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Evaluating Health-Related Quality of Life of Lost to Follow-Up Tuberculosis Patients in Yemen

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***Abstract*—**Tuberculosis (TB) is considered as a major disease that affects daily activities and impairs health-related quality of life (HRQoL). The impact of TB on HRQoL can affect treatment outcome and may lead to treatment defaulting. Therefore, this study aims to evaluate the HRQoL of TB treatment lost to follow-up during and after treatment in Yemen. For this aim, this prospective study enrolled a total of 399 TB lost to follow-up patients between January 2011 and December 2015. By applying HRQoL criteria, only 136 fill the survey during treatment. Moreover, 96 were traced and fill out the HRQoL survey. All eight HRQol domains were categorized into the physical component score (PCS) and mental component score (MCS), which were calculated using QM scoring software. Results show that all lost to follow-up TB patients reported a score less than 47 for all eight domains, except general health (67.3) during their treatment period. Low scores of 27.9 and 29.8 were reported for emotional role limitation (RE) and mental health (MH), respectively. Moreover, the mental component score (MCS) was found to be only 28.9. The trace lost follow-up shows a significant improvement in all eight domains and a mental component score of 43.1. The low scores of 27.9 and 29.8 for role emotion and mental health, respectively, in addition to the MCS score of 28.9, show that severe emotional condition and reflect the higher depression during treatment period that can result to lost to follow-up. The low MH, RE, and MCS can be used as a clue for predicting future TB treatment lost to follow-up.

***Keywords*—**Yemen, tuberculosis, health-related quality of life, khat.

I. Introduction

HEALTH-RELATED quality of life (HRQoL) is defined as a self-reporting survey used to ascertain the quality of life of either a healthy or sick person [1]. It measures the impact of severe or chronic disease on the life activities of patients [2] and may act as a predictor of future treatment outcome [3]. Tuberculosis (TB) is regarded worldwide as a lethal disease, with an estimated 1.5 million annual deaths [4], [5]. It adversely affects daily activities and impairs HRQoL, which may result in negative treatment outcomes such as treatment lost to follow-up [6].

TB lost to follow-up is a critical challenge in tuberculosis control. It may lead to the development of resistant strains and bring about the persistence of infectious source, upsurge in mortality and increased relapse rates [7]. Moreover, lost to follow-up is a major challenge faced by the National Tuberculosis Control Program (NTCP) and WHO [7]. Therefore, recent WHO guidelines emphasize the importance of evaluating the HRQoL of TB patients as a way to prevent unfavorable treatment outcome [8], [9]. Accordingly, this study aims to evaluate and compare HRQoL of tuberculosis patient who lost to follow-up during and after treatment. Moreover, the aim is to identify the risk factors associated with HRQol of TB lost to follow-up, specifically those in Yemen. This is imperative since no study has evaluated the HRQoL of TB treatment lost to follow-up in Yemen. This study will contribute to developing better planning and intervention programs to control the disease.

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II. Method and Study Population

This study employs a prospective study. During this period between January 2011 and December 2015, a total of 3764 TB patients have registered in the cities of Taiz and Alhodidah city. Among them, a total of 399 lost to follow-up were reported. HRQoL survey was given to all TB patients during treatment duration. By applying the HRQoL screening criteria (18 years old and literate), only 146 patients were found to be literate, among which 136 were reported HRQoL survey in the study.

Moreover, lost to follow-up were traced after defaulting. Only 96 lost to follow-up were traced, and HRQoL questionnaire was given to them (Fig. 1).

Despite the plethora of questionnaires presently available to measure HRQoL in TB patients, the Short Form-36 (SF-36) health survey remains the most valid choice [9]. The psychometric evaluations of the SF-36v2 health survey provide evidence that it is a reliable and valid tool for the detection of differences among groups defined by socio-demographic status and social factors [9]. The socio-demographic, clinical and treatment-related data of the patients were obtained from their medical records and TB notification forms (Table I).

