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Validation of public stigma of tuberculosis scale during the COVID-19 pandemic using the Rasch model

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Abstract. – OBJECTIVE: Tuberculosis (TB) is still a major global health problem, and it has been particularly concerning during the COVID-19 pandemic. Non-compliance with anti-TB treatment increases the number of multidrug-resistant cases, causing ongoing transmission and increased morbidity and mortality. The main factors causing TB patients' non-compliance are stigma and lack of financial resources. Stigma harms patients and may cause them to delay seeking and adhering to treatment. Thus, it is important to measure the public stigma surrounding TB. However, few scales are available to measure this stigma as it developed during the COVID-19 pandemic. This study, therefore, aimed to develop and validate such a scale.

SUBJECTS AND METHODS: Mixed methods were employed in this study, consisting of a qualitative phase using in-depth interviews with 26 community leaders and a descriptive quantitative survey of 37 people in the Sumedang District to validate the public stigma of tuberculosis scale during the COVID-19 pandemic. The qualitative data were analyzed using thematic analysis, and the quantitative data were analyzed using the Rasch model.

RESULTS: The 21 items yielded by an initial qualitative analysis of the data gathered were validated using the RASCH model, yielding 17 valid items with a Cronbach's Alpha of 0.95, person separation of 3.61, real root mean square deviation (RMSE) of 0.37, infit mean square (INFIT MNSQ) of > +1.25, differential item functioning (DIF) of 1.000, the raw variance of 52.4%, and an unexplained variance ranging from 3.4% to 6.9%.

CONCLUSIONS: The scale developed to measure the public stigma surrounding TB during the COVID-19 pandemic is valid and reliable to measure stigma surrounding TB in the community, especially the pandemic. Further research is needed to apply the scale to bigger and broader populations to evaluate its measurement consistency.

Key Words:
Public stigma, Tuberculosis scale, Rasch model.

Introduction

Tuberculosis (TB) is still a major global health problem, and the case detection process remains essential in its management and control. Early detection is always carried out through clinical-based passive case finding (PCF), namely waiting for people who develop symptoms to seek treatment[1,2]. People with limited access to TB services often fail to obtain early diagnosis and treatment due to socioeconomic factors and the uneven distribution of services. This situation has worsened during a pandemic such as COVID-19, which has required people to perform social distancing and minimize non-emergency direct contact with health services.

COVID-19 is a disease caused by the Novel Coronavirus (2019-nCoV), which, on February 11, 2020, was publicly named the Coronavirus disease (COVID-19) by the World Health Organization (WHO). The Indonesian government[3] has used data from the COVID-19 Task Force National in various massive, systematic, and comprehensive efforts to prevent the broader transmission of COVID-19. However, these efforts have often been hampered by the existence of a negative stigma in society attached to this disease. Moreover, the COVID-19 pandemic was also significantly impacting mental health[4], which could affect the stigma in society.

The COVID-19 pandemic also increased the stigma surrounding – and, thus, non-compliance with – anti-TB treatment, potentially leading to

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an increased risk of multidrug-resistant cases that cause ongoing transmission and increased morbidity and mortality. Stigma harms patients and may cause them to delay seeking and adhering to treatment[5]. Economic factors also affect TB treatment; in fact, patients with financial limitations cannot afford the cost of treatment and choose not to seek it[6].

Stigma causes people to hide their symptoms, avoid medical examinations until their condition is truly severe, and not cooperate in efforts to trace positive contacts[1]. Stigma can cause individuals to feel ashamed of their illness and isolated and shunned by those around them, withdraw from social life, and fear the disease from which they are suffering[5]. As widespread stigma in society can cause a slowdown in TB treatment, efforts to reduce such stigma must be the main focus of attention and the central point of action to overcome the high incidence of TB during the COVID-19 pandemic.

To date, efforts to globally reduce TB-specific stigma have not been carried out optimally, as a specific measurement tool has been lacking. Various cultural and spiritual background differences exist that cause stigma to be handled following local cultural conditions, especially in the Indonesian context. The manifestation of stigma may vary from a cultural perspective because attitudes, beliefs, and values within the community influence stigma[7]. Tools such as a stigma scale to measure TB-specific stigma already exist; still, it does not cover aspects of cross-cultural adaptation, particularly those that have arisen during the COVID-19 pandemic, because of the similarity of signs and symptoms between TB and COVID-19. Thus, the research question addressed by the current study is how to develop and validate an instrument measuring the public stigma surrounding TB during the COVID-19 pandemic in Indonesia.

Subjects and Methods

Study Design

This study used sequential mixed methods to develop and validate an instrument to measure the public stigma surrounding TB during the COVID-19 pandemic in Indonesia. The first step was to conduct a qualitative study comprising in-depth interviews with 26 community leaders, and the second was a quantitative study of 37 respondents.

