Original Article

Health-related quality of life and sociodemographic factors as predictors of treatment outcomes in pulmonary tuberculosis patients in a tertiary hospital in Cebu City

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ABSTRACT

Background: Pulmonary tuberculosis (PTB) remains a global health concern affecting millions of lives despite intensified screening and treatment efforts. PTB affects physical health and emotional, environmental, and psychological well-being—collectively influencing a patient's quality of life. This study examined the relationship between pre-treatment health-related quality of life (HRQOL) and sociodemographic data, and their impact on treatment outcomes, whether completed or not, in PTB patients.

Methodology: This prospective cohort study was conducted at the TB DOTS Center of Chong Hua Hospital. It included patients aged 18 years or older without multidrug-resistant or extrapulmonary PTB and without significant comorbidities affecting HRQOL. Sociodemographic data were collected, and HRQOL was assessed using the World Health Organization QOL—Brief Version (WHOQOL-BREF) questionnaire before the start of treatment.

Results: The mean age of our population was 37.18 ± 15.99; 56% were female, 62.5% were single, and 80% completed tertiary education. Fifty-five percent of the participants had comorbidities, the most common of which were hypertension and diabetes mellitus. Before treatment, participants reported a generally acceptable quality of life across all domains (physical, psychological, social, and environmental). Seventy-six patients completed treatment (i.e., treatment success), while four were lost to follow-up. There were no treatment failures. Those who completed treatment showed higher physical and psychological health scores at baseline, albeit the correlation was weak. Sociodemographic factors had minimal association with HRQOL, except for the absence of formal education which was associated with lower psychological scores. None of the analyzed sociodemographic factors were associated with lost to follow-up status.

Conclusions: While PTB treatment is highly effective in achieving clinical success, this study highlights that other factors like QOL are crucial for optimal outcomes. Pre-treatment physical and psychological health are strongly associated with an increased likelihood of treatment completion. The sociodemographic profile had no significant association with HRQOL and treatment outcome.

Keywords: pulmonary tuberculosis (PTB), health-related quality of life (HRQOL), treatment outcomes, World Health Organization Quality of Life—Brief Version (WHOQOL-BREF)

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INTRODUCTION

Pulmonary tuberculosis (PTB) remains a significant global health concern, affecting millions annually. In the Philippines, there has been an increasing trend of TB incidence rate from 554 per 100,000 in 2020 to 650 per 100,000 in 2021. The incidence is predicted to increase by 130 percent and PTB deaths by 170 percent by the year 2025.[1]

PTB is transmitted by respiratory droplets. A third-world country like the Philippines, where poverty and overcrowding are widespread, creates a good medium for the spread of tuberculosis. Most third-world countries lack awareness about the signs and symptoms of PTB disease, often resulting in delayed treatment and further transmission of the bacterium. Another factor that can promotes the spread of PTB is social stigma, which leads to avoidance of medical care and limited access to health care, especially in rural areas.[2] The increase in PTB incidence can be attributed to different factors. The study of Macatangay et al. examined multiple sociodemographic factors that could affect the treatment outcomes among PTB patients. Unlike the results of most studies that showed age is a factor associated with treatment outcome, this study did not find any association between age and treatment outcome. In the studies where age was a factor, it was pointed out that the older population is more likely to have comorbid conditions, immunosuppression, and an increased likelihood of adverse drug reactions, which increase the probability of discontinuation or unsuccessful treatment. In this study, the younger population may not seek appropriate medical treatment because of concerns about their work or school. As to gender, women exhibit better health-seeking behavior than men. The use of tobacco and alcohol also affect treatment outcomes. There is a positive correlation between occupations and education and completion of treatment; craft workers and those with higher levels of education have higher completion rates. The risk of treatment failure is higher in lower-class municipalities than higher-class municipalities for many reasons.[3]

