



Evaluation of health-related quality of life in patients with tuberculosis who completed treatment in Kiribati

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Abstract

Objective: To examine the health-related quality of life (HRQoL) and related factors among patients with smear-positive and smear-negative pulmonary tuberculosis (TB) within 2 years after completion of directly observed treatment, short course (DOTS), and to compare their HRQoL with a comparison group of community-dwelling individuals without TB in South Tarawa, Kiribati.

Methods: A cross-sectional questionnaire survey was conducted among 206 pulmonary TB patients who had completed DOTS and 214 individuals without TB, from July to September 2012. HRQoL was measured using the Short Form (36) Health Survey (SF-36).

Results: The patients with TB had a statistically significantly higher physical component summary (PCS) score and mental component summary (MCS) score on the SF-36 than the comparison group after adjustment for background characteristics. However, the differences did not exceed the 3-point threshold for clinically significant differences. Multiple liner regression showed that older age and presence of persistent symptoms after completion of DOTS were related to a lower PCS score in TB patients. Patients who were smear-positive before DOTS treatment had higher MCS scores than those who were smear-negative.

Conclusions: Our results suggest the effectiveness of DOTS treatment. Health professionals can enhance HRQoL among posttreatment TB patients by managing their symptoms.

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Keywords

DOTS, health related quality of life, SF-36, tuberculosis

Date received: 10 June 2016; accepted: 27 January 2017

Introduction

Tuberculosis (TB), a severe, chronic lung disease, remains a serious public health issue worldwide, especially in low- and middle-income countries. In 1993, the World Health Organization initiated a program to reduce TB morbidity and mortality and developed a strategy called directly observed treatment, short course (DOTS). The aims were to detect and treat patients with all forms of TB to reduce transmission of the disease, control its spread and increase cure rates.¹ The DOTS program has been carried out in over 180 countries, and the average rate of treatment success in notified cases of smear-positive TB is more than 80%.²

In the past decade, the concept of quality of life was developed to measure overall health status in multiple domains for individuals and groups, with health being the most important domain of quality of life.³ Health-related quality of life (HRQoL) measures the physical and functional status, and social and emotional well-being of an individual.⁴⁻⁷ Several previous studies have showed HRQoL varies among TB patients at different stages of treatment and is significantly worse than HRQoL among the general population at all stages of treatment.⁸⁻¹² After starting and completing TB treatment, HRQoL among TB patients improves significantly compared with pre-treatment baseline;⁹⁻²¹ however, HRQoL scores remain lower than in the general population in many domains.⁹⁻¹⁶ Other researchers have reported that HRQoL among TB patients was not different from that among the general population within 1 year of completing DOTS treatment.²²⁻²⁴

A cross-sectional study of sputum-positive TB patients 14 to 18 years of age

after successful treatment revealed that HRQoL among treated patients was worse than that among the general population.²⁵ Several studies have reported that a significant number of TB patients continue to have symptoms related to impaired pulmonary function.^{10-12,22,25,26} Long-term HRQoL and complications among TB patients after completion of DOTS require further investigation.^{10,13,25}

Previous researchers have identified the factors that are significantly associated with HRQoL among TB patients; these include age, education, cigarette smoking and number of symptoms.^{11,27-29} Older TB patients had significantly lower HRQoL than younger patients, especially in physical functioning.^{9,11,21,22,28,30} TB-related symptoms, such as cough, chest pain and hemoptysis, were negatively associated with HRQoL.^{22,31} In India, nearly 30% of TB patients had persistent respiratory symptoms 14-18 years after completion of TB treatment.²⁵ In Laos, about 53.3% of patients still had TB-related symptoms within 3 years after completing treatment.²⁶

