

Risk factors for disabilities among leprosy patients: A systematic review

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KEYWORDS

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ABSTRACT:

Background:Physical disability is the main sequelae of leprosy disease that leads to stigma, discrimination, socioeconomic and healthcare burden. The countries with the highest number of new leprosy cases every year are India, Brazil, Indonesia, and Bangladesh. More than half of all new cases of leprosy in the world are diagnosed in India. Considering this, National Strategic Plan (NSP) and Roadmap for leprosy was launched in January 2023, for zero transmission of leprosy by 2027. However, newly reported leprosy cases still have high incidence of disabilities due to multiple factors.

Methods and Materials: A total of 110 research articles were reviewed in the (PubMed, Google Scholar, Cochrane library, Academia, Open access, Directory of open access journals) databases by using the keywords “leprosy”, “disabilities”, risk factors”. Based on the inclusion and exclusion criteria studies were sorted out and 22 studies were selected for the main analysis. The present systematic review was conducted following published guidelines for reporting systematic reviews and meta-analysis (PRISMA).

Results:Most studies used cross-sectional research design and significant studies were retrospective record based. Maximum studies were from India. Sample size ranged from 55 to 22585 cases. Age, male gender, duration of disease, delayed diagnosis, multibacillary lepromatous type of leprosy, number of affected nerves and leprosy reactions were among the most evaluated risk factors.

Introduction:

In 2023, total 184 countries reported 182 815 new cases, of which 72 845 (39.8%) were among females and 10 322 (5.6%) were among children. Globally, 9 729 new cases with grade II disability were detected and 266 (2.7%) of them were among children. Most of the countries with high rates of detection of new cases are in WHO African and South-East Asia Regions. India has reported maximum number of new cases (107851) in 2022-23 which is 4032 higher compared to previous year. India has also reported 2335 new cases with grade II disability in 2022-23. Being the country with the most leprosy cases in the world, it has a significant healthcare burden for managing leprosy and its sequela. Currently the health department is working in line with National Strategic Plan (NSP) and Roadmap for leprosy (2023-27). It was launched on January, 30, 2023 by Government of India, for zero transmission of leprosy by 2027¹.

Leprosy presents itself as a public health problem due to the disabilities it causes and the costs associated with its management. The efficacy of the leprosy treatment and prevention program can be assessed by determining the prevalence of disability before and after treatment. India particularly has reported highest number of new cases and disabilities associated with them. Several demographic, environmental, socioeconomic, and clinical factors are responsible for the occurrence of disability amongst leprosy patients. Disability caused by leprosy often results in stigmatization and discrimination, leading to decreased social participation and quality of life. Hence, it is crucial to address the risk factors related to these disabilities. The risk of disability is multifactorial, including type of leprosy, duration of disease, number of affected nerves, leprosy reactions, gender, age, education, ethnicity, occupation as reported by various studies².

Globally, the prevalence of leprosy has decreased over the years, mainly due to the introduction and subsequent modification of the multidrug treatment (MDT). Despite the availability of effective MDT therapy, early diagnosis of the disease remains the most effective way to stop the transmission chain and avoid late diagnosis and its subsequent disabilities. However, until the risk factors are identified and assessed, the treatment outcomes cannot be improved, and new cases will continue to emerge. Studying the association of each risk factor—alone or associated—empowers policymakers, health professionals and

researchers in the implementation of preventive and curative strategies and would assist the leprosy programme officials to prioritize the interventions. We report here a systematic review to assess the clinical and sociodemographic factors associated with physical disability in leprosy.

The objectives of the current systematic review were

1. To understand the research methodology used in the various studies.
2. To find out the association between various risk factors and disability grades.
3. To understand the data analysis methods used in the studies.

Methods and Materials:

This study followed the published guidelines for reporting systematic reviews and meta-analysis (PRISMA). Institutional review board approval and informed consent were not required because all data were obtained from secondary data sources and data were deidentified.