Settings

This study is community-based and was conducted in 26 regions of Sumedang Regency, one of the regencies in West Java Province, Indonesia. The research and development ran from March 2022 to December 2022. The quantitative phase was also located in Sumedang Regency, West Java Province, Indonesia. The quantitative respondents were recruited from various social media such as WhatsApp, Instagram, and Facebook.

Data Collection

Qualitative data were collected using semi-structured interviews with 26 community leaders who were also the leaders of the COVID-19 Task Force in the sub-districts. The interview questions were about community leaders' perspectives on tuberculosis care and management during the COVID-19 pandemic. In the quantitative phase, the instrument was filled in by 37 respondents. The instrument was distributed, filled out online, and distributed by a social media application to the public. This paper uses the Rasch Model to report the quantitative stage to validate the public stigma of tuberculosis scale during the COVID-19 pandemic. For the Rasch analysis, "as a general rule, test users should strive for using tests containing at least 20 items to ensure that decisions about individuals can be made with sufficient certainty[8]", also with 95% confidence and item calibrations or person measures stable within one logit then a minimum 30 respondents are required. This study's respondents were 37, thus meeting the minimum requirement for respondents.

Ethical Considerations

This research upholds ethical principles, and it received ethical approval from the Research Ethics Commission of Universitas Padjadjaran, Bandung number 474. Before collecting data, the researchers explained the research objectives and ensured that participants had full rights to decide whether to participate in the study voluntarily or refuse to be involved. Informed consent was obtained from all participants in the qualitative and quantitative stages. The researchers also guaranteed the confidentiality of participant data identity by giving each participant a code and protecting research data by ensuring that only the research team could access the computer system on which the data were stored. The researchers further assured that all participants involved in this study were physically and psychologically safe. All par-

Table I. Distribution of diagnoses of patients receiving narrowband UVB phototherapy.

Characteristic	f	%
Sex		
Male	11	30%
Female	26	70%
Age		
17-30 years	21	57%
31-50 years	15	40%
>50 years	1	3%
Education		
University	21	57%
High school	13	32%
Middle school	3	11%
Occupation		
Homemaker	8	22%
Student	10	27%
Teacher	7	19%
Midwife	1	3%
Civil servant	3	8%
Private	2	5%
Entrepreneur	1	3%
Not working	5	13%

ticipants were treated fairly, whatever their backgrounds.

Data Analysis

Data analysis on the instrument developed to measure the public stigma surrounding TB during the COVID-19 pandemic varied according to the research method applied at each stage. For qualitative research, data analysis was carried out thematically and interactively, while for psychometric data, the analysis used the Rasch model. Qualitative data analysis yielded seven themes according to seven dimensions of public stigma[9], namely 1) social distancing, 2) traditional prejudice, 3) exclusionary sentiments, 4) negative affect, 5) treatment carryover, 6) disclosure carryover, and 7) perceptions of dangerousness. After the qualitative phase was completed, an initial set of instruments was constructed, which covered seven dimensions and consisted of 21 statement items of the public stigma of tuberculosis scale. The stigma scale was sent through social media for an online survey, and 37 people responded. This quantitative data was then analyzed using Rasch Model, which can be used to document and evaluate the measurement functioning of instruments. This study chose Rasch analysis because it allows researchers to construct "maps" to explain the meaning of a test score or survey score and develop alternative forms of tests and surveys[10].

Results

In the quantitative phase, the set of 21 items was answered by 37 respondents. Most of the respondents were women aged between 17 and 30. As regards education and working backgrounds, most respondents were educated at the university level and worked (Table I).

In Figure 1, the person measures in the statistical summary show the average respondent's score in the instrument measuring public stigma surrounding TB during the COVID-19 pandemic. The person measures correlation in the instrument is +0.99. The average value of more than logit 0.0 shows the tendency of respondents who answered to agree more than disagree with the items on statements on various items. Cronbach's alpha (measuring reliability) is the interaction between the person and the item. The Cronbach's alpha value in the person reliability is 0.95 and is included in the "very good" criterion (< 0.5 = Very Bad, 0.5-0.6 = Bad, 0.6-0.7 = Enough, 0.7-0.8 = Good, > 0.8 = Very good).

The value of item reliability in the TB stigma instrument is 0.79. It can be concluded that the consistency of the answers from the respondents is sufficient, and the quality of the items in the instrument is high.

The grouping of people and items can be seen from the separation value in Figure 1. The greater the value of separation, the higher the quality of the instrument in terms of overall respondents and items because it can identify groups of respondents and groups of items. The person separation of the public stigma surrounding TB during the COVID-19 pandemic was 4.16, and the separation item in the stigma instrument was 1.83.

