testing or treatment, adhering to additional testing and treatment plans can be challenging. Several studies have shown a higher likelihood of incomplete treatment or treatment delays in the homeless population. Therefore, in cases where inactive Tuberculosis is observed on CXR, it is important to exclude active Tuberculosis, especially in homeless individuals. The need for personalized care strategies for the treatment of Tuberculosis among the homeless should be emphasized and implemented in policies regarding vulnerable groups. Table 1 shows that approximately 89 % of homeless people in facilities and 82 % of sleepover apartment users were screened in the 2021 TB screening project. Although more than the estimated number of street homeless people were screened, the exact number is questionable due to the difficulty in identifying this population. Certain groups, such as unregistered foreigners, face challenges verifying their residence or identity, requiring significant effort to obtain accurate numbers. Verifying the exact number of individuals in this group is critical to ensuring accurate data collection and understanding of TB in the homeless population to create effective policies.

The suggested comparison of TB on chest X-rays between the homeless and the general population by age group is <0.001

DISCUSSION

Tuberculosis (TB) remains a major global health issue, particularly affecting vulnerable populations. Residents of social institutions, such as nursing homes, prisons, and shelters, often face an elevated risk of TB infection due to factors such as overcrowded living conditions, inadequate ventilation, and restricted access to timely healthcare services (14-17). This combination fosters the rapid spread of the disease and can lead to delayed diagnosis and treatment, exacerbating the problem within these communities.

TB transmission is primarily airborne, so environments with close, prolonged contact make it easier for the bacteria to spread. Public health measures to combat TB in such settings typically include routine screenings, improved living conditions, better ventilation, and targeted health interventions to ensure that infected individuals receive prompt and effective treatment. Screening Tuberculosis with early detection of active TB cases, prevention of the spread of TB in social care settings, and identification of individuals who require immediate medical intervention.

The prevalence of TB in the Indonesian population aged 15 years and over was 759 per 100 000; the highest TB prevalence was in the old age group (55 years and over). Indonesia's basic health research data shows that the smoking behavior of the Indonesian population aged 15 years and over amounted to 33.8 % in 2018. Men who smoke every day or smoke occasionally are 57.3 %, while women are only 1.2 %. Tuberculosis prevalence in Indonesia was higher in urban areas than in rural areas. This could occur because there was more access to health services, but it was slightly different for island areas. According to the tuberculosis prevalence of the Philippines, which has similar island patterns to Indonesia, it has identical results, as the participation rate was higher amongst women and rural areas, and TB prevalence was higher in the old age group.

The prevalence of TB with positive chest X-ray was higher at the age of 15-24 years, higher in males than females, and higher in rural areas. The proportion of participants aged 65 years and over who underwent chest X-ray was lower than that of younger participants. Most of the reason was that they could not visit the study sites because of illness, disability, or inability to walk. The proportion of female participants who underwent chest X-rays was lower than that of males because some pregnant women did not have chest X-rays. The TB prevalence was higher in the other regions of Indonesia. Apart from the possibility that the participants in these areas were more frequently exposed to TB germs and TB risk factors, this might be because the area was still underdeveloped, so a lack of education could be one of the determining factors. As symptom-based case finding was not optimal, the passive TB case detection that has been carried out so far might also have contributed to the delay in TB diagnosis and treatment—the limitation of case finding or symptom detection tools and access to health services needed to be improved. Among participants who screened positive, 44 % had no cough symptoms for 14 days or more, and coughed up blood. Tuberculosis prevalence, according to chest X-ray, increased the number of asymptomatic TB cases. If the chest X-rays had not been used in screening, this study would have lost

42.5 cases. This means that the use of chest X-rays could improve case findings. All levels of society must support intensive case findings, including communities and community organizations that care about TB (18-21).

The prevalence of TB with positive smears was higher in males than in females (5,6). The prevalence increased with age and in urban areas. The higher prevalence in urban areas differed from other studies in China, which indicated an association between TB prevalence and rural residence. Generally, in urban areas, the participation rate was relatively low. However, the TB prevalence in urban areas and the low participation rate could estimate the interval from urban prevalence to be wide. The high prevalence of TB in the Indonesian region could be caused by the density of many cities and districts on the island, which resulted in more people being directly exposed to TB germs and suffering from TB. This could also be caused by the limited geographical location of other island areas, making it challenging to send samples. The accuracy of TB diagnosis was reduced when only a microscopic examination was used. Contamination in morning sputum, 3 %, was higher than spot sputum, 1.1 %. This difference was suspected because the participant was accompanied by laboratory staff when removing the sputum spots (22-24). The limitations of this study are the lack of genomic sequencing and the availability of negative culture results. Additional accurate examinations were needed to enhance the quality of the microscopic examination. Sputum genetic test examination was proven to reduce false-positive results. Since this study was conducted in a community, further research is needed to see the trend in routine health services to update the TB diagnostic algorithm (25).

CONCLUSION

TB screening for street homeless people should be continued due to the highest TB prevalence observed in this study (545 per 100 000 persons). An accurate estimate of unregistered foreigners with TB should also be established based on the prevalence of 109 per 100 000 persons observed in this study. TB incidence and BMI were reported to show a linear relationship. This study confirmed that low BMI in homeless people is significantly associated with Tuberculosis. Among subjects who showed significant TB findings on CXR, BMI was significantly lower at 22.50 compared to the BMI of 23.76 in the other group. In addition, street homeless individuals who showed the highest prevalence of the disease had a significantly lower BMI of 23.25 compared to non-registered foreigners and homeless individuals in facilities. Since the homeless population is exposed to irregular food and poor environmental conditions and shows a lower BMI distribution compared to the general population, a concurrent nutritional support program as an incentive, combined with Tuberculosis screening, would be effective in improving treatment adherence and nutritional status of the homeless. In a total of 17 713 cases, 29 were confirmed TB, with a prevalence of 164 per 100 000 persons. CXR findings of inactive Tuberculosis showed the highest prevalence with 19 out of 3 077 cases, suggesting that further aggressive screening is recommended for this group. This suggestion can be applied in general national health screening, where previous studies confirmed a significantly higher proportion of inactive TB in the confirmed Tuberculosis group at 2 761 (24.6 %) compared to the control group at 3 072 (15.9 %; $p<0.00001$). Given recent advances in diagnostic technology, findings suggestive of Tuberculosis on CXR can be determined using deep learning algorithms. Nutritional status and CXR results, especially those of inactive Tuberculosis, should be considered in active Tuberculosis screening in the socially disadvantaged population, where the prevalence of Tuberculosis is higher than in the general population.

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Author contribution

KK was responsible for the conception and design of the study, screening articles, data extraction, data analysis, and quality appraisal. AH and IL were in charge of screening articles, extracting data, and assessing each included article's quality. FC and TY are drafting and revising the manuscript. All authors have read and approved the manuscript and take full responsibility for its content

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