

Health-Related Quality of Life of Patients with Tuberculosis

Subjects: Public, Environmental & Occupational Health

Contributor: Sandul Yasobant, Mahalaqua Nazli Khatib, Zahiruddin Quazi Syed, Abhay M. Gaidhane, Harsh Shah, Kiran Narkhede, Priya Bhavsar, Jay Patel, Anish Sinha, Tapasvi Puwar, Somen Saha, Deepak Saxena

Tuberculosis (TB) is a major killer and cause of human suffering worldwide and imposes a substantial reduction in patients' health-related quality of life (HRQoL). HRQoL indicates the consciousness of patients regarding their physical and mental health. HRQoL is markedly impaired in patients with TB. The factors affecting HRQoL differ with active and latent TB, socio-demographics, socio-economic status, presence of co-infections, etc.

Keywords: HRQoL ; QoL ; tuberculosis

1. Introduction

Tuberculosis (TB) is the number one infectious killer worldwide, ranking above HIV/AIDS. TB is a significant concern for public health as a key reason for morbidity and mortality, resulting in nearly 4000 deaths a day. Regardless of advancements in identification and management, approximately 10 million people developed TB, and an estimated 1.4 million people died from TB globally in 2019 ^{[1][2]}. About one-fourth of the global population has been infected at least once with *Mycobacterium tuberculosis* in their lifetime ^[3]. Higher risk is reported in people living with HIV and comorbidities such as malnutrition, diabetes mellitus, substance abuse, etc. TB patients may exhibit a broad range of symptoms, from asymptomatic to symptoms involving single-organ or total manifestations. Fever and cough are the most common reported symptoms ^[4]. Patients are known to suffer due to the disease symptoms and subsequent decline in patient health-related quality of life (HRQoL) ^{[5][6]}. The disease adversely affects all quality of life domains, ranging from physical, economic, and social to psychological distress resulting from stigmatization and discrimination associated with the disease ^[7]. Quality of life (QoL) is a comprehensive and multifaceted idea that integrates physical, social, mental, economic, and other domains. It defines the satisfaction sensed by an individual and measures the patient's self-perceived health status, functioning, and overall well-being ^[8]. As QoL emphasizes an "individual's perception of their position in life in the context of the value systems and culture in which they live and in relation to their expectations, goals, standards, and concerns", it becomes difficult to assess ^[9]. Therefore, rather than assessment by healthcare providers, QoL should reflect the inclination and values of the patient. As HRQoL indicates the consciousness of patients regarding their mental and physical health, it is very relevant in comprehending and measuring the exact impact of the disease. However, the existing TB identification and management approaches depend on clinical courses and microbiology, and there is no room to evaluate patients' physical and psychological health.

With scientific advances in the management strategies for TB, an increasing number of patients can survive the disease. Thus, a change in TB patients' routine assessment of clinical status and microbiological outcomes is essential. Efficient management of disease relapse, in addition to the appearance of multidrug-resistant tuberculosis (MDR-TB), is linked to the adherence to anti-TB treatment (ATT) and subsequently to HRQoL ^[10]. The assessment of patient-reported outcomes (PROs) provides evidence about the experience of living with the diseased condition and goes beyond clinical parameters, encompassing physical, mental, and social well-being. Thus, nowadays, PROs are better acknowledged and appreciated in managing diseases and evaluating disease outcomes ^[11]. Evaluation of HRQoL using PROs permits a complex interpretation of health and aids in measuring the efficacy of treatment on a patient's health and daily life.

2. Health-Related Quality of Life of Patients with Tuberculosis

2.1. Instruments for Describing and Quantifying QoL in TB

Different questionnaires and scales have been used to assess self-rated HRQoL in TB patients and patients infected with nontuberculous mycobacteria (NTM) ^{[6][7][12][13]}. Some questionnaires assess HRQoL holistically, while others assess specific domains, such as physical or emotional domains. HRQoL instruments can be generic or disease-specific.

Standardized instruments to assess HRQoL have been used in TB patients [14][15][16]. Frequently used tools to assess QoL in TB patients include the Short Form 36 (SF-36) [5][11][14][15][16][17][18][19][20][21][22][23][24][25][26][27][28][29][30], the EQ-5D, [15][23][31][32][33][34], and the abbreviated World Health Organization Quality of Life scale (WHOQOL-BREF) [35][36][37][38][39][40][41]. TB-specific QoL tools have not been extensively used.

