DOI: 10.55522/jhpo.V3I5.0100 Year 2026 - Volume 3 - Issue 5 ISSN NO: 3049 - 2637

Journal of Health Physiotherapy and Orthopaedics

Research Article

# The relationship of depression and anxiety with severity and duration in leprosy-affected patients

**Pratik R Ingle, Swati Kubal**

Department of Physiotherapy, PT School and Centre, Topiwala National Medical College (TNMC) & BYL Nair Charitable Hospital, Mumbai, Maharashtra, India

**Corresponding author:** Pratik R Ingle, ✉ prateekingle123456@gmail.com, **Orcid Id**: https://orcid.org/0009-0000-1253-7030

© The author(s). This is an open access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by-nc/4.0/). See https://ijtinnovation.com/reprints-and-permissions for full terms and conditions.

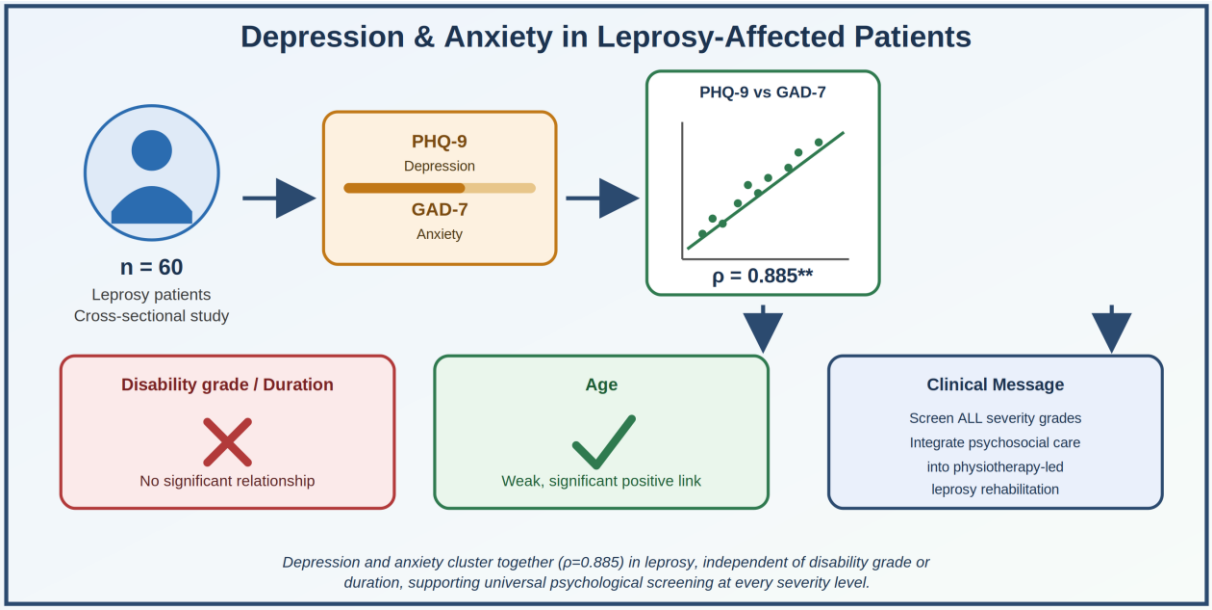
**Received** - 15-07-2026**, Revised** - 20-09-2026, **Accepted** - 13-10-2026 **(DD-MM-YYYY)**

**Refer this article**

Simranjit Kaur, Supreet Bindra, Pankajpreet Singh, Gurmanpreet Kaur. Effect of virtual reality-based interventions in the management of work-related musculoskeletal disorders among office workers: a narrative review. September-October 2026, V 3 - I 5, Pages - 10 – 14. Doi: https://doi.org/10.55522/jhpo.V3I5.0100.

