

ORIGINAL ARTICLE

Health Index Formula for Tuberculosis Patients: A Study on Family Self-Care at Public Health Center in 2018 at Blitar, East Java, Indonesia

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ABSTRACT

Introduction: The health index of a patient of tuberculosis can be calculated using variables obtained from the indicators that were developed based on the sufferer and family's behaviors while preventing the disease based on the nursing theory of self-care. It is expected that a family must be able to treat infected members at home properly using technical treatment. Therefore, this study aims to construct a health index formula for tuberculosis patients.

Methods: A cross-sectional design was used and further divided into two phases. The first is focus group discussions, which were carried out between tuberculosis treatment holders, Puskesmas nurses, and researchers to develop measurement instrument indicators. A survey was performed in the second phase for patients who were registered and treated in Public Health Center at Blitar, East Java, Indonesia. The 141 responses obtained were selected using a simple random sampling technique. The data were collected using a questionnaire developed from the focus group discussions and then analyzed using factor analysis.

Results: A Goodness of Fit Index (GFI) value of 0.98 was recorded along with composite value reliability of 53%. The formula of Health index obtained from the analysis was $(0.238 * \text{Home environment}) + (0.226 * \text{Family prevention efforts}) - (0.659 * \text{Coughing habits of patients}) + (0.250 * \text{Impact of treatment})$. The index was then calculated in four categories, namely low, enough, good, very good.

Conclusion: So, the health index formula of tuberculosis patients is illustrated as $\text{Health Index} = 0.238 * X_1 + 0.226 * X_2 - 0.659 * X_3 + 0.250 * X_4$.

Introduction

The 2013 Basic Health Research showed that occupancy densities above and below 8m² were obtained in East Java at 92.1% and 7.9% levels, respectively. A previous study also revealed that 17% of houses in the province were in the slums, while 83.0% were located in other areas.¹ Occupancy and slums are the risk factors for the transmission of tuberculosis because active patients live in densely populated areas. However, the spread of the disease can be prevented by the adherence of the infected individuals to healthy behaviours, such as not spitting anywhere and keeping the mouth closed while coughing.

Transmission can also be prevented by increasing the body's immunity, maintaining environmental hygiene, and keeping healthy daily habits.¹ Some unhealthy habits observed in tuberculosis patients include: a) the

unuse of cloth to cover their mouth while coughing and spitting, b) using their hands to wipe the mouth, and c) mixing receptacles. However, during an interview, the families revealed that they have been educated on how to prevent the transmission of the disease, remind the sufferers of safe behaviors, and making efforts to curtail its spread.²

Nursing Theory by Dorothea E. Orem defined self-care as the series of activities performed by individuals to maintain life, health, and wellbeing. The ability to take action can be grouped into three, namely minimal, partial, and total help categories.³ Furthermore, Orem's nursing theory can be applied to families suffering from tuberculosis. They have a role in providing tools to prevent the transmission of the disease, support the healing of patients as well as avoiding drug resistance.⁴ Therefore, this study aims to develop a formula for the



health index of tuberculosis patients who are being taken care of at home by their families.

Methods

A cross-sectional design was used and further divided into two phases. In the first phase, focus group discussions were held between Tuberculosis Treatment Holders, Puskesmas Nurses, and researchers to develop measurement instrument indicators. Meanwhile, a survey was carried out in the second phase on tuberculosis patients who were registered and treated at Public Health Center in Blitar, East Java, Indonesia. The variables used for measurement include home environment, family prevention efforts, coughing habits, as well as the impact of treatment. The survey was performed using a questionnaire developed from focus group discussions between September and October 2018. Data collection was carried out through interviews with families, and the analytic tools include factor analysis as well as structural equations to assess the reliability and validity construct. This study was approved by the Health Research Ethics Committee of the Poltekkes Kemenkes Malang with reference number 364/KEPK-POLKESMA/2018 on August 5, 2018.

