

Quality of Life in Leprosy Patients at a Tertiary Care Centre in Western Uttar Pradesh: A Cross-Sectional Assessment Using the WHOQOL-BREF Questionnaire

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ABSTRACT

Background: Leprosy (Hansen's disease) remains a significant public health concern in India despite the availability of effective multidrug therapy (MDT). Beyond microbiological cure, the disease inflicts sustained physical, psychological, social, and environmental burdens, substantially degrading health-related quality of life (HRQoL). Systematic assessment of HRQoL using validated instruments is sparse in the Indian context, particularly among patients attending tertiary care facilities. **Methods:** A hospital-based cross-sectional study was conducted at the Department of Dermatology, Venereology and Leprosy, L.L.R.M. Medical College and Hospital, Meerut, from June 2024 to November 2025. Using consecutive sampling, 106 confirmed leprosy patients (≥ 18 years) were enrolled. The WHOQOL-BREF questionnaire was administered via face-to-face interview. Domain scores were transformed to a 0–100 scale. Associations between domain scores and sociodemographic and disease-related variables were examined using one-way ANOVA and Pearson correlation; $p < 0.05$ was considered statistically significant. Statistical analysis was performed using JAMovi 2.6.24. **Results:** The mean age of participants was 39.79 ± 15.6 years; males predominated (61.3%). Lepromatous leprosy was the most frequent clinical form (27.4%), and 50.9% of patients had Grade 2 disability. Mean WHOQOL-BREF domain scores were: social relationships 53.30 ± 14.80 , physical health 49.76 ± 13.0 , psychological health 47.79 ± 12.59 , and environment 47.70 ± 10.47 . Disability grade was significantly associated with physical health ($p < 0.001$) and psychological health ($p = 0.004$). Disease duration inversely predicted physical, psychological, and environmental domain scores ($p \leq 0.002$). Type of leprosy significantly influenced physical health scores ($p = 0.007$). Sociodemographic variables showed no statistically significant association with any domain. **Conclusion:** Physical disability particularly Grade 2 disability and hand deformity constitutes the most significant determinant of impaired QoL in leprosy patients. Early case detection, timely management of lepra reactions, disability prevention, and integrated psychosocial rehabilitation are imperative to improve QoL in this population.

Keywords: leprosy; Hansen's disease; quality of life; WHOQOL-BREF; disability; multibacillary; psychosocial burden; India

1. INTRODUCTION

Hansen's disease, commonly referred to as leprosy, is a chronic infectious condition caused by *Mycobacterium leprae* an obligate intracellular, acid-fast bacillus with a well-documented tropism for cutaneous tissue and peripheral nerves.

Chronic infection results in advancing peripheral neuropathy characterised by sensory deficits, motor dysfunction, and autonomic impairment. Untreated or insufficiently managed disease leads to deformities including claw hand, foot drop, trophic ulcers, and lagophthalmos.^{1,2} These sequelae diminish autonomy, constrain mobility, and substantially disrupt activities of daily living, generating enduring functional restrictions and a measurable decline in quality of life (QoL).

Despite the availability of highly efficacious multidrug therapy (MDT), leprosy continues to impose a substantial public health burden in India. The National Leprosy Eradication Programme (NLEP) reduced national prevalence from 57.8 per 10,000 in 1983 to 0.66 per 10,000 in 2016.³ India currently accounts for more than 60% of global annual new case detections, with approximately 1,00,000 incident cases identified in 2024–25.^{27,28} The persistent identification of Grade 2 disability at diagnosis reflects ongoing deficiencies in early case detection and referral systems.⁶

Beyond microbiological outcomes, leprosy profoundly affects social and psychological well-being. Stigmatisation, discrimination, social isolation, and diminished self-esteem frequently follow physical deformity. Anxiety, depression, marital strain, and occupational discrimination further compound patient burden, and the likelihood of poor QoL outcomes is amplified by physical disability, which exacerbates psychological distress.

The World Health Organization (WHO) defines quality of life as “a person's own perception of their position in life, contextualised within their cultural setting, personal goals, expectations, and prevailing social standards.”¹² This multidimensional construct encompassing physical well-being, psychological health, social relationships, and environmental conditions offers a more comprehensive assessment of disease burden than clinical or bacteriological measures alone.