## ABSTRACT

Leprosy is a chronic neglected tropical disease associated with substantial physical disability and a disproportionately high burden of depression and anxiety. The association of these symptoms with objective disability grade and disease duration is under studied in India. Objective: To assess depression and anxiety in leprosy patients by using validated scales and to find out their association with the severity of disability and duration of disease. Methods: A six months observational study was conducted in tertiary care physiotherapy department on 60 adults with confirmed leprosy by purposive sampling method. The PHQ-9, GAD-7 and WHO disability grading were administered and data were analysed using Spearman's rank correlation. Mean PHQ-9 was 10.22±5.21 and mean GAD-7 was 7.63±4.14. Depression and anxiety were highly correlated (rho=0.885, p<0.001). Neither was significantly correlated with disability grade (rho=0.145 and 0.237) or duration (rho=-0.163 and -0.065). Both showed a significant weak positive correlation with age (rho=0.351, p=0.006; rho=0.274, p=0.034). Leprosy patients have co-morbidities of depression and anxiety regardless of grade of physical disability and duration of disease. This supports universal psychological screening at all grades of severity and integration of physiotherapist-led psychosocial strategies into standard rehabilitation.




**Keywords:** Leprosy, Depression, Anxiety, PHQ-9, GAD-7, Disability, Physiotherapy.

## INTRODUCTION

Leprosy (Hansen's disease), caused by Mycobacterium leprae, is one of the oldest and most neglected tropical diseases, primarily affecting the skin and peripheral nerves and, if untreated, leading to progressive and often irreversible disability [1,7]. Bacteria

are transmitted via nasal and oral droplets during close, frequent contact with untreated cases, and although the disease is curable with multidrug therapy, the majority of new cases continue to be detected in South-East Asia [2].

Depression involves a persistently sad mood or loss of interest or pleasure in activities, and is among the most frequent mental disorders reported in leprosy-affected populations; more than 30% of people affected by leprosy have been reported to have mental-health problems, and anxiety is estimated to affect approximately 20% [2,3]. Persons with lower education, lower socio-economic status and any degree of leprosy-related disability are at particular risk of depression and/or anxiety. In developing countries, the very concept of mental illness is stigmatising, and the person affected by leprosy bears a dual burden of physical disease and unaddressed psychological distress [4,5].

Understanding the links between depression and anxiety and disease severity and duration could help clinicians to target interventions appropriately, raise awareness among policy-makers of the need to provide comprehensive leprosy care and inform physiotherapy-led rehabilitation pathways. Limited Indian literature quantifying such relationships and the lack of physiotherapy-specific management guidelines for the psychosocial burden of leprosy necessitated the present study [2,5].

Objective: To study the association of depression and anxiety with severity and duration among leprosy patients.

To evaluate the level of depression in leprosy-affected patients using the PHQ-9 scale.

To assess anxiety in leprosy patients using the GAD-7 scale

To assess relationship of depression and anxiety with severity and duration of leprosy.

**Alternative hypothesis (H1)**

Depression and anxiety and severity and duration have a relationship in leprosy-affected patients.

**Null hypothesis (H0)**

Depression, anxiety, severity and duration are not related in leprosy-affected patients.

## MATERIAL AND METHOD

**Study design**

Study design and setting: A six-month observational cross-sectional study was conducted in the physiotherapy outpatient department of a tertiary care teaching hospital using a purposive sampling technique.

Participants: Sixty adult subjects (male or female) aged 18 years or older with a clinical diagnosis of leprosy were enrolled. Exclusion was applied to those who declined to take part or who had other dermatological or neurological conditions that might confound assessment.

"Outcome measures: Depression was assessed with the Patient Health Questionnaire-9 (PHQ-9) scored 0 ('not at all') to 3 ('nearly every day') and classified as no significant symptoms (0-9) or depression (10 and above); sensitivity 82%, specificity 70% [6]. Anxiety was assessed using the Generalised Anxiety Disorder-7 (GAD-7) scale, scored in the same way, classified as no significant (0-4), mild (5-9), moderate (10-14) or severe (15 and above); sensitivity 84%, specificity 59% [6]. These validation statistics are based on an Arabic-speaking Lebanese psychiatric outpatient sample and not an Indian or leprosy-affected population [6]. Cross-cultural validity of these cut-offs in Indian leprosy patients has not been established separately and is considered a limitation. Interviews were conducted by a single trained interviewer; formal inter-rater reliability was not calculated. Disability was graded for hands, feet and eyes using the WHO disability grading system (Grade 0 = no visible impairment, Grade 1 = loss of protective sensation without visible deformity, Grade 2 = visible deformity or damage present). For data entry and analysis, grades were encoded as numeric values from 1 to 3 (1 = WHO Grade 0, 2 = WHO Grade 1, 3 = WHO Grade 2). Table 1 and Figure 4 show this 1-3 encoding, and readers should translate this to the standard 0-2 WHO grade by applying this offset.