To check the fitness of items, the INFIT mean square (INFIT MNSQ) was used for each item: the mean and standard deviation were summed and then compared, and a higher logit score showed that the item was a misfit. The sum of logit from MEAN and SD was 1.00 + 0.25 = +1.25. Therefore, four items had an INFIT MNSQ score higher than +1.33, namely SD1 (Social Distancing), SD2, SD4, ES1 (Exclusionary Sentiments), and TP1 (Traditional Prejudice). SD3 had INFIT MNSQ score below +1.33, thus SD3 was excluded. The researcher revised the instrument item set again by deleting these five items, namely, SD1, SD2, SD4, ES1, and TP1, from the instrument. Finally, the public stigma scale consisted of 16 valid and reliable items. The items consisted of sev-

Table II. Public stigma of TB instrument during the COVID-19 pandemic.

No.		Domain/Item
Social Distance (SD)		
1.	SD3	People who are infected with TB (Tuberculosis) feel shunned
Traditional Prejudice (TP)		
2.	TP2	TB patients hide their status from other people
3.	TP3	TB patients are afraid that their identity is spread to other people in the community
4.	TP4	Many TB patients do not tell their TB status to other people.
5.	TP5	Stores refuse money from TB survivors
6.	TP6	TB patients do not want to report their disease because of ashamed and afraid being shunned.
7.	TP7	People are ashamed when they are diagnosed with TB
Exclusionary Sentiments (ES)		
9.	ES2	Many people who have TB signs and symptoms do not contact health care provider or community health center.
Negative Affect (NA)		
10.	NA1	People felt that TB is a shameful disease
11.	NA2	People with TB are considered as disgusting
Treatment Carryover (TC)		
12.	TC1	TB survivors are rejected by local grocery stores
13.	TC2	TB survivors felt uncomfortable and afraid to see people in community
Disclosure Carryover (DC)		
14.	DC1	People do not want to do TB test when they have signs and symptoms of TB.
15.	DC2	People do TB test in private clinic but do not report the result to the local community health center.
16.	DC3	People hide their TB status because they are afraid of losing jobs.
Perceptions of Dangerousness (PD)		
17.	PD1	People do not mention their close contact during contact tracing because of fear other people lose their job.

en dimensions, namely social distance (1 item), traditional prejudice (6 items), exclusionary sentiments (1 item), negative affect (2 items), treatment carryover (2 items), disclosure carryover (3 items), and perception of dangerousness (1 item). The final instrument can be seen in Table II.

Table III shows the measure as the logit value for persons. Item TC1, with a +1.13 logit, showed that this item is the most difficult for respondents, while SD3, with a -1.47 logit, is the easiest for respondents.

Differential Item Functioning (DIF) = 1.000, and DIF for gender, age, and educational background = 1.000, showing no bias among different participant characteristics.

Overall results, the 21 items yielded by an initial qualitative analysis of the data gathered were validated using the Rasch model. A total of 17 valid items were found with statistical significance, Cronbach's Alpha of 0.95, person separation of 3.61, real root mean square deviation (RMSE) of 0.37, INFIT MNSQ (Mean Square) of > +1.25, differential item functioning (DIF) of 1.000, the raw variance of 52.4%, and an unexplained variance ranging from 3.4% to 6.9%. These results showed that the instrument measuring the public stigma surrounding TB is valid and reliable for measuring this TB stigma in the community

Table III. Item measure.

No.	Entry Number	Measure	Item Code
1.	16	1.13	TC1
2.	9	.73	TP5
3.	13	.68	ES2
4.	2	.62	SD2
5.	18	.40	DC1
6.	15	.35	NA2
7.	21	.13	PD1
8.	17	.08	TC2
9.	19	.02	DC2
10.	12	-.03	ES1
11.	20	-.03	DC3
12.	10	-.09	TP6
13.	11	-.20	TP7
14.	14	-.20	NA1
15.	6	-.31	TP2
16.	1	-.36	SD1
17.	5	-.47	TP1
18.	8	-.47	TP4
19.	7	-.53	TP3
20.	4	-.70	SD4
21.	3	-.76	SD3
	Mean	.00	
	SD	.49	

SUMMARY OF 37 MEASURED Person

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	64.4	21.0	.12	.32	.99	-.5	.98	-.5
S.D.	14.4	.0	1.37	.04	.77	2.5	.76	2.4
MAX.	91.0	21.0	3.07	.40	2.92	4.9	2.86	4.4
MIN.	38.0	21.0	-2.58	.28	.08	-5.6	.08	-5.3

REAL RMSE	.37	TRUE SD	1.32	SEPARATION 3.61	Person RELIABILITY .93
MODEL RMSE	.32	TRUE SD	1.34	SEPARATION 4.16	Person RELIABILITY .95
S.E. OF Person MEAN = .23					