Treatment of PTB does not always lead to success; occasionally, some fail in their treatment. A study conducted by Namukwaya et al. at the Tuberculosis Clinic at Mulago Hospital in Kampala showed that a positive sputum smear test after two months of anti-TB treatment and poor adherence to the regimen were predictors of treatment failure. Distance to the treatment clinic was also associated with treatment failure however, in this study, no such associations were seen, likely because of the presence of more urban tuberculosis treatment clinics. Several

factors that were associated with treatment failure in several studies, like alcohol abuse, low education, and significant comorbidities like diabetes mellitus and HIV seropositivity, were not found to be significant predictors of treatment failure in this study.[4]

Quality of life can also be significantly affected by PTB. The World Health Organization (WHO) defines the quality of life as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns.[5] In the study by Dhuria et al., the health-related quality of life (HRQOL) scores of PTB patients were significantly lower compared to the control group, with the physical and psychological domains being the most affected.[6] In a study conducted by Matsumoto et al. in the Philippines, similar results were shown. Contributing factors were socioeconomic status, lack of social support, lower educational level, number of symptoms, and the presence of adverse effects.[7] These two studies demonstrate that PTB patients undergoing TB treatment have poor HRQOL; however, these studies did not explore the relationship between HRQOL and treatment outcomes.

This research aimed to address this gap in knowledge by assessing the association between pre-treatment HRQOL and treatment outcomes among patients with PTB. Specifically, it aimed to 1) measure the HRQOL of patients before undergoing PTB treatment, 2) relate this with treatment outcomes, as well as 3) determine the association between sociodemographic factors and HRQOL and between sociodemographic factors and treatment outcomes. While physicians often focus primarily on physical health, emotional and psychological factors may also affect treatment outcomes. By examining these associations, the study sought to contribute to a more holistic and patient-centered approach to PTB care.

METHODOLOGY

Study design

The study had a prospective cohort design conducted in a TB DOTS center of a 660-bed capacity tertiary hospital in Cebu City.

Study participants

Patients enrolled in the TB DOTS program who were 18 years old and above, and diagnosed with PTB, either bacteriologically or clinically, were included. Patients who were unwilling to participate or who possessed any of the following features were excluded: multidrug-resistant tuberculosis; extrapulmonary tuberculosis; and/or severe comorbidities (e.g., end-stage cancer, severe chronic obstructive pulmonary diseases, decompensated congestive heart failure, end-stage liver cirrhosis, severe mental health conditions, severe neurologic diseases, advanced infection with human immunodeficiency virus or acquired immunodeficiency syndrome.

Ethical consideration

The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The protocol was submitted to the Chong Hua Hospital (CHH) Institutional Review Board (IRB) for approval (IRB reference code 2023-086), and informed consent was incorporated in the online survey, allowing participants to voluntarily engage in the study. Measures were taken to ensure that all data collected, stored, and analyzed were protected to maintain privacy and confidentiality.

WHOQOL-BREF questionnaire

The study measured HRQOL using the WHO Quality of Life—Brief version (WHOQOL-BREF). The WHOQOL-BREF questionnaire is a standardized and open-access tool developed by the WHO. The self-administered instrument has 26 items, each rated on a 5-point Likert scale, which assesses the four primary domains of physical, psychological, social, and environmental health.[9] It is reliable, easy to use, and has been tested in different cultural settings and diseases, including PTB. Domain scores are calculated by averaging the scores of items within each domain and then multiplying by four to align with the score used in the original WHOQOL-100 assessment. We adopted the cut-off value of 60 from the study conducted by Silva et al. A score above 60 indicates a higher QOL, which implies that they are generally satisfied, while a score below 60 suggests that intervention may be needed to improve QOL.[10]

Study procedures

Consented participants were enrolled before the start of PTB treatment. Baseline data were collected, including sociodemographic data as part of the WHOQOL-BREF questionnaire. Sociodemographic and clinical variables were collected as follows: birth date (for age computation), recorded in years as a continuous variable; sex, categorized as male or female; marital status, categorized as single, married, widowed, or live-in; education level, classified as none, primary, secondary, or tertiary; and comorbidities, identified based on history. Participants answered the WHOQOL-BREF and, while the questionnaire was self-administered, the researchers were present to provide clarification or answer questions from the participants.

