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Psychometric attributes of WHOQOL-BREF among tuberculosis patients: Rasch model analysis

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ABSTRACT

The World Health Organization quality of life-BREF (WHOQOL-BREF) instrument has been used to assess several diseases, including chronic pain sufferers' quality of life. In Indonesia it can be utilized for evaluating the quality of life among tuberculosis (TBC) patients. This study aimed to assess the psychometric attributes of quality of life questionnaires among 123 respondents with TBC (56.9% males, 43.1% females) in Yogyakarta. This study employed the Rasch analysis technique for psychometric analysis. The findings indicate that six questions are biased in favour of the respondent's qualities. Four items do not statistically match an MNSQ (Mean-square or Standardized fit statistics) output value of >1.5 but are still acceptable (Pt. Meas Corr 0.3-0.8). Between the elements Q14-Q12 and Q12-Q21, there is a gap The responders' ability level is higher than the average problem difficulty level. The WHOQOL-BREF instrument revealed unidimensionality, and the evaluation scale worked properly when it was used with TBC patients with Cronbach's α value of 0.89. The WHOQOL-BREF scale continues to be appropriate for evaluating the patient quality of life since it has solid psychometric qualities.

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1. INTRODUCTION

An infectious illness known as tuberculosis (TBC) is one of the world's leading causes of mortality and a significant contributor to poor health. Prior to the coronavirus (COVID-19) epidemic, TBC surpassed HIV/AIDS as the most common infectious cause of mortality. With an estimated 845,000 new cases and 98,000 fatalities from TB each year, Indonesia has the second-highest TB burden globally [1]. Communities who tested positive for TB experience effects on their psychological, economic, and social well-being as well; therefore, we also need to turn our attention to quality of life [2]. The prevalence of depression among TBC patients was 20.9%, with societal stigma, a lack of family support, the difficulty of the disease's treatment, and its side effects among its causes [3].

Indicators of physical, psychological, social, and environmental health make up the quality of life. For six months after starting treatment for TBC, all aspects of quality of life can be improved [4]–[6]. However, psychological and social issues persist until the completion of the course of therapy [7]. Low quality of life is a common complaint among TBC patients, and physical, mental, and social constraints, as well as internal variables such as education level and residency, can all contribute to this [8]. The belief that tuberculosis is easily contagious makes people less likely to engage and communicate, which leads to low emotional and social functioning among TBC patients [9]. Many TBC patients with poor health Patients with TBC are

primarily male, reside in rural regions [9], and struggle with money [10]. TBC patients can improve their quality of life by consistently taking anti-tuberculosis drugs, increasing self-efficacy, getting support from their families, and socializing in the surrounding community to reduce stigmatization [10]–[12]. Quality of life is also influenced by compliance with treatment and management of TB patients accompanied by the patient's specific mental and psychosocial needs; this can increase the patient's quality of life [13], [14].

Numerous instruments may be used to measure the quality of life, and these instruments are developed based on the results of previous studies. In a heterogeneous general population, where there are many groups and people with various diseases as indicated by various health-related features, generic quality of life (QoL) measures is utilized. Research on health policy uses the quality of life to evaluate how a condition affects social and psychological functioning [15]. The WHOQOL is a quality of life assessment created concurrently by the WHOQOL Group and fifteen worldwide field centers in an attempt to establish a cross-culturally relevant quality of life evaluation [16].