The number of reported TB cases in Kiribati is the second highest among Pacific Island countries, after the Solomon Islands.³² The National Tuberculosis Program (NTP) in Kiribati focuses on DOTS and epidemic control. Provision of free DOTS treatment was begun in 1998. In the intensive phase, isoniazid, rifampicin, pyrazinamide and ethambutol are used for 2 months; this is followed by the continuation phase in which isoniazid and rifampicin are used for 4 months.³³ After free DOTS treatment was initiated in Kiribati, less effort was made to follow up the TB condition and health status of patients after completion of their treatment. Previous

studies in other countries have indicated that HRQoL among TB patients was lower than or no different from that among the general population.^{8–16,22–24} However, no studies have focused on HRQoL among TB patients in Kiribati after completing treatment. Therefore, we examined HRQoL and related factors, including sociodemographics, cigarette and alcohol use and disease characteristics, among patients with smear-positive and smear-negative pulmonary TB within 2 years after completing DOTS, and we compared their HRQoL with a comparison group of community-dwelling individuals without TB in South Tarawa, Kiribati.

Patients and methods

Study setting and design

This cross-sectional survey with a two-group comparative design was conducted in South Tarawa, Kiribati from July through September, 2012. The case group included patients with a diagnosis of pulmonary TB who had completed treatment during the past 2 years at the only TB clinic specializing in DOTS in Tarawa. The inclusion criteria were new pulmonary TB patients aged 18 years or older, who had registered at the TB clinic from July 2010 to June 2012, and had completed treatment. We excluded patients with extrapulmonary TB or who had failed treatment, restarted treatment, or defaulted. We collected data from TB patients through home visits and face-to-face interviews. The comparison group comprised healthy adults who had no TB diagnosis. We recruited individuals at community activities, as comparisons. Because age and sex are consistently found to be related to HRQoL,^{11,22} the comparison group was frequency-matched to the TB group in terms of age and sex distribution, to enhance the comparability between groups.

Endorsement by the Ministry of Health and Medical Services (MOHW) in Kiribati

and institutional review board approval from Taipei Veterans General Hospital (2012-07-009ACY) were obtained before inception of the study.

Data collection

A self-developed structured questionnaire was used to collect data, including socio-demographics, cigarette and alcohol use, disease characteristics and the Short Form (36) Health Survey (SF-36). These variables were included because a literature review showed they can affect HRQoL among TB patients.

To measure HRQoL, the SF-36 was administered, which includes eight health domains: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role-emotional (RE) and mental health (MH). The eight domains are aggregated into two different component summaries, the physical component summary (PCS), which includes PF, RP, BP and GH, and the mental component summary (MCS), which includes VT, SF, RE and MH.^{34,35}

We first designed the questionnaire in English, and it was reviewed by the authors. The questionnaire was then translated into the Kiribati language by an NTP staff member and a Kiribati–English translator. The translated questionnaire was reviewed and modified by NTP and MOHW staff. The interviewers were DOTS workers in the NTP. We conducted a half-day workshop to train the interviewers in administering the questionnaire before data collection.

Sample size considerations

A previous study showed that the differences in HRQoL between the TB patient group (SF-36 mean = 69.12, SD = 26.03) and comparison group (mean = 79.46, SD = 18.67)¹¹ yielded an effect size of 0.45. In general,

the effect size was most commonly in the range of 0.2 to 0.4.³⁶ Therefore, we assumed the effect size was 0.3, the power was 0.8 and α was 0.05; the resultant sample size was 176 per group. The sample size of the current study was deemed acceptable.

Statistical analysis

Data analysis was performed using SPSS version 17.0 (SPSS, Chicago, IL, USA). Analysis of covariance (ANCOVA) statistics were used to examine differences in group means when the confounders were controlled. To compare HRQoL between groups, the independent *t*-test and analysis of variance (ANOVA) statistics were used, with the significance level at $\alpha=0.05$. Multivariable analysis was conducted using linear regression to examine factors associated with HRQoL in the TB group. We first entered those variables that were associated with the PCS or MCS with *p*-values of less than 0.25 on bivariate analysis into the linear regression model. We then dropped one least significant variable at a time until all independent variables in the linear regression model had a two-sided *p*-value of less than 0.05.

