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Original Article

Knowledge of Leprosy Prevention and Management Among Physiotherapists in Pakistan: A National Cross-Sectional Study

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ABSTRACT

Background: Leprosy remains a preventable cause of peripheral neuropathy, deformity, disability, and social stigma in endemic pockets despite elimination-level prevalence in Pakistan. Physiotherapists can support early recognition, disability prevention, rehabilitation, self-care education, and timely referral; however, national evidence on their leprosy-related knowledge is limited. Objective: To assess physiotherapists' knowledge regarding prevention and management of leprosy across Pakistan. Methods: A descriptive cross-sectional survey was conducted among 422 physiotherapists from Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan. A structured 17-item questionnaire assessed prevention and management knowledge. Knowledge was categorized as good, fair, or poor using predefined percentage cutoffs. Data were analyzed using descriptive statistics and chi-square tests in SPSS version 27, with $p<0.05$ considered statistically significant. Results: Overall, 330 participants demonstrated good knowledge, representing 78.2% of the sample, while 19.4% had fair knowledge and 2.4% had poor knowledge. Good knowledge was highest in Punjab (81.1%), followed by Sindh (76.9%), Khyber Pakhtunkhwa (76.2%), and Balochistan (76.2%), with no significant provincial difference ($\chi^2=4.3$, $p=0.37$). Stronger domains included screening recognition (82.7%) and claw-hand deformity recognition (80.6%), while late-stage exercise prescription showed the largest gap (51.2%). Conclusion: Pakistani physiotherapists demonstrated generally good knowledge of leprosy prevention and management, but targeted training is needed in late rehabilitation and reaction recognition. Keywords: Leprosy; Hansen Disease; Physiotherapists; Knowledge; Rehabilitation; Disability Prevention; Pakistan.

INTRODUCTION

Leprosy, or Hansen's disease, is a chronic infectious disease caused by Mycobacterium leprae, with primary involvement of the skin, peripheral nerves, eyes, and upper respiratory mucosa. Although global and national control programmes have substantially reduced its prevalence, leprosy remains clinically important because delayed recognition can lead to irreversible neuropathy, deformity, activity limitation, social stigma, and grade-2 disability. The disease has been eliminated as a public health problem in many countries according to prevalence-based targets, yet new cases continue to occur annually, particularly in endemic pockets where poverty, low awareness, delayed consultation, and limited case detection contribute to ongoing transmission and disability (1,2).

Pakistan achieved elimination-level prevalence decades ago, but focal transmission and delayed diagnosis continue to challenge leprosy control. Available national and regional evidence indicates that Sindh, particularly Karachi, remains a major hotspot, with a considerable proportion of newly diagnosed cases presenting with multibacillary disease and visible disability. Grade-2 disability at diagnosis is especially important because it reflects missed opportunities for early detection, timely multidrug therapy, nerve-function monitoring, and disability prevention. In this context, leprosy should not be viewed only as a dermatological or infectious disease problem, but also as a rehabilitation concern requiring early identification of sensory loss, motor weakness, nerve involvement, deformity risk, self-care needs, and functional limitations (3–5).

Physiotherapists have a clinically relevant role in leprosy care because peripheral neuropathy, muscle imbalance, joint stiffness, claw-hand deformity, plantar ulcers, sensory loss, and activity limitation are central contributors to long-term disability. Rehabilitation interventions such as range-of-motion exercises, strengthening, splinting, sensory re-education, neural mobilization, wound-care education, gait training, protective self-care, and functional retraining can reduce impairment progression and improve participation when applied early and appropriately. However, the effectiveness of physiotherapy in leprosy depends on whether clinicians can recognize early symptoms, understand prevention strategies, identify complications, and refer patients promptly for medical management when reactions, neuritis, or progressive nerve dysfunction occur (6–8).

Previous studies among healthcare workers, medical students, physiotherapy students, caregivers, and leprosy-affected communities have shown that knowledge is often moderate but incomplete, with persistent misconceptions about transmission, treatment, stigma, disability prevention, and rehabilitation. Evidence from India, Ethiopia, Nigeria, and other endemic settings suggests that structured training can improve knowledge and clinical skills, but gaps remain in late-stage rehabilitation, leprosy reactions, nerve-function assessment, and stigma-sensitive counselling. Studies focusing specifically on physiotherapists remain limited, and available evidence is largely localized rather than nationally representative. For Pakistan, where leprosy services are concentrated in selected centres and where high-burden regions still experience diagnostic delays, there is insufficient evidence on whether physiotherapists possess adequate knowledge to support prevention and management across different provinces (9–14).