A. Ethics Approval and Consent to Participate

This study was approved by the Yemen Ministry of Health and the National Tuberculosis Control Program (NTCP). The consent of all participating patients was obtained before data collection.

III. Statistical Analysis

SF-36v2 has eight scales that gauge eight HRQoL domains: physical function (PF, 10 items), role physical (RP, four items), role emotion (RE, three items), body pain (BP, two items), vitality (VT, four items), social function (SF, two items), general health (GH, five items) and mental health (MH, five items). All HRQoL domains are compressed to two main domains known as Physical and Mental component score [16], [17]. The eight domains of HRQoL were categorized into

PCS and MCS, which were calculated using QM scoring software equipped with HRQoL license. Compared with the eight health domains, PCS and MCS are more accessible to interpret and simpler to analyze statistically [17].

Standard deviation and means for all continuous variables were obtained. All categorical variables were reported by counts and percentage proportions. Mean and standard deviation of all mental component score and physical component score were reported. The scores on the health domain scales and component summary measures (PCS and MCS), ranging from 43 to 47, were considered equivalent to the US general population norms and low with the risk of depression below 43. Therefore, a score on a health domain scale or component summary measure that was less than 43 NBS point was considered indicative of impaired function within that health domain or dimension. An individual having MCS score ≤ 43 NBS point is considered to be at the risk of depression. The socio-demographic characteristics of TB treatment lost to follow-up are outlined in Table I.

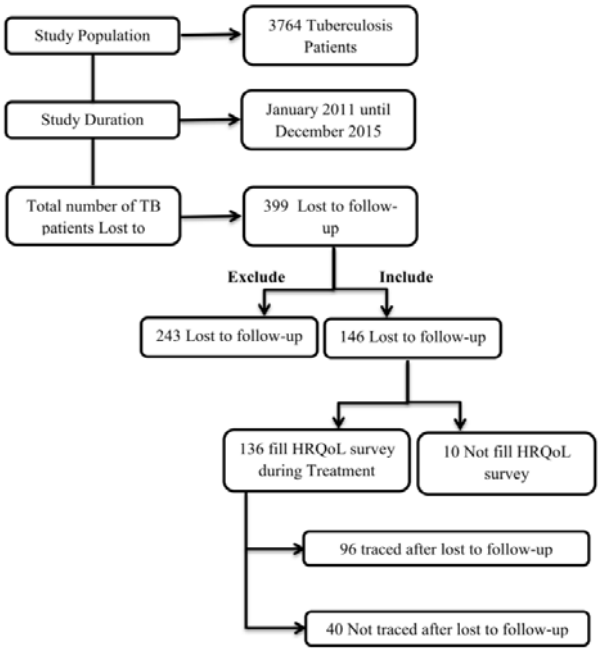

Fig. 1 Flow chart of the study

IV. Results

The study population for the prospective study included 146 new smear positive PTB and EPTB patients. Of these, 136 completed the SF-36v2 questionnaire during their treatment. The remaining 10 patients were either judged ineligible or were unwilling to participate in the study. Table I describes the socio-demographic and clinical characteristics of the study patients. This study found that the majority of the lost to follow-up patients are of productive age (97.1%), rural dwellers (94.2%), low monthly income earners (92%), habitual khat chewers (89%), unemployed (88.2%) and stigmatized (88.2 %) (Table I).