Results

Participant characteristics

Table 1 describes the sociodemographics and use of cigarettes and alcohol among participants. A total of 262 patients met the inclusion criteria. There were 206 participants in the TB group (52.4% male) and 214 in the comparison group (51.9% male). There were no significant differences in sex, age or marital status between groups; however, the education level in the TB group was significantly lower than in the comparison group ($p=.02$). Nearly 79% of patients in the TB group were unemployed, which was significantly higher than in the comparison group ($p<.001$).

Before DOTS was started, 61.7% of participants in the TB group had smear-positive results; the rest were smear-negative. One-third of patients in the TB group had completed DOTS less than 6 months previously, 28% between 7 and 12 months previously and 42% from 1 to 2 years previously (Table 2). However, nearly 18.5% of the TB patients still had persistent symptoms such as cough (12.6%), chest pain (3.8%), fatigue (3.4%), occasional breathlessness (2%), night sweats (1%), fever (1%) and haemoptysis (1%).

Comparison of SF-36 scores between groups

The overall physical and mental health scores in the TB group and comparison group were 48.09 (SD: 6.48) and 44.20 (SD: 9.23), and 47.22 (SD: 7.99) and 42.83 (SD: 7.97), respectively. After adjustment for potential confounders (age, education and occupation), the adjusted mean PCS and MCS scores in the TB group were significantly higher than those in the comparison group (Table 3). The TB group had significantly higher scores in the BP, VT and MH domains than the comparison group (Table 4). However, none of the differences between the TB and comparison group reached the 3-point threshold for clinical significance (Tables 3 and 4).^{34,35}

Multiple linear regression of factors associated with HRQoL in TB patients

Associations between the SF-36 scores and explanatory factors were assessed using multiple linear regression. The variables sex ($t=-1.40$, $p=.163$), age ($F=9.11^{***}$, $p<.001$), marital status ($F=4.04^*$, $p<.05$), education ($F=5.25^{***}$, $p<.001$), current alcohol use ($t=-2.489^*$, $p<.05$) and persistent symptoms ($t=3.773^{***}$, $p<.001$) were the explanatory factors associated with PCS scores. Only a few variables were

Table 1. Sociodemographics and substance use behaviour of participants

| Variable | TB group N (%) | Comparison group N (%) | p-value |
|-----------------------------|----------------------|---------------------------|---------------------|
| Sex | 206 | 214 | 0.909 |
| Male | 108 (52.43%) | 111 (51.87%) | |
| Female | 98 (47.57%) | 103 (48.13%) | |
| Age (mean ± SD) | 38.04 ± 15.90 | 37.86 ± 15.71 | 0.910 |
| 18–24 years | 60 (29.1%) | 62 (29.0%) | |
| 25–34 years | 37 (18.0%) | 40 (18.7%) | |
| 35–44 years | 33 (16.0%) | 35 (16.4%) | |
| 45–54 years | 39 (18.9%) | 39 (18.2%) | |
| 55–64 years | 27 (13.1%) | 27 (12.6%) | |
| ≥65 years | 10 (4.9%) | 11 (5.1%) | |
| Marital status | | | 0.375 |
| Single | 54 (26.21%) | 46 (21.50%) | |
| Married | 118 (57.28%) | 131 (61.21%) | |
| Divorced/Widowed | 34 (16.50%) | 37 (17.29%) | |
| Education | | | 0.018* |
| No schooling | 9 (4.37%) | 14 (6.54%) | |
| Primary level | 54 (26.21%) | 34 (15.89%) | |
| Intermediate level | 15 (7.28%) | 7 (3.27%) | |
| Secondary level | 118 (57.28%) | 125 (58.41%) | |
| University | 10 (4.85%) | 34 (15.89%) | |
| Occupation | | | <0.001*** |
| Employed | 44 (21.36%) | 89 (41.59%) | |
| Unemployed | 162 (78.64%) | 125 (58.41%) | |
| Current smoker | | | 0.406 |
| Yes | 69 (33.50%) | 80 (37.38%) | |
| No | 137 (66.50%) | 134 (62.62%) | |
| Current alcohol user | | | 0.702 |
| Yes | 72 (34.95%) | 71 (33.18%) | |
| No | 134 (65.05%) | 143 (66.82%) | |