This knowledge gap is important because physiotherapists may encounter patients with neuropathic symptoms, deformities, wounds, weakness, or disability before leprosy is suspected, particularly in general rehabilitation settings. Inadequate awareness may delay referral and rehabilitation, whereas strong knowledge may support early detection, patient education, stigma reduction, and disability prevention. Therefore, a national assessment of physiotherapists' knowledge can help identify provincial and practice-level training needs, guide continuing professional development, and support integration of rehabilitation professionals into leprosy elimination strategies. This study was conducted to assess the level and distribution of knowledge regarding leprosy prevention and management among physiotherapists in Pakistan, with the objective of identifying strengths, gaps, and priority areas for targeted training and policy integration (15,16).

MATERIALS AND METHODS

This study was designed as a descriptive cross-sectional observational survey to assess physiotherapists' knowledge regarding prevention and management of leprosy across Pakistan. A cross-sectional design was considered appropriate because the objective was to estimate the current level of knowledge and compare knowledge distribution across demographic and professional subgroups at a single point in time. The study was conducted over a six-month period after ethical approval in selected hospitals, physiotherapy clinics, rehabilitation centres, and academic institutes located in major provincial hubs, including Lahore and Faisalabad in Punjab, Karachi and Hyderabad in Sindh, Peshawar and Abbottabad

in Khyber Pakhtunkhwa, and Quetta in Balochistan. These locations were selected to provide representation from all four provinces while ensuring access to registered physiotherapists working in clinical or academic rehabilitation environments.

The target population comprised registered physiotherapists currently involved in clinical practice, teaching, or rehabilitation services in Pakistan. Participants were eligible if they were qualified physiotherapists, had one to five years of professional experience, were working in a hospital, clinic, rehabilitation centre, or academic institute, and provided informed consent. Physiotherapists who declined participation, provided incomplete responses, were not actively engaged in physiotherapy-related work, or did not meet the defined professional experience criteria were excluded. Restricting the sample to early-career and mid-career physiotherapists was intended to obtain a relatively comparable professional group while minimizing extreme variation caused by very limited exposure or long-term specialist experience.

A multistage sampling approach was used. First, the sample was stratified by province to ensure national geographic coverage. Second, facilities were selected from major urban centres within each province, including public and private hospitals, physiotherapy clinics, and educational institutes. Third, eligible physiotherapists from selected facilities were invited to participate until the required provincial quota was achieved. The planned provincial allocation was based on approximate physiotherapy workforce distribution and feasibility of recruitment, with 148 participants from Punjab, 169 from Sindh, 63 from Khyber Pakhtunkhwa, and 42 from Balochistan, giving a total sample of 422 participants. Although facility-level selection aimed to improve geographic representation, purposive recruitment within selected facilities may have introduced selection bias; therefore, eligibility criteria were applied consistently, and responses were checked for completeness before analysis.

The sample size was calculated using the single-population proportion formula, $n = Z^2p(1-p)/e^2$, with a 95% confidence level, Z value of 1.96, expected proportion of 0.50 because no prior national estimate was available for physiotherapists' leprosy-related knowledge in Pakistan, and margin of error of 5%. The minimum required sample size was 384 participants. To account for possible non-response and incomplete forms, the sample was increased by approximately 10%, resulting in a final target sample of 422 participants.

Data were collected using a structured questionnaire adapted from previously published work assessing physiotherapists' awareness of disability prevention and management in leprosy. The questionnaire included demographic and professional variables followed by knowledge items related to leprosy prevention and management. The knowledge component consisted of 17 items, including 9 items addressing prevention and early identification and 8 items addressing rehabilitation, disability management, reaction awareness, and physiotherapy-related care. The tool was reviewed for relevance to the Pakistani context and pilot-tested before formal data collection. Internal consistency was assessed using Cronbach's alpha, with a value above 0.80 considered acceptable for reliability. Data were collected through Google Forms and in-person questionnaire administration. Before participation, each respondent received information regarding the study purpose, voluntary participation, confidentiality, and the right to withdraw.