Literature Search Strategy: we systematically searched the PubMed, Scopus, and Web of Science databases from July 7, 2024, to August 15, 2024, to identify studies published from February 8, 2010, to March 15, 2024, using the keywords leprosy and physical disability and related terms. The literature search was done by using national and international databases such as PubMed, Google Scholar, Cochrane library, Academia, Open Access, Science Direct and Directory of open. Google search engine was also used to explore the open access publications. The studies were then read in full for consideration for inclusion in the final analysis. Studies were included if (1) physical disability assessment was done using WHO leprosy disability grading; (2) the association between the clinical presentation and physical disability was assessed; and (3) the socio-demographic, clinical factors were described according to the presence or absence of physical disability. We excluded publications without original data, such as reviews and opinions and those with overlapping data.

We considered age, gender, clinical presentation categories, the presence of leprosy reactions, and the WHO leprosy classification stage as exposure factors. The WHO classification includes paucibacillary leprosy (≤ 5 skin lesions, only 1 affected nerve trunk, or both; or negative findings on microscopy), MB leprosy (> 5 skin lesions, more than 1 affected nerve trunk, or both; or positive findings on microscopy).¹⁵ Clinical forms include tuberculoid, borderline, lepromatous, and indeterminate presentations.¹⁶ Leprosy reactions include episodes characterized by the acute inflammation of skin lesions or nerves (type 1) and the appearance of inflamed cutaneous nodules with or without neuritis (type 2).¹⁷ Our primary outcome was physical disability according to the WHO disability classification.¹ In this classification, grade 0 indicates no sensory impairment or disability or damage to the eyes, hands, or feet; grade 1 indicates the presence of eye (visual acuity $> 6/60$ in either eye) or sensory impairment in the hands or feet, without visible deformities or damages; and grade 2 indicates severe visual impairment (visual acuity $< 6/60$ or inability to count fingers at 6m) or the presence of visible deformity in the eyes (lagophthalmos, iridocyclitis, or corneal opacities) or visible deformity or damage on hands or feet (i.e., ulcerations, traumatic injuries, resorption, claw, fallen hand, foot drop, or ankle contracture).

Inclusion Criteria

- Articles published in peer reviewed journals.
- Articles written in English language.
- Open access thesis available on databases.
- Articles & thesis published from February 2010 to March 2024.
- Quantitative studies.
- Experimental studies.

Exclusion Criteria

- Reviews and opinions.
- Duplication/lack of original data.

The primary literature search resulted in 140 documents. Duplicate and irrelevant articles were removed. 45 articles were selected for careful and complete reading. A total of 16 full text articles were selected for review.

Quality assessment –

Authors thoroughly evaluated the research according to the publication's title and abstract before deciding about further exploration of additional publications. All the suitable articles as per inclusion criterion were further evaluated as per the criteria set forth for the purpose of review. The articles were then included in the review depending on the findings of this evaluation. Same criteria were utilised in the process of selecting additional research articles for further assessment.

Results -

Our search strategy identified 145 articles. After screening titles and abstracts, 28 full-text articles were assessed for eligibility and 22 were included in the analysis (Fig.1). The table no.1 describes the characteristics of the studies included. Total 8 studies were cross-sectional, 8 were cohort, and 6 had case-control design. Almost all studies had retrospective, record-based approach. Only one study has prospective research design. Maximum 9 studies were from India, 5 were from Indonesia, 5 from Brazil, 2 from China and 1 from the country of Africa. Maximum sample size was noted in the studies from Brazil followed by studies from India. Total 5 studies had tertiary care research setting, 9 studies retrieved data from information system, 3 studies were hospital based, 4 were from primary health care setting, and one prospective study had community-based setting.

Discussion –

Studies have observed several socio-demographic and disease related clinical factors which were significantly associated with development of physical disabilities among leprosy patients.

Socio-demographic factors - Eight out of 22 studies have reported age as a prominent risk factor for the disabilities^{4,5,9,10,13,14,16,17,24}. High burden of disabilities was observed in the productive age group. Rest of the studies state that age was directly related to the disease duration, and due to chronic nature of leprosy the elderly population are prone for potential disability^{25,27}.