***p < .001, **p < .01, *p < .05 TB: tuberculosis

associated with MCS scores, namely, age ($F = 1.70$, $p = .136$), persistent symptoms ($t = 1.677$, $p = .095$) and smear results (positive or negative) ($t = -2.369^*$, $p < .05$).

Table 5 reveals the final model and indicates that age over 45 years ($\beta = -4.36$, 95% CI: -6.07 to -2.64 , $p < .001$) and persistent symptoms ($\beta = -3.42$, 95% CI: -5.55 to -1.29 , $p < .01$) had significant associations with lower PCS scores among participants in the TB group. These two variables could explain about 16% of the variance in PCS scores. However, TB

patients with smear-positive results before DOTS was started had significantly higher MCS scores than patients with smear-negative results ($\beta = 3.10$, 95% CI: 0.52 to 5.68 , $p < .05$), which explained about 2.2% of the variance in MCS scores.

Discussion

This is the first comparative study reporting HRQoL among TB patients in Kiribati. Our findings indicated that crude scores on the PCS and MCS of the SF-36 for TB patients

Table 2. Disease characteristics of TB patients

| Variable | TB group N (%) |
|---|-------------------|
| Sputum results before DOTS started | |
| Smear-positive | 127 (61.7%) |
| Smear-negative | 79 (38.3%) |
| Time since completion of treatment | |
| ≤6 months | 61 (29.6%) |
| 7–12 months | 58 (28.2%) |
| 13–24 months | 87 (42.2%) |
| Persistent symptoms at present | |
| Yes | 38 (18.45%) |
| No | 168 (81.55%) |
| Type of persistent symptoms (n = 38) | |
| Chest pain | 8 (3.8%) |
| Night sweats | 2 (1%) |
| Cough | 26 (12.6%) |
| Occasional breathlessness | 4 (2%) |
| Fever | 2 (1%) |
| Fatigue | 7 (3.4%) |
| Haemoptysis | 2 (1%) |

TB: tuberculosis.

Table 3. Mean PCS and MCS scores on the SF-36 in the TB and comparison groups^a

| SF-36 | TB group (N = 206) Mean ± S D | Comparison (N = 214) Mean ± SD | p-value |
|------------------------|-------------------------------------|--------------------------------------|---------|
| Crude scores | | | |
| PCS | 48.09 ± 6.48 | 47.22 ± 7.99 | 0.218 |
| MCS | 44.20 ± 9.23 | 42.83 ± 7.97 | 0.103 |
| Adjusted scores | | | |
| PCS | 48.43 ± 0.48 | 46.90 ± 0.47 | 0.025* |
| MCS | 44.43 ± 0.61 | 42.61 ± 0.59 | 0.035* |

*** $p < .001$, ** $p < .01$, * $p < .05$

SD: standard deviation; PCS: physical component summary; MCS: mental component summary; SF- 36: Short Form (36) Health Survey; TB: tuberculosis.

^aAdjusted for age, education and occupation.

within 2 years after completing DOTS were not significantly different from those among the general population.^{22,23} Nevertheless, the adjusted PCS and MCS scores were