The main outcome variable was knowledge regarding leprosy prevention and management. Each correct response was scored as one and each incorrect or uncertain response was scored as zero. Total knowledge scores were converted into percentages and categorized as good knowledge for scores of 80% or above, fair knowledge for scores from 50% to 79%, and poor knowledge for scores below 50%. Independent variables included province, age, gender, years of professional experience, type of workplace, and professional designation where available. Prevention knowledge included awareness of early symptoms, sensory loss, screening, deformity prevention, and physiotherapy's role in preventing disability. Management knowledge included awareness of reaction management, neural rehabilitation, exercises, splinting, ulcer prevention, and functional rehabilitation.

Several steps were taken to reduce bias and improve data quality. The same questionnaire was used for all respondents, instructions were standardized, duplicate responses were checked, and incomplete questionnaires were excluded before analysis. To reduce social desirability bias, participants were informed that responses would remain confidential and would be analyzed in aggregate form only. To minimize data-entry errors, electronic responses were exported directly, and manually collected forms were reviewed before entry. Data cleaning included range checks, missing-value screening, verification of categorical coding, and review of inconsistent responses. Missing data were handled using complete-case analysis because only fully completed questionnaires were included in the final dataset.

Data were analyzed using IBM SPSS Statistics version 27. Descriptive statistics were used to summarize demographic characteristics and knowledge responses. Frequencies and percentages were reported for categorical variables, while means and standard deviations were reported for continuous variables such as age and years of experience. Knowledge levels were compared across provinces, gender, and experience categories using chi-square tests. Where appropriate, effect estimates such as odds ratios with 95% confidence intervals were planned to examine predictors of good knowledge. A p-value below 0.05 was considered statistically significant. Subgroup analyses were planned for province and professional experience because these variables were considered clinically relevant to knowledge variation. Ethical approval was obtained before data collection, and informed consent was obtained from all participants. Data were stored securely, analyzed anonymously, and used only for research purposes.

RESULTS

A total of 422 physiotherapists were included in the final analysis. The mean age of participants was 28.4 ± 4.2 years, and the mean professional experience was 3.1 ± 1.2 years. Females represented 58.0% of the sample. Overall, 330 participants demonstrated good knowledge, corresponding to 78.2% of the sample. Fair knowledge was observed in 82 participants, while 10 participants had poor knowledge. The overall distribution indicated a strong knowledge base among physiotherapists, although approximately one-fifth of respondents still had only fair or poor knowledge.

Table 1. Overall Knowledge Level Among Physiotherapists Regarding Leprosy Prevention and Management

Knowledge Level	n	%	95% CI
Good knowledge	330	78.2	74.0–81.9
Fair knowledge	82	19.4	16.0–23.5
Poor knowledge	10	2.4	1.3–4.3
Total	422	100.0	—

Provincial comparison showed that good knowledge was highest in Punjab, where 120 of 148 participants demonstrated good knowledge. Sindh showed good knowledge in 130 of 169 participants, while Khyber Pakhtunkhwa and Balochistan each showed good knowledge in approximately three-fourths of participants. The difference in knowledge distribution across provinces was not statistically significant, indicating broadly comparable knowledge levels across regions.

Table 2. Provincial Distribution of Knowledge Levels

Province	n	Good n (%)	95% CI	Fair n (%)	Poor n (%)	χ^2	p-value
Punjab	148	120 (81.1)	74.0–86.6	26 (17.6)	2 (1.3)		
Sindh	169	130 (76.9)	70.0–82.6	36 (21.3)	3 (1.8)		
Khyber Pakhtunkhwa	63	48 (76.2)	64.3–85.0	13 (20.6)	2 (3.2)		
Balochistan	42	32 (76.2)	61.5–86.5	9 (21.4)	1 (2.4)	4.3	0.37
Total	422	330 (78.2)	74.0–81.9	82 (19.4)	10 (2.4)		

Item-wise analysis showed the highest correct response rate for screening recognition, followed by claw-hand deformity recognition and neural rehabilitation. The weakest area was late-stage exercise prescription, where only 216 participants answered correctly. Reaction management also showed a moderate gap, with 306 participants responding correctly. These findings suggest that physiotherapists were more confident in early identification and general preventive roles than in advanced rehabilitation and complication-specific management.

