

Burden of Leprosy Patients at Post-Elimination Stage: Evidence from Bangladesh

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Abstract: *Introduction:* There has been a marked decline in the prevalence rate of leprosy in Bangladesh, but understanding the current magnitude is important for both the service providers and the community. Therefore, the present study is undertaken to describe the pattern and prevalence of leprosy at post-elimination stage.

Materials and Methods: This is a descriptive retrospective cross-sectional study carried out using the register records of patients attending the leprosy clinic in Chittagong Medical College Hospital (CMCH) during the period 2004 and 2019.

Results: Among a total of 865 patients, males 631 (72.95%) outnumbered females 234 (27.05%). There were 259 (29.59%) paucibacillary (PB) and 606 (70.05%) multibacillary (MB) cases. Smear positive cases were only 218 (25.20%). Of the 865 patients, 515 (59.54%) were BT, which was higher compared to other forms of leprosy. Four age groups were computed. The calculated age-specific cumulative detection rates showed that the highest case detection was in 26- 40 years group 324 (37.46%) patients. A total of 388 (44.87%) patients developed leprosy reactions and 149 (17.22%) patients presented with grade 2 deformities. The LR's comprised of 212 (24.50%) Type 1 Reaction, 74 (8.55%) Type 2 Reaction and 102 (11.79%) neuritis patients. From all, 865 new leprosy patients only 115 (13.29%) had presented with limb deformity, 61 (7.05%) had a trophic ulcer and 29 (3.35%) patients presented with ocular complication. Among the 115 (13.29%) patients with limb deformity 75 (8.67%) had a claw hand followed by foot drop 20 (2.31%), wrist drop 17 (1.96%) and nerve abscess 3 (0.35%).

Conclusions: The study shows that new case detection rate is declining but burden of leprosy in the community has not changed significantly. MB (70.05%) patients with grade 2 deformities (17.22%) are still high. Although leprosy has been eliminated globally on paper, the disease continues to be significant cause of peripheral neuropathy, deformity, disability and disfigurement in some developing countries like Bangladesh.

Keywords: Leprosy, Reactions, Deformity, Chittagong, Bangladesh.

INTRODUCTION

Leprosy or Hansen's disease (HD) is a slowly progressive and infectious disease caused by *Mycobacterium leprae*, which may be very mutilating if not diagnosed and treated early. Cutaneous lesions and involvement of the peripheral nerves are the cardinal signs of leprosy [1, 2]. Nerve damage in leprosy is associated with physical disability, deformity, psychological disturbances, economic dependence and social exclusion [3-9].

Bangladesh has achieved elimination of leprosy at national level at the end of December 1998 and sustaining elimination level with gradual decreasing of prevalence rate [10]. Periodic epidemiological evaluation of any disease is an important public health activity and it enables us to understand the trend of the

disease under natural conditions or following interventions [11, 12]. There has been a marked decline in the prevalence rate of leprosy in Bangladesh, but understanding the current magnitude is important for both the service providers and the community. Therefore, the present study is undertaken to describe the pattern, the prevalence of HD after leprosy has been declared eliminated in the year 1998.

MATERIALS AND METHODS

Study Design and Setting

The present investigation is a descriptive retrospective cross-sectional study carried out using the register records of patients attending the leprosy clinic in Chittagong Medical College Hospital (CMCH) during the period 2004 and 2019. CMCH is the oldest tertiary care teaching hospital of the country. The leprosy clinic of CMCH caters for the patients from the Chittagong city as well as from neighboring districts

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and Multi drug therapy (MDT) is available at the leprosy clinic of CMCH. The patients' cards were studied and the following clinical data were recorded: age, sex, clinical type of leprosy according to Ridley and Jopling classification [13], World Health Organization (WHO) classification for treatment, leprosy reactions (LRs), smear positivity with bacterial index (BI) and deformity status.

Diagnostic Procedures

The diagnosis was made by a specialist based on clinical history, physical examination and laboratory investigations including biopsy for histopathology. After the diagnosis of leprosy the patient was categorized either as paucibacillary (PB) or multibacillary (MB). The patient was classified as PB if he or she had ≤ 5 skin patches with or without 1 to 2 thickened major peripheral nerves. Patients with ≥ 6 patches and/or > 2 thickened nerves and those with infiltrations with or without papules or nodules and smear positive were classified MB.