Table 4. Mean SF-36 domain scores in the TB and comparison groups

| SF-36 domains | TB (N = 206) Mean ± SD | Comparison (N = 214) Mean ± SD | p-value |
|-------------------|------------------------------|--------------------------------------|---------|
| Physical activity | 42.28 ± 7.45 | 41.36 ± 7.90 | 0.219 |
| Role-physical | 41.66 ± 9.98 | 42.03 ± 8.76 | 0.683 |
| Body pain | 52.68 ± 10.11 | 50.44 ± 9.42 | 0.019* |
| General health | 50.14 ± 8.80 | 49.11 ± 10.15 | 0.269 |
| Vitality | 53.67 ± 8.42 | 51.77 ± 7.84 | 0.017* |
| Social function | 42.92 ± 10.74 | 41.25 ± 10.93 | 0.115 |
| Role-emotional | 37.08 ± 12.51 | 36.93 ± 11.00 | 0.895 |
| Mental health | 46.51 ± 9.10 | 44.84 ± 7.72 | 0.043* |

*** $p < .001$, ** $p < .01$, * $p < .05$

SD: standard deviation; TB: tuberculosis; SF-36: Short Form (36) Health Survey.

significantly higher in TB patients than in the general population after adjusting for potential confounders. Participants in the TB group had lower socioeconomic status than the comparison group in this study, which may be the reason their adjusted quality of life scores were significantly higher than the comparison group. Although the differences in adjusted PCS and MCS scores between the TB and comparison groups were statistically significant, these differences were not deemed clinically significant.^{34,35}

Altogether, our results suggest that TB patients did not have lower quality of life than the comparison group after completing DOTS. The results seem to be inconsistent with previous findings describing scores for the physical and mental components of quality of life in TB patients after successful completion of treatment remained lower than in the general population.^{9,11} This lack of a difference suggests that DOTS improves quality of life among people with TB. TB patients might feel very sick at the time of diagnosis and feel much better after completing treatment. Most previous studies have showed that HRQoL improved significantly among TB patients after

Table 5. Multiple linear regression results for factors associated with HRQoL in the TB group

| Dependent variable | Independent variable | β | SE | 95% CI for β | | t | r squared | Adjusted r squared |
|--------------------|---|---------|-------|--------------------|-------------|-----------|-----------|--------------------|
| | | | | Lower Bound | Upper Bound | | | |
| PCS | (Constant) | 50.333 | .542 | 49.264 | 51.402 | 92.856*** | | |
| | Age: >45 years | -4.360 | .868 | -6.072 | -2.648 | -5.021*** | .128 | .123 |
| | Had persistent symptoms | -3.417 | 1.080 | -5.547 | -1.287 | -3.163** | .169 | .160 |
| MCS | (Constant) | 42.287 | 1.027 | 40.262 | 44.313 | 41.157*** | | |
| | Sputum smear-positive before DOTS started | 3.100 | 1.309 | .520 | 5.680 | 2.369* | .027 | .022 |

*** $p < .001$, ** $p < .01$, * $p < .05$

HRQoL: health-related quality of life; PCS: physical component summary; MCS: mental component summary; TB: tuberculosis; CI: confidence interval; SE: standard error.

successful completion of DOTS, compared with baseline.^{9,11,14,30} Unfortunately, this study was limited by a lack of pretreatment scores on the SF-36; therefore, improvement in HRQoL after completion of treatment was unknown and could not be compared.

Overall, mean PCS and MCS scores in our TB patients were similar to those reported in previous case series studies.^{9,20,23,24} The findings of this study showed that scores on VT, SF and GH were the highest of all health domains. Similar findings have been reported previously.^{10,11,21,28} Even after completion of TB treatment, physical health domains were more affected than mental health ones.^{11,21}

We did not have HRQoL data for 22% of participants in the TB group who we were unable to contact in this study. The reasons for loss of contact included death after completing treatment ($n = 23$), returning to their home islands ($n = 30$) and moving overseas ($n = 5$). We assumed that HRQoL was lower among the participants who died, but we did not know the HRQoL among those who we could not contact. The comparison group consisted of healthy community residents. We assumed their HRQoL was higher than that of other participants because they attended social activities in the

community. Caution may be required when considering the representativeness of the TB and comparison participants in this study. Nonetheless, the two groups were generally comparable in age and sex distribution.

