

Disability Adjusted Life Years (DALYs) of Persons affected by Leprosy in Bangladesh

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Abstract:

Background: Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. Globally 2,10,671 cases were detected in 2017 with an incidence of 2.77 per 1,00,000 population. Though Bangladesh achieved national elimination of leprosy in 1998, 3,754 new cases were detected in 2017 and 3,729 in 2018. The prevalence of disability due to leprosy among adults was 45.35 per 1,00,000 population in an endemic area of Bangladesh. Disability-Adjusted Life Years (DALYs) have been accepted as a useful method to estimate the burden of disease. This study was designed to find out the DALYs of leprosy affected persons living with disabilities in Bangladesh.

Materials and Methods: This cross sectional descriptive type of observational study was conducted in 12 districts of 4 administrative divisions of Bangladesh during the period from July 2019 to June 2020 among 64 persons affected by leprosy living with disability who were ever registered to any Tuberculosis and Leprosy clinics. Data were collected by face to face interview of the selected patients with leprosy using a pretested, semi-structured case record form. Data were input and analyzed in SPSS. DALYs were calculated using the following formulas: $DALYs = \text{Years lost to disability (YLD)} + \text{Years of lost life (YLL)}$; $YLD = \text{Duration of disease with disability} \times \text{disability weight (no mortality)}$; $YLL = \text{Duration from death to life expectancy} \times \text{disability weight (mortality)}$. Disability weight for leprosy cases was considered as 0.152. Ethical clearance was obtained from the Institutional Review Board of Mymensingh Medical College, Bangladesh.

Results: The results of the study revealed that among the respondents majority (57, 89.1%) were in the age group of 31-70 years. Mean age of persons affected with leprosy was 51.5 years with a standard deviation of 14.8 years. Among the respondents (44, 68.8%) were male and the remaining 20 (31.3%) were female. More than two third (43 (67.2%)) of the patients with leprosy had disability on diagnosis. Calculated minimum DALYs was 0.46 years and maximum was 9.69 years. Range of DALYs was 9.23 years. Mean of DALYs was 5.64 years with a standard deviation of 2.28 years. Mean DALYs of Rangpur division was 6.22 ± 1.94 years followed by 6.08 ± 2.17 years in Mymensingh division, 5.22 ± 2.54 years in Khulna division and 5.19 ± 2.38 years in Sylhet division. Difference in DALYs among divisions was not statistically significant ($p > 0.05$). DALYs were highest in the age group of 1-20 years and lowest in the age group of 71-80 years. It was found that the less the age, the more the DALY is and vice versa. Difference of DALYs among different age groups was statistically significant ($p < 0.05$). Mean DALYs of male was 5.35 ± 2.29 years and that of female was 6.29 ± 2.18 years. In this study sex difference DALYs was not statistically significant ($p > 0.05$).

Conclusion: Average DALYs of leprosy in Bangladesh was 5.64 ± 2.28 years. More than two third (67.2%) of the patients had disability on diagnosis. Despite free availability of MDT of leprosy, many patients make delay to start treatment until visible disabilities appear and become unable to perform normal work.

Key Word: Disability-Adjusted Life Years (DALYs), Leprosy, Bangladesh.

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I. Introduction

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. The disease affects peripheral nerves, skin, mucosa of upper respiratory tract, muscles, eyes, bones, testes and internal organs. It is a very ancient disease. It was recognized in the oldest civilizations of China, Egypt and India¹. Globally 2,10,671 cases were detected in 2017 with an incidence of 2.77 per 1,00,000 population². Among the cases 1,53,487 were from the South East Asian countries with an incidence of 7.72 per 1,00,000 population². Though Bangladesh achieved national elimination of leprosy in 1998, 3,754 new cases were detected in 2017² and 3,729 in 2018³.

Invasion of Schwann cells by *Mycobacterium leprae* and subsequent immunological reaction results in damage to peripheral nerve⁴. Limitation of physical activities and often social participation in people affected by leprosy occurs mainly due to damage to ulnar, median, posterior tibial, facial, lateral popliteal, trigeminal and radial nerves⁵. Loss of sensory function is because of repeated injury, ulceration and shortening of limb. Loss of corneal sensation results from unrecognized corneal injury and significant loss of vision. Loss of motor function leads to finger and toe clawing; foot and wrist drop and failure of eye closure or lagophthalmos⁶. Leprosy reaction (LR) is also a major cause of morbidity, disability and deformity in persons affected by leprosy. LR can occur before, during and after multidrug therapy (MDT). LR is often difficult to manage in patients having severe reactions⁷. Though MDT shortened the duration of therapy, the patients with leprosy are still in the danger of developing LR because MDT can only kill bacteria but it cannot remove all bacterial fragments from the body⁸. Unfortunately, persons affected by leprosy remain at risk of neuropathy resulting from LR during and even after successful MDT⁹⁻¹⁶.