Follow-up procedures were carried out by TB DOTS staff per the National Tuberculosis Control Program's Manual of Procedures (NTP MOP), 6th edition.[8] The researchers had no role in patient follow-up. Treatment outcomes were obtained from the facility. Based on the definitions used in the NTP MOP, the outcomes recorded were: successful treatment, referring to a patient who completed PTB treatment for 6 months; treatment failure, referring to a patient who had no sputum conversion after 5 months or later, acquired resistance, or did not show any clinical improvement during treatment; and lost to follow-up, referring to a patient who had treatment interruption for two months or more.[8]

Sample size

The sample size was determined using Cochran's formula for finite populations. During a specific timeframe, the hospital documented 100 patients diagnosed with PTB. With the assumption of maximum variability ($p = 0.5$), a 95% confidence level, a 5% margin of error, and a population size of 100, the minimum required sample size was calculated to be 80.

Statistical analysis

Data were consolidated and cleaned through data coding and imputation of missing values, then analyzed using JASP version 0.19. WHOQOL-BREF raw domain scores were transformed to a 0-100 scale following the WHOQOL-BREF: Introduction, Administration, Scoring and Generic Version of the Assessment manual (World Health Organization, 1996), with higher scores indicating better quality of life. This was done for the purpose of standardizing the scores and to ease interpretation.[9,10]

Continuous variables were summarized as mean ± standard deviation, while nominal variables were presented as frequency counts and percentages. Confidence intervals (CI) were calculated to estimate population parameters. Multiple and binary logistic regression models were used to assess associations, while point-biserial correlation was used to examine relationships between variables. For analysis of treatment outcome, categorical variables were coded numerically: in correlation analysis, "Completed" treatment was coded as 1, while "Lost to follow-up" was 0; in logistic regression predicting lost to follow-up, the coding was reversed. All patients were included, including those lost to follow-up. Statistical significance was set at $p < 0.05$.

RESULTS

Table 1 shows the baseline characteristics of 80 patients diagnosed with pulmonary tuberculosis (PTB). The mean age of the patients was 37.18 years ± 15.99 years. There was a slight predominance of females (56.25%) compared to males (43.75%). Most patients were single (62.5%) and had completed tertiary education (80%). Nearly half reported comorbidities, the most common being hypertension and diabetes mellitus.

Table 2 presents the HRQOL scores, assessed using the WHOQOL-BREF questionnaire.[9] In the physical health domain, the mean raw score (RS) was 24.31 ± 4.08, corresponding to a transformed score (TS) of 61.88 ± 14.53, with 95% confidence interval (CI) ranging from 58.64 to 65.11. In the psychological health domain, the mean RS was 21.96 ± 3.65 which translates to a TS of 66.34 ± 15.32, with 95% CI ranging from 62.93 to 69.75. For social relationships domain, the mean RS was 10.98 ± 2.21, with a corresponding TS of 66.66 ± 18.57 and a 95% CI ranging from 62.53 to 70.80. In the environmental health domain, patients have a mean RS of 28.31 ± 5.09, resulting in a TS of 65.33 ± 15.95, with 95% CI ranging from 61.78 and 68.87. All scores were above the cut-off of 60 established by Silva et al.[10]

Table 1. Baseline characteristics of patients diagnosed with PTB

	n = 80
Age (years), mean ± SD	37.18 ± 15.99
Sex	
Male	35 (43.75)
Female	45 (56.25)
Marital status	
Single	50 (62.50)
Married	23 (28.75)
Widow	6 (7.50)
Live in	1 (1.25)
Education	
None	1 (1.25)
Primary	2 (2.50)
Secondary	13 (16.25)
Tertiary	64 (80.00)
Comorbidities	
Yes	36 (45.00)
No	44 (55.00)

Values are presented in frequency (percentage) unless otherwise stated

Table 2. Pre-treatment QOL of patients diagnosed with PTB, n = 80

QOL domain	Raw score (RS)	Transformed score (TS)	95% CI for TS
Physical health	24.31 ± 4.08	61.88 ± 14.53	58.64 to 65.11
Psychological health	21.96 ± 3.65	66.34 ± 15.32	62.93 to 69.75
Social relationships	10.98 ± 2.21	66.66 ± 18.57	62.53 to 70.80
Environmental health	28.31 ± 5.09	65.33 ± 15.95	61.78 to 68.87