**Procedure**

After approval by the institutional ethics committee, written informed consent was obtained from the eligible patients. Demographic and clinical details were noted on the case record form. Then interview administration of the PHQ-9 and GAD-7, and WHO disability grade by clinical examination.

**Statistics**

Data were tested for normality by Kolmogorov-Smirnov and Shapiro-Wilk tests. PHQ-9, disability severity and duration violated the assumption of normality; Spearman's rank-order correlation was therefore used to examine associations between all study variables, with statistical significance set at $p<0.05$. Analyses were performed using SPSS software.

## RESULTS

The sample (n=60) had a mean age of 38.98±15.56 years (range 18-77) and was predominantly male, consistent with the higher reported prevalence of diagnosed leprosy among men in Indian clinical series; diabetes mellitus was the most common comorbidity where present. Descriptive statistics for the principal study variables are shown in Table 1.

***Table 1:*** Descriptive statistics of study variables (n=60).

| Variable | N | Minimum | Maximum | Mean | SD |
|---|---|---|---|---|---|
| PHQ-9 (Depression) | 60 | 0.00 | 23.00 | 10.22 | 5.21 |
| GAD-7 (Anxiety) | 60 | 1.00 | 19.00 | 7.63 | 4.14 |
| Disability Severity Grade | 60 | 1.00 | 3.00 | 1.52 | 0.54 |
| Duration (months) | 60 | 1.00 | 132.00 | 33.35 | 29.39 |
| Age (years) | 60 | 18.00 | 77.00 | 38.98 | 15.56 |

Depression severity was distributed across minimal, mild, moderate and moderately-severe/severe categories (Figure 1), and anxiety severity showed a comparable spread across the four GAD-7 categories (Figure 2).

Spearman correlation analysis (Table 2) revealed a significant, very strong positive correlation between GAD-7 and PHQ-9 scores (rho=0.885, $p<0.001$; Figure 3). Depression and

anxiety were not significantly correlated with disability severity grade or disease duration. Age showed a significant, weak positive correlation with both depression (rho=0.351, p=0.006) and anxiety (rho=0.274, p=0.034).