The WHOQOL-BREF assessment tool has been widely used to evaluate the quality of life in a variety of cultural contexts, including those of Norway [17] and New Zealand [18], multiple sclerosis in the UK [19], bronchial asthma in North India [20], polio syndrome in the UK [21], cancer patients in Taiwan [22], including in Indonesia, and bronchial asthma in the UK. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) have been used in Taiwan to apply metrics for the quality of life of pulmonary TBC patients [23]. The literature on its application in treating TBC patients, notably in Indonesia, is scarce. The WHOQOL-BREF has been assessed for its psychometric qualities in Indonesian culture using a traditional test theory method, namely factorial validity with EFA and constructs validity with factor analysis (principal component analysis) [24]. The classical test theory (CTT) was found to have several drawbacks, such as the respondent's raw score being interval data rather than the measurement result, the intermediate score not indicating ability or describing the difficulty of the questions, and the raw score with the percentage of correct answers not being linear [25]. Rasch modelling, based on contemporary test theory, offers an alternate strategy. The Rasch model has advantages like following measurement standards (linear scale with equal intervals, anticipating missing data, providing more precise estimates, finding model errors, and producing plausible thinking) [26] and the Rasch model approach has the enormous benefit of developing item difficulty ratings individually for each group without considering human ability [27]. Rasch analysis should be used to evaluate the WHOQOL-BREF questionnaire's external validity and effectiveness to measure the quality of life at the national rural level [28]. Therefore, this study aims to evaluate the psychometric characteristics of quality of life in TBC patients to close the current literature gap.

2. RESEARCH METHOD

This research study used a quantitative descriptive approach. The population of this study consisted of all pulmonary tuberculosis patients in Sleman Regency and Yogyakarta City who met the inclusion criteria. The criteria are: i) pulmonary tuberculosis patients who were still receiving treatment, ii) did not have comorbidities like diabetes mellitus and human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), iii) able to communicate effectively, iv) at least 18 years old, and v) willing to participate in the study by providing written informed consent. The purposive sampling technique selected 123 of the 166 TBC patients who matched the requirements for the study's. The WHOQOL-BREF tool was then used to conduct interviews regarding the quality of life experienced during therapy.

Here, the term "quality of life" refers to the attitudes that people with TBC have while going about their everyday lives, which encompass the areas of physical health, psychological health, social interactions, and surroundings. The end variables in this study are the validity and reliability of measures used to evaluate the quality of life in TBC patients. Four domains are included in the WHOQOL-BREF instrument items: physical health, psychological health, social connections, and the environment. A preliminary investigation was carried out to ascertain the prevalence of TBC in the Special Region of Yogyakarta, Indonesia. According to the preliminary survey's findings, Yogyakarta City and Sleman Regency were the two most prevalent districts/cities. A systematic interview questionnaire was used to obtain data from individuals with pulmonary TBC receiving primary medical treatment (*Puskesmas*). Indonesian translations of the WHOQOL-BREF questionnaire were utilized. There are 26 items in the quality of life questionnaire and socio-demographic information. Nine skilled data collectors in all were enlisted to gather the information. Using the WHOQOL-BREF questionnaire, 123 TBC patients in Yogyakarta's Special Region were questioned about their quality of life while undergoing treatment. In order to address the issues identified during data collecting, supervision, assessment, and discussion are conducted. Before processing the data, the acquired data is confirmed by examining the questionnaire's accuracy and the respondents' responses. The Ethics Committee of Univesitas Ahmad Dahlan reviewed the study and issued an ethical clearance (registered number 012208121).

The data was checked is then coded, entered in Microsoft Excel, and then exported to Winsteps version 5.1.4.0 to be analyzed using the Rasch model. To check the fit and misfit items using the MNSQ value.

Misfit item instrument if the MNSQ infit value is greater than the number of logit items than the mean and SD. In addition, to determine valid items, where item fit, if the MNSQ outfit value is 0.5< MNSQ <1.5 [26], and point measure correlation is in the range 0.3-0.8 to predict latent traits [29]. To measure the reliability of the interaction between the person and the items was based on the value of Cronbach's alpha ≥0.7. Detection of item bias in Rasch analysis based on item probability value less than 5% (0.05) [26].