Male gender was reported as a significant risk factor for leprosy related disabilities by eight studies^{3,5,6,13,17,18,19,24}. This may be due to the lifestyle of men which exposes them to greater risk of infection. It was observed in previous studies that men often ignore the early symptoms and approach the health services at more advanced clinical stage of the disease^{26,27}.

Higher prevalence of disability was noted among manual workers than other professions^{3,8,14}. Leprosy patients suffer from loss of sensation and motor weakness in the affected limbs due to neurological involvement. This may increase their vulnerability towards burns, injuries etc. Disability can cause severe activity limitations, which may force them to change the occupation which demand low physical efforts or even stop working entirely^{27,28}.

Leprosy is associated with low socioeconomic status. It includes low levels of education and low income. This may be due to poor access to healthcare services. Such poor class individuals may not afford the cost of transport to healthcare services, special investigations, and treatment^{6,16,20}. Low socioeconomic status forces these people to reside in the high population zones, where there is increased risk of disease transmission due to overcrowding.

Low level of education has been reported as a risk factor by five studies^{12,13,15,16,22}. Due to low education levels these individuals may not understand the symptoms of the disease until late complications ensue. Treatment default can occur among these individuals due to underestimating the importance of continuing the proper treatment for specific time duration.

Ethnicity and specific geographic area location were reported as a risk factor by some studies^{17,18}. These were mainly non-endemic regions of the country. Lack of health infrastructure, scarcity of trained professionals, difficult access to health services were the barriers responsible for delayed diagnosis and monitoring leading to high prevalence of the disability.

Disease related clinical factors –

Significant correlation has been observed between the duration of disease and disability. A long duration of symptoms for a leprosy patient before seeking treatment has been a significant risk factor for disability among leprosy patients^{4,7,9,10}. Longer duration disease can worsen the nerve damage, sensory loss, and reversal reactions²⁹. Shorter the duration of active disease, minor the disability develops due to less involvement of nerves and other tissues. The control on medication and treatment compliance is also better in short term duration.

Multibacillary patients had significantly more disability than paucibacillary patients. The high bacillary load may lead to early and extensive nerve damage leading to disability. Untreated multibacillary cases increase the threat for disease transmission. This may indicate delayed diagnosis causing high bacillary load among untreated patients^{8,11,12,13,14,15,19,20,21,23}.

Leprosy reaction was associated with both grade 1 and grade 2 disability in leprosy^{7,11,13,15,17,19}. It occurs due to changes in the immune balance between the host and infectious agent which can accentuate the tissue damage and worsen the disability grade. Such reactions can occur before, during or after the multidrug therapy for leprosy. Hence the surveillance for disabilities should be continued even after completion of the treatment for early detection and prevention^{30,31}.

Nerve thickening or enlargement along with number of affected nerves and lesions are major risk factors for the development of disability^{7,11,12,13,23,24}. Higher number of affected and thick nerves is responsible for severe neuropathy causing more advanced grade of disability^{32,33}.

Delayed diagnosis was associated with development of severe form of disability. Most of the cases with registration delay present with the disability itself. Multiple socioeconomic, emotional, and economic factors are responsible for the registration delay. Such delay increases the bacillary load causing severe sensory and motor neural damage, further worsening the disability grade^{17,18,20,21,22,23,24}.

Inadequate and irregular treatment was associated with worsening of the disability grade. Multiple factors like low education status, access to information, access to healthcare facilities, limited working hours at health units, lack of transport facilities, can affect the compliance with the treatment. Treatment defaulters had more severe disabilities compared to regular treatment followers^{5,8,15}.

Physical disabilities are more common in lepromatous subtype of leprosy. This could be due to poor host immune response, compared to other types of leprosy. Sensory neuro deficit was predominantly noted in lepromatous type which increases the risk for trophic ulcers followed by deformities. Such pure neuritic type cases are missed in early stages due to atypical presentation. Classical hypopigmented, anaesthetic skin patches may not be present till late stage of the disease^{8,11,12,17,18,19,20}.