2.2. Factors Associated with HRQoL in TB

Several studies have found that overall well-being, including HRQoL, is strikingly compromised in patients with TB as compared to healthy people across many domains [7][14][16][18][19][23][29][32][35][36][39][42][43][44][45][46][47]. Both general and precise QoL tools showed a broad spectrum of imbalances in scores and outcomes that differed across different countries and different patient groups. The included studies assessed factors associated with HRQoL in TB patients such as socio-demographic factors (age, gender), socio-economic factors (income, education, housing, social security), presence of co-infections (especially HIV) or comorbidities (such as diabetes, anemia), factors associated with ATT (adverse drug reactions), and psycho-social aspects (isolation and stigmatization) [6][7][11][14][20][21][33][35][36][39][44][46][48][49][50][51][52][53][54][55]. Few studies found a larger impact of psycho-social burden than clinical symptoms in TB patients [42][44].

2.2.1. Active and Latent Tuberculosis (LTBI)

Several studies have found that patients with active TB reported poorer HRQoL as compared to patients with LTBI or previously cured TB or untreated individuals or healthy controls [5][6][11][15][20][23][30][39][44][56][57][58][59][60]. The psychological domain was more negatively affected than the physical domain among patients with active and latent TB [6]. The HRQoL scores of LTBI patients were normal and similar to those in the general population [59]. The number of people reporting problems was lower in LTBI patients than in patients with active TB [61].

2.2.2. Socio-Demographic (Age, Gender, and Others) and Socio-Economic (Income, Education, Housing, Social Security) Status

Overall, QoL seems largely independent of age and gender [62][63]. However, some studies reported that advancing age negatively correlated with QoL [20][33][35][48]. Among women, others reported worse QoL [29][35][39]. One study reported that males have unfavorable outcomes in the psychological domain of HRQoL [48]. A study conducted on the Indian subcontinent observed high HRQoL scores in females for the physical and environmental domains, perhaps indicative of improved managing strength in females [39].

2.2.3. QoL in Tuberculosis with HIV Co-Infection

In high-burden settings, HIV co-infection is one of the key risk factors for tuberculosis development, escalating the susceptibility to primary infection, reinfection, and risk of reactivation of TB in patients with latent TB. Thus, we assessed QoL in TB with HIV co-infection. Several studies included patients co-infected with TB and HIV [33][52][54][64][65][66][67][68][69][70].

2.2.4. QoL in Tuberculosis with Other Comorbidities

Studies have found that comorbidities such as undernutrition or diabetes mellitus (DM) impact the TB care cascade [71][72]. For other diseased conditions, comorbidities or concomitant treatment is prognostic of lower QoL scores, especially in the physical domain [48].

2.3. QoL during and after Treatment

The WHO reports that the annual number of TB patients accessing ATT increased from 6 million in 2015 to 7.1 million in 2019 [3]. Several studies have demonstrated that ATT resulted in substantial improvement in HRQoL [4][5][6][7][11][14][21][23][35][45][50][51][54][55][73][74][75]. Although HRQoL improves during ATT, most TB patients continue to demonstrate some impairment in HRQoL. While all domains of HRQoL were compromised in TB patients, the maximum impact was observed on the mental domain and least on the physical domain, particularly in the early months of treatment [5]. Integrated TB treatment strategies, such as the TB-tobacco treatment strategy, have been shown to potentially improve overall QoL outcomes among TB patients [50]. HRQoL scores differ with the type of treatment and may be used to identify possible defaulters during ATT [8]. A paper by Kastien-Hilka et al. found that, although ATT improved all HRQoL domains, the psycho-social domain remained impaired after treatment [75]. A paper [75] suggests that patient-reported HRQoL outcomes may vary after the completion of treatment depending on the HRQoL measures. Studies have indicated that, although HRQoL improved with treatment, it was compromised in TB patients at the initiation and completion of treatment [5][18][23]. The best improvements in HRQoL were observed during the intensive phase of ATT [7]. One study suggested that the HRQoL was low at the completion of ATT [11]. Some studies suggested significant improvements in HRQoL after six

months of ATT [28][76]. After the successful completion of ATT, HRQoL scores of TB patients were almost at the same levels as those of the general population [28][77]. Adverse drug reactions (ADR) from ATT may sometimes deteriorate HRQoL more in the mental dimension than the physical dimension [21][27][78][79]. Gastrointestinal disturbances, visual impairment, or peripheral neuropathy associated with ATT may negatively affect HRQoL [44].