3. RESULTS AND DISCUSSION

3.1. Statistical summary of WHOQOL-BREF for tuberculosis patients

According to Table 1, the person measure value is +0.71 logit, which indicates that more respondents are likely to agree with statements on different items because the logit value is more significant than 0.00. If an instrument in social research has a reliability index in logit size, it is excellent and high-quality. The reliability score for people was 0.88, while the reliability index for items was 0.94, meaning that both the consistency of person replies and the consistency of item responses were excellent. The WHOQOL-BREF instrument for assessing the quality of life in TBC patients has great internal consistency, is regarded as a very trustworthy instrument, and demonstrates an interaction between items and the individual as a whole with Cronbach's α coefficient value of 0.89. An instrument has solid internal consistency if the reliability criterion is >0.70 [30]. The WHOQOL-BREF instrument in TBC patients has an excellent reliability value, as shown by Cronbach's α value, which for the instrument has a value of 0.89. The dependability of people and items shows the regularity of responses and the quality of each instrument statement [31]. High-scale dependability is indicated by Cronbach's α score above 0.8 [32].

Table 1. Statistical summary based on Rasch prameters

Category	Person	Item
N	123	26
Measures (logit)		
Mean	0.71	0.00
SD	0.86	0.56
SE	0.08	0.11
Outfit MNSQ		
Mean	1.00	1.00
SD	0.37	0.42
Outfit ZSTD		
Mean	-0.07	-0.36
SD	1.32	3.04
Separation	2.70	3.98
Strata	3.93	5.64
Reliability	0.88	0.94
Cronbach's α	0.89	
Chi-square (χ^2)	6798.0619	
Probability	0.5180	

Additionally, people and things are grouped using the separation index indication. The WHOQOL-BREF quality of life instrument's item groups could be distinguished by respondents who had TBC, and the quality of life for individuals could be divided into three groups, according to the separation values of 2.70 for people and 3.98 for items. The item separation index demonstrates the four levels of difficulty that may be assigned to the items utilized in this scale. The instrument or scale is more sensitive, the higher this index is. If an instrument cannot discriminate between two degrees of item difficulty, it has a low separation or less than two [33] The quality of the instrument in terms of all respondents and items and respondents' ability to appropriately reply to the item increases with increasing separation value [26]. Other data that can be used by looking at the OUFIT MNSQ (outlier-sensitive fit statistic of Mean-square) with a value of 1.00 means that it has good quality on the person or item, while the OUTFIT ZSTD (outlier-sensitive fit statistic of z-standardized) where the ideal value is 0.0, the closer the value 0.0 than the quality of the person and item is better [26]. In this study, the value of ZSTD= -0.07 and -0.36 shows that the data has a logical estimate.

3.2. Rating scale

Table 2 explains the WHOQOL-BREF quality of life instrument rating scale with 26 items. The categories of instruments have three types of categories. Item 1 and item 15 with very poor, poor, neither poor nor goof, good and very good categories. Item 2 and items 16 to 25 with very dissatisfied, dissatisfied, neither satisfied nor dissatisfied, satisfied and very satisfied categories. While items 3-14 and item 26 with categories not at all, a little, a moderate amount, very much, and extreme amount categories.

Table 2. Five-point Likert rating scale functionality statistics

Condition	Category	Rating scale	Count	Observed average	Infit MNSQ	Outfit MNSQ	Andrich Threshold	Threshold distance
1	**Item 1 and 15**							
	Very poor	1	1	-1.99	1.18	1.17	NONE	-
	Poor	2	8	-1.61	0.84	0.81	-3.96	3.96
	Neither poor nor good	3	85	0.60	0.99	1.00	-2.82	1.14
	Good	4	129	2.68	1.09	1.01	1.21	4.03
	Very good	5	23	4.79	0.96	0.96	5.57	4.36
2	**Item 2, and 16-25**							
	Very dissatisfied	1	1	-0.99	1.19	1.34	NONE	-
	Dissatisfied	2	8	-0.65	0.96	0.96	-2.69	2.69
	Neither satisfied nor dissatisfied	3	42	0.29	0.96	0.96	-1.90	0.79
	Satisfied	4	41	1.44	0.90	0.92	0.88	2.78
	Very satisfied categories	5	7	2.53	1.12	1.06	3.71	2.83
3	**Item 3-14 and 26**							
	Not at all	1	3	-1.27	0.94	0.95	NONE	-
	A little	2	13	-0.32	1.10	1.11	-2.21	2.21
	Amoderate amount	3	40	0.40	0.89	0.88	-1.10	1.11
	Very much	4	31	1.15	0.92	0.92	1.03	2.13
	An extreme amount	5	13	1.65	1.07	1.07	2.27	1.24

