

## MANAGEMENT OF PULMONARY TUBERCULOSIS PATIENT WITH THEIR CULTURE CONVERSION STATUS IN KENDARI CITY, PROVINCE OF SULAWESI TENGGARA, INDONESIA

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(Submitted: 10 March 2017 – Revised version received: 10 August 2017 – Accepted: 1 September 2017)

### Abstract

**Background:** Tuberculosis (TB) conversion is a vital milestone that remains rarely assessed in TB mitigation programs. **Objectives:** This study aimed to explain the effects of body mass index (BMI) and housing index status on TB conversion in a developing country. **Methods:** A cross-sectional study was conducted on 51 TB patients in the three health centres (*Puskemas*) with the highest TB incidences in Kendari City, Southeast Sulawesi, Indonesia, using data reported in the the first quarterly report of 2008. We used bivariate association with Fisher's exact test to review TB conversion determinants. **Results:** The results indicated that TB occurred predominantly in men (51%) and people over 40 years old (74,5%). Factors indicating that TB conversion is associated with both adequate nutrition and housing in TB patients approached significance (RP = 1.0 and  $p = 0.05$ ). **Conclusions:** However, housing and nutrition status are rarely considered as determinants of TB conversion in the assessment of TB outcomes. We suggest increasing sample distribution and introducing other factors related to healthcare as supply variables for further study.

**Keyword:** tuberculosis, culture conversion, determinants, Indonesia

### Introduction

Directly observed treatment, short course (DOTS) strategies for TB are successful, especially for diagnosing latent TB in developing countries (1–3). TB sufferers who had been receiving care at healthcare facilities showed inactive TB bacilli that would not lead to transmission (negative MTB bacilli status) after two weeks' treatment of active TB bacilli (positive MTB bacilli status) (4,5). Yet

this TB condition, also known as TB conversion, was rarely being evaluated (6–9).

Various physical circumstances affect reactions to TB bacilli, including nutrition (10,11), and it has been established that starvation and poor nutrition reduce the body's immunity to TB infection (12). In impoverished areas, nutrition plays a key role in TB infections, not only in adults but also in children, who are affected more severely (13,14). Poor

nutrition includes insufficient nutritional quantities and quality, and it deprives the body's processes of the sustenance required to operate (15). Thus, it damages the immune system and reduces antibody counts (10). Consequently, in malnourished individuals, TB tends to be symptomatic, with symptoms including chills, fever, coughing, and diarrhoea, and TB tends to spread more readily in these populations (16).

Body mass index (BMI) has been indicted as a TB incidence measurement, as identified by a systematic and consistent log-linear relationship in six cohort studies in different settings (17). Similarly, poor nutrition status according to BMI has been established as a risk factor for pulmonary TB (18). It increases the risk of latent TB infections converting to active TB due to the effects on the immune system of consuming insufficient micro- and macronutrients (protein; vitamins A, D, C, and E; zinc; and selenium) (19,20). Moreover, social determinants of TB incidence include poverty, low socioeconomic development, and environmental change (21).

Housing conditions have previously been described and defined as a proxy indicator for socioeconomic determinants of TB (22). The suitability of housing depends on the availability of rooms for specific purposes and on humidity, ventilation, and the number of people living in the house. Although several studies reported housing conditions as a confounder or as directly associated with TB incidence in various settings, this

factor's role in conversion has not been confirmed, especially in developing countries with high TB burdens. This study aimed to reveal socioeconomic determinants of TB by examining the effect of nutrition status and housing indexes on conversion status in developing countries.

## **Methods**

A cross-sectional study was conducted on 51 TB patients in the three health centres (Puskesmas) with the highest TB incidences in Kendari City, Southeast Sulawesi, Indonesia. The sample was selected using proportional stratified random sampling, and it was gathered from the entire population of 161 TB patients with active MTB bacilli registered for TB treatment at the three centres—the Poasia, Puuwatu, and Wua-wua Health Centres—as reported in the first-quarter report of 2008. TB conversion status was diagnosed by change of MTB bacilli status via clinical assessment after two weeks of treatment.

Housing conditions were indexed according to the availability of rooms for specific purposes, humidity, ventilation, and population, as reported in a census conducted by the Ministry of Health of the Republic of Indonesia. Nutrition status was assessed according to the BMI standard reported in the World Health Organization's gold standard, adapted from the National Center for Health Statistics (NCHS) and Centers for Disease Control (CDC) (23).