3. Summary

Due to the lack of validated TB-specific instruments for assessing HRQoL, a wide range of tools have been used in TB patients [12]. Studies suggest that overall well-being and HRQoL are clearly impaired across all domains in patients with TB [16][35][42][44][46]. Economic burden due to reduced work capacity, social stigmatization, and psychological issues may deteriorate HRQoL in this population [64]. Several studies have found that subjects with active TB had poorer HRQoL than patients treated for LTBI and untreated individuals [5][6][7][11][20][23][30][39][44][57][58][59]. In contrast to active TB, LTBI is usually asymptomatic and does not affect HRQoL. However, diagnosis and treatment for LTBI can be linked with adverse events and mental health challenges. Studies have reported lower HRQoL in co-infected (TB-HIV) individuals as compared to patients with TB [33][54][64][66][67][69][80]. TB co-infection worsens the symptoms of HIV and advances the disease to the next stage, which can further deteriorate the HRQoL [66]. Additionally, studies have found that TB patients are negatively impacted by comorbidities such as undernutrition, diabetes mellitus (DM), anemia, or HIV infection [71][72].

This measure is important in evaluating and measuring the actual effect of disease on patients. Poor baseline HRQoL status may indicate physical and mental health issues, which can lead to a greater risk of undesirable outcomes. Thus, self-reported HRQoL can be considered as an adjunct to disease outcomes and not merely an alternative tool. Lower HRQoL scores have been reported among TB patients at the start of treatment as well as after the completion of ATT [5]. Though all of the HRQoL domains were affected, maximum derangements were observed in mental health dimensions and lowest derangements in physical health dimensions [5]. Although ATT improved HRQoL scores, they remained below normal [5][18][23][81]. HRQoL scores differ with the course of treatment and may even help to recognize possible defaulters during treatment [8]. The possibility of experiencing adverse drug reactions is higher in TB patients with low baseline (pre-treatment) HRQoL scores than those with normal baseline (pre-treatment) HRQoL scores [21]. This implies that HRQoL assessments at baseline (pre-treatment) can help the healthcare provider in recognizing patients likely to develop an ADR to ATT.

TB is known to be a significant cause of mortality and morbidity across the globe. However, the detrimental effects of TB and its treatment on HRQoL are immense and have been unattended. There is scope for considering the assessment of HRQoL at diagnosis as an adjunct outcome measure for evaluation and outcome measure for patients under ATT [11]. The evaluation of the link between HRQoL and adherence to ATT may provide important evidence on treatment efficiency, optimal management of TB patients, and policymaking. These findings call the attention of healthcare providers to tackle issues related to HRQoL in TB patients.

References

1. World Health Organization. Ministry of Health of the Russian Federation Moscow Declaration to End TB. First WHO Global Ministerial Conference on Ending TB in the Sustainable Development Era: A Multisectoral Response; Geneva, Switzerland. 2017. Available online: https://www.who.int/tb/features_archive/Moscow_Declaration_to_End_TB_final_ENGLISH.pdf (accessed on 20 March 2021).
2. World Health Organization. Global Tuberculosis Report 2018; WHO: Geneva, Switzerland, 2018.
3. World Health Organization. Global Tuberculosis Report 2020; WHO: Geneva, Switzerland, 2020. Available online: <https://apps.who.int/iris/bitstream/handle/10665/336069/9789240013131-eng.pdf> (accessed on 1 April 2021).
4. Banerjee, S.; Bandyopadhyay, K.; Taraphdar, P.; Dasgupta, A. Effect of DOTS on quality of life among tuberculosis patients: A follow-up study in a health district of Kolkata. *J. Family Med. Prim. Care* 2019, 8, 1070–1075.
5. Bauer, M.; Ahmed, S.; Benedetti, A.; Greenaway, C.; Lalli, M.; Leavens, A.; Menzies, D.; Vadeboncoeur, C.; Vissandjée, B.; Wynne, A.; et al. Health-related quality of life and tuberculosis: A longitudinal cohort study. *Health Qual. Life Outcomes* 2015, 13, 65.
6. Guo, N.; Marra, F.; Marra, C.A. Measuring health-related quality of life in tuberculosis: A systematic review. *Health Qual. Life Outcomes* 2009, 7, 14.