Results

Table 1 shows the confirmatory factor analysis result of variable indicators using LISREL 8.50. Furthermore, Figure 1 illustrates the effect of each variable on the health index using PLS 3.0. The sub-variable in the variable as a health index factor for tuberculosis patients if it has a t-value when the test is > 1.96 and each sub-variable has a coefficient. The value of each Goodness of Fit Index of the four factors that make up the health index of tuberculosis patients is ≥ 0.98 , which means that the four factors have a predictive ability for health index of at least 98%.

The next step is to determine the health index category of patients. The index ranged from 0.24 to 9.62 with an average of 5.5 and a standard deviation of 1.81. Next, grouping was then calculated using the SPSS 24.0 for MAC. The grouping of health index categories for tuberculosis patients, namely if the score < 3.36 is low, between 3.37 - 5.57 is sufficient, 5.58 - 7.57 is good, and > 7.57 is very good. The composite reliability factors that affect the health index of tuberculosis patients, namely the home environment of 0.667; prevention efforts by the family of 0.710; the patient's coughing habit was 0.833; and the impact of treatment is 0.166.

Table 1. Confirmatory factor analysis of variable indicators using LISREL 8.50

Variable – Sub variable	t value	Coefficient	Fit test value
Home environment			
Habits to open the window	2.940	0.304	GFI = 0.98
Summary of glass tile	2.340	0.260	
Habits to drying the mattress	3.720	0.596	
Sunlight entered the room	4.420	0.744	
Clothes hanging in the room	3.120	0.714	
Family prevention efforts			
Availability of sputum container	5.880	0.692	GFI = 1.00
Provision of cutlery/drink	4.660	0.690	
Washing clothes habits of patients	3.820	0.806	
Availability of disinfectant liquid in sputum containe	3.040	0.212	
Coughing habits of patients			
Face direction when coughing	2.980	0.995	GFI = 1.00
The habit of closing your mouth when coughing	7.470	0.949	
The existence of a mouth covering device	-8.080	-0.957	
Impact of treatment			
Bored with taking medicine	-4.140	0.766	GFI = 0.99
Thinking to stop taking medicine	4.970	0.778	
Nausea	2.010	-0.662	
Urine color	-4.940	-0.202	

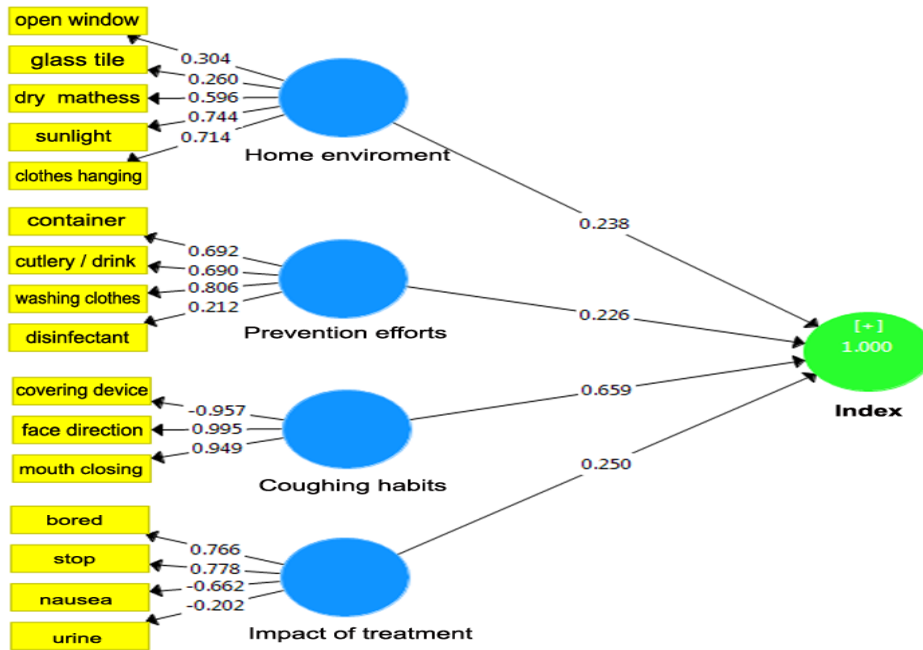


Figure 1. Health index of tuberculosis patients by PLS 3.0

Based on Figure 1, the health index formula of tuberculosis patients is illustrated below:

$$\text{Health Index} = 0.238 * X_1 + 0.226 * X_2 - 0.659 * X_3 + 0.250 * X_4$$

Where:

X1 = Home environment

X1 = (0.304 x Habits of opening the window) + (0.260 x Summary of glass tile) + (0.596 x Habits of drying the mattress) + (0.744 x Sunlight entered the room) + (0.714 x Clothes hanging in the room)

X2 = Family prevention effort

X2 = (0.692 x Availability of sputum container) + (0.690 x Provision of cutlery/drink) + (0.806 x Washing clothes habits of patients) + (0.212 x Availability of disinfectant liquid in sputum container)

X3 = Coughing habits of patients

X3 = (0.995 x Face direction while coughing) + (0.949 x Habits of closing mouth while coughing) - (0.957 x The existence of a mouth covering device)

X4 = Impact of treatment

X4 = (0.766 x Bored with taking medicine) + (0.778 x Thinking of stopping the intake of medicine) - (0.662 x Nausea) - (0.202 x Urine colour)

Discussion

Based on focus group discussions, the indicators of the variables produced include 1) tuberculosis patients' home environment, such as glass tiles, floor, and the condition of the room, 2) prevention of transmission, such as patient habits while coughing and handling sputum, and 3) healing efforts, which include the type and amount of protein nutrients provided by the family as well as their financial situation. An additional element that can provide information about family efforts is their perceptions about the attempts made by the affected member. The indicators obtained are consistent with a study in India that they have an important role in preventing the transmission of tuberculosis.^{5,6}

Indicator variables vary by region, and it is dependent on the perceptions of the health workers while providing healthcare services. There are various indicators in Tajikistan including family income, which can influence the success of tuberculosis treatment, particularly among migrants.⁷ Initial examinations while treating the disease have been actively carried out by patients supported by their families. They can also get an initial diagnosis from Puskesmas in each sub-district,⁸ which has the priority of controlling communicable diseases.⁹ The first correction made at the facility is that the community behaviors must be

appreciated by health workers, followed by the prevention efforts established by the government. Preventing the spread of diseases is a community effort carried out in collaboration with Puskesmas as a first-level health service facility.⁸

The variable indicators that were obtained after the statistical test using LISREL 8.50 are presented in Table 1. Latent variables were formed from valid indicator as index compilers of tuberculosis health patients, namely:

1. The home environment, such as habits of opening the window, glass tiles as well as drying the mattress, sunlighting the room, and hanging clothes.
2. Family prevention efforts, such as the availability of sputum containers, provision of cutlery/drinks, patients' clothes washing habits as well as the availability of disinfectant liquid in the sputum container.
3. Coughing habits of patients, such as the direction of the face, the closing of mouth as well as the existence of a mouth covering device.
4. Impacts of treatment, such as being tired or forgetting to take medicine, nausea, and urine color. The analysis results showed that the indicator variable's Goodness of Fit Index (GFI) had a minimum value of 0.98, which indicates that it has a 98% predictive power, and 100% was obtained in some.

The home environment as a residence for tuberculosis patients plays a role in the health index.^{10,11} Furthermore, it can be used as an effort to prevent transmission to other family members.^{12,13} It also helps in healing as planned or worsens the patient's condition. The home environment that affects the health index of tuberculosis patients include temperature, humidity, NO₂ levels, O₃ levels, as well as the lack of sunlight entering the house.¹⁴ These factors can increase the risk of contracting the disease for other members.¹⁵ Home environment indicators revealed that the role of the family in maintaining the cleanliness of the house is a sign for patients at home, as shown in Table 1.12 Smokers living with the sufferers are 1.49 times more at risk of suffering from the disease compared to non-smokers.¹⁶⁻¹⁸ This situation illustrates the importance of the home environment as an indicator of the health index for tuberculosis patients.