The findings indicate that the rating scale observed count has a unimodal distribution. The average observation rose from -1.99 to 4.79 logit for item 1 and item 15, from -0.99 to 2.53 for item 2 and items 16 to 25, and from -1.27 to 1.65 logit for items 3–14 and item 26. Value and wealth thresholds are another metric used to evaluate how well the scale choices in the instrument work. The distance between the chosen parks in conditions 1, 2, and 3 was 1.4, showing that the respondents understood how to use the Likert rating scale, but the distance between options was also found to have minor values. Any threshold or scale-up, as well as the precise contrast value between categories, must be at least 1.4 logits larger than the preceding category [34]. For each category, the andrich threshold value has increased progressively from negative to positive. The Likert scale category works appropriately if the boundary values on the rating scale grow monotonously and consistently [35].

In the quality of life instrument (WHOQOL-BREF), there are several frequencies, including category 1 (very bad, bad, not bad and not wrong, good and very good), namely in items number 1 and 15 (Figure 1), category 2 (very dissatisfied, dissatisfied, dissatisfied and dissatisfied, satisfied and very satisfied) namely on items 16-25 (Figure 2), and category 3 (not at all, a little, moderate, very often, in excessive amounts) namely on items 3-14 and item 16 (Figure 3). The probability distribution curves are shown in Figures 1 and 2, and it can be observed from the curves that the rating scale of each instrument item for the five categories has a peak. These data conclude that the WHOQOL-BREF quality of life questionnaire rating scale is at its peak performance. Different answer rating units can be distinguished by probability curves with peaks >0.5 logit respondents and different shapes [36].

3.3. Dimensionality

Validity analysis used raw variance explained by measure to see the unidimensionality of the instrument and whether the instrument was able to measure what it was supposed to measure (Table 3). The raw variance explained by measure is 35.4% which means that the instrument meets the unidimensionality requirements in a good category where the minimum requirement is 20%. The Rasch model shows that each factor is unidimensional because items from the same WHOQOL-BREF domain are grouped to represent the same construct [22]. The value of the raw variable >20% proves that the instrument items in the Indonesian version can be measured consistently and show a link between the quality of life items [31]. The unexplained variance in the first contrast value of 7.1% indicates no noise in the measurement. In addition, the eigen values also show no items derived from other variables.