7. Bauer, M.; Leavens, A.; Schwartzman, K. A systematic review and meta-analysis of the impact of tuberculosis on health-related quality of life. *Qual. Life Res.* 2013, 22, 2213–2235.
8. Olufemi, A.O.; Chikaodinaka, A.A.; Abimbola, P.; Oluwatoyin, A.T.; Oluwafunmilola, A.; Fasanmi, K.T.; Efosa, E.G. Health-Related Quality of Life (HRQoL) scores vary with treatment and may identify potential defaulters during treatment of tuberculosis. *Malawi Med. J.* 2018, 30, 283–290.
9. WHO The World Health Organization Quality of Life assessment (WHOQOL): Position paper from the World Health Organization. *Soc. Sci. Med.* 1995, 41, 1403–1409.
10. Munro, S.A.; Lewin, S.A.; Smith, H.J.; Engel, M.E.; Fretheim, A.; Volmink, J. Patient adherence to tuberculosis treatment: A systematic review of qualitative research. *PLoS Med.* 2007, 4, e238.
11. Marra, C.A.; Marra, F.; Colley, L.; Moadebi, S.; Elwood, R.K.; Fitzgerald, J.M. Health-related quality of life trajectories among adults with tuberculosis: Differences between latent and active infection. *Chest* 2008, 133, 396–403.
12. Brown, J.; Capocci, S.; Smith, C.; Morris, S.; Abubakar, I.; Lipman, M. Health status and quality of life in tuberculosis. *Int. J. Infect. Dis* 2015, 32, 68–75.
13. Khan, S.; Tangiisuran, B.; Imtiaz, A.; Zainal, H. Health status and quality of life in tuberculosis: Systematic review of study design, instruments, measuring properties and outcomes. *Health Sci. J.* 2017, 11. Available online: <http://www.hsj.gr/medicine/health-status-and-quality-of-life-in-tuberculosis-systematic-review-of-study-design-instruments-measuring-properties-and-outcomes.php?aid=18409> (accessed on 5 April 2021).
14. Chamla, D. The assessment of patients' health-related quality of life during tuberculosis treatment in Wuhan, China. *Int. J. Tuberc. Lung Dis.* 2004, 8, 1100–1106.
15. Dion, M.J.; Tousignant, P.; Bourbeau, J.; Menzies, D.; Schwartzman, K. Feasibility and reliability of health-related quality of life measurements among tuberculosis patients. *Qual. Life Res.* 2004, 13, 653–665.
16. Rajeswari, R.; Muniyandi, M.; Balasubramanian, R.; Narayanan, P.R. Perceptions of tuberculosis patients about their physical, mental and social well-being: A field report from South India. *Soc. Sci. Med.* 2005, 60, 1845–1853. Available online: <https://linkinghub.elsevier.com/retrieve/pii/S0277953604004071> (accessed on 5 April 2021).
17. Ahmad, N.; Javaid, A.; Syed Sulaiman, S.A.; Basit, A.; Afridi, A.K.; Jaber, A.A.S.; Khan, A.H. Effects of multidrug resistant tuberculosis treatment on patients' health related quality of life: Results from a follow up study. *PLoS ONE* 2016, 11, e0159560.
18. Atif, M.; Sulaiman, S.A.S.; Shafie, A.A.; Asif, M.; Sarfraz, M.K.; Low, H.C.; Babar, Z.-U.-D. Impact of tuberculosis treatment on health-related quality of life of pulmonary tuberculosis patients: A follow-up study. *Health Qual. Life Outcomes* 2014, 12, 19.
19. Dos Santos, A.P.C.; Lazzari, T.K.; Silva, D.R. Health-related quality of life, depression and anxiety in hospitalized patients with Tuberculosis. *Tuberc. Respir. Dis.* 2017, 80, 69–76.
20. Guo, N.; Marra, C.A.; Marra, F.; Moadebi, S.; Elwood, R.K.; FitzGerald, J.M. Health State Utilities in Latent and Active Tuberculosis. *Value Health* 2008, 11, 1154–1161. Available online: <https://linkinghub.elsevier.com/retrieve/pii/S1098301510605979> (accessed on 10 April 2021).
21. Guo, N.; Marra, F.; Fitzgerald, J.M.; Elwood, R.K.; Marra, C.A. Impact of adverse drug reaction and predictivity of quality of life status in tuberculosis. *Eur. Respir. J.* 2010, 36, 206–208.
22. Jaber, A.A.S.; Khan, A.H.; Syed Sulaiman, S.A.; Ahmad, N.; Anaam, M.S. Evaluation of health-related quality of life among tuberculosis patients in two cities in Yemen. *PLoS ONE* 2016, 11, e0156258.
23. Kruijschaar, M.E.; Lipman, M.; Essink-Bot, M.-L.; Lozewicz, S.; Creer, D.; Dart, S.; Maguire, H.; Abubakar, I. Health status of UK patients with active tuberculosis. *Int. J. Tuberc. Lung Dis.* 2010, 14, 296–302.
24. Kisaka, S.M.B.; Rutebemberwa, E.; Kasasa, S.; Ocen, F.; Nankya-Mutyoba, J. Does health-related quality of life among adults with pulmonary tuberculosis improve across the treatment period? A hospital-based cross sectional study in Mbale Region, Eastern Uganda. *BMC Res. Notes* 2016, 9, 467.
25. Roba, A.A.; Dasa, T.T.; Weldegebreal, F.; Asfaw, A.; Mitiku, H.; Teklemariam, Z.; Naganuri, M.; Gedduogol, B.J.; Mesfin, F.; Befikadu, H.; et al. Tuberculosis patients are physically challenged and socially isolated: A mixed methods case-control study of health related quality of life in Eastern Ethiopia. *PLoS ONE* 2018, 13, e0204697.
26. Shahdadi, H.; Salarzaee, M.; Balouchi, A. Quality of life of diabetic patients with smear positive PTB in southeastern Iran: A cross-sectional study in a poor region of Iran. *Indian J. Tuberc.* 2018, 65, 159–163. Available online: <https://linkinghub.elsevier.com/retrieve/pii/S0019570717301385> (accessed on 25 May 2021).
27. Sineke, T.; Evans, D.; Schnippel, K.; van Aswegen, H.; Berhanu, R.; Musakwa, N.; Lönnmark, E.; Long, L.; Rosen, S. The impact of adverse events on health-related quality of life among patients receiving treatment for drug-resistant