Table 3. Item-Wise Knowledge Performance

Knowledge Item	Correct n	Correct %	95% CI
Screening recognition	349	82.7	78.8–86.0
Claw-hand deformity recognition	340	80.6	76.6–84.1
Neural rehabilitation	334	79.1	75.0–82.8
Early numbness/sensory symptom	320	75.8	71.5–79.7
Reaction management	306	72.5	68.1–76.6
Late-stage exercise prescription	216	51.2	46.4–55.9

Experience-based analysis indicated that physiotherapists with approximately three years of experience had the highest proportion of good knowledge, reaching 82.0%. The association between experience category and good knowledge was statistically significant, suggesting that early professional exposure may improve applied understanding of leprosy-related prevention and rehabilitation. However, because only aggregated data were available, adjusted regression estimates could not be generated without individual-level participant data.

Table 4. Association Between Professional Experience and Knowledge

Variable	Key Finding	Inferential Test	p-value
Professional experience	Good knowledge peaked at approximately 3 years of experience (82.0%)	$\chi^2 = 8.7$	0.01
Gender	No significant difference in knowledge distribution	$\chi^2 = 1.2$	0.55
Province	No significant difference across provinces	$\chi^2 = 4.3$	0.37

The provincial pattern demonstrated a narrow gradient in good knowledge, ranging from 76.2% in Khyber Pakhtunkhwa and Balochistan to 81.1% in Punjab. Sindh, despite being a high-burden province for leprosy, showed a good-knowledge proportion of 76.9%, slightly below the national average of 78.2%. This pattern suggests that training needs may be greatest in areas where disease burden is high but knowledge advantage is not proportionally higher.

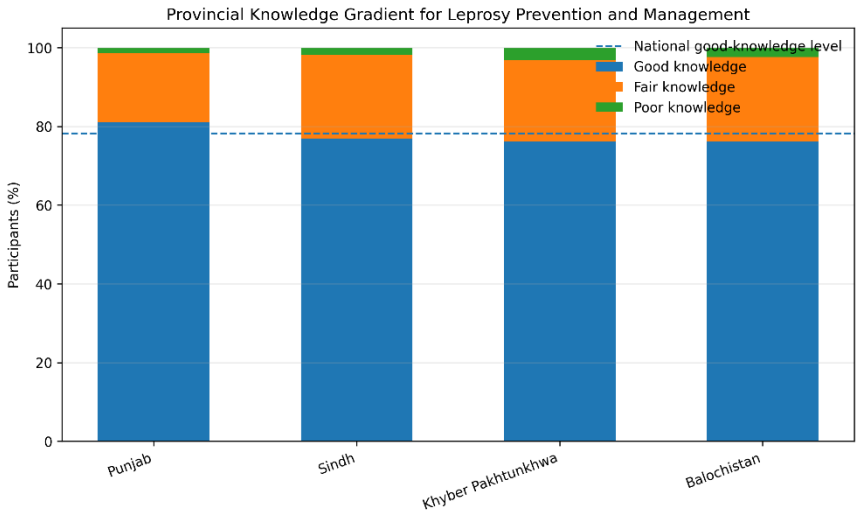

Figure 1 Provincial Knowledge Gradient for Leprosy Prevention and Management

The figure shows that good knowledge remained above 75% in all provinces, with Punjab exceeding the national good-knowledge level by 2.9 percentage points. Sindh, Khyber Pakhtunkhwa, and Balochistan remained slightly below the national benchmark, with fair knowledge ranging from 20.6% to 21.4% in the latter three provinces. The small poor-knowledge segment across all provinces indicates that severe knowledge deficiency was uncommon, but the persistent fair-knowledge band highlights a clear training opportunity, particularly for late-stage rehabilitation and reaction management.