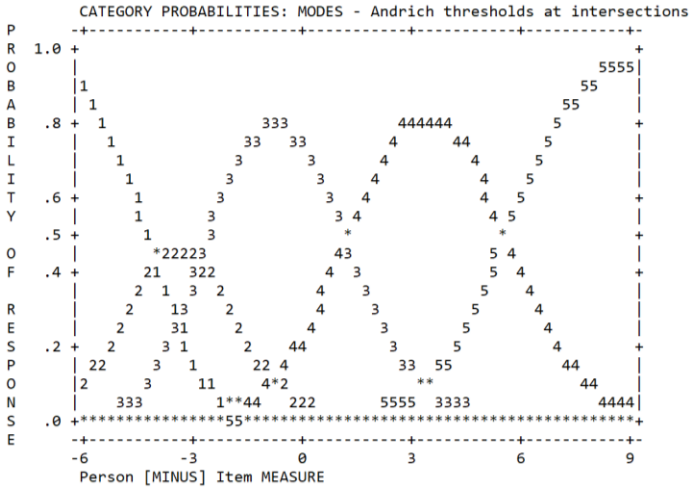

Figure 1. Item category curves 1 and 15

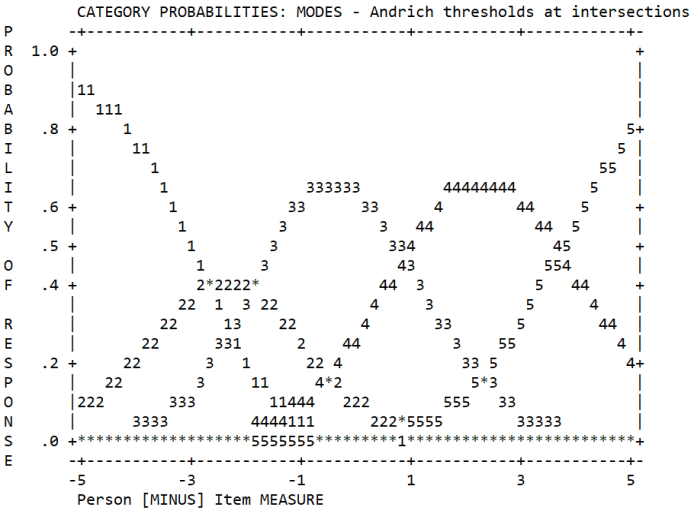

Figure 2. Curve of category 2 items and items 16-25

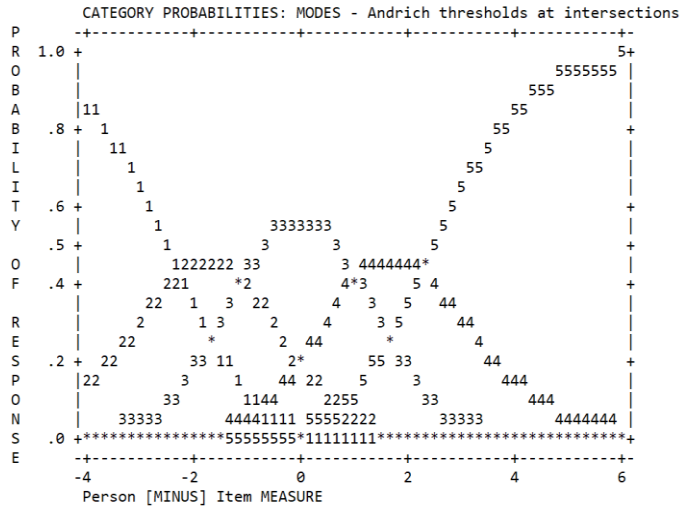

Figure 3. Curves for category items 3-14 and item 26

Table 3. Unidimensionality and local independence

Unidimensionality indicators	Value
Raw variance explained by measures	35.4%
Unexplained variance in the 1st contrast	7.1%
Eigen values	2.84

3.4. Item fit

The four concept dimensions of the WHOQOL-BREF questionnaire are physical, psychological, social, and environmental health. Items Q3-4, Q10, Q15-18 are in the area of physical health while Q5-7, Q11, Q19, and Q26 are in the domain of psychological health. Furthermore, Q20-22 are in the domain of social health while Q8-9, Q12-14, Q23-25 are in the domain of environmental health, and Q1-2 are in the domain of general health.

Based on Table 4, it can be seen that items Q3 (To what extent does your physical pain prevent you from carrying out activities according to your needs?), Q4 (How often do you need medical therapy to function in your daily life?), Q11 (Are you able to accept the appearance of your body?) and Q16 (How satisfied were you with your sleep?) indicate that the item is inappropriate because the MNSQ clothing score is outside the accepted value (0.5-1.5) [32]. A reasonable person fit score if the MNSQ infit and outfit score range is 0.5-1.5. In addition, the item fit parameter can be seen from the Pt. Mea Corr value of 0.3-0.7 indicates that it is still within the acceptance range and can be maintained as an item fit so that all items can function and predict latent properties [26].