TABLE I
Socio-Demographic Characteristics of TB Treatment Lost to Follow-Up

Variable	Type of TB patients		Tb patient's
	PTB‴	EPTB¶	N (%)
Gender			
Male	11 (8.9)	112 (91.1)	123 (90.4)
Female	4 (30.7)	9 (69.2)	13 (9.6)
	15	121	136 (100)
Age			
≤ 45	14 (10.6)	118 (89.4)	132 (97.1)
>45	1 (25)	3 (75)	4 (2.9)
	15	121	136 (100)
Area			
Urban	1 (12.5)	7 (87.5)	8 (5.8)
Rural	14 (10.9)	114 (89.1)	128 (94.2)
	15	121	136 (100)
Marital status			
Married	7 (5.9)	111 (94.1)	118 (86.8)
Unmarried	8 (44.4)	10 (55.6)	18 (13.2)
	15	121	136 (100)
Employment Status			
Employed	5 (31.3)	11 (68.8)	16 (11.8)
Unemployed	10 (8.3)	110 (91.7)	120 (88.2)
	15	121	136 (100)
Smoking Habit			
Yes	7 (5.8)	114 (94.2)	121 (89)
No	8 (53.3)	7 (46.7)	15 (11)
	15	121	136 (100)
Chewing khat ǂ			
Yes	10 (7.8)	117 (92.8)	127 (93.4)
No	5 (55.6)	4 (44.4)	9 (6.6)
	15	121	136 (100)
Monthly income (Rial ˜)			
≤10,000	12 (9.6)	113 (90.4)	125 (92)
>10,000	3 (27.3)	8 (72.7)	11 (8)
	15	121	136 (100)
Stigma			
Yes	9 (7.5)	111 (92.5)	120 (88.2)
No	6 (37.5)	10 (62.5)	16 (11.3)
	15	121	136 (100)
Knowledge			
1-3 poor	9 (7.6)	109 (92.4)	118 (86.8)
4-6 good	6 (33.3)	12 (66.7)	18 (13.2)
	15	121	136 (100)
Comorbidity			
Yes	6 (5)	114 (95)	120 (80.9)
No	9 (56.3)	7 (43.7)	16 (19.1)
	15	121	136 (100)
Family TB History			
Yes	8 (6.8)	109 (93.2)	117 (86)
No	7 (36.8)	12 (63.2)	19 (14)
	15	121	136 (100)
BCG*			
Yes	9 (7.5)	111 (92.5)	120 (88.2)
No	6 (37.5)	10 (62.5)	16 (11.8)
	15	121	136 (100)

‴ PTB: Smear-Positive Pulmonary Tuberculosis; ¶ EPTB: Extra Pulmonary Tuberculosis; *BCG: Bacillus Calmette-Guerin; ǂkhat: a shrub plant that grows in parts of East Africa and Yemen; ˜Rial: one dollar equivalent to 215 Rial.

Table II describes the NBS of eight health domains of 136 lost to follow-up during treatment. All eight domains reported NBS values of less than 47, except general health (51). The minimum score was reported for emotional role limitation (27.9) followed by mental health (29.8). Mean scores of 44.8, 41.8, 37, 34 and 33.6 were reported for physical functioning,

vitality, bodily pain, social functioning, and physical role limitation, respectively.

TABLE II
HEALTH-RELATED QUALITY OF LIFE SF 36V2 SCORES USING NORM-BASED SCORING (NBS) FOR TUBERCULOSIS LOST TO FOLLOW-UP

Scale	Mean score (SD)
Physical Functioning (PF)	44.8 (10)
Physical Role limitation (RP)	33.6 (6.6)
Bodily Pain (BP)	37 (7)
General Health (GH)	51 (12.8)
Vitality (VT)	41.8 (10)
Social Functioning (SF)	34 (7.2)
Emotional Role limitation (RE)	27.9 (8.5)
Mental Health (MH)	29.8 (10.4)

Table III describes the NBS of eight health domains of 96 traced lost to follow-up TB patients. Most of the eight domains reported a significant improvement of HRQoL. A higher NBS were reported for General Health (56), Physical Functioning (50.3) and Mental Health (47.3). The minimum score was reported for Bodily Pain (41.1) followed by Social Functioning (43.7).