RS and TS are presented in mean ± SD
The instrument used to measure the Quality of Life is the WHOQOL-BREF questionnaire.[9] The ≥60 cut-off for interpretation follows Silva et al.[10]

Table 3. Treatment outcomes of patients diagnosed with PTB

Treatment outcome	n (%)[a]
Success	76 (95.00)
Failure	0 (0.00)

aFour patients were lost to follow-up during treatment

Table 4. Correlation between QOL and treatment outcome

	Correlation coefficient	p-value
Physical health	0.232*	0.038
Psychological health	0.269*	0.016
Social relationships	-0.007	0.949
Environmental health	0.106	0.349

*Significant at 0.05; Completed (i.e., treatment success) is coded as 1, Lost to Follow-up is coded as 0.

Table 3 shows that PTB treatment had a 95% success rate. There were no cases of treatment failure; however, four patients were lost to follow-up.

Table 4 shows that both physical and psychological health were significantly associated with treatment outcomes, albeit the correlations were weak ($r = 0.232$; $p = 0.038$ and $r = 0.269$; $p = 0.016$, respectively). On the other hand, social relationships and environmental health showed no significant correlation with treatment outcomes.

Table 5 shows that none of the analyzed sociodemographic factors were significantly associated with the physical health component of QOL. The model explains about 24.8% of the variance in physical health QOL.

Table 6 shows that most of the analyzed sociodemographic factors did not have a significant association with the psychological health component of QOL. The only significant association was the lack of formal education; patients who had no formal education experienced notably lower psychological health QOL scores ($p = 0.045$). The model explains only 16.2% of the variance in psychological health QOL.

Table 7 shows that none of the patient characteristics have an association with the social relationships component of QOL, with the model explaining only 13.5% of the variance in social relationships QOL.

Table 8 shows that none of the patient characteristics have an association with the environmental health aspect of QOL, with education at the secondary level ($p = 0.056$) and married status ($p = 0.087$) having p-values close to significance. The model

Table 5. Regression analysis to assess the relationship between pre-treatment QOL (physical health) and sociodemographic characteristics of patients diagnosed with PTB, n = 80

	Coefficient	SE	t	p-value	95% CI	
					Lower	Upper
Gender						
Male	0.833	3.127	0.266	0.791	-5.405	7.070
Education						
Secondary	-7.986	4.369	-1.828	0.072	-16.699	0.727
Primary	-1.986	10.362	-0.192	0.849	-22.652	18.680
None	-21.735	14.811	-1.467	0.147	-51.275	7.806
Marital status						
Married	3.628	4.406	0.824	0.413	-5.159	12.415
Widow	-1.793	7.571	-0.237	0.813	-16.894	13.307
Live in	0.160	13.377	0.012	0.990	-26.519	26.839
Presence of illness	-5.842	3.099	-1.885	0.064	-12.024	0.339
Age	-0.240	0.157	-1.530	0.131	-0.554	0.073

*Significant at 0.05 using multiple regression; Dependent variable: Pre-treatment QOL (physical health); R = 0.498, R^2 = 0.248, adjusted R^2 = 0.151, and RMSE = 13.133

Table 6. Regression analysis to assess the relationship between pre-treatment QOL (psychological health) and sociodemographic characteristics of patients diagnosed with PTB, n = 80

	Coefficient	SE	t	p-value	95% CI	
					Lower	Upper
Gender						
Male	-0.221	3.296	-0.067	0.947	-6.794	6.353
Education						
Secondary	-3.157	4.604	-0.686	0.495	-12.339	6.026
Primary	-11.700	10.921	-1.071	0.288	-33.480	10.081
None	-31.807	15.610	-2.038 *	0.045	-62.940	-0.673
Marital Status						
Married	-0.071	4.643	-0.015	0.988	-9.331	9.190
Widow	-3.290	7.980	-0.412	0.681	-19.205	12.625
Live in	11.764	14.098	0.834	0.407	-16.354	39.881
Presence of illness	1.049	3.266	0.321	0.749	-5.466	7.563
Age	-0.120	0.166	-0.725	0.471	-0.450	0.210

