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Determinants of Diagnostic Delay in Leprosy Among Rural Populations: A Cross-Sectional Study from a Tertiary Care Centre

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Abstract:

Background: Leprosy remains a significant public health problem in rural India, where delayed diagnosis contributes to continued transmission, disability, and stigma. Early identification and treatment are essential for preventing deformities and reducing disease burden.

Objectives: To determine the magnitude of diagnostic delay in leprosy among rural patients and to identify socio-demographic, clinical, and healthcare-related determinants contributing to delayed diagnosis.

Methods: A hospital-based cross-sectional study was conducted at Mata Gujri Medical College, Kishanganj over 12 months. A total of 90 confirmed leprosy patients from rural areas were included. Diagnostic delay was defined as time from onset of symptoms to confirmed diagnosis. Data regarding socio-demographic profile, clinical presentation, healthcare-seeking behaviour, and knowledge about leprosy were collected using a structured questionnaire. Statistical analysis was performed using Chi-square test and logistic regression. A p-value <0.05 was considered statistically significant.

Results: The mean diagnostic delay was 9.8 ± 5.6 months. Delayed diagnosis (>6 months) was observed in 63.3% of patients. Factors significantly associated with delay included illiteracy (p=0.01), low socioeconomic status (p=0.02), initial consultation with traditional healers (p=0.004), lack of awareness of leprosy symptoms (p=0.001), and stigma-related concealment (p=0.03). Multibacillary leprosy was significantly more common among delayed cases (p=0.02).

Conclusion: A high proportion of rural leprosy patients experience diagnostic delay, primarily due to poor awareness, social stigma, and inappropriate initial healthcare contact. Strengthening community awareness and improving rural referral systems may reduce delay and disability burden.

Keywords: Leprosy; Diagnostic delay; Rural population; Stigma; Multibacillary leprosy; Health-seeking behaviour.

Introduction

Leprosy (Hansen's disease) is a chronic granulomatous infection caused by Mycobacterium leprae that primarily affects the skin and peripheral nerves.

Despite the availability of effective multidrug therapy (MDT), leprosy continues to persist as a public health issue, especially in developing countries. India contributes the largest share of global leprosy burden, accounting for a major proportion of new cases detected annually. [1]

Early diagnosis and timely treatment remain the most important strategies for preventing disability and interrupting disease transmission. However, diagnostic delay is common, particularly in rural and underserved populations. This delay results in prolonged infectivity, increased nerve damage, irreversible deformities, and higher stigma. [2, 3]

Diagnostic delay in leprosy is influenced by multiple factors such as poor awareness of symptoms, low literacy, socio-economic deprivation, and limited access to trained healthcare providers. [4] In many rural communities, early symptoms such as hypopigmented patches or sensory loss are often ignored or misinterpreted, leading to late presentation. [5] Additionally, patients frequently consult unqualified practitioners, traditional healers, or pharmacists before seeking appropriate medical attention. [6]

Social stigma remains another major contributor to delayed diagnosis. Leprosy has long been associated with misconceptions and fear, resulting in concealment of symptoms and avoidance of healthcare facilities. [7] Women in rural settings may face additional barriers due to gender inequality and reduced autonomy in seeking medical care. [8]

Although national leprosy elimination programmes have improved detection rates, diagnostic delay continues to be reported even in regions with ongoing surveillance. Understanding the determinants of delay in rural patients is essential for strengthening case detection strategies and preventing disability. [9] Therefore, this study was conducted to assess the magnitude and determinants of diagnostic delay in leprosy among rural patients attending a tertiary care centre in Kishanganj.

Materials and Methods

Study Design and Setting

This hospital-based cross-sectional study was conducted in the Department of Dermatology at Mata Gujri Medical College, Kishanganj.

Study Duration

12 months.

Study Population

A total of 90 confirmed leprosy patients from rural areas were included.

Inclusion Criteria

- Confirmed diagnosis of leprosy (clinical ± slit skin smear)
- Rural residence
- Age ≥ 15 years
- Willingness to participate

Exclusion Criteria

- Urban patients
- Patients with relapse or incomplete records
- Patients unwilling to consent

Data Collection

A structured questionnaire was used to collect:

- socio-demographic data (age, sex, literacy, occupation)
- clinical presentation (type of leprosy, disability grade)
- health-seeking behaviour
- awareness regarding leprosy symptoms and treatment
- first point of healthcare contact

Operational Definition

Diagnostic delay was defined as the duration between **first noticed symptom** and **confirmed diagnosis**.

- **Early diagnosis:** ≤ 6 months
- **Delayed diagnosis:** >6 months

Clinical Classification

Patients were classified as paucibacillary (PB) or multibacillary (MB) as per WHO guidelines.