TABLE III
HEALTH-RELATED QUALITY OF LIFE SF 36V2 SCORES USING NORM-BASED SCORING (NBS) FOR TRACED TUBERCULOSIS PATIENTS (N=126)

Scale	Mean score (SD)
Physical Functioning (PF)	50.3 (4.2)
Physical Role limitation (RP)	44.2 (4.5)
Bodily Pain (BP)	41.1 (1.9)
General Health (GH)	56.7 (8.4)
Vitality (VT)	46.7 (4.7)
Social Functioning (SF)	43.7 (6.7)
Emotional Role limitation (RE)	45.1 (5.1)
Mental Health (MH)	47.3 (9.9)

Table IV describes the mean PCS and MCS scores for TB patients lost to follow-up during treatment and traced lost to follow-up patients. During TB treatment, lost to follow-up were reported very low MCS score of 28.9 and good PCS score of 46.7. On another hand, a clear improvement of MCS and PCS of 43.1 (SD = 6.2) and 52.1 (SD=5.2) obtained in the tracing period.

TABLE IV
PHYSICAL AND MENTAL COMPONENT SUMMARY (PCS AND MCS) FOR TUBERCULOSIS LOST TO FOLLOW-UP

Scale	Mean score (SD) lost to follow-up	Mean score (SD) Traced lost to follow-up
PCS*	46.7 (8.1)	52.1 (5.2)
MCS‡	28.9 (10.5)	43.1 (6.2)

*PCS: Physical component score; ‡MCS: Mental Component Score

V. DISCUSSION

A. Evaluating HRQoL of TB lost to Follow-Up Based on Normal Based Score (NBS)

In preceding studies, TB lost to follow-up has been associated with the male gender [5], [6], [9], [18]. Similarly, this study found a gender difference for treatment default, particularly for PTB patients. Given that men are the main economic providers for families in the study area, they are inclined to leave for work early and thus, faced with the issue of noncompliance with treatment and follow up. In contrast to previous studies [16], older aged patients were associated with higher rates of default. Furthermore, higher default rates were recorded for patients living in a rural area, which may be due to the distance to treatment centers located in an urban area as well as difficulties encountered in travels to reach treatment centers a rural area. This is consistent with earlier studies that documented distance to health facilities as a predictor of lost to follow-up [9]. Therefore, treatment programs should be expanded to remote geographic areas, or diagnosed rural TB cases should be appropriately transferred to reduce default rates. An insignificant relationship was found between TB default rates and married and stigmatized patients, while smokers with EPTB were most likely to default compared to non-smokers. Smoking is known to adversely compromise the immune system and can increase susceptibility to infections. Likewise, smokers are inclined to have higher bacillary loads due to a compromised immune system, which can increase the severity of the TB disease [26]. Furthermore, it has been established that people with higher monthly income face low economic hardships. Consequently, they are expected to exhibit better mental satisfaction than persons that fall in the low socio-economic cadre [27].

This study shows that the HRQoL of Yemeni lost to follow-up during TB treatment program is related to their physical and mental states. The normal based score (NBS) was used to assess the HRQoL of TB treatment lost to follow-up. Domains with NBS between 47 and 53 are considered normal and correspond to United States' population norms [10]. During the treatment period, all eight domains for 136 TB patients exhibited NBS values below 47, except General Health (GH) which has a score of 51. A recent study in Yemen reported a similar finding for TB patients at the end of treatment with a GH score of 54 [6], which shows that overall health improves even at the end of treatment. GH score after defaulting reported to increase to 56.7, which reflects the higher general health status of lost to follow-up.

On the contrary, lower scores of 27.9 and 29.8 were found for RE and MH, respectively. Similarly, a study conducted in the UK to evaluate the HRQoL of TB patients indicated that RE was the most affected among other scores at the end of the treatment [11], [12]. This finding confirms that severe emotional conditions are associated with TB treatment. The low RE scores can be attributed to the high development of depression during TB treatment [12]. Similarly, a related study performed in China reported non-improvement of RE with treatment [14].