**Figure 1:** Distribution of depression severity categories (PHQ-9, n=60)

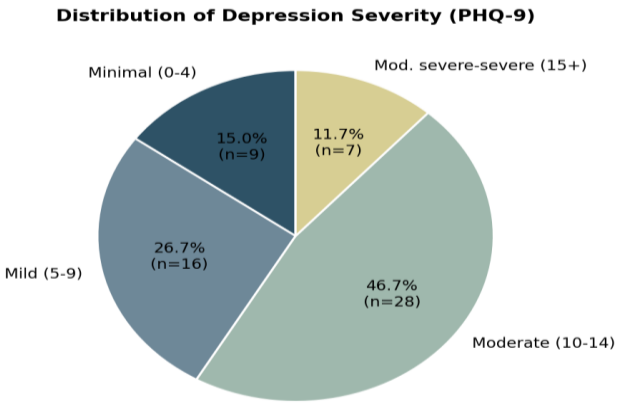



**Figure 2:** Distribution of anxiety severity categories (GAD-7, n=60)

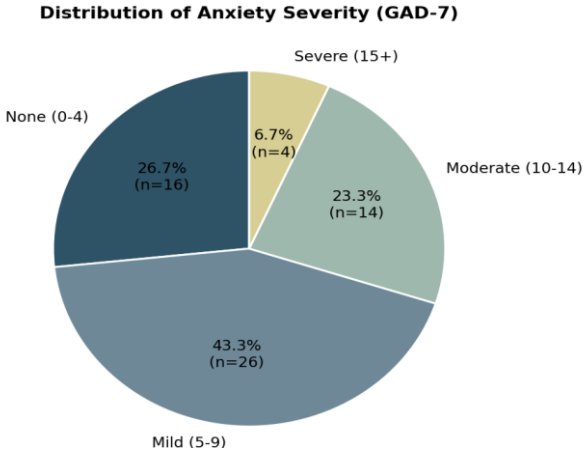



**Table 2:** Spearman correlation matrix of depression, anxiety, disability severity, duration and age (n=60)

| Correlation | Spearman's rho | p-value | Interpretation |
|---|---|---|---|
| GAD-7 vs PHQ-9 | 0.885 | <0.001 | Very strong positive, significant |
| PHQ-9 vs Disability Severity | 0.145 | 0.269 | Weak, non-significant |
| GAD-7 vs Disability Severity | 0.237 | 0.068 | Weak, non-significant |
| PHQ-9 vs Duration | -0.163 | 0.212 | Weak negative, non-significant |
| GAD-7 vs Duration | -0.065 | 0.622 | Negligible, non-significant |
| PHQ-9 vs Age | 0.351 | 0.006 | Weak positive, significant |
| GAD-7 vs Age | 0.274 | 0.034 | Weak positive, significant |

**Figure 3:** Correlation between PHQ-9 and GAD-7 scores with regression line (rho=0.885, p<0.001)

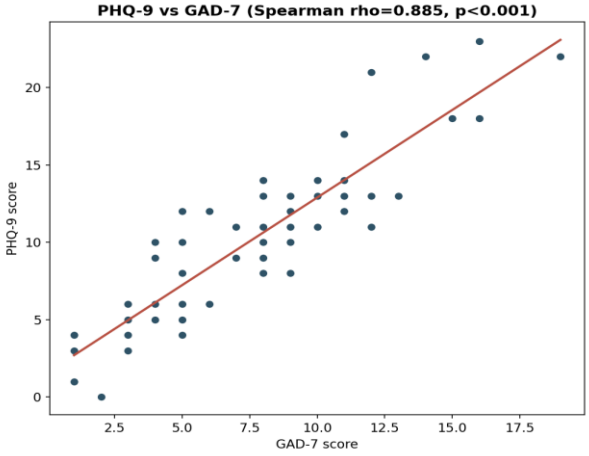
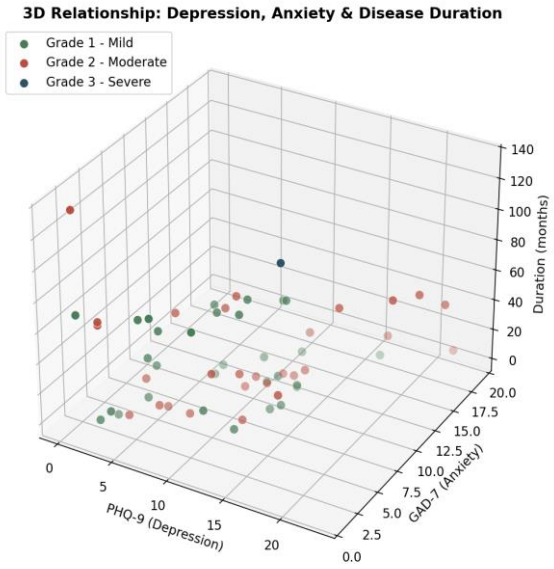



**Figure 4:** Three-dimensional relationship between depression (PHQ-9), anxiety (GAD-7) and disease duration, stratified by WHO disability grade. Visual inspection did not suggest a clear stratification pattern by disability grade, consistent with the non-significant correlations reported in Table 2; this plot is presented as descriptive supporting detail rather than as a basis for separate inferential claims