The WHOQOL-BREF, developed by the WHO Quality of Life Group, is a psychometrically validated, cross-culturally adapted instrument encompassing four domains: physical well-being, psychological well-being, social relationships, and environmental conditions.^{12,13} Its brevity, cultural versatility, and multifaceted framework render it particularly appropriate for assessing health-related QoL in leprosy.^{14,15}

Evidence from endemic regions including India, Brazil, Nepal, Indonesia, and Bangladesh consistently demonstrates that individuals with leprosy exhibit

markedly diminished QoL scores relative to healthy controls and patients with other dermatological conditions.^{16,17,18,19} Psychological and social relationship domains bear disproportionate burden owing to stigma, fear of rejection, and social isolation.^{20,21,22}

Within the Indian context, however, rigorous QoL assessment using standardised instruments such as the WHOQOL-BREF remains limited. Prior investigations have predominantly focused on clinical patterns, bacteriological indices, and disability grading, leaving psychosocial outcomes comparatively underexplored.²³ The few Indian studies that do employ the WHOQOL-BREF suggest that QoL is substantially influenced by age, gender, socioeconomic status, leprosy subtype, and disability extent^{24,25}, but evidence from tertiary care settings in northern India where multibacillary and advanced forms predominate is particularly sparse. The present study was therefore designed to comprehensively assess QoL among leprosy-affected individuals attending a tertiary care centre in Meerut, Western Uttar Pradesh, using the WHOQOL-BREF instrument, and to systematically examine the influence of demographic parameters (age, sex, educational attainment, marital status, occupation), clinical features (leprosy classification, disability grade, disability type, disease duration, treatment status), and their associations with domain-specific QoL outcomes.

2. METHODS

2.1 Study Design and Setting

A hospital-based cross-sectional observational study was conducted at the Department of Dermatology, Venereology and Leprosy, L.L.R.M. Medical College and Hospital, Meerut, a tertiary care centre serving Western Uttar Pradesh. The study was conducted over 18 months, from 1 June 2024 to 30 November 2025.

2.2 Sample Size and Sampling Technique

Sample size was estimated using the formula $n = Z^2pq/d^2$. Applying a 95% confidence level ($Z = 1.96$), an expected prevalence of $p = 0.5$ (based on Das *et al.*),⁵¹ and an allowable error of 9.5%, the minimum sample size was calculated as 106 patients. A consecutive sampling strategy was employed: every patient attending the outpatient or inpatient department during the study period who met the eligibility criteria was invited to participate until the required sample size was attained.

2.3 Eligibility Criteria

Patients aged 18 years or above with a confirmed diagnosis of leprosy (any clinical type), either currently receiving WHO-recommended MDT or having completed MDT, and providing written informed consent were included. Exclusion criteria comprised: age below 18 years; pregnant or lactating

women; severe psychiatric disorders or cognitive impairments precluding questionnaire completion; concomitant diabetic neuropathy, traumatic nerve injury, or excessive alcohol intake; and patients receiving palliative care.

2.4 Data Collection and Instruments

Participants were evaluated through structured face-to-face interviews conducted by a trained interviewer. Sociodemographic data including age, sex, marital status, educational attainment, occupation, and family income were recorded using a standardised proforma. Detailed history encompassing symptom onset, disease duration, and treatment history was obtained. Thorough general, systemic, cutaneous, and peripheral nerve examination was performed. Leprosy type was classified according to the Ridley–Jopling classification system. Disability was graded using the WHO disability grading system (Grades 0–2) for eyes, hands, and feet. Treatment status was categorised as newly diagnosed, under treatment, or treatment completed. Quality of life was assessed using the WHOQOL-BREF questionnaire, a 26-item validated instrument scored on a five-point Likert scale, covering four domains: physical health (7 items), psychological

health (6 items), social relationships (3 items), and environment (8 items).¹² Raw domain scores were transformed to a 0–100 scale per WHO guidelines, with higher scores indicating better QoL. A transformed score >50 was considered indicative of adequate QoL in a given domain.

2.5 Statistical Analysis

Data were tabulated and analysed using MS Excel and JAMOV 2.6.24. Descriptive statistics were used to characterise the study population. Mean domain scores and standard deviations were computed. Associations between QoL domain scores and categorical independent variables were examined using one-way ANOVA. Pearson correlation coefficients were calculated to assess inter-domain relationships. All statistical tests were two-tailed, with $p < 0.05$ considered statistically significant.

2.6 Ethical Approval

Ethical clearance was obtained from the Institutional Ethics Committee of L.L.R.M. Medical College, Meerut. Written informed consent was obtained from all participants. Anonymity and confidentiality were maintained throughout; participants were assigned unique identifiers.