Table 4 shows that items Q3 (To what extent does your physical pain prevent you from doing activities according to your needs?) and Q4 (How often do you need medical therapy to function in your daily life?) and Q11 (Are you able to accept your body's appearance?) and Q16 (How satisfied are you with your sleep?) indicated that item is fit because the MNSQ outfit value is outside the accepted range (0.5–1.5). Infit and outfit scores are more significant than 1.5 and less than 0.5 indicate you have a good personality fit score. In addition, the item fit parameter can be seen from the Pt. Mea Corr value of 0.3–0.7, indicating that it is still within the acceptance range and can be maintained as item fit so that all items can function and predict latent properties.

3.5. Item and person mapping

The person-item map (Wright map) describes the interactions between persons and items. Figure 4 explains that the distribution pattern of items is spread out at each item difficulty level, namely very high, high, moderate, and low. Based on the distance conditions, there are gaps between items, namely in items Q14 and Q12 and items Q12 and Q21. However, this distance needs to be more comprehensive so it does not significantly impact the quality of the WHOQOL scale. If there is a distance between items, there will be missing information for respondents between these two items. The wide gap between items will impact the sensitivity and reliability of the developed scale [37], [38]. The Wright map is divided into four areas. The upper left area of the map shows the position of respondents who tend to have a good quality of life, while the lower left area shows the position of respondents who have a poor quality of life. The upper right area shows items on quality of life that are considered difficult, while the lower right area shows items on quality of life that are easy for respondents. A person's ability and item difficulty in this map have been calibrated on the same logit scale. Based on the picture, it shows that the mean item is lower than the mean person, with an average ability person value of 0.71 logits (standard deviation =0.86) and item difficulty level of 0.00 (standard deviation =0.56); this means that the respondent's level of ability to answer questions higher than the difficulty level of the item. The average person and item difference is less than 1.0 logit and is positive, meaning that the respondents are at a higher quality of life level than the average scale [39]. The item person map is used to determine how items and persons fit together in a logit continuum; the higher the Level Value Item (LVI) value, the more difficult the item is for respondents to agree. Based on the figure, it is known that the difficulty level of the item that is the most difficult to agree on is item 14 (How often do you have the opportunity to have fun or recreation?); on the other hand, the item that has the most accessible level of difficulty to agree is item 24 (How satisfied are you with your access in health services?).

3.6. Differential item functioning (DIF)

Differential item functioning (DIF) is a statistical trait of an item that indicates how much it may be evaluating various talents for various subgroups of respondents. Figure 4 shows the items Q1 (How do you feel about your quality of life?) Q6 (To what extent do you feel your life is meaningful?) Q20 (How satisfied are you with your personal and social relationships?) and Q26 (How often do you have negative feelings such as loneliness, hopelessness, anxiety, and depression?) have a probability value of less than 0.05, indicating that the item is biased for the gender category, which means that the response between male and female is different in answering. Items Q1 and Q6 show that it is more difficult for male to answer than female, while in items Q20 and Q26, it is more difficult for female to answer than male (Figure 5).