Statistical Analysis

Data were analyzed using statistical software. Categorical variables were expressed as frequency and percentage. Continuous variables were expressed as mean ± SD. Association between diagnostic delay and determinants was analyzed using Chi-square test. Multivariate logistic regression was applied to identify independent predictors of diagnostic delay. p-value <0.05 was considered significant.

Results

A total of **90 confirmed leprosy patients** from rural areas were included in the study. The mean age of participants was **34.6 ± 13.2 years** (range: 15–68 years). Male patients constituted **61.1% (n=55)**, while females constituted **38.9% (n=35)**. Illiteracy was observed in **42.2% (n=38)** of the participants, and **60.0% (n=54)** belonged to low socioeconomic status. The detailed socio-demographic profile of the study population is presented in **Table 1**.

Table 1. Socio-demographic characteristics of study participants (n = 90)

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	15–30	34	37.8
	31–45	32	35.6
	>45	24	26.6
Gender	Male	55	61.1
	Female	35	38.9
Literacy status	Illiterate	38	42.2
	Literate	52	57.8
Socioeconomic status	Low	54	60.0
	Middle/High	36	40.0

Prevalence and Duration of Diagnostic Delay

The overall mean diagnostic delay was found to be **9.8 ± 5.6 months**. Diagnostic delay was categorized into early diagnosis (≤6 months) and delayed diagnosis (>6 months). It was observed that **63.3% (n=57)** of patients had a diagnostic delay of more than 6 months, while **36.7% (n=33)** were diagnosed within 6 months.

The distribution of patients according to duration of diagnostic delay is summarized in **Table 2**.

Table 2. Distribution of diagnostic delay among study participants (n = 90)

Diagnostic delay duration	Number of patients (n)	Percentage (%)
≤ 6 months	33	36.7
> 6 months	57	63.3
Total	**90**	**100**

Clinical Characteristics of Leprosy Patients

Out of the 90 patients, **multibacillary (MB) leprosy** was diagnosed in **64.4% (n=58)**, while **paucibacillary (PB) leprosy** was seen in **35.6% (n=32)** cases. Disability grading revealed that **57.8% (n=52)** had Grade 0 disability, **22.2% (n=20)** had Grade 1 disability, and **20.0% (n=18)** had Grade 2 disability.

The clinical distribution of leprosy type and disability grading is shown in **Table 3**.

Table 3. Clinical characteristics of leprosy patients (n = 90)

Variable	Category	Number of patients (n)	Percentage (%)
Type of leprosy	Paucibacillary	32	35.6
	Multibacillary	58	64.4
Disability grade	Grade 0	52	57.8
	Grade 1	20	22.2
	Grade 2	18	20.0

Association Between Socio-demographic Factors and Diagnostic Delay

A statistically significant association was observed between literacy status and diagnostic delay. Among illiterate participants, **76.3% (n=29)** had delayed diagnosis, whereas among literate participants, **53.8% (n=28)** experienced delay (**χ^2 = 6.32, p = 0.01**). Similarly, low socioeconomic status was significantly associated with delayed diagnosis, where **72.2% (n=39)** of low SES patients had diagnostic delay compared to **50.0% (n=18)** among middle/high SES patients (**χ^2 = 5.20, p = 0.02**).

These associations are summarized in **Table 4**.

Table 4. Association between socio-demographic variables and diagnostic delay (>6 months)

Variable	Category	Delay Present n (%)	Delay Absent n (%)	χ^2 value	p-value
Literacy status	Illiterate	29 (76.3)	9 (23.7)	6.32	0.01*
	Literate	28 (53.8)	24 (46.2)		
Socioeconomic status	Low	39 (72.2)	15 (27.8)	5.20	0.02*
	Middle/High	18 (50.0)	18 (50.0)		

*Statistically significant ($p < 0.05$)

Health-Seeking Behaviour and Its Influence on Diagnostic Delay

The first healthcare contact was analyzed. It was found that **25.6% (n=23)** initially consulted traditional healers, **22.2% (n=20)** approached private practitioners, **20.0% (n=18)** used pharmacy/self-medication, and only **32.2% (n=29)** visited government health facilities initially.

Delayed diagnosis was highest among those who first consulted traditional healers (**82.6%, n=19**) compared to those who first consulted government facilities (**51.7%, n=15**). This association was statistically significant (**χ^2 = 8.20, p = 0.004**).

The relationship between first healthcare contact and diagnostic delay is shown in **Table 5**, and the same distribution is graphically represented in **Figure 1**.