3. RESULTS

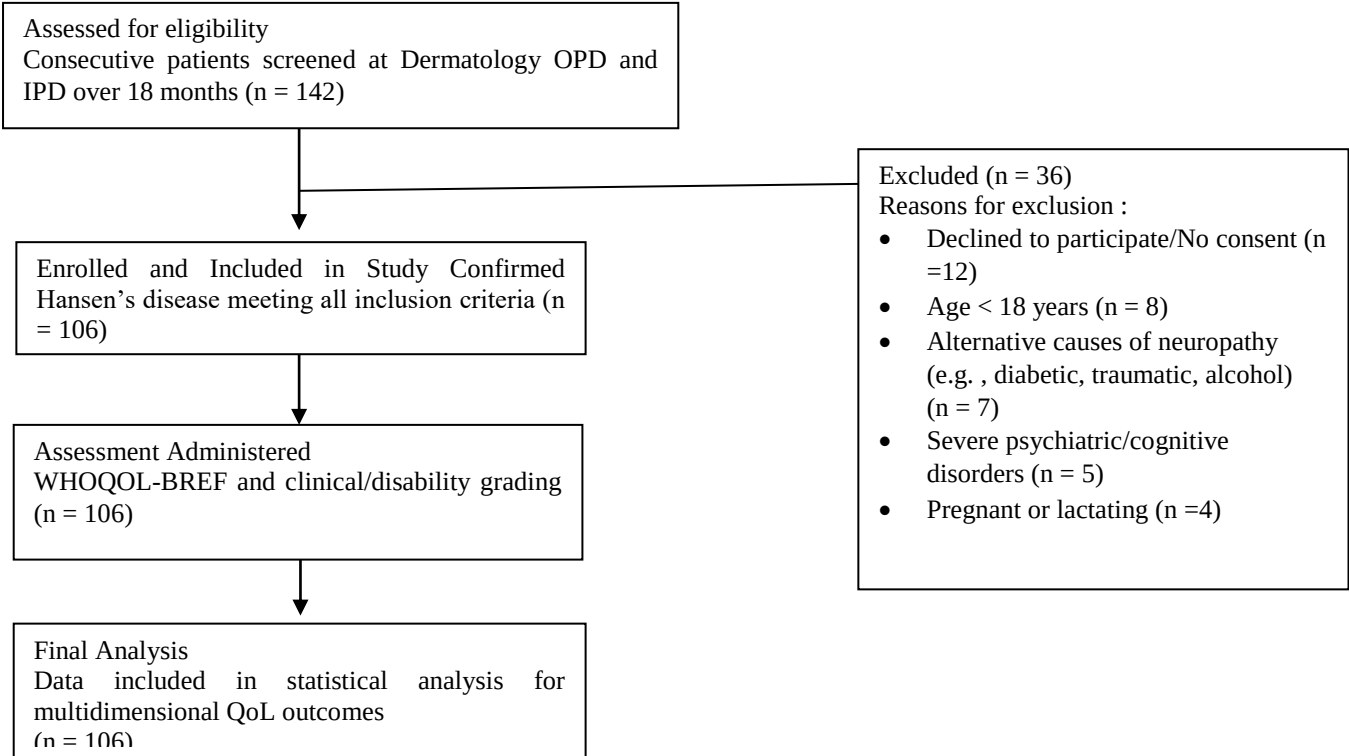


Figure 1. STROBE flow diagram detailing the screening, enrollment, and assessment of study participants. Patients were recruited consecutively from the outpatient and inpatient departments. Exclusion criteria were strictly applied to eliminate confounding causes of neuropathy or an inability to complete the psychometric evaluation, resulting in a final analytical cohort of 106 patients.

3.1 Sociodemographic Characteristics

A total of 106 patients with confirmed Hansen's disease were enrolled. The mean age was 39.79 ± 15.6 years. The largest age cohort comprised patients aged 21–30 years ($n = 32$; 30.2%), followed by those aged 31–40 years ($n = 27$; 25.5%). Male patients predominated ($n = 65$; 61.3%); females constituted 38.7% of the sample. The majority were married ($n = 82$; 77.4%). With respect to educational attainment, 30.2% were illiterate, 24.5% had primary education, 33.0% secondary, and 12.3% senior secondary. Occupationally, housewives were most prevalent (32.1%), followed by those in other occupations (28.3%), farmers (22.6%), and labourers (17.0%).

Full sociodemographic characteristics are presented in Table 1.