tuberculosis in Johannesburg, South Africa. *Health Qual. Life Outcomes* 2019, 17, 94.

28. Ramkumar, S.; Vijayalakshmi, S.; Seetharaman, N.; Pajanivel, R.; Lokeshmaran, A. Health-related quality of life among tuberculosis patients under revised national tuberculosis control programme in rural and urban Puducherry. *Indian J. Tuberc.* 2017, 64, 14–19.
29. Unalan, D.; Soyuer, F.; Ozturk, A. Comparison of SF-36 and WHOQOL-100 life quality scales in early period tuberculosis subjects. *J. Pak. Med. Assoc.* 2012, 62, 1161–1167.
30. Unalan, D.; Soyuer, F.; Ceyhan, O.; Basturk, M.; Ozturk, A. Is the quality of life different in patients with active and inactive tuberculosis? *Indian J. Tuberc.* 2008, 55, 127–137.
31. Jørstad, M.D.; Aßmus, J.; Marijani, M.; Sviland, L.; Mustafa, T. Diagnostic delay in extrapulmonary tuberculosis and impact on patient morbidity: A study from Zanzibar. *PLoS ONE* 2018, 13, e0203593.
32. Kastien-Hilka, T.; Rosenkranz, B.; Sinanovic, E.; Bennett, B.; Schwenkglenks, M. Health-related quality of life in South African patients with pulmonary tuberculosis. *PLoS ONE* 2017, 12, e0174605.
33. Kittikraisak, W.; Kingkaew, P.; Teerawattananon, Y.; Yothasamut, J.; Natesuwan, S.; Manosuthi, W.; Chongsuvivatwong, V.; Whitehead, S.J. Health related quality of life among patients with tuberculosis and HIV in Thailand. *PLoS ONE* 2012, 7, e29775.
34. Saleem, S.; Malik, A.A.; Ghulam, A.; Ahmed, J.; Hussain, H. Health-related quality of life among pulmonary tuberculosis patients in Pakistan. *Qual. Life Res.* 2018, 27, 3137–3143.
35. Aggarwal, A.N.; Gupta, D.; Janmeja, A.K.; Jindal, S.K. Assessment of health-related quality of life in patients with pulmonary tuberculosis under programme conditions. *Int. J. Tuberc. Lung Dis.* 2013, 17, 947–953.
36. Chung, W.-S.; Lan, Y.-L.; Yang, M.-C. Psychometric testing of the short version of the world health organization quality of life (WHOQOL-BREF) questionnaire among pulmonary tuberculosis patients in Taiwan. *BMC Public Health* 2012, 12, 630.
37. Dar, S.A.; Shah, N.N.; Wani, Z.A.; Nazir, D. A prospective study on quality of life in patients with pulmonary tuberculosis at a tertiary care hospital in Kashmir, Northern India. *Indian J. Tuberc.* 2019, 66, 118–122.
38. Sharma, R.; Yadav, R.; Sharma, M.; Saini, V.; Koushal, V. Quality of life of multi drug resistant tuberculosis patients: A study of north India. *Acta Med. Iran.* 2014, 52, 448–453.
39. Dhuria, M.; Sharma, N.; Singh, N.P.; Jiloha, R.C.; Saha, R.; Ingle, G.K. A study of the impact of tuberculosis on the quality of life and the effect after treatment with DOTS. *Asia Pac. J. Public Health* 2009, 21, 312–320.
40. Laxmeshwar, C.; Stewart, A.G.; Dalal, A.; Kumar, A.M.V.; Kalaiselvi, S.; Das, M.; Gawde, N.; Thi, S.S.; Isaakidis, P. Beyond “cure” and “treatment success”: Quality of life of patients with multidrug-resistant tuberculosis. *Int. J. Tuberc. Lung Dis.* 2019, 23, 73–81.
41. Singh, S.K.; Agrawal, A.; Tiwari, K.K. Improvement in quality of life in pulmonary tuberculosis patients: A prospective study. *Trop. Dr.* 2017, 47, 97–100.
42. Chang, B.; Wu, A.W.; Hansel, N.N.; Diette, G.B. Quality of life in tuberculosis: A review of the English language literature. *Qual. Life Res.* 2004, 13, 1633–1642.
43. Dhuria, M.; Sharma, N.; Ingle, G. Impact of tuberculosis on the quality of life. *Indian J. Community Med.* 2008, 33, 58–59.
44. Hansel, N.N.; Wu, A.W.; Chang, B.; Diette, G.B. Quality of life in tuberculosis: Patient and provider perspectives. *Qual. Life Res.* 2004, 13, 639–652.
45. Kastien-Hilka, T.; Rosenkranz, B.; Bennett, B.; Sinanovic, E.; Schwenkglenks, M. How to evaluate health-related quality of life and its association with medication adherence in pulmonary tuberculosis—Designing a prospective observational study in South Africa. *Front. Pharmacol.* 2016, 7, 125.
46. Masumoto, S.; Yamamoto, T.; Ohkado, A.; Yoshimatsu, S.; Querri, A.G.; Kamiya, Y. Factors associated with health-related quality of life among pulmonary tuberculosis patients in Manila, the Philippines. *Qual. Life Res.* 2014, 23, 1523–1533.
47. Peddireddy, V. Quality of life, psychological interventions and treatment outcome in tuberculosis patients: The Indian Scenario. *Front. Psychol.* 2016, 7, 1664.
48. Adeyeye, O.O.; Ogunleye, O.O.; Coker, A.; Kuyinu, Y.; Bamisile, R.T.; Ekrikpo, U.; Onadeko, B. Factors influencing quality of life and predictors of low quality of life scores in patients on treatment for pulmonary tuberculosis: A cross sectional study. *J. Public Health Afr.* 2014, 5, 366.
49. Aggarwal, A.N. Health-related quality of life: A neglected aspect of pulmonary tuberculosis. *Lung India* 2010, 27, 1–3.