DISCUSSION

This national cross-sectional survey found that Pakistani physiotherapists demonstrated a generally strong knowledge base regarding leprosy prevention and management, with 78.2% achieving good knowledge, 19.4% fair knowledge, and only 2.4% poor knowledge. This finding suggests that most early-

and mid-career physiotherapists are aware of the core preventive and rehabilitation-related aspects of leprosy care. However, the pattern of responses also shows that knowledge was not uniform across domains. Participants performed better on screening recognition, claw-hand deformity identification, and general neural rehabilitation, but showed weaker understanding of late-stage exercise prescription and reaction management. This distinction is clinically important because leprosy-related disability is often driven not only by delayed diagnosis but also by inadequate recognition of neuritis, reactions, progressive nerve impairment, deformity risk, and the need for stage-specific rehabilitation (1–8).

Provincial analysis showed no statistically significant difference in knowledge distribution across Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan. Punjab had the highest proportion of good knowledge at 81.1%, while Sindh, Khyber Pakhtunkhwa, and Balochistan showed good-knowledge levels between 76.2% and 76.9%. The absence of significant provincial variation indicates that physiotherapy knowledge may be broadly comparable across major urban centres. However, Sindh's slightly lower score is noteworthy because the province carries a substantial proportion of Pakistan's leprosy burden, particularly in Karachi. This creates an important service-delivery concern: regions with higher disease burden should ideally demonstrate stronger provider preparedness, especially in early detection, disability prevention, and referral pathways (3–5).

The item-wise findings highlight specific training priorities. Screening recognition was the strongest domain, with 82.7% correct responses, followed by claw-hand deformity recognition at 80.6% and neural rehabilitation at 79.1%. These results suggest that physiotherapists are relatively familiar with visible deformities and general rehabilitation roles. In contrast, late-stage exercise prescription had the lowest correct response rate at 51.2%, indicating a substantial gap in applied rehabilitation decision-making. This is important because late-stage leprosy care requires careful balancing of strengthening, joint mobility, protective strategies, ulcer prevention, sensory loss, deformity correction, and avoidance of tissue overload. Inadequate knowledge in this area may reduce rehabilitation effectiveness and increase the risk of preventable disability (6–8).

Reaction management also emerged as a moderate knowledge gap, with 72.5% correct responses. Leprosy reactions, including type 1 reversal reactions and type 2 erythema nodosum leprosum, are major contributors to acute nerve inflammation, pain, sensory deterioration, and functional decline. Physiotherapists are not responsible for pharmacological management, but they should recognize warning signs, monitor function, modify rehabilitation intensity, and refer urgently when nerve symptoms worsen. Therefore, this gap has direct clinical relevance and supports the need for continuing professional development modules focused on reaction recognition, neuritis red flags, referral timing, and safe rehabilitation modification during inflammatory episodes (9–14).

The significant association between experience and knowledge, with the strongest performance around three years of professional experience, suggests that applied clinical exposure may improve recognition of leprosy-related rehabilitation needs. However, this finding should be interpreted cautiously because the study included physiotherapists with one to five years of experience only. Senior physiotherapists and rural practitioners were not fully represented, limiting conclusions about the entire physiotherapy workforce. Future studies should include broader experience groups, rural facilities, and leprosy-specialized rehabilitation centres to determine whether knowledge improves with longer practice or specialized exposure.

This study has several strengths. It included a large sample of 422 physiotherapists from all four provinces, used a structured questionnaire, and assessed both prevention and management domains. It also provides one of the first nationwide physiotherapy-focused assessments of leprosy-related knowledge in Pakistan. Nevertheless, limitations should be acknowledged. The urban focus may limit generalizability to rural settings where delayed diagnosis and access barriers may be greater. The use of self-reported questionnaire responses may overestimate actual clinical competence. The cross-sectional design prevents assessment of causal relationships or knowledge change over time. Moreover, because

only aggregated data were available, multivariable regression and adjusted predictors of good knowledge could not be fully explored.

CONCLUSION

Pakistani physiotherapists demonstrated generally good knowledge regarding leprosy prevention and management, with 78.2% achieving good knowledge and only 2.4% showing poor knowledge. Knowledge was broadly comparable across provinces, but clinically relevant gaps were identified in late-stage exercise prescription and reaction management. These findings suggest that physiotherapists are well positioned to support leprosy disability prevention, but targeted continuing education is needed to improve advanced rehabilitation decision-making, early recognition of complications, and timely referral. Strengthening physiotherapy participation in leprosy control services may help reduce preventable disability and improve functional outcomes among affected patients.

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