Only two factors (age and persistent symptoms) were associated with the physical health aspect of quality of life among TB patients after successful completion of treatment. The finding that older patients with TB had poor physical health quality of life was compatible with previous studies reporting that HRQoL among those older than 45 years was lower than younger participants during different stages of treatment and after completion of treatment.^{9,11,22,30,37} The results concerning persistent symptoms were comparable with previous studies reporting that persistent symptoms in TB patients negatively impacted HRQoL during different stages of treatment and after completing treatment.^{10-12,22,26} TB damages lung tissue, leading to a persistence of symptoms even after treatment is completed.³⁸

Only one factor, smear-positive results before DOTS was started, was related to the mental health aspect of quality of life among participants in the TB group after completing treatment. In Kiribati, a TB diagnosis

is mainly based on symptoms, reference chest X-ray and sputum smear results. If doctors give a diagnosis of TB, patients start and complete DOTS regardless of their initial smear results. TB patients with positive smear results before treatment may feel more stigmatized than those with negative results. It is also possible that TB patients with smear-positive results before treatment starts may feel that DOTS is more effective compared with patients who have negative smear results. These reasons might explain why the mental health aspect of quality of life improved more in TB patients with positive smear results than in those with negative ones. Further investigation is needed to examine this issue.

Nearly 18.5% of participants in the TB group still had persistent symptoms 1 or 2 years after completion of treatment in this study, including chest pain, cough and fatigue. This prevalence of persistent symptoms was lower than that in studies in India (40%) and Laos (53%).^{22,26} Our finding was similar to a study reporting that chest pain and cough were the most common symptoms after treatment,³⁸ but there was no evidence showing how persistent symptoms could be improved. One study found that an inpatient chest physiotherapy program in lung cancer patients was associated with a significant decrease in the severity of dyspnoea, fatigue and pain symptoms, as well as improvements in HRQoL and exercise capacity.³⁹ Another study found that exercise had several beneficial effects and mitigated chest wall pain in breast cancer patients.⁴⁰ Clinical staff could encourage patients with persistent symptoms to exercise to improve symptoms. More study is needed to develop effective strategies to manage persistent symptoms in TB patients after DOTS completion.

A limitation of the present study was that it was a cross-sectional study and causal relationships could not be inferred. A total 22% of participants in the TB group could

not be contacted, so selection bias could exist. The HRQoL data were self-assessed. Comparison group members were participants in community activities; their HRQoL might not be the same as that of the general population. We noted that about 38% of the TB group had negative sputum smear results before DOTS was started. Misclassification of TB status may be a concern. We did not have information on income and adverse drug effects. Nonetheless, because only 23% of participants were employed, work status may serve as a proxy for income. Adverse drug effects from TB medications generally disappeared after discontinuing the drugs. Persistent symptoms were more likely to be caused by impaired lung function rather than adverse drug effects.

In conclusion, HRQoL among TB patients within 2 years after completion of DOTS was comparable to individuals without TB in South Tarawa, Kiribati. The findings indicated the effectiveness of DOTS in improving the HRQoL of TB patients. We suggest that DOTS be continued in high-prevalence countries. TB causes lung damage, leading to persistence of symptoms even after completion of DOTS. We found that persistent symptoms negatively impacted HRQoL and a significant number of TB patients had persistent symptoms 2 years after completing DOTS. No evidence was found to indicate how persistent symptoms in TB patients can be improved after treatment. From a clinical point of view, we encourage patients with persistent symptoms to exercise, improve lung capacity, eat a healthy diet and get plenty of sleep. We need more evidence to prove that those interventions can improve persistent symptoms in TB patients.

Acknowledgements

The authors would like to thank the NTP staff and DOTS community workers for their kind support in conducting the research.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. A travel grant to CT Li was partially funded by the Office of International Affairs, National Yang-Ming University, Taipei, Taiwan. Publication fee for this article was sponsored by the Ministry of Science and Technology, Taiwan.

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