Table 4. Item fit

Item	Item description	Measure	Model S.E	Infit MNSQ	Outfit MNSQ	Pt. Mea. Corr
	Domain 1 : Physical					
Q3	Physical discomfort (pain)	-0.20	0.13	1.53	1.51*	0.44
Q4	Medication to carry out function in daily life	-0.52	0.13	2.27	2.28*	0.39
Q10	Vitality	0.04	0.13	1.11	1.13	0.62
Q15	Ability to get around	-0.65	0.13	0.85	0.85	0.50
Q16	Sleep	0.29	0.13	1.11	1.10	0.38
Q17	Satisfaction with ability to activities	0.28	0.13	0.54	0.55	0.64
Q18	Satistaction with work capacity	0.42	0.12	0.91	0.90	0.59
	Domain 2: Psychological					
Q5	Life enjoyment	-0.17	0.13	0.61	0.62	0.60
Q6	Life meaning	-0.37	0.13	0.97	0.97	0.58
Q7	Concentration	0.21	0.13	0.59	0.60	0.58
Q11	Acceptance of appearance	-0.48	0.13	1.11	1.73*	0.57
Q19	Self satisfaction	-0.14	0.13	0.52	0.52	0.77
Q26	Negative feeling	-0.43	0.13	1.65	1.65*	0.37
	Domain 3: Environment					
Q8	Life safety	0.04	0.13	0.73	0.74	0.64
Q9	Environmental health	0.02	0.13	0.68	0.68	0.59
Q12	Finance	1.22	0.12	1.32	1.35	0.59
Q13	Information availability	0.37	0.13	0.85	0.87	0.60
Q14	Leisure activities	1.68	0.12	1.11	1.12	0.52
Q23	Satisfaction with home	-0.52	0.13	0.87	0.90	0.51
Q24	Access health services	-0.95	0.13	0.74	0.72	0.44
Q25	Transportation	-0.27	0.13	0.70	0.70	0.50
	Domain 4: Social					
Q20	Personal relationships	0.01	0.13	0.67	0.68	052
Q21	Sex life	0.79	0.12	1.26	1.27	0.38
Q22	Friend support	-0.38	0.13	0.71	0.73	0.47
	General health					
Q1	Rate quality of life	-0.27	0.13	0.70	0.71	0.48
Q2	Satisfaction about health	0.01	0.13	1.07	1.07	0.58
	Mean	0.00	0.13	0.99	1.00	
	P.SD	0.56	0.00	0.42	0.42	