A chi-square analysis was conducted to test the proportion mean difference of socioeconomic status described by nutrition and housing index status as its proxy, associated with TB conversion status. Measurement size resulted in ratio prevalence (RP) as a crude estimation.

The results showed that TB is more likely to affect those under 40 years old (74,5%) than those over 40 years old (25,5%). In addition, although the results indicated that TB occurs more often in men (51%) than in women (49%), it is likely that infection rates are equal between these groups.

## Results

The baseline characteristic of the study sample consisted of age, sex, and TB

**Table 1. Baseline of TB Conversion**

Characteristics	N	%
Age		
≥40 years old	13	25,5
<40 years old	38	74,5
Sex		
Male	26	51
Female	25	49
TB conversion		
Yes	48	94,1
No	3	5,9

Normality sampling distribution indicated that the proportion of conversion of TB status that occurred where the conversion was greater (94,1%) than non-conversion (5,9%) was not comparable. However, this probability still could be tested based on a hypothetical assessment.

Both the variables examined indicated that TB was more prevalent in cases accompanied by poor nutrition and inadequate housing than in cases with adequate nutrition and housing (Table 2).

The analysis also approached significance ( $p = 0.05$ ) when measuring whether TB conversion is associated with adequate nutrition and housing in TB patients. However, the risk difference in both, described as ratio prevalence (RP), was unable to predict the outcome measures ( $RP = 1.0$ ).

Tabel 2. Chi-square Analysis of TB Conversion

Variables	TB Un-conversion		TB Conversion		Total		RP	p value
	n	(%)	n	(%)	n	(%)		
Nutrition status								
Poor	2	5,9	32	94,1	34	100	1,0	0,05
Good	1	5,9	16	94,1	17	100		
House conditions								
Unmet	2	5,6	34	94,4	36	100	1,0	0,05
Met	1	6,7	14	93,3	15	100		

**Discussion**

*Nutrition status*

Immunity against MTB is affected by nutrient intake (10). This study showed how nutrient intake measured by BMI could increase TB conversion status in Kendari City. It has been shown that infectious diseases can affect patients' body mass, and when TB occurs, it decreases BMI (18). A similar trend was observed when patients underwent DOTS therapy, and even after two weeks of treatment, their BMI remained the same (15).

TB sufferers are vulnerable and do not have adequate protection against the disease if their immune systems are compromised (24). TB patients are especially prone to having a BMI below normal, and poor nutrition further affects BMI (25). However, although the association was unclear in this study, previous studies have shown a significant relationship between nutrition and IMT (17).

*Housing status*

This study examined housing status by physical condition, and it was found that there was little difference between TB infection rates in people in different

housing situations. This can be explained by improvements in housing and population movement that occurred after diagnosis or treatment. Therefore, the study indicated that TB conversion is not clearly linked to housing conditions. However, TB conversion has rarely been assessed in this light, and the results of several studies differed regarding housing status (22,26,27). Some studies reported that housing significantly affects TB, while others did not directly associate this factor with TB in other settings (28). Studies that indicated an indirect association identified housing as a confounder with a negligible effect on TB outcomes (29).

According to the Ministry of Health's Act No. 829 of 1999 on Adequate Housing, a house should meet several minimum requirements to be considered adequate housing. The Act states that adequate housing is characterized by the availability of rooms for specific purposes and by sufficient ventilation, is not overcrowded, and is not overly humid, with sufficient natural illumination (30).

Separate rooms are necessary for specific uses, such as a bedroom, kitchen, and living room; each adult should have 8–9 m<sup>2</sup> of living space (30); and each child should have 3 m<sup>2</sup> (31). Ventilation refers to air circulation, and 10% of the housing's

total area should be open to regulate carbon dioxide and oxygen levels. Humidity should also be low, while illumination should be adequate.

### Conclusion

From our novel study that explored housing conditions and nutrition as determinants of TB conversion, factors which are rarely assessed in TB outcomes, we found no significant relationship. However, when undertaking further study on this topic, we suggest increasing sample distribution and introducing other factors related to healthcare as supply variables (healthcare accessibility, facility conditions, the empowerment of health professionals, etc.).

### Acknowledgement

This study organized by several parties which are contibuted on various ways. We appreciates to Kendari City Health Office, health professionals of Poasia Health Center, Puuwatu Health Center, and Benu-benua Health Center, especially to each of TB programmers at *Puskemas* respectively. We are also thank you to Faculty of Public Health, Halu Oleo University as the host institution that prepares academic requirement relating to this study.

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