*Significant at 0.05 using multiple regression; Dependent variable: Pre-treatment QOL (psychological health; R = 0.403, R^2 = 0.162, adjusted R^2 = 0.054, and RMSE = 13.842

Table 7. Regression analysis to assess the relationship between pre-treatment QOL (social relationships) and sociodemographic characteristics of patients diagnosed with PTB, n = 80

	Coefficient	SE	t	p - value	95% CI	
					Lower	Upper
Gender						
Male	-2.103	4.264	-0.493	0.623	-10.608	6.401
Education						
Secondary	-4.968	5.957	-0.834	0.407	-16.848	6.912
Primary	-18.101	14.128	-1.281	0.204	-46.279	10.077
None	-28.288	20.195	-1.401	0.166	-68.566	11.989
Marital status						
Married	7.085	6.007	1.180	0.242	-4.895	19.066
Widow	-5.263	10.323	-0.510	0.612	-25.852	15.326
Live in	6.680	18.239	0.366	0.715	-29.695	43.056
Presence of illness	-3.161	4.226	-0.748	0.457	-11.589	5.267
Age	-0.059	0.214	-0.275	0.784	-0.486	0.368

*Significant at 0.05 using multiple regression; Dependent variable: Pre-treatment QOL (social relationships); R = 0.368, R^2 = 0.135, adjusted R^2 = 0.024, and RMSE = 17.907

Table 8. Regression analysis to assess the relationship between pre-treatment QOL (environmental health) and sociodemographic characteristics of patients diagnosed with PTB, n = 80

	Coefficient	SE	t	p - value	95% CI	
					Lower	Upper
Gender						
Male	2.080	3.070	0.678	0.500	-4.043	8.204
Education						
Secondary	-8.321	4.289	-1.940	0.056	-16.875	0.233
Primary	-4.418	10.173	-0.434	0.665	-24.707	15.871
None	-9.767	14.541	-0.672	0.504	-38.769	19.234
Marital status						
Married	7.500	4.325	1.734	0.087	-1.126	16.127
Widow	4.301	7.433	0.579	0.565	-10.524	19.126
Live in	9.495	13.132	0.723	0.472	-16.697	35.687
Presence of illness	-4.584	3.043	-1.507	0.136	-10.652	1.485
Age	-0.137	0.154	-0.886	0.379	-0.444	0.171

*Significant at 0.05 using multiple regression; Dependent variable: Pre-treatment QOL (environmental health); R = 0.388, R^2 = 0.150, adjusted R^2 = 0.041, and RMSE = 12.894

Table 9. Binary logistic regression analysis to assess the relationship between lost to follow-up and sociodemographic characteristics of patients diagnosed with PTB, n = 80

Characteristics	Estimate	Standard Error	z	p-value
Age	0.012	0.057	0.216	0.829
Gender				
Male	-0.727	1.319	-0.551	0.582
Education				
Secondary	0.734	1.470	0.500	0.617
Primary	3.009	2.177	1.382	0.167
None	-14.371	3956.181	-0.004	0.997
Marital status				
Married	-0.172	1.818	-0.094	0.925
Widow	0.273	2.021	0.135	0.893
Live in	-13.888	3956.180	-0.004	0.997
Presence of illness	0.876	1.288	0.680	0.496

*Significant at 0.05, Lost to Follow-up is coded as 1

accounts for only 15.0% of the variance in environmental health QOL.

Table 9 presents the results of binary logistic regression analysis examining the association between patient characteristics and the likelihood of being lost to follow-up. None of the analyzed characteristics were found to have a statistically significant effect on the likelihood of follow-up loss.

DISCUSSION

This study assessed the association between pre-treatment HRQOL and treatment outcomes. Different factors may affect a patient's treatment outcome, and this study aimed to identify some of those factors.

The majority of the patients were young (37.18 ± 15.99 years), female (56.25%), single (62.5%), and completed tertiary education (80%). Nearly half of the population (45%) reported the presence of comorbid illnesses, the most common of which were hypertension and diabetes mellitus.