Disability due to leprosy is often persists lifelong. Estimation of burden of leprosy in a community based on registered leprosy cases can help determining the number of disabled people in the community requiring support services¹⁷. Proportion of visible physical impairment (WHO Grade 2 disability) among newly affected persons with leprosy in Bangladesh was about 9% in 2003⁶. The accumulated prevalence of disability as a result of leprosy among adults was 45.35 per 100000 population of a previously highly endemic area of Bangladesh¹⁷.

Bangladesh retains a specialist arm to leprosy and tuberculosis control. The health authority of Bangladesh encourage active role by Non-Government Organizations (NGOs) in controlling leprosy. NGOs are primarily responsible diagnosis, treatment and care for about 75% of new leprosy cases since 1995. The leprosy Mission International Bangladesh care for 50%, over 4000 new cases annually¹⁸. There is no exact data regarding the burden of leprosy in Bangladesh. Disability-Adjusted Life Years (DALYs) have been accepted as a useful method to estimate the burden of disease¹⁹. This study was designed to find out the disability adjusted life years of leprosy affected persons living with disabilities in Bangladesh. The study results will help the clinicians and policy makers to strengthen leprosy control in Bangladesh and to prevent re-emergence of leprosy as well.

II. Material And Methods

Study design: This was a cross sectional descriptive type of observational study.

Study place: The study was conducted in 12 districts of 4 administrative divisions of Bangladesh.

Duration of study: The study was conducted during the period of one year from July 2019 to June 2020.

Study population: Leprosy patients with disability who were ever registered to Tuberculosis and Leprosy clinics run by GOB & NGOs.

Sample size and its determination:

Calculation of sample size: Guilford &Frucher Formula

Sample size, $n = z^2pq/d^2$

Here, z = Critical value of alpha at 5% significant level (1.96)

p = Proportion of disability due to leprosy (0.04535% = 0.0004535)17

q = Proportion of non-disable leprosy affected persons (1- p = 0.9995465)

d = Acceptable margin of error (1% = 0.01)

So, $n = (1.96)^2 \times 0.0004535 \times 0.9995465 / (0.01)^2$

$= 3.8416 \times 0.0004535 \times 0.9995465 / 0.0001$

$= 0.00174137553 / 0.0001$

$= 17.4137553$

$= 18$ (minimum sample size)

Ultimately 64 persons with leprosy and disability were included in the study from 12 districts of 4 administrative divisions of Bangladesh.

Sampling technique: Sylhet, Mymensingh, Rangpur and Khulna divisions were selected purposively. From these 4 administrative divisions, 12 district namely- Sylhet, Moulvibazar, Sunamganj, Habiganj, Mymensingh, Sherpur, Nilphamary, Rangpur, Dinajpur, Kurigram, Meherpur and Kustia were selected purposively.

Data collection instrument: A semi-structured case record form was developed, pre-tested in Sirajganj district and finalized accordingly for collection of data.

Data collection procedures: Data were collected by face to face interview of the selected patients with leprosy living with disability and who were ever registered to Tuberculosis and Leprosy Clinics of selected districts.

Calculation of DALYs:

DALYs = Years lost to disability (YLD) + Years of lost life (YLL)

YLD = Duration of disease with disability X Disability weight (no mortality)

YLL = Duration from death to life expectancy X Disability weight (mortality)

Disability weight for leprosy (WHO GBD, 1990, 2004; Mathers et al, 2007):

Cases without disability: 0.00

Cases with disability: 0.152

Died cases (DW mortality): 1.00

Data editing, processing, analysis and presentation: Filled in checklist or data collection sheet were checked for incompleteness, duplication and inconsistency and manage accordingly. Finally collected data were input into SPSS version 22.0. Qualitative variables were summarized by percentage and quantitative variables were summarized by mean & standard deviation. Necessary bivariate & multivariate analysis were done. At the end of analysis data were presented in tables, graphs and texts.