Table 1. Sociodemographic characteristics of study participants (n = 106)

Distribution of age, sex, marital status, educational attainment, and occupation among leprosy patients

Variable	Category	n (%)	Mean $\pm$ SD
Age (years)	18–20	7 (6.6%)	39.79 ± 15.6
	21–30	32 (30.2%)	
	31–40	27 (25.5%)	
	41–50	16 (15.1%)	
	51–60	14 (13.2%)	
	>60	10 (9.4%)	
Gender	Male	65 (61.3%)	—
Marital Status	Female	41 (38.7%)	—
	Married	82 (77.4%)	
	Unmarried	22 (20.8%)	
	Widowed	2 (1.9%)	
Education	Illiterate	32 (30.2%)	—
Occupation	Primary	26 (24.5%)	—
	Secondary	35 (33.0%)	
	Senior Secondary	13 (12.3%)	
	Housewife	34 (32.1%)	
	Farmer	24 (22.6%)	
	Labourer	18 (17.0%)	
	Others	30 (28.3%)	

3.2 Clinical Characteristics

Lepromatous leprosy was the predominant clinical form ($n = 29$; 27.4%), closely followed by lepromatous leprosy with reaction ($n = 25$; 23.6%). Borderline tuberculoid accounted for 17.9% of cases, borderline lepromatous for 11.3%, and borderline lepromatous with reaction for 9.4%. Borderline tuberculoid with reaction was observed in 8.5% and pure neuritic leprosy in 1.9%. Collectively, over 50% of the study cohort presented with lepromatous or borderline lepromatous disease, indicating a pattern of advanced or multibacillary presentation at the tertiary level.

The mean disease duration was 16.28 ± 8.6 months. The largest group (43.4%) had a disease duration of 13–24 months; 28.3% had 7–12 months and 17.9% had six months or less. Regarding treatment status, 67.9% were newly diagnosed at enrolment, 23.6% were under active treatment, and 8.5% had completed MDT. With respect to disability, 50.9% of patients exhibited Grade 2 disability, 15.1% Grade 1, and 34.0% had no disability (Grade 0). Hand deformity was the most common disability type (40.6%), followed by loss of sensation in the limbs (15.1%), facial deformity (5.7%), and foot deformity (4.7%).

Full clinical characteristics are presented in Table 2.

Table 2. Clinical characteristics of study participants (n = 106)

Distribution of leprosy subtype, disability grade, disability type, disease duration, and treatment status among enrolled patients (n = 106). Leprosy type classified per Ridley–Jopling criteria. Disability graded using WHO grading system (Grades 0–2).

Variable	Category	n (%)
Type of Leprosy	Lepromatous	29 (27.4%)
	Lepromatous with Reaction	25 (23.6%)
	Borderline Tuberculoid	19 (17.9%)
	Borderline Lepromatous	12 (11.3%)
	BL with Reaction	10 (9.4%)
	BT with Reaction	9 (8.5%)
	Pure Neuritic	2 (1.9%)
Disability Grade	Grade 0 - No disability	36 (34.0%)
Disability Type	Grade 1 - Anaesthesia/reduced vision	16 (15.1%)
	Grade 2 - Visible deformity	54 (50.9%)
	Hand Deformity	43 (40.6%)
	Loss of Sensation in limbs	16 (15.1%)
	Facial Deformity	6 (5.7%)
	Foot Deformity	5 (4.7%)
	No disability	36 (34.0%)
Disease Duration	≤6 months	19 (17.9%)
	7–12 months	30 (28.3%)
	13–24 months	46 (43.4%)
	>24 months	11 (10.4%)
Treatment Status	Newly Diagnosed	72 (67.9%)
	Under Treatment	25 (23.6%)
	Treatment Completed	9 (8.5%)

3.3 WHOQOL-BREF Domain Scores

The WHOQOL-BREF domain scores are presented in Table 3. The social relationships domain achieved the highest mean score (53.30 ± 14.80), followed by physical health (49.76 ± 13.0). Psychological health (47.79 ± 12.59) and environment (47.70 ± 10.47) recorded the lowest mean scores, both falling below the 50% threshold that delineates adequate QoL.

Table 3. WHOQOL-BREF domain scores (n = 106)

Mean transformed domain scores and standard deviations for the four WHOQOL-BREF domains in the study cohort (n = 106). Scores range from 0 to 100, with higher values indicating better quality of life. A score > 50 represents the threshold for adequate QoL in a given domain.

WHOQOL-BREF Domain	Mean Score (0–100)	SD	Adequacy Status (>50 threshold)
Physical Health	49.76	13.0	Below threshold
Psychological Health	47.79	12.59	Below threshold
Social Relationships	53.30	14.80	Above threshold
Environment	47.70	10.47	Below threshold

3.4 Association between Sociodemographic Variables and QoL

No statistically significant association was observed between any sociodemographic variable including age group, sex, marital status, educational attainment, and occupation and domain-specific QoL scores ($p > 0.05$ for all comparisons). While descriptive trends were observed (e.g., marginally lower physical health scores in patients aged above 60 years, and slightly higher mean scores in female participants across most domains), none reached statistical significance.