This study found a very strong, statistically significant positive correlation between depression and anxiety scores in leprosy-affected patients (rho=0.885, p<0.001), consistent with prior reports that psychological distress in leprosy clusters as a combined depressive-anxious syndrome rather than as isolated symptoms [2,5]. Nevertheless, this strong association should be interpreted in light of the well-established general-population finding that depression and anxiety scales are highly intercorrelated, as they share overlapping symptom items and a common underlying distress factor. The present data cannot differentiate a leprosy-specific clustering from this general psychometric overlap. Depression or anxiety were not significantly associated with the WHO disability grade or disease duration. As this was a cross-sectional design and all variables were measured at the same time, this finding is descriptive, not causal. This finding suggests that psychological distress in leprosy is not simply a linear consequence of physical severity or chronicity. Most of the participants had low to moderate disability (mean grade 1.52±0.54), which may also have suppressed a detectable correlation due to a restricted range of disability scores. Apart from physical severity, stigma, discrimination and social and demographic factors have been elsewhere described as important determinants of mental wellbeing in this population independent of physical disability [7].

There was a significant, albeit weak, positive correlation between both PHQ-9 and GAD-7 and age. This is notable, as older leprosy-affected patients may have a longer cumulative exposure to stigma, greater comorbidity burden, or reduced social support, any of which could plausibly mediate this relationship and warrant dedicated future study. This interpretation is speculative, considering that no direct measures of stigma, comorbidity, or social support were obtained, and the reported rho values (0.351 and 0.274)

should be interpreted cautiously given the modest sample size and lack of reported confidence intervals.

Since disability grade was not predictive of psychological distress, mental health screening should be universally applied across all severity grades and not restricted to those with visible or advanced disability. Physiotherapists are a key point of contact for patients affected by leprosy, as they are often the only sustained contact for patients receiving lifelong disability-prevention care. They are therefore well placed to provide this screening and to integrate evidence-informed psychosocial approaches into routine rehabilitation.

Limitations of this study include the single-centre, cross-sectional design which limits causal inference and generalisability because PHQ-9, GAD-7, disability grade and duration were all measured simultaneously. The use of purposive sampling, rather than random or consecutive sampling, risks selection bias. The sample size (n=60) is modest for correlation analysis, particularly for the weak correlations reported (rho approximately 0.15-0.35); no a priori power calculation was performed, and the study is likely underpowered to reliably detect small-to-moderate effects. The seven correlations examined in Table 2 were not adjusted for multiple comparisons, and some approach the conventional level of significance. The single-centre, tertiary-care setting may also limit generalisability. The lack of a control or comparison group means that claims of a disproportionately high burden of depression and anxiety in leprosy are based on external literature, rather than the data of this study. Screening rather than diagnostic instruments were used, and the proposed referral trigger (PHQ-9 ≥10) should be used as a pragmatic threshold rather than a validated diagnostic cut-point. Future research should include multi-centre studies with larger, more diverse, consecutively or randomly sampled cohorts, including an appropriate comparison group; longitudinal designs to clarify temporal relationships; and pilot randomised trials of physiotherapist-delivered psychosocial intervention specifically in leprosy-affected cohorts.

From a clinical standpoint, these findings support the routine implementation of PHQ-9/GAD-7 screening at the intake of leprosy physiotherapy, irrespective of the disability grade. This screening should be integrated with the management of physical disability and structured psychosocial intervention from the time of diagnosis, utilising peer-support and family-based training to address the social and stigma-related dimensions. Moreover, a clear referral pathway to mental-health services should be established for patients scoring in the moderate-to-severe range or reporting suicidal ideation.

**Physiotherapy Interventions and Strategies*:***

**Note on scope**

The following is a narrative synthesis of trial evidence published in non-leprosy populations to provide a clinical context for the findings. It is not based on the data from the present study. Physiotherapists are frequently the health professionals who have the most consistent clinical contact with patients affected by leprosy, because of the need to prevent disability, monitor nerve function and train patients in self-care. This presents a natural opportunity to integrate psychosocial care into standard rehabilitation. The strategies presented below are based on randomised controlled trials and systematic reviews in populations with chronic diseases and in physiotherapy-adjacent fields, none of which were conducted in cohorts affected by leprosy; there is a lack of disease-specific leprosy trials, so cautious extrapolation is suggested pending confirmatory research.