Person RAW SCORE-TO-MEASURE CORRELATION = .99
CRONBACH ALPHA (KR-20) Person RAW SCORE "TEST" RELIABILITY = .95

SUMMARY OF 21 MEASURED Item

	TOTAL SCORE	COUNT	MEASURE	MODEL ERROR	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
MEAN	113.4	37.0	.00	.24	1.00	.0	.98	-.1
S.D.	8.9	.0	.49	.00	.25	1.1	.25	1.0
MAX.	127.0	37.0	1.13	.24	1.47	1.9	1.50	1.9
MIN.	93.0	37.0	-.76	.23	.60	-2.0	.60	-1.9

REAL RMSE	.25	TRUE SD	.43	SEPARATION 1.72	Item RELIABILITY .75
MODEL RMSE	.24	TRUE SD	.43	SEPARATION 1.83	Item RELIABILITY .77
S.E. OF Item MEAN = .11					

UMEAN=.0000 USCALE=1.0000

Figure 1. RASCH model results.

Discussion

Stigma can be seen as a stereotype resulting from individuals' behavior towards others. Stigma and discrimination can arise due to ignorance about the mechanism of disease transmission. Health workers must have adequate knowledge about Tuberculosis to minimize the stigma associated with that disease[11].

Stigma is also related to the perception that infected people will put others at risk of infection, and many patients are not received or treated well by their health workers, friends, and family members[12]. The stigma domain consists of fear, pity, needing help, avoiding, blaming, anger, separation, feeling dangerous, and coercive actions against the patient[13]. This negative stamp needs to be explained to the community so that these characteristics of the stigma domain no longer occur in society.

There are several types of stigmas: public, perceived, secondary, self-stigma (stigma for oneself), experienced, and structural stigma[14]. Of these, public stigma and structural stigma need serious attention. Public stigma is a negative attitude, belief, and label in the community or in the general public towards individuals with a disease. This public stigma against TB sufferers can lead to social isolation, negative prejudice, exclusion from the community, and suffering negative effects. Even though individuals may have recovered, they are still considered to carry the disease and be dangerous to society[9].

Another stigma that needs to be considered is the structural stigma generated by an agency, company, or law that rejects sick people. Structural stigma includes social conditions, cultural norms, and institutional practices that limit the stigmatized population's opportunities, resources, and well-being. Both types of stigmas can impact social isolation and cause people not to seek care to cope with the disease[15]. The stigma can cause patients with TB symptoms not to seek medical attention immediately and even refuse to continue their treatment. Therefore, education and services must be integrated to reduce stigma in the community[16].

Besides causing many deaths and severely damaging people's physical health, the COVID-19 pandemic has also affected their mental health. The decline in mental health is a vicious cycle that can lead to a decline in physical health. Thus, these two aspects cannot be separated[17]. The mental health problem can also worsen due to social stigma around the infectious disease. Thus, it is necessary to measure the social stigma in various populations. Creating efficient techniques to assist those who encounter social stigma is also essential to improving the health outcomes of people with Tuberculosis.

Strengths and Limitations

The main strength of this study is that it provides a comprehensive perspective from the qualitative approach that involves community leaders, who are also the leaders of the COVID-19 Task Force in sub-districts. Views from these participants provided a complete picture for understanding the domains of the public stigma of tuberculosis scale during the COVID-19 pandemic. The qualitative approach was followed by a quantitative design to test the validity and reliability of the scale.

The study's main limitation is that it is a mixed-method study conducted in a city in the region of West Java, which may have a different context from other areas in Indonesia or the broader global community. However, the findings of this study can be used to inform other researchers beyond the sites investigated. Another acknowledged limitation of the study was the small number of samples. Even though this study has met the minimum requirement of samples, further studies with a larger sample size can improve the stability of the public stigma scale.

Conclusions

Overall, the public stigma of tuberculosis scale consisted of 16 valid and reliable items. The items were separated into seven dimensions, namely social distance (1 item), traditional prejudice (6 items), exclusionary sentiments (2 items), negative affect (2 items), treatment carryover (2 items), disclosure carryover (3 items), and perception of dangerousness (1 item). Further research needs to be conducted to examine the level of stigma and devise interventions to overcome the social stigma surrounding TB in the community, particularly during pandemics.

Conflict of Interest

The authors declare that they have no conflict of interests.

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Authors' Contributions

NJ, TP, and NN equally contributed to conducting the research, analyzing the data, and writing for publication.

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Data Availability

The data are available upon request to the corresponding author.

Ethics Approval

This research received ethical approval from the Research Ethics Commission of Universitas Padjadjaran, Bandung number 474, dated June 3, 2022.

Informed Consent

The participants gave written informed consent for the study.

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