3.5 Association between Disease-Related Variables and QoL

3.5.1 Type of Leprosy

A statistically significant difference in physical health domain scores was identified across leprosy types ($p = 0.007$). Patients with borderline tuberculoid leprosy with reaction reported the highest physical health scores (60.3 ± 9.6), while pure neuritic leprosy patients reported the lowest (44.6 ± 7.5) and lepromatous leprosy patients (45.3 ± 13.7) also scored markedly lower. Differences in psychological health, social relationships, and environment domains across leprosy types did not reach statistical significance ($p = 0.220$, 0.293 , and 0.067 , respectively).

3.5.2 Disability Grade

Disability grade demonstrated statistically significant associations with both physical health ($p < 0.001$) and psychological health ($p = 0.004$). Patients with no disability (Grade 0) reported the highest scores in physical health (56.6 ± 12.7) and psychological health (53.2 ± 11.8), while those with Grade 2 disability reported the lowest (physical: 44.6 ± 11.0 ; psychological: 44.3 ± 11.7). Social relationships ($p = 0.062$) and environment ($p = 0.406$) did not differ significantly by disability grade.

3.5.3 Disability Type

Hand deformity was associated with significantly lower scores in physical health (44.6 ± 11.7 ; $p < 0.001$), psychological health (43.9 ± 10.9 ; $p = 0.013$), and social relationships (48.6 ± 12.9 ; $p = 0.038$) compared to patients with other disability types or no disability. The environmental domain did not differ significantly by disability type ($p = 0.233$).

3.5.4 Disease Duration

Disease duration was significantly inversely associated with physical health ($p < 0.001$), psychological health ($p < 0.001$), and environmental domain scores ($p = 0.002$). Patients with a disease duration of six months or less reported the highest mean scores across these domains (physical: 60.1 ± 12.2 ; psychological: 57.0 ± 12.4 ; environment: 54.7 ± 11.3), whereas those with 13–24 months' duration reported the lowest (physical: 44.1 ± 9.6 ; psychological: 43.5 ± 10.6). Social relationship scores did not differ significantly across duration categories ($p = 0.192$).

3.5.5 Treatment Status

Treatment status demonstrated no statistically significant association with QoL scores in any domain ($p > 0.05$). Patients who had completed MDT reported slightly higher mean scores in physical and psychological domains, but differences were not significant.

Table 4. Association between Clinical Characteristics, Disease Duration, and WHOQOL-BREF Domain Scores

Comparative analyses of clinical parameters revealed that disease-specific factors, rather than treatment status, are the primary determinants of QoL impairment (Table 4). The specific type of leprosy significantly influenced Physical Health ($p = 0.007$), with pure neuritic and lepromatous patients experiencing the most severe declines. Crucially, disease duration emerged as a vital threshold metric; patients diagnosed within ≤ 6 months of symptom onset retained significantly superior Physical ($p < 0.001$), Psychological ($p < 0.001$), and Environmental ($p = 0.002$) QoL compared to those with longer chronicity. Furthermore, the presence of physical impairment specifically Grade 2 hand deformities drastically degraded patient well-being, driving statistically significant collapses across Physical ($p < 0.001$), Psychological ($p = 0.013$), and Social Relationship ($p = 0.038$) domains. Notably, treatment completion alone showed no significant association with improved QoL in any domain, underscoring that antimicrobial clearance does not reverse established psychosocial and functional damage.