Ethical considerations: No physical or psychological risk was associated with the study. Informed written consent from the participants was taken prior to interview. Permission from the concerned authorities was obtained prior conducting the study. Ethical clearance was obtained from the IRB of Mymensingh Medical College, Bangladesh (Memo no. MMC/IRB/2019/143; Dated: 18.06.2019).

III. Result

The study was conducted among 64 persons affected by leprosy and living with disability, from 12 districts of 4 administrative divisions of Bangladesh. Respondents from 12 districts of 4 administrative divisions were included in the study. Among the respondents each 18 (28.1%) respondents were from Sylhet and Mymensingh divisions; 16 (25.0%) were from Khulna and 12 (18.8%) were from Rangpur division (Table 1).

Table no 1: District wise distribution of persons affected by leprosy (n=64)

Name of the Division	Name of the district	Frequency	Percent (%)
Sylhet	Sylhet	7	10.9
	Moulvibazar	6	9.4
	Sunamganj	3	4.7
	Habiganj	2	3.1
	Total	18	28.1
Mymensingh	Mymensingh	17	26.6
	Sherpur	1	1.6
	Total	18	28.1
Khulna	Meherpur	9	14.1
	Kustia	7	10.9
	Total	16	25.0
Rangpur	Nilphamary	7	10.9
	Rangpur	3	4.7
	Dinajpur	1	1.6
	Kurigram	1	1.6
	Total	12	18.8
Grand total		64	100.0

Regarding age of the respondents, majority (57, 89.1%) were in the age group of 31-70 years. Each 3 (4.7%) respondents were from the age group of 11-20 years and 71-80 years. Mean age of persons affected with leprosy was 51.5 years with a standard deviation of 14.8 years (Table 2). Among the respondents majority were male (44, 68.8%) and the remaining 20 (31.3%) were female (Figure 1).

Table no 2: Age* distribution of persons affected by leprosy (n=64)

Age group	Frequency	Percent (%)
11-20	3	4.7
21-30	1	1.6
31-40	14	21.9
41-50	11	17.2

Disability Adjusted Life Years (DALYs) of Persons affected by Leprosy in Bangladesh