**Group exercise therapy under supervision**

Generated large reductions in depressive and anxiety symptoms in patients with clinical depressive and anxiety disorders compared with a relaxation-only control, although compliance was the main barrier to sustained benefit [8]. For leprosy-affected patients, this suggests low-impact, joint-protective group circuits of 2-3 sessions per week (30-45 minutes), tailored to allow for peripheral sensory loss and avoid pressure areas on anaesthetic hands and feet.

**Graded exercise aerobic**

Demonstrates an inverse relationship between physical activity level and anxiety symptoms in primary-care anxiety populations [9]; an individualised, graded aerobic dosage titrated to disability grade is recommended, with monitoring for pressure-ulceration risk during weight-bearing activity in insensate feet.

**Mind body intervention yoga**

In chronic pain patients, an intensive residential yoga program resulted in significantly greater reductions in anxiety and depression than standard physiotherapy exercise [10]. A feasible adaptation is modified, seated or disability adapted asana and pranayama sequences with brief guided relaxation at the end of physiotherapy sessions.

**Tele-delivered mind-body interventions**

Tele-rehabilitation combining a home exercise program with guided breathwork is supported by evidence of effect sizes for anxiety and depression similar to pharmacological therapy for adults with chronic physical conditions using internet- or mobile device-based mind-body interventions [11]. This is particularly relevant for patients facing mobility or access barriers.

**Family-based rehabilitation and self-care**

Community self-care and family-based rehabilitation programs integrating self-management training, economic empowerment and psychosocial support improve physical and psychosocial outcomes in leprosy, podoconiosis and lymphatic filariasis [12,14]. Physiotherapists should train patients and a family member in daily skin and limb self-inspection and use of protective footwear, together with psychoeducation on recognising depression and anxiety.

**Peer support and self-help groups**

A cluster-randomised study of combined leprosy and Buruli ulcer self-help groups found a significant reduction in stigma

scores in the intervention arm, which adds support for peer-support groups as a low-cost adjunct to clinical rehabilitation.

Table 3 summarises a stepwise physiotherapy-led pathway integrating universal screening, first-line group-based physical and mind-body intervention, family/peer-based adjuncts, and a defined escalation criterion to mental-health referral.

**Table 3:** Proposed stepwise physiotherapy-led screening and intervention pathway for depression and anxiety in leprosy-affected patients

| Step | Intervention | Basis / Reference |
|---|---|---|
| Screen | Administer PHQ-9 and GAD-7 to every leprosy patient at intake, irrespective of disability grade | Present study: no significant severity-distress correlation |
| First-line | Supervised group exercise + adapted yoga/pranayama, 2-3 sessions/week, embedded in disability-prevention physiotherapy | Zhai et al, Tekur et al. |
| Adjunct | Family-based self-care training; tele-rehabilitation for access-limited patients | van't Noordende et al, Johnson et al. |
| Social support | Referral to leprosy/NTD self-help or peer-support groups | Cluster-randomised self-help group trial |
| Escalation | Formal mental-health referral if PHQ-9 ≥10, GAD-7 ≥10, or suicidal ideation reported; re-screen at follow-up | Standard clinical threshold; present study cut-offs |

These recommendations have been developed based on evidence from RCTs in related chronic-disease and mental-health populations, and not from leprosy-specific trials. Disease-specific randomised trials of physiotherapy-delivered psychosocial intervention in leprosy are needed, and a dedicated systematic review is recommended before these strategies are formally adopted as a clinical guideline [10-12].

## CONCLUSION

Depression and anxiety are strongly and significantly correlated in leprosy patients irrespective of the grade of disability or duration of disease. Both depression and anxiety increase modestly with age. These findings argue for universal psychological screening across disability grades, the inclusion of physiotherapist-led psychosocial strategies (supervised group exercise, adapted yoga, tele-rehabilitation, family and peer-based support) in standard rehabilitation, and a clear referral pathway to mental-health services. Given the single-centre, cross-sectional design and modest sample size, these conclusions need to be confirmed by multi-centre, sufficiently powered studies and disease-specific trials before wider clinical adoption.