Table 5. Association between first healthcare contact and diagnostic delay (>6 months)

First healthcare contact	Delay Present n (%)	Delay Absent n (%)	χ^2 value	p-value
Government health facility	15 (51.7)	14 (48.3)	8.20	0.004*
Private practitioner	13 (65.0)	7 (35.0)		
Pharmacy/self-medication	12 (66.7)	6 (33.3)		
Traditional healer	19 (82.6)	4 (17.4)		

*Statistically significant ($p < 0.05$)

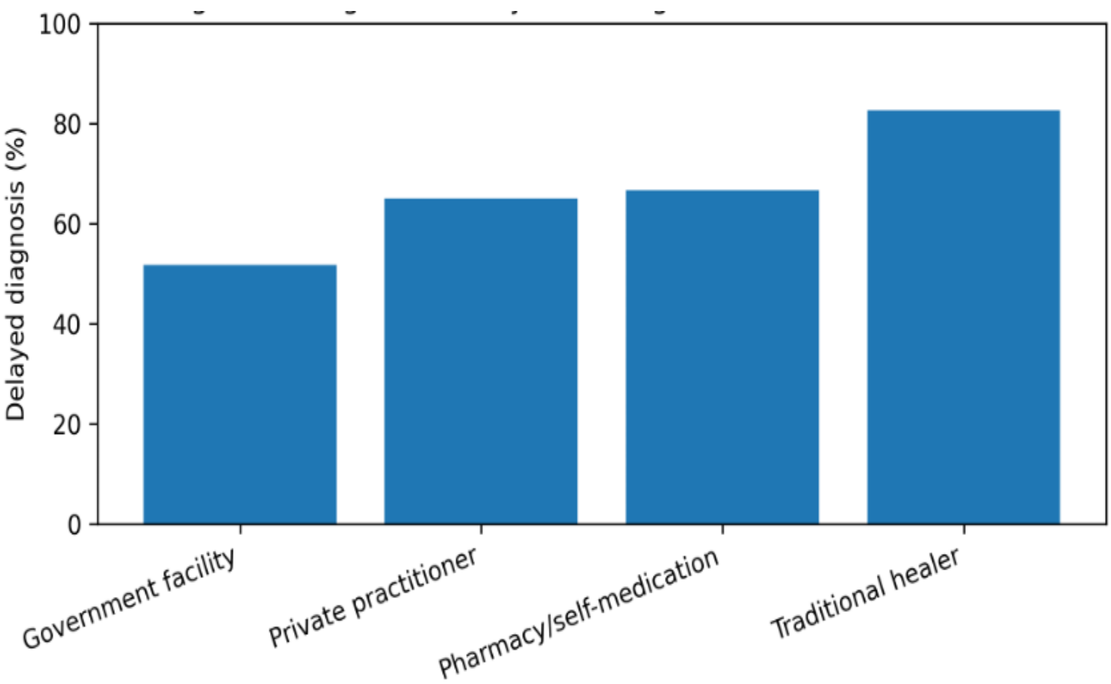

Figure 1. Bar chart showing percentage of patients with diagnostic delay (>6 months) based on first healthcare contact.

Awareness and Stigma as Determinants of Diagnostic Delay

Lack of awareness regarding leprosy symptoms was present in **58.9% (n=53)** participants. Among these, **77.4% (n=41)** had delayed diagnosis, whereas among those with awareness, only **43.2% (n=16)** had diagnostic delay. This association was statistically significant (**χ^2 = 10.50, p = 0.001**).

Stigma-related concealment was reported by **33.3% (n=30)** of participants. Among them, **73.3% (n=22)** experienced diagnostic delay compared to **58.3% (n=35)** among those without stigma-related concealment. This was statistically significant (**χ^2 = 4.60, p = 0.03**).

These findings are summarized in **Table 6**.

Table 6. Association of awareness and stigma with diagnostic delay (>6 months)

Variable	Category	Delay Present n (%)	Delay Absent n (%)	χ^2 value	p-value
Awareness of symptoms	No	41 (77.4)	12 (22.6)	10.50	0.001*
	Yes	16 (43.2)	21 (56.8)		
Stigma concealment	Present	22 (73.3)	8 (26.7)	4.60	0.03*
	Absent	35 (58.3)	25 (41.7)		

*Statistically significant ($p < 0.05$)

Association Between Clinical Type of Leprosy and Diagnostic Delay

Diagnostic delay was significantly more frequent among multibacillary cases. Among MB patients, **72.4% (n=42)** experienced delayed diagnosis, whereas among PB cases, **46.9% (n=15)** experienced delay. This difference was statistically significant (**χ^2 = 5.60, p = 0.02**).

This association is shown in **Table 7**.

Table 7. Association between type of leprosy and diagnostic delay (>6 months)

Type of leprosy	Delay Present n (%)	Delay Absent n (%)	χ^2 value	p-value
Multibacillary	42 (72.4)	16 (27.6)	5.60	0.02*
Paucibacillary	15 (46.9)	17 (53.1)		

*Statistically significant (p < 0.05)

Multivariate Logistic Regression Analysis

On multivariate logistic regression, lack of awareness, illiteracy, and initial consultation with traditional healers were found to be independent predictors of diagnostic delay.