In contrast, lost to follow-up score of 45.1 and 47.3 NBS for RE and MH. This finding reflects the low HRQoL associated with TB patients due to treatment during the treatment course. Others studies in Columbia and Canada reported TB treatment can affect significantly HRQoL [12], [13]. Furthermore, a study conducted in China to assess the reliability of all HRQoL domains found that MH is the most appropriate

measure because it reflects the true mental health of TB patients [15]. Other studies found a large number of mental health problems in sub-Saharan Africa due to physical disorders associated with infectious diseases such as TB. Thus, they recommended MH and its relation to TB should be further explored [16]. Similarly, a study in Malaysia reported an increased risk of depression among TB treatment lost to follow-up based on their low MH score [17]. It can be inferred from the studies that low scores of RE and MH can serve as important outcome indicators of defaulting from treatment. Some studies have shown a higher association between income and MH [15], [18], and between unemployment and MH [19]. Accordingly, this study assumes that other factors such as low income and unemployment in Yemen may directly affect the MH of a high percentage of TB patients, which can subsequently lead to treatment defaulting. Therefore, unraveling MH of TB patients during treatment may play a role in the early identification of prospective treatment lost to follow-up.

B. Evaluating HRQoL of TB Lost to Follow-Up by PCS and MCS Score

During the TB treatment period, all 136 TB patients who defaulted later from treatment show a low mean PCS and MCS score of less than 47 NBS points, which indicates compromised health. Likewise, lower average MCS values compared to PCS obtained.

A PCS score of 46.7 was obtained for lost to follow-up during treatment, indicating an improvement of physical functions with treatment, as compared to mental health. Similar studies have also reported improvement in PCS at the end of treatment and faster recovery compared to mental health [24], [25]. Thus, treatment may play a significant role in enhancing PCS due to improvement in physical body activities [6]. However, other studies reported lower averages of PCS at the end of the treatment compared with MCS [11], [18].

The MCS of 28.9 indicates the poor mental condition and high risk of. This result is consistent with a similar study conducted in Malaysia [20]. Related studies performed in China [14], South India [21] and Colombia [22] also reported lower MCS compared to PCS. However, the lower MCS score obtained was mainly due to low MH score. Lower MH score may result in reduced daily activities of TB patients. The lower MCS scores indicated that the patients experienced more psychological distress and role limitation as a result of emotional problems than the physical problems.

The study findings also showed that, at the start of the treatment, more than 70% patients were at the risk of depression (MCS score $\leq$ 42 NBS point). The significant finding is the improvement of MCS to 43.1. Therefore, this finding clearly shows the treatment can play a significant role of low MCS score and the main risk of TB lost to follow-up. Moreover, the low MCS during treatment and the higher risk of depression can be used as an indicator of future TB treatment lost to follow-up if considered seriously [23]. Therefore, it is imperative to evaluate HRQoL during TB treatment, particularly among groups that face the high risk of lost to follow-up.

VI. Conclusion and Recommendation

This study reports that TB lost to follow-up are inundated by low MH and RE during treatment, reflected as high depression status, which can be an important indicator of future TB treatment lost to follow-up. The study also found that relatively lower MCS compared to PCS could be a clue in the detection of future TB treatment lost to follow-up. Consequently, evaluating HRQoL during treatment is important, particularly for groups that face a high risk of default. Therefore, HRQoL should be conducted for all TB patients during treatment. In addition, higher monitoring should be provided to TB patients with low MCS and MH and RE scores to avoid future default. Further research should be carried out in Yemen to evaluate risk factors associated with the poor quality of life of patients with TB lost to follow-up during treatment in all provinces.

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Conflict of Interest

The authors declare that they have no conflict of interests.

Contributions of Authors

Prof Syed and Dr. Amer wrote the proposal, followed up and monitored the stages of data collection, and contributed to writing this paper. Ammar Ali participated in data collection, analyzed the data and drafted the paper. All authors read and approved the final manuscript.

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