50. Awaisu, A.; Haniki Nik Mohamed, M.; Noordin, N.M.; Muttalif, A.R.; Aziz, N.A.; Syed Sulaiman, S.A.; Mahayiddin, A.A. Impact of connecting tuberculosis directly observed therapy short-course with smoking cessation on health-related quality of life. *Tob. Induc. Dis.* 2012, 10, 2.
51. Balgude, A.; Sontakke, S. Study of impact of antitubercular therapy on quality of life. *Indian J. Med. Sci.* 2012, 66, 71–77.
52. Deribew, A.; Deribe, K.; Reda, A.A.; Tesfaye, M.; Hailmichael, Y.; Maja, T.; Colebunders, R. Change in quality of life: A follow up study among patients with HIV infection with and without TB in Ethiopia. *BMC Public Health* 2013, 13, 408.
53. Dias, A.A.L.; de Oliveira, D.M.F.; Turato, E.R.; de Figueiredo, R.M. Life experiences of patients who have completed tuberculosis treatment: A qualitative investigation in southeast Brazil. *BMC Public Health* 2013, 13, 595.
54. Louw, J.; Peltzer, K.; Naidoo, P.; Matseke, G.; Mchunu, G.; Tutshana, B. Quality of life among tuberculosis (TB), TB retreatment and/or TB-HIV co-infected primary public health care patients in three districts in South Africa. *Health Qual. Life Outcomes* 2012, 10, 77.
55. Ralph, A.P.; Kenangalem, E.; Waramori, G.; Pontororing, G.J.; Tjitra, E.; Maguire, G.P.; Kelly, P.M.; Anstey, N.M. High morbidity during treatment and residual pulmonary disability in pulmonary tuberculosis: Under-recognised phenomena. *PLoS ONE* 2013, 8, e80302.
56. Dhingra, V.K.; Rajpal, S. Health related quality of life (HRQL) scoring (DR-12 score) in tuberculosis--additional evaluative tool under DOTS. *J. Commun. Dis.* 2005, 37, 261–268.
57. Dion, M.-J.; Tousignant, P.; Bourbeau, J.; Menzies, D.; Schwartzman, K. Measurement of health preferences among patients with tuberculous infection and disease. *Med. Decis. Making* 2002, 22, S102–S114.
58. Marra, C.A.; Marra, F.; Cox, V.C.; Palepu, A.; Fitzgerald, J.M. Factors influencing quality of life in patients with active tuberculosis. *Health Qual. Life Outcomes* 2004, 2, 58.
59. Shedrawy, J.; Jansson, L.; Röhl, I.; Kulane, A.; Bruchfeld, J.; Lönnroth, K. Quality of life of patients on treatment for latent tuberculosis infection: A mixed-method study in Stockholm, Sweden. *Health Qual. Life Outcomes* 2019, 17, 158.
60. Wang, Y.; Lii, J.; Lu, F. Measuring and assessing the quality of life of patients with pulmonary tuberculosis. *Zhonghua Jie He He Hu Xi Za Zhi* 1998, 21, 720–723.