Variable	Category	Physical Health (Mean $\pm$ SD)	p-value	Psychological Health (Mean $\pm$ SD)	p-value	Social Relationships (Mean $\pm$ SD)	p-value	Environment (Mean $\pm$ SD)	p-value
Type of Leprosy	Borderline tuberculoid (BT)	57.5 $\pm$ 11.9	0.007	51.3 $\pm$ 13.7	0.220	53.0 $\pm$ 8.4	0.293	47.8 $\pm$ 7.5	0.067
	BT with reaction	60.3 $\pm$ 9.6		57.4 $\pm$ 11.3		60.1 $\pm$ 18.0		54.8 $\pm$ 13.5	
	Borderline lepromatous (BL)	50.6 $\pm$ 12.4		46.2 $\pm$ 12.2		54.5 $\pm$ 20.1		49.1 $\pm$ 12.5	
	BL with reaction	46.7 $\pm$ 13.8		47.0 $\pm$ 12.1		44.1 $\pm$ 13.0		44.0 $\pm$ 8.3	
	Lepromatous (LL)	45.3 $\pm$ 13.7		46.7 $\pm$ 12.2		50.8 $\pm$ 15.6		44.0 $\pm$ 8.1	
	LL with reaction	46.4 $\pm$ 10.4		44.1 $\pm$ 12.2		56.3 $\pm$ 14.0		50.7 $\pm$ 12.1	
	Pure neuritic	44.6 $\pm$ 7.5		47.9 $\pm$ 8.8		54.1 $\pm$ 5.8		45.3 $\pm$ 2.1	
Disease Duration	≤ 6 months	60.1 $\pm$ 12.2	<0.001	57.0 $\pm$ 12.4	<0.001	58.7 $\pm$ 15.3	0.192	54.7 $\pm$ 11.3	0.002
	7–12 months	50.9 $\pm$ 11.4		48.3 $\pm$ 11.3		50.2 $\pm$ 13.5		48.9 $\pm$ 9.8	
	13–24 months	44.1 $\pm$ 9.6		43.5 $\pm$ 10.6		52.1 $\pm$ 15.0		44.0 $\pm$ 8.9	
	>24 months	50.9 $\pm$ 19.2		48.1 $\pm$ 16.0		56.8 $\pm$ 14.8		47.1 $\pm$ 10.7	
WHO Disability Grade	Grade 0	56.6 $\pm$ 12.7	<0.001	53.2 $\pm$ 11.8	0.004	55.5 $\pm$ 14.0	0.062	49.0 $\pm$ 10.7	0.406
	Grade 1	51.5 $\pm$ 12.7		47.1 $\pm$ 13.5		58.8 $\pm$ 17.0		49.2 $\pm$ 10.6	
	Grade 2	44.6 $\pm$ 11.0		44.3 $\pm$ 11.7		50.1 $\pm$ 14.0		46.3 $\pm$ 10.2	
Specific Deformity Type	Hand Deformity	44.6 $\pm$ 11.7	<0.001	43.9 $\pm$ 10.9	0.013	48.6 $\pm$ 12.9	0.038	45.1 $\pm$ 9.7	0.233
	Loss of sensation (limbs)	51.5 $\pm$ 12.7		47.1 $\pm$ 13.5		58.8 $\pm$ 17.0		49.2 $\pm$ 10.6	
	Foot Deformity	48.6 $\pm$ 8.1		50.8 $\pm$ 14.2		63.3 $\pm$ 21.7		54.4 $\pm$ 13.0	
	Facial Deformity	41.6 $\pm$ 8.3		42.3 $\pm$ 15.4		49.9 $\pm$ 10.5		48.4 $\pm$ 9.6	
	Absent (None)	56.6 $\pm$ 12.7		53.2 $\pm$ 11.8		55.5 $\pm$ 14.0		49.0 $\pm$ 10.7	
Treatment Status	Newly diagnosed	49.3 $\pm$ 12.3	0.750	47.1 $\pm$ 12.3	0.503	51.9 $\pm$ 15.0	0.354	47.4 $\pm$ 10.8	0.883
	Under Treatment	50.0 $\pm$ 13.7		48.1 $\pm$ 13.2		55.3 $\pm$ 13.8		48.6 $\pm$ 10.4	
	Treatment Completed	52.7 $\pm$ 17.0		52.3 $\pm$ 12.6		58.3 $\pm$ 15.5		47.5 $\pm$ 8.6	

*Note: Data evaluated using one-way ANOVA. Statistically significant p-values (<0.05) are indicated in bold, highlighting the profound negative impact of prolonged disease duration (>6 months), advanced disability grading, and specific physical deformities on multidimensional quality of life.

3.6 Inter-Domain Correlations

Pearson correlation analysis revealed strong, statistically significant positive correlations among all four WHOQOL-BREF domains ($p < 0.001$ for all pairs). The strongest correlation was observed between physical health and psychological health ($r = 0.728$), followed by social relationships and environment ($r = 0.675$). Moderate correlations were found between psychological health and environment ($r = 0.551$) and between physical health and environment ($r = 0.507$). The weakest, though still significant, correlations were observed between physical health and social relationships ($r = 0.334$) and between psychological health and social relationships ($r = 0.333$).

Table 5. Pearson correlation coefficients between WHOQOL-BREF domains

Pearson correlation coefficients (r) between all pairwise combinations of the four WHOQOL-BREF domains in leprosy patients ($n = 106$). All correlations were statistically significant at $p < 0.001$ (two-tailed). ** denotes significance at the 0.01 level.