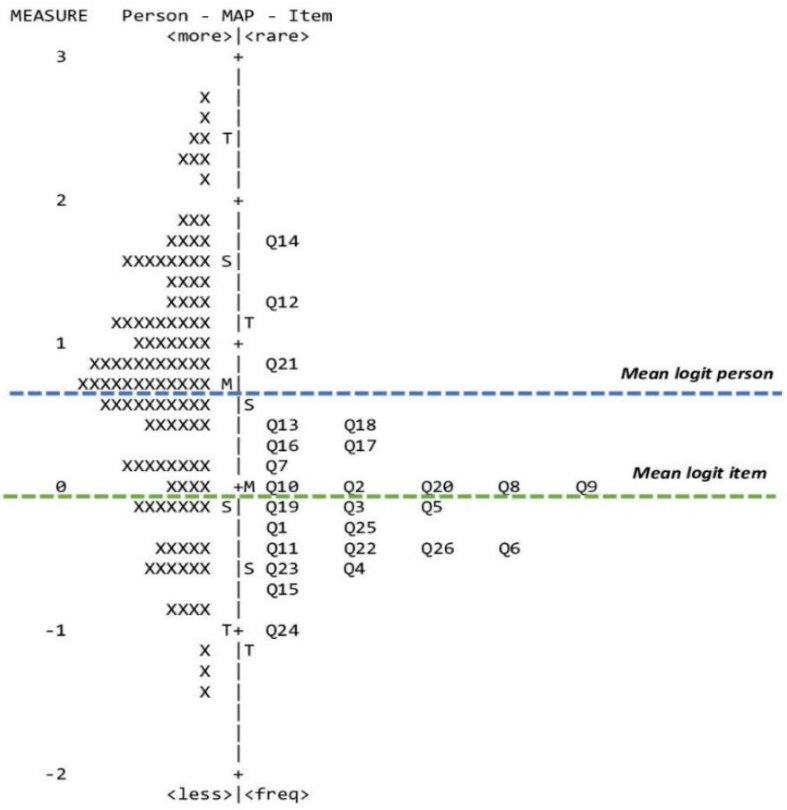

Figure 4. Wright map

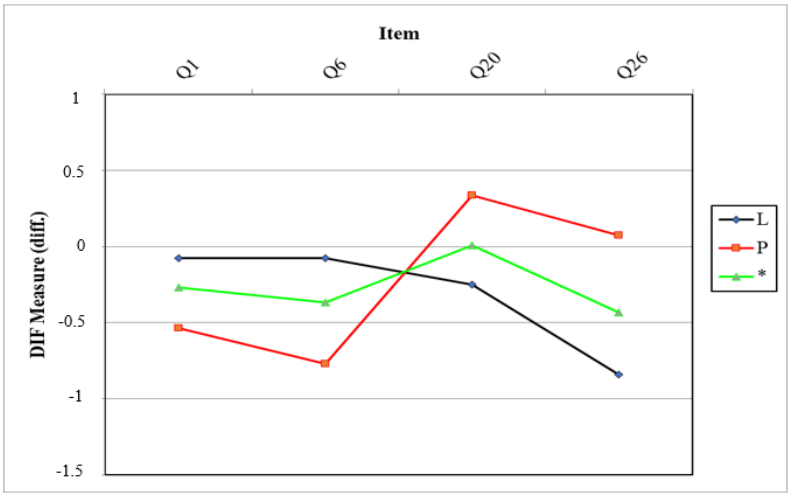

Figure 5. Person DIF based on gender

Based on the respondent's last educational level, bias was found in items Q4, Q12, and Q26. In item Q12 (do you have enough money to meet your needs?), respondents with no school education status tend to find it more challenging to answer than other respondents with prior education status (Figure 6). Respondents with lower education create a limitation in this study due to the possibility that the respondent needed to comprehend the questions [40]. Items with bias can be further selected to be retained or discarded [41]. The results show that DIF based on the demographics of the respondents may occur but does not necessarily imply bias and must be investigated to confirm whether there is a bias [38].

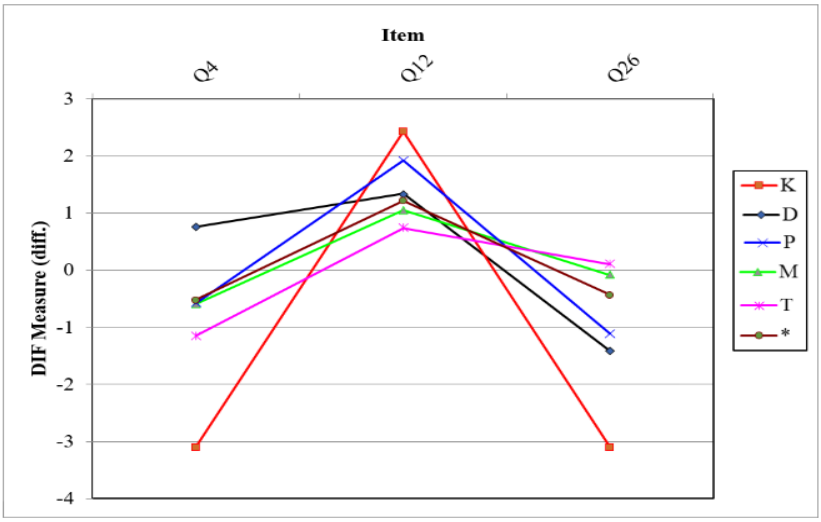

Figure 6. Person DIF based on educational

4. CONCLUSION

The WHOQOL-BREF scale's psychometric characteristics have been studied among TBC patients. There are 22 out of 26 items show good performance and have unidimensionality. Six of these items are biased towards the attributes of respondents based on gender and educational status. A Likert scale with five evaluations works nicely. The psychometric features of the WHOQOL-BREF scale is suficient to assess the quality of life of tuberculosis patients. Adding items with a degree of difficulty between Q14, Q12, and Q21 while still employing five rating scales allows the WHOQOL-BREF instrument to be utilized for additional research.

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