The adjusted odds ratio (AOR) showed that patients without awareness were **3.1 times** more likely to have diagnostic delay (AOR=3.1, 95% CI: 1.4–6.8, p=0.004). Similarly, those consulting traditional healers first were **2.7 times** more likely to experience delay (AOR=2.7, 95% CI: 1.1–6.5, p=0.02). Illiterate patients had a significantly increased likelihood of delay (AOR=2.2, 95% CI: 1.0–4.9, p=0.04).

The regression analysis is summarized in **Table 8**.

Table 8. Multivariate logistic regression analysis of predictors of diagnostic delay (>6 months)

Predictor	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
Lack of awareness	3.1	1.4 – 6.8	0.004*
Traditional healer as first contact	2.7	1.1 – 6.5	0.02*
Illiteracy	2.2	1.0 – 4.9	0.04*

*Statistically significant (p < 0.05)

Summary of Key Findings

Overall, **63.3%** of rural leprosy patients experienced diagnostic delay exceeding 6 months. Diagnostic delay was significantly associated with illiteracy and low socioeconomic status, inappropriate first healthcare contact such as traditional healers, lack of awareness, stigma concealment, and multibacillary leprosy. Logistic regression confirmed lack of awareness, illiteracy, and traditional healer consultation as independent predictors.

Discussion

The present study highlights that diagnostic delay in leprosy remains a major concern among rural populations. More than sixty percent of patients experienced a delay greater than six months, with a mean delay of 9.8 months. Similar findings have been reported in previous studies from endemic regions, where delays ranged from 6 to 18 months depending on healthcare access and awareness levels. [10, 11]

Illiteracy and low socioeconomic status were strongly associated with delayed diagnosis in the present study. Patients with limited education may fail to recognize early symptoms such as hypopigmented patches or sensory loss, resulting in prolonged self-neglect. Such associations have been consistently documented in earlier research, where low literacy correlated with poor health-seeking behaviour and delayed case detection. [12, 13]

The first point of healthcare contact plays a crucial role in determining diagnostic delay. In this study, individuals who consulted traditional healers experienced the highest delay. This reflects the continued reliance on indigenous or informal healthcare systems in rural communities. Similar findings have been observed in other Indian studies, where traditional healing practices were linked with delayed leprosy diagnosis and higher disability rates. [14, 15]

Lack of awareness about leprosy symptoms emerged as the strongest predictor of delay. Patients often misinterpret skin lesions as fungal infections or allergic disorders and do not seek specialist care until neurological symptoms or deformities develop. This lack of awareness has been widely described as a major obstacle to early diagnosis, particularly in endemic rural areas. [16]

Social stigma remains a persistent barrier. In the present study, stigma-related concealment was significantly associated with delayed diagnosis. Leprosy is still surrounded by misconceptions, resulting in fear of discrimination and isolation. Many patients hesitate to disclose symptoms due to concerns about marriage, employment, and social acceptance. Earlier studies have similarly highlighted stigma as a major determinant of diagnostic delay. [17, 18]

Multibacillary leprosy was more frequently observed among delayed cases. This is clinically important because multibacillary patients carry a higher bacterial load and contribute more significantly to transmission. Late diagnosis may therefore prolong community exposure and increase disease burden. Previous studies have also reported that diagnostic delay is strongly linked to multibacillary presentation and higher disability grades. [19, 20]

Multivariate analysis identified lack of awareness, initial consultation with traditional healers, and illiteracy as independent predictors of delay. These findings indicate that improving rural health literacy and strengthening early referral mechanisms can significantly reduce delay. National leprosy elimination strategies emphasize early case detection through community-based screening, health education campaigns, and integration of leprosy services into primary healthcare. [21, 22]

The findings of this study highlight the need for targeted awareness programmes focusing on early symptoms, reducing stigma, and encouraging early medical consultation. Training frontline health workers, ASHA workers, and primary care physicians can improve early detection and reduce disability burden. [23, 24] Community-based interventions such as active case detection and contact screening have shown promising outcomes in endemic regions and should be strengthened. [25]

Conclusion

Diagnostic delay in leprosy remains highly prevalent among rural populations. Illiteracy, low socioeconomic status, lack of symptom awareness, stigma, and inappropriate initial healthcare contact were major determinants. Strengthening community awareness, improving rural healthcare accessibility, and enhancing early referral systems are crucial to reducing diagnostic delay and preventing disability.

Limitations

This study was conducted in a single tertiary care centre with a limited sample size, which may restrict generalizability. Recall bias regarding onset of symptoms may have influenced the estimation of diagnostic delay. Additionally, the study did not assess long-term treatment outcomes or follow-up disability progression.

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