Domain	Physical Health	Psychological Health	Social Relationships	Environment
Physical Health	—	0.728**	0.334**	0.507**
Psychological Health	0.728**	—	0.333**	0.551**
Social Relationships	0.334**	0.333**	—	0.675**
Environment	0.507**	0.551**	0.675**	—

** Correlation significant at the 0.01 level (two-tailed).

Representative clinical presentations driving severe Quality of Life impairment.

(A) A partial claw hand complicated by a traumatic ulcer, representing the predominant Grade 2 disability in the cohort (40.6%), which was significantly associated with physical and psychological QoL collapse.	
(B) Advanced facial impairment demonstrating partial supraciliary madarosis and saddle nose deformity in lepromatous leprosy.	

(C) Erythema Nodosum Leprosum (ENL) manifesting as widespread, painful inflammatory nodules, a frequent complication in the multibacillary cohort.	
(D) Severe necrotic ulceration (ENL necroticans) illustrating the extreme tissue destruction that precipitates profound psychosocial stigma and functional restriction.	

4. DISCUSSION

This cross-sectional study assessed health-related quality of life among 106 leprosy patients attending a tertiary care centre in Western Uttar Pradesh using the WHOQOL-BREF instrument, and systematically examined the influence of sociodemographic and disease-related variables on domain-specific QoL outcomes. The findings reveal that leprosy continues to impair QoL substantially across all domains, with physical disability and disease duration constituting the principal determinants of QoL impairment a pattern consistent with the emerging body of evidence from South Asia.

The mean age of 39.79 ± 15.6 years and the predominance of patients in the 21–40 years cohort confirm that leprosy predominantly afflicts individuals during their economically productive years, amplifying its socioeconomic consequences. This aligns with prior Indian studies.^{8,10}

Male predominance (61.3%) is consistent with national surveillance data and is attributed to greater occupational exposure, higher mobility, and superior health-seeking behaviour among males.^{56,57}

The clinical profile of the cohort with over 50% presenting with lepromatous or borderline lepromatous disease reflects the referral dynamics of a tertiary centre, where advanced and multibacillary cases accumulate due to diagnostic delays and inadequate peripheral management. The high proportion of patients with ongoing lepra reactions (>30%) underscores persistent immunological instability in

multibacillary disease and its consequent morbidity burden. The mean disease duration of 16.28 months further indicates substantial diagnostic delay, consistent with the documented association between prolonged symptom-to-diagnosis intervals and accelerated nerve injury in the Indian context.¹¹

A striking 50.9% of patients exhibited Grade 2 disability at the time of assessment, with hand deformity being the most prevalent type (40.6%). This high rate of visible disability at presentation to a tertiary facility reflects the cumulative impact of delayed diagnosis, inadequate early management of lepra reactions, and insufficient disability prevention at the primary care level. The association between Grade 2 disability and markedly impaired physical health ($p < 0.001$) and psychological health ($p = 0.004$) domain scores corroborates the findings of Govindharaj *et al.*,¹⁰ who identified visible deformity as the most significant predictor of diminished QoL among leprosy patients in Eastern India. Comparable observations were reported by Joseph and Rao⁸ and Sinha *et al.*⁵⁴ The significant impact of hand deformity across physical, psychological, and social relationship domains in this study underscores the unique functional and social consequences of upper limb disability in leprosy, which directly compromises occupational capacity, self-care, and social participation.

Among the four WHOQOL-BREF domains, the social relationships domain recorded the highest mean score (53.30), followed by physical health (49.76).

Psychological health (47.79) and environment (47.70) were the lowest, both below the 50% threshold. The relative preservation of social relationship scores despite documented stigma and social isolation in leprosy may reflect the protective role of family support systems, as similarly observed by Govindharaj *et al.* However, the suppressed psychological and environmental scores are consistent with prior evidence implicating psychological distress, stigma-related shame, and socioeconomic constraints including limited access to healthcare and restricted livelihood opportunities as dominant drivers of QoL impairment in leprosy.

The significant inverse association between disease duration and physical, psychological, and environmental QoL scores (all $p \leq 0.002$) confirms that protracted illness progressively deteriorates QoL across multiple domains. Patients with disease durations of six months or less consistently reported the highest QoL scores, reinforcing the critical importance of early diagnosis and prompt initiation of MDT. This finding is congruent with Rao *et al.*⁸ and underscores the public health imperative of strengthening community-level case detection mechanisms.