Conclusion –

Several socio-economic, individual, community and disease related risk factors were revealed in these studies. Health education to improve the health-related behaviour, targeting the high-risk groups is a need of an hour. Minimising the health service-related barriers and improving the active case detection will help to control the contribution of delayed diagnosis in worsening the disease condition. Ensuring timely treatment and compliance will further reduce the prevalence of disease related disabilities in long term.

Systematic Review of Risk factors for disabilities among leprosy patients (2010 to 2024)

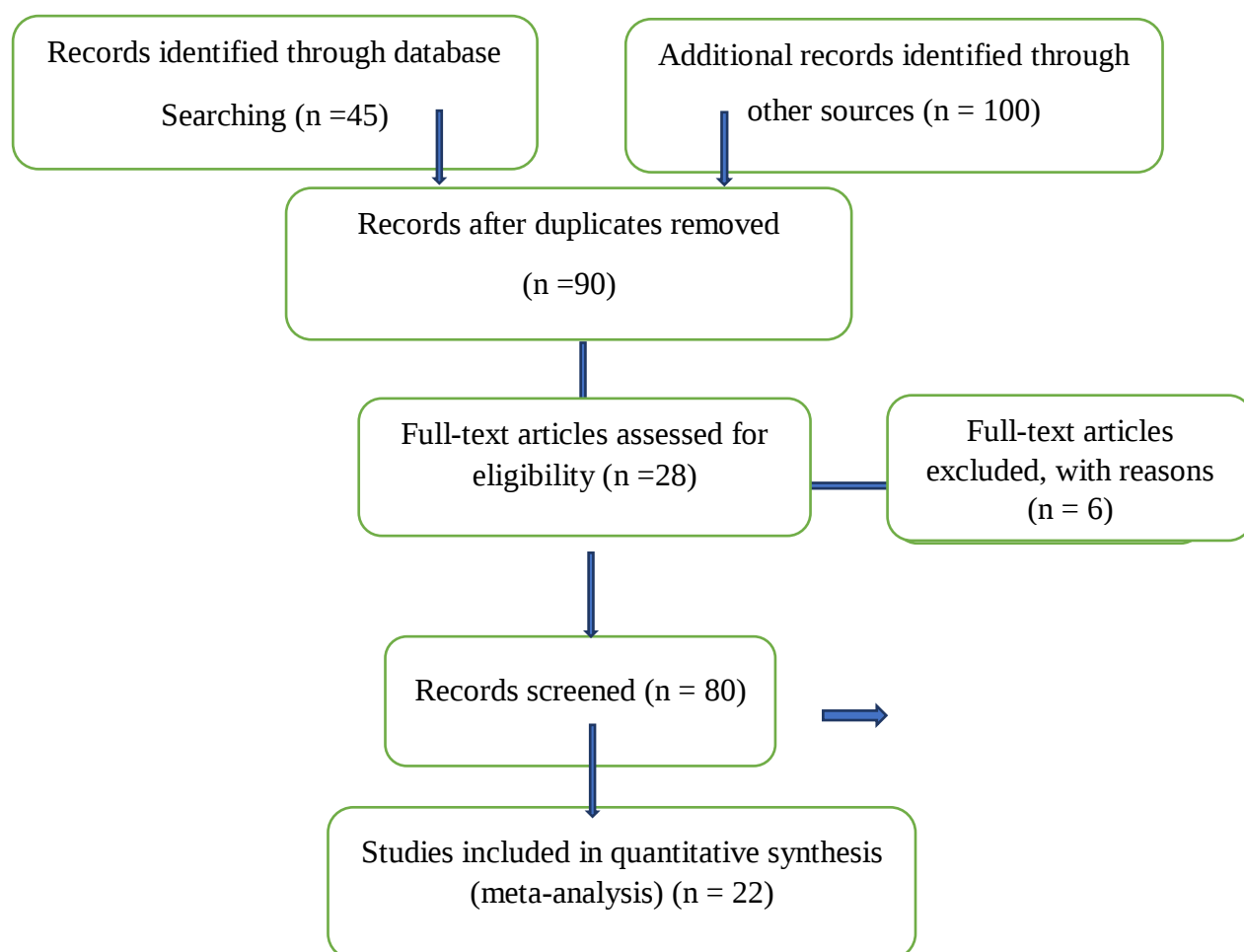


Figure-1- Systematic Review Flow Diagram.