## ACKNOWLEDGEMENT

The authors wish to acknowledge the patients who participated in this study and the staff of the Physiotherapy Department, PT School and Centre, TNMC & BYL Nair Charitable Hospital, Mumbai, for their support during data collection.

**Conflict of interest**

None to declare. Funding Information: None. The Institutional Ethics Committee gave ethical approval before enrolment, and written informed consent was taken from all the participants.

## REFERENCES

1. Govindharaj P, Srinivasan S, Darlong J, 2018. Perception toward the disease of the people affected by leprosy. Int J Mycobacteriol. 7(3), Pages 247-250. Doi: 10.4103/ijmy.ijmy_66_18.

2. Govindasamy K, Jacob I, Solomon RM, et al, 2021. Burden of depression and anxiety among leprosy-affected and associated factors—a cross-sectional study from India. PLoS Negl Trop Dis. 15(1), Pages e0009030. Doi: https://doi.org/10.1371/journal.pntd.0009030.

3. Thwaites VAV, Rao K, 2014. Sources of anxiety amongst leprosy patients in urban treatment setting in Hyderabad, India. Lepr Rev. 85(4), Pages 328-331.

4. Mangeard-Lourme J, Robert de Arquer G, Parasa J, et al, 2020. Depression and anxiety in people affected by leprosy and lymphatic filariasis: a cross-sectional study in four states in India. Lepr Rev. 91, Pages 367-382. Doi: 10.47276/lr.91.4.367.

5. Sawaya H, Atoui M, Hamadeh A, et al, 2016. Adaptation and initial validation of the Patient Health Questionnaire-9 (PHQ-9) and the Generalised Anxiety Disorder-7 Questionnaire (GAD-7) in an Arabic-speaking Lebanese psychiatric outpatient sample. Doi: 10.1016/j.jpsychires.2023.06.027.

6. Somar PMW, Waltz MM, van Brakel WH, 2020. The impact of leprosy on the mental wellbeing of leprosy-affected persons and their family members: a systematic review. Glob Ment Health (Camb). 7, Pages e15. Doi: 10.1017/gmh.2020.3.

7. Zhai Q, Folkesson M, Hörnsten C, et al, 2025. A randomised controlled trial of supervised group exercise therapy in patients with clinical depressive and anxiety disorders: the challenge of patient compliance. Eur Psychiatry. Doi: 10.1192/j.eurpsy.2025.352.

8. Andersson E, 2019. Effects of exercise on symptoms of anxiety, cognitive ability and sick leave in patients with anxiety disorders in primary care: study protocol for PHYSBI, a randomised controlled trial. Trials. 20, Pages 317. Doi: 10.1186/s12888-019-2169-5.

9. Tekur P, Nagarathna R, Chametcha S, et al, 2012. A comprehensive yoga program improves pain, anxiety and depression in chronic low back pain patients more than exercise: an RCT. Complement Ther Med. 20(3), Pages 107-118. Doi: 10.1016/j.ctim.2011.12.009.

10. Johnson E, Corrick S, Isley S, et al, 2024. Mind-body internet and mobile-based interventions for depression and anxiety in adults with chronic physical conditions: a systematic review of RCTs. PLOS Digit Health. Doi: https://doi.org/10.1371/journal.pdig.0000435.

11. Van't Noordende AT, Aycheh MW, Tadesse T, et al, 2022. Family-based intervention for prevention and self-management of disabilities due to leprosy, podoconiosis and lymphatic filariasis versus usual care in Ethiopia: study protocol for a cluster-randomised controlled trial. BMJ Open. 12(3), Pages e055260. Doi: 10.1371/journal.pntd.0009167.

12. Hotez PJ, Alvarado M, Basáñez MG, et al, 2014. The Global Burden of Disease Study 2010: interpretation and implications for the neglected tropical diseases. PLoS Negl Trop Dis. 8(7), Pages - e2865. Doi: 10.1371/journal.pntd.0002865.