61. Shedrawy, J.; Jansson, L.; Bruchfeld, J.; Lönnroth, K. Health-related quality of life among persons treated for tuberculosis in a European setting. *Int. J. Tuberc. Lung Dis.* 2020, 24, 461–463.
62. Duyan, V.; Kurt, B.; Aktas, Z.; Duyan, G.C.; Kulkul, D.O. Relationship between quality of life and characteristics of patients hospitalised with tuberculosis. *Int. J. Tuberc. Lung Dis.* 2005, 9, 1361–1366.
63. Jankowska-Polanska, B.K.; Kamińska, M.; Uchmanowicz, I.; Rycomb, A. Quality of life and health behaviours of patients with tuberculosis—Sex differences. *Pneumonol. Alergol. Pol.* 2015, 83, 256–265.
64. Deribew, A.; Tesfaye, M.; Hailmichael, Y.; Negussu, N.; Daba, S.; Wogi, A.; Belachew, T.; Apers, L.; Colebunders, R. Tuberculosis and HIV co-infection: Its impact on quality of life. *Health Qual. Life Outcomes* 2009, 7, 105.
65. Dowdy, D.W.; Israel, G.; Vellozo, V.; Saraceni, V.; Cohn, S.; Cavalcante, S.; Chaisson, R.E.; Golub, J.E.; Durovni, B. Quality of life among people treated for tuberculosis and human immunodeficiency virus in Rio de Janeiro, Brazil. *Int. J. Tuberc. Lung Dis.* 2013, 17, 345–347.
66. Hailu, T.; Yitayal, M.; Yazachew, L. Health-related quality of life and associated factors among adult HIV mono-infected and TB/HIV co-infected patients in public health facilities in Northeast Ethiopia: A comparative cross-sectional study. *Patient Prefer. Adherence* 2020, 14, 1873–1887.
67. Jha, D.K.; Jha, J.; Jha, A.K.; Achappa, B.; Holla, R. Quality of life among HIV-tuberculosis co-infected patients. *Perspect. Clin. Res.* 2019, 10, 125–129.
68. Mthiyane, T.; Pym, A.; Dheda, K.; Rustonjee, R.; Reddy, T.; Manie, S. Longitudinal assessment of health related quality of life of HIV infected patients treated for tuberculosis and HIV in a high burden setting. *Qual. Life Res.* 2016, 25, 3067–3076.
69. de Souza Neves, L.A.; Canini, S.R.M.; Reis, R.K.; Santos, C.B.D.; Gir, E. Aids and tuberculosis: Coinfection from the perspective of the quality of life of patients. *Evista Esc. Enferm. USP* 2012, 46, 704–710.
70. Opollo, V.; Sun, X.; Lando, R.; Miyahara, S.; Torres, T.S.; Hosseinipour, M.C.; Bisson, G.P.; Kumwenda, J.; Gupta, A.; Nyirenda, M.; et al. The effect of TB treatment on health-related quality of life for people with advanced HIV. *Int. J. Tuberc. Lung Dis.* 2020, 24, 910–915.
71. Edwards, T.; White, L.V.; Lee, N.; Castro, M.C.; Saludar, N.R.; Faguer, B.N.; Fuente, N.D.; Mayoga, F.; Ariyoshi, K.; Garfin, A.M.C.G.; et al. Effects of comorbidities on quality of life in Filipino people with tuberculosis. *Int. J. Tuberc. Lung Dis.* 2020, 24, 712–719.