Prevention efforts carried out by families must include behaviors that can keep the health index of patients in good or very good condition.¹⁹ The family has a major role in preventing the spread of the disease.^{20,21} However, they must also be educated about the prevention of transmission as well as the administration of treatment after the diagnosis is made.^{22,23} Efforts to dilute the stored sputum using disinfectants need to be balanced with natural air ventilation or by opening the windows.²⁴ Transmission is basically not through eating utensils and clothes, but early prevention is more important because it cannot be guaranteed that patients' saliva containing bacilli is not present in the equipment they use.²⁵

Provision of closed sputum containers and diluting using disinfectants are highly recommended as preventive measures. When patients spit anywhere, the saliva areas containing mycobacterium tuberculosis flies around after it is dry. This situation is dangerous for family members or other people who inhale the contaminated air. The use of lysol disinfectant can kill the germs contained in patients' sputum.²⁶ Therefore, the family plays a very important role in providing disinfectants as an effort to prevent transmission and its disposal needs to be carried out properly. Sputum must be disposed in a closed place with running water, and it can be burnt using a microwave when necessary.²⁷

Patients' behavior while coughing also affects the transmission and health index of tuberculosis. Several studies stated that it is highly recommended that they cover their mouth,²⁵ look away, and use mouth covering tools, such as tissues. Family members or people around tuberculosis patients also need to maintain personal hygiene²⁸ by washing their hands with soap and running water after touching objects or items containing splashed saliva. Furthermore, covering the mouth while coughing is very important, but health workers need to be more concerned about the low income of patients. Good habits of the sufferers include covering the mouth with a towel for several days or the bottom of the clothes or the inner arm. A clean environment must be provided and health education efforts are also needed about the disease transmission.

Tuberculosis treatment must be carried out for at least 6 months and evaluation/examination of sputum can be performed twice.^{9,29} However, patients can experience some side effects, such as loss of appetite, nausea, abdominal pain, joint pain, tingling in the legs, and reddish urine.²⁵ These effects are often not revealed to them during health

education to avoid treatment refusal, which can lead to the persistence of the disease as well as drug resistance.

The validity value of each latent variable indicator has a t-test value above 1.96, which indicates that it can be used. Theoretically, indicators provide a broader view by examining smaller measurement variables that have established the requirements and data sources.¹² They can also be used as a measure because they are defined in operational definitions and ascertained through focus group discussions with experts before data collection was performed. Indicators of latent variables are validity values, namely t-test > 1.96 and reliability coefficient > 0.70, which indicate that statistically they can be used.³⁰

Figure 1 show the influence of latent variables on the compilation of tuberculosis patients health index. Furthermore, their total effect on the index was organized from the largest to smallest, namely the habit while coughing, treatment impact, home environment, and family prevention efforts with scores of 0.659, 0.250, 0.238, and 0.226, respectively. The four variables used were based on factors that need to be studied to determine health status.^{22,25,31} Generally, indicators for each latent variable have no full effect, but there are some that need to be developed to increase the optimal ability as well as the description of patients' condition. The ability of the indicator to describe their effect include 83.3% cough habits, 71.0% family prevention efforts, 66.7% home environment, and 16.6% impact of treatment.

The ability of the four latent variables to describe the health index of tuberculosis patients was 53.0%, hence, 47.0% were not developed. The study results showed that the index can be grouped into four categories, namely low < 3.35, sufficient 3.36 – 5.56, good 5.57 – 7.56, and very good > 7.57, as shown in Table 4.21

Conclusion

The formula of Health index obtained from the analysis was $(0.238 * \text{Home environment}) + (0.226 * \text{Family prevention efforts}) - (0.659 * \text{Coughing habits of patients}) + (0.250 * \text{Impact of treatment})$. The index was then calculated for four categories, namely low, enough, good, very good with GFI of 0.98 and composite reliability of 53.0%. The formula can be used to calculate the health index of tuberculosis patients in four categories, namely low, enough, good, very good. This can also serve as the basis for improving healing as well as contributing to further studies, which complement the variables used.

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Conflict of Interest

All authors declare that they have no conflict of interest.

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