Treatment status did not independently predict QoL in any domain, consistent with the observations of Govindharaj *et al.*¹⁰ This finding is clinically significant: it demonstrates that microbiological cure through MDT, while essential, is insufficient to restore QoL among patients who have already developed disabilities or experienced prolonged disease. Comprehensive rehabilitation encompassing physical therapy, psychological counselling, and social support is indispensable for meaningful QoL improvement.

The absence of statistically significant associations between sociodemographic variables and QoL domain scores is noteworthy. Although prior studies have reported associations between female sex, lower educational attainment, and impaired QoL in leprosy, the present study found no such significant relationships. This finding suggests that, within this tertiary care sample, disease-related factors particularly disability grade and disease duration exert a dominant influence on QoL, effectively attenuating the independent contribution of sociodemographic variables.

The strong positive inter-domain correlations observed particularly between physical and psychological health ($r = 0.728$, $p < 0.001$) affirm the multidimensional and interconnected nature of QoL in leprosy, consistent with observations by Martins *et al.*⁵⁷ Impairment in one domain propagates across others, reinforcing the need for holistic, integrated care models.

5. STRENGTHS OF THE STUDY

This study has several strengths. First, it evaluated health-related quality of life in a well-defined cohort of 106 confirmed leprosy patients attending a tertiary care

centre in Western Uttar Pradesh. Second, consecutive sampling was used to recruit eligible participants during the study period, thereby reducing the likelihood of selective recruitment. Third, quality of life was assessed using the validated WHOQOL-BREF instrument, allowing evaluation across physical, psychological, social, and environmental domains. Fourth, the study incorporated both sociodemographic and clinically relevant disease-related variables, including leprosy type, disability grade, disability type, disease duration, and treatment status. Finally, the use of standardized WHO disability grading and predefined statistical analyses enabled systematic assessment of factors associated with domain-specific quality of life.

6. LIMITATIONS AND FUTURE WORK

This study has several limitations that should be considered when interpreting the findings. As a hospital-based cross-sectional study conducted at a single tertiary centre, results may not generalise to community-dwelling leprosy patients or those managed at primary or secondary care levels. The recruitment of a tertiary referral population may have enriched the sample with more severe cases, potentially inflating rates of advanced disability and multibacillary disease relative to the broader leprosy-affected population in the region. The cross-sectional design precludes causal inference and does not permit assessment of temporal changes in QoL or the impact of rehabilitation interventions over time.

Future longitudinal and community-based studies are warranted to evaluate QoL trajectories before, during, and after MDT, and to assess the QoL impact of comprehensive rehabilitation programmes. Multi-centre studies across endemic districts in Uttar Pradesh and other high-burden states would enhance generalisability. Qualitative research examining the lived experience of stigma and social exclusion would complement quantitative QoL assessments and inform the design of targeted psychosocial interventions.

7. CONCLUSION

This study demonstrates that leprosy continues to substantially impair health-related quality of life across all WHOQOL-BREF domains, even in the era of effective multidrug therapy. Physical disability particularly Grade 2 disability and hand deformity constitutes the most significant determinant of diminished QoL, followed by prolonged disease duration. Psychological health and environmental domains were most severely affected, reflecting the burden of stigma, chronic disease, and socioeconomic constraints.

The absence of QoL improvement with MDT completion alone underlines the inadequacy of pharmacological treatment as a standalone strategy. Comprehensive leprosy management must integrate early case detection, timely and aggressive

management of lepra reactions, disability prevention, reconstructive surgery, physiotherapy, psychological counselling, anti-stigma community education, and vocational rehabilitation.

These findings have direct implications for the NLEP and national disability prevention programmes: routine QoL assessment using validated instruments such as the WHOQOL-BREF should be incorporated into standard leprosy care protocols to identify and address patient-centred needs systematically.

8. DECLARATIONS

Ethics Approval and Consent to Participate

Ethical approval was obtained from the Institutional Ethics Committee of L.L.R.M. Medical College, Meerut, Uttar Pradesh, India. Written informed consent was obtained from all participants before enrolment. Participant anonymity and confidentiality were maintained throughout the study.

Consent for Publication

Not applicable. No individually identifiable personal information is reported in this manuscript.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

All authors contributed to the study conception and design, data collection, analysis and interpretation of the findings, and preparation and critical revision of the manuscript. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Data Availability

The data generated and/or analysed during the present study are available from the corresponding author on reasonable request, subject to appropriate ethical and confidentiality considerations.

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AI Use Disclosure

The authors declare that no generative artificial intelligence tools were used to generate or substantially modify the scientific content of this manuscript.

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