72. Yeung, M.W.; Khoo, E.; Brode, S.K.; Jamieson, F.B.; Kamiya, H.; Kwong, J.C.; Macdonald, L.; Marras, T.K.; Morimoto, K.; Sander, B. Health-related quality of life, comorbidities and mortality in pulmonary nontuberculous mycobacterial infections: A systematic review. *Respirology* 2016, 21, 1015–1025.
73. Aggarwal, A.N. Quality of life with tuberculosis. *J. Clin. Tuberc. Other Mycobact. Dis.* 2019, 17, 100121.
74. Chung, W.-S.; Li, C.-R. Can DOTS improve quality of life among patients with pulmonary tuberculosis? *Int. J. Tuberc. Lung Dis.* 2013, 17, 425–426.
75. Kastien-Hilka, T.; Abulfathi, A.; Rosenkranz, B.; Bennett, B.; Schwenkglenks, M.; Sinanovic, E. Health-related quality of life and its association with medication adherence in active pulmonary tuberculosis—A systematic review of global literature with focus on South Africa. *Health Qual. Life Outcomes* 2016, 14, 42.
76. Datta, S.; Gilman, R.H.; Montoya, R.; Quevedo Cruz, L.; Valencia, T.; Huff, D.; Saunders, M.J.; Evans, C.A. Quality of life, tuberculosis and treatment outcome; a case-control and nested cohort study. *Eur. Respir. J.* 2020, 56, 1900495.
77. Salehitali, S.; Noorian, K.; Hafizi, M.; Dehkordi, A.H. Quality of life and its effective factors in tuberculosis patients receiving directly observed treatment short-course (DOTS). *J. Clin. Tuberc. Other Mycobact. Dis.* 2019, 15, 100093.
78. Valadares, R.M.C.; da Silva Carvalho, W.; de Miranda, S.S. Association of adverse drug reaction to anti-tuberculosis medication with quality of life in patients in a tertiary referral hospital. *Rev. Soc. Bras. Med. Trop.* 2019, 53, e20190207.
79. Alene, K.A.; Clements, A.C.A.; McBryde, E.S.; Jaramillo, E.; Lönnroth, K.; Shaweno, D.; Gulliver, A.; Viney, K. Mental health disorders, social stressors, and health-related quality of life in patients with multidrug-resistant tuberculosis: A systematic review and meta-analysis. *J. Infect.* 2018, 77, 357–367.
80. Babikako, H.M.; Neuhauser, D.; Katamba, A.; Mupere, E. Feasibility, reliability and validity of health-related quality of life questionnaire among adult pulmonary tuberculosis patients in urban Uganda: Cross-sectional study. *Health Qual. Life Outcomes* 2010, 8, 93.
81. Atif, M.; Toghrayee, Z.; Sulaiman, S.S.; Shafie, A.A.; Low, H.C.; Babar, Z.U.D. Missing data analysis in longitudinal studies: Findings from a quality of life study in Malaysian Tuberculosis Patients. *Value Health* 2014, 17, A778.

Retrieved from <https://encyclopedia.pub/entry/history/show/62200>