51-60	17	26.6
61-70	15	23.4
71-80	3	4.7
Total	64	100.0

*Mean±SD = 51.5±14.8 years

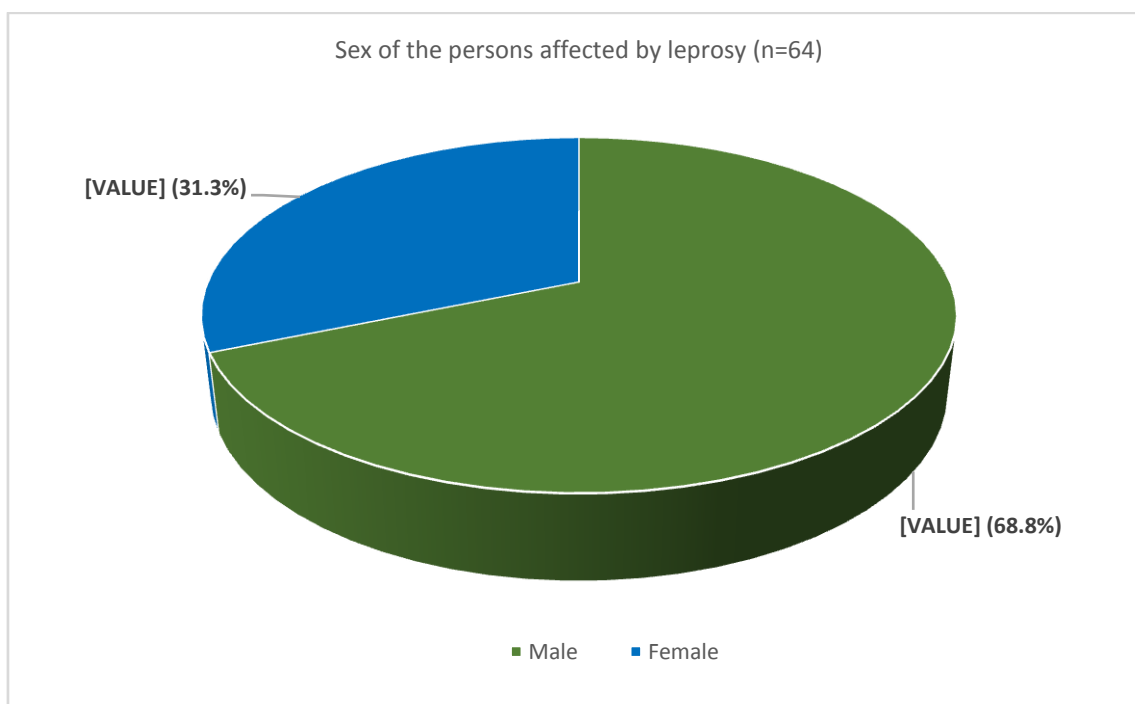


Figure no 1: Pie diagram showing sex distribution of persons affected by leprosy (n=64)

Table no 3: DALYs* of leprosy affected persons (n=64)

Statistics	DALYs
Minimum	0.46
Maximum	9.69
Range	9.23
Mean	5.64
Standard deviation	2.28

*Mean±SD = 5.64±2.28 DALYs

Calculated minimum DALY was 0.46 years and maximum was 9.69 years. Range of DALY was 9.23 years. Mean of DALYs was 5.64 years with a standard deviation of 2.28 years (Table 3).

Table no 4: Comparison of DALYs of different administrative divisions (n=64)

Name of the Division	Frequency	DALYs mean±SD	P (ANOVA)
Sylhet	18	5.19±2.38	0.452
Mymensingh	18	6.08±2.17	
Khulna	16	5.22±2.54	
Rangpur	12	6.22±1.94	
Total	64	5.64±2.28	

Table 4 showed DALYs of different administrative divisions of Bangladesh. Average DALY of Rangpur division was 6.22±1.94 years followed by 6.08±2.17 years in Mymensingh division, 5.22±2.54 years in Khulna division and 5.19±2.38 years in Sylhet division. Difference in DALYs among divisions was not statistically significant (p>0.05).

Table no 5: DALYs of different age groups (n=64)

Age group	Frequency	DALYs mean±SD	P (ANOVA)
11-20	3	9.13±0.62	0.003
21-30	1	8.93±0.00	
31-40	14	6.71±1.50	
41-50	11	5.72±1.28	
51-60	17	5.22±2.11	
61-70	15	4.53±2.60	
71-80	3	3.83±3.19	
Total	64	5.64±2.28	

Table 5 showed average DALYs of different age group of patients with leprosy. DALY was highest in the age group of 1-20 years and lowest in the age group of 71-80 years. It was found that the less the age, the more the DALY is and vice versa. Difference of DALYs among different age groups was statistically significant (p<0.05).

Table no 6: DALYs and sex of the persons affected by leprosy (n=64)

Sex	Frequency	DALYs mean±SD	P (ANOVA)
Male	44	5.35±2.29	0.129
Female	20	6.29±2.18	
Total	64	5.64±2.28	

Mean DALYs of male was 5.35±2.29 years and that of female was 6.29±2.18 years. In this study sex difference DALYs was not statistically significant (p>0.05) (Table 6).

IV. Discussion

Assessment of burden of disease by either morbidity rates or mortality rates for individual disease may result in different conclusions. Summary health measures, combining morbidity and mortality, may give better insight in the true burden of chronic diseases. The World Health Organization and the World Bank developed such a complete measure called Disability-Adjusted Life Years (DALYs)²⁰⁻²¹. DALYs were used to define how many DALYs were attributable to several lifestyle factors²². DALYs are also used in risk-benefit assessments and economic evaluations²³⁻²⁵. DALYs were used in this study to find out the burden of leprosy.

This study estimated the DALYs of leprosy affected persons living with disability in Bangladesh. The study results revealed that average DALYs of leprosy in Bangladesh is 5.64 years. A study conducted in 2015 found DALYs of Leprosy of 195 countries was 0.04 years²⁶. Global DALYs of leprosy during 1990-2016 was 31.6 years²⁷. Colin et al. (2007) found global DALYs of leprosy was 14.65 years²⁸. A study conducted in Brazil in 2016 found DALYs of leprosy as 2.02 years²⁹. DALYs varied widely from time to time and country to country.

V. Conclusion

The findings of the revealed that average DALYs of leprosy in Bangladesh is 5.64±2.28 years. More than two third (67.2%) of the patients had disability on diagnosis. Despite free availability of MDT of leprosy, many patients make delay to start treatment until visible disabilities appear and become unable to perform normal work.

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