Table- 1 Characteristics of Systematic Review Studies (2010-2024)							
SN	First author	Year	Country	Setting	Design	Sample size	Risk factors
3	Melani Marissa	2022	Indonesia	Tertiary health care	Cross-sectional	205	Male gender, employability
4	Silvani Geani	2022	Indonesia	Hospital	Cross-sectional	275	Age, duration of disease, MDT history
5	RK Wardhani	2020	Indonesia	Hospital	Cross-sectional	77	Age, male gender, treatment defaulters
6	Mannat Bhatia	2018	India	Information system	Retrospective	55	Male gender, socioeconomic status
7	Paula Samosir	2022	Indonesia	Primary health care	Cross-sectional	189	Nerve enlargement, leprosy reaction, duration of disease >2 years, symmetric lesion distribution
8	Jhuma Sarkar	2012	India	Tertiary health care	Cross-sectional	244	Neuritic type, MB leprosy, delayed treatment, occupation, no of lesions
9	Solomon Sisay Mulugeta	2022	Africa	Tertiary health care	Retrospective cohort	205	Age, duration of disease >2 years, sensory loss,
10	Umi Nadhiroh	2018	Indonesia	Hospital	Case-control	140	Age, poor self-care, duration of disease
11	Victor Santana Santos	2015	Brazil	Primary health care	Retrospective	2358	No of affected nerves, MB leprosy, leprosy reaction, lepromatous form
12	Cristiane Moschioni	2010	Brazil	Information system	Retrospective	19283	lepromatous form, >1 thickened nerve, MB leprosy, No formal education
13	Veras GCB	2020	Brazil	Information system	Case-control	1239	Age, Male gender, educational level, MB leprosy, >5 lesions, leprosy reaction, no of nerves affected
14	Srinivas G	2019	India	Primary	Case-control	1400	Age,

				health care			Occupation, MB leprosy, patient delay, HCP delay
15	Costa LG	2015	Brazil	Information system	Retrospective cohort	22585	Geography, MB leprosy, leprosy reaction, low education, irregular treatment
16	Priscilla Almeida	2021	Brazil	Information system	Cross sectional	603	Age, level of education, poor socioeconomic condition, MB leprosy
17	Xiaohua Chen	2021	China	Information system	Retrospective	3402	Delayed diagnosis, nerve damage, no skin lesions, WHO and Ridley-Jopling classifications, leprosy reactions, advanced age, rural occupation, Han ethnicity, and male gender
18	Si-Yu Longa	2021	China	Tertiary health care	Prospective case-control	644	Delayed diagnosis. Lepromatous type, Malegender, ethnicity, Weighted genetic risk score
19	A Williams	2019	India	Information system	Retrospective	139	Male gender, MB leprosy, positive skin smear, leprosy reaction, lepromatous type
20	S Saha	2021	India	Tertiary health care	Cross-sectional	81	MB leprosy, Neuritic type, delayed diagnosis, low socioeconomic status
21	Shrinivas G	2022	India	Information system	Retrospective Case-control	140	Delayed diagnosis, MB leprosy
22	Karotia D	2022	India	Primary health care	Retrospective Case-control	448	low education level, delayed diagnosis,

							accessibility to healthcare system
23	B. Upputuri	2022	India	Information system	Retrospective Cross-sectional	79	Delayed diagnosis, MB leprosy, nerve thickening, neuritis
24	Anil Kumar	2012	India	Community	Prospective cohort	205	Age, male gender, delayed diagnosis, >3 nerve involvement, thickened nerves

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