HRQOL and treatment outcomes

The pre-treatment HRQOL scores were generally satisfactory across all domains, with psychological health and social relationships scoring slightly higher than physical health and environmental health. In comparison, a study conducted in Malaysia in 2014 found that the HRQOL of the population was poor at the start of treatment. A significant finding in this study was that 67.1% of the study participants were at risk for depression at the start of treatment. After the completion of treatment, there was a significant improvement in the HRQOL. However, the overall HRQOL was still low compared to the general population.[11] A similar study conducted in Bangladesh showed that patients who completed PTB treatment had significant improvement in their HRQOL, which was now equal to healthy individuals.[12] These contradicting results underscore the imperfect association between the impact of PTB treatment on the overall HRQOL outcome, suggesting that factors beyond medical treatment may influence HRQOL in PTB patients. The findings of our study showed an association between successful treatment outcomes and good physical and psychological well-being before treatment, suggesting that there may be a role in enhancing both to improve treatment outcomes. Moreover, HRQOL can be used to identify high-risk individuals who should be followed up more closely so that additional interventions can be implemented to improve their overall QOL and treatment outcomes. Lastly, baseline QOL scores are valuable for tracking changes over time and understanding the impact of PTB and its treatment on various aspects of life.

Sociodemographic data and HRQOL

Sociodemographic data had limited association with HRQOL across the four domains. The lack of formal education was the only variable associated with lower psychological HRQOL scores. Similar findings were observed in studies conducted in several Asian countries which demonstrated poor HRQOL before the start of PTB treatment.[12-16] In our study, the majority of the participants had received tertiary education (80%), which could correlate with the higher baseline HRQOL.

Sociodemographic data and treatment outcomes

The treatment success rate was notably high (95%). However,

four patients (5%) were lost to follow-up, emphasizing the need for robust follow-up strategies during treatment. Sociodemographic data did not have any effect on treatment outcomes. When compared to a study conducted in Bangladesh from 2015 to 2017, prolonged disease duration, increased number of symptoms, low socioeconomic status, and low educational attainment were found to be factors that negatively affected treatment outcomes.[12]

Limitations

This study has the following limitations: First, it has a relatively small sample size and a single-center design, which may reduce the generalizability of the findings. In addition, several important variables were not included like lifestyle factors (e.g., tobacco, alcohol use, and occupation), clinical factors (e.g., sputum positivity). Second, the self-reported HRQOL measures introduce a potential response bias. Lastly, the observational design limits the ability to establish a causal relationship between HRQOL and treatment outcomes.

Recommendations

This study recommends that future research be conducted with larger sample sizes and a multicenter approach to better represent the diverse populations affected by PTB. Additional data can also be collected to further characterize patients with PTB. A randomized controlled trial is suggested to more definitively establish a causal relationship between HRQOL and treatment outcomes. Additionally, conducting a pre- and post-treatment HRQOL analysis can help evaluate the impact of successful PTB treatment on patients' HRQOL.

Given the observed association between the physical and psychological dimensions of HRQOL and treatment outcomes, we advocate the integration of additional support services aimed at improving these aspects during TB treatment. Such interventions would be particularly beneficial for patients with low baseline HRQOL.

Furthermore, since a low level of education was found to significantly impact psychological well-being, we recommend implementing targeted health education campaigns and community programs to enhance health literacy and reduce stigma related to PTB. Lastly, we propose long-term follow-up assessments of HRQOL even after treatment completion, to identify ongoing challenges and to inform the development of sustained support strategies for PTB survivors.

CONCLUSIONS

This study highlights that better physical and psychological well-being are associated with favorable treatment outcomes. Improving HRQOL, particularly these domains, may contribute to more successful treatment outcomes for PTB patients. The analyzed sociodemographic characteristics have a limited association with HRQOL, underscoring the multifaceted nature of HRQOL and the importance of addressing not only clinical but also non-clinical factors, such as psychological support, socioeconomic conditions, education, and social support, to achieve comprehensive improvements in the well-being of patients undergoing treatment for PTB.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Authors' Disclosure

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