LRs were assessed as Type 1 reaction (T1R), Type 2 reaction (T2R) and neuritis. Reversal reaction (RR) or T1R was diagnosed if the patient had redness and swelling of (already existing) lesions or the appearance of a few erythematous or hypochromic lesions close to the existing lesions or at distant sites, with or without tenderness of lesions, nerve thickenings, edema in the hands and feet or face and /or diffuse cutaneous hyperesthesia. Erythema nodosum leprosum (ENL) or T2R was diagnosed if a patient developed multiple usually small, tender, evanescent nodules, with or without ulceration which were usually associated with constitutional symptoms, such as fever, asthenia, nerve thickening and pain, myalgia and lymphadenitis. Another category was termed as neuritis within lepra reaction group. Neuritis was designed for some cases, where reaction not occurred within skin patches but reaction was within the nerves presented as spontaneous pain (shooting, tingling or burning) or tenderness of nerves with nerve function impairment (NFI). NFI is defined as any reduction in sensory or motor function and the detection of NFI is done clinically. Graded Semmes-Weinstein monofilaments (or a ball point-pen) are used to detect sensory loss. Voluntary muscle testing (VMT) is used to assess motor nerve function.

Face, eyes, hands and feet were examined for any visible deformities. The WHO classification of physical disability in leprosy is defined in 3 categories [14]:

- 1) No disability (no anesthesia) and no visible deformity or damage to the eyes, hands or feet (Grade 0);
- 2) Only disability (anesthesia, but no visible deformity or damage to the eyes, hands or feet) (Grade 1); and
- 3) Visible deformity or damage to the eyes (lagophthalmos, iridocyclitis, corneal opacities, severe visual impairment), hands (claw hands, ulcers, absorption of the digits, thumb-web contracture and swollen hand), feet (plantar ulcers, foot-drop, inversion of the foot, clawing of the toes, absorption of the toes, collapsed foot and callosities) (Grade 2).

The ulcers in leprosy patients are categorized as 1) Primary ulcers or specific ulcers and 2) Secondary ulcers or non-specific ulcers. Primary ulcer was defined as which was caused by *Mycobacterium leprae* and contain *M. leprae*. Secondary ulcer was classified as which was not caused by *M. leprae* but by an injuries.

Case Detection

Mode of detection was categorized as active and passive. Active detection meant found by household survey done by health workers of National Leprosy Program (NLP) and passive detection meant that they were either referred by physicians or voluntary reporting by the leprosy patients themselves. The NLP workers usually carry out the contact tracing (at least 40 household survey) in the area where a new case was detected.

A new case was defined as one "who had not been diagnosed earlier and had no history of treatment for leprosy in the past". Slit skin smear (SSS) were done to define positive or smear negative cases. Smear positivity was always labeled as MB.

Relapses were diagnosed by supportive information such as clinical course, mode of onset, site of lesions, accompaniment of systemic features, changes (by bacterial test and biopsy) in BI and treatment status if necessary.

Treatment Protocol

All the newly detected patients were put on WHO recommended MDT (dapsone, rifampicin, clofazimine) according to type of disease, 6 months for PB (rifampicin + dapsone), 12 months for MB (rifampicin +

dapsone + clofazimine). T1R, including neuritis was treated mainly with a standard 12 week course of steroids as recommended by WHO with a starting dose of 40mg/day. T2R was mainly treated with the same dose of 40mg/day of prednisolone in a tapering regime.

Exclusion Criteria

Patients with deformities of some other known cause.

Statistical Analysis

Age and gender were analyzed separately. Period prevalence and new case detection rate (NCDR) were computed per 10,000 populations. The data were filed and processed using Microsoft Excel software, 2007 version. Data were presented by table, bar diagram and line chart accordingly.

Ethical Adherence

The study was approved by our institute's ethics committee.

RESULTS

The mode of case detection was active in 73 (8.44%) patients and 792 (91.56%) were passive. Among a total of 865 patients, males 631 (72.95%) outnumbered females 234 (27.05%). There were 259 (29.59%) PB patients and 606 (70.05%) MB patients. Smear positive cases were only 218 (25.20%) (Table 1). Of the 865 patients, 515 (59.54%) were BT, which was higher compared to other forms of leprosy (Table 2). Four age groups were computed. The calculated age-specific cumulative detection rates showed that the highest case detection was in 26- 40 years group 324 (37.46%) patients. A total of 388 (44.87%) patients developed leprosy reactions and 149 (17.22%) patients presented with grade 2 deformities. The LRs comprised of 212 (24.50%) T1R, 74 (8.55%) T2R and 102 (11.79%) neuritis cases (Table 1). From all, 865 new leprosy patients only 115 (13.29%) had presented with limb deformity, 61 (7.05%) had a trophic ulcer and 29 (3.35%) patients presented with ocular complication. Among the 115 (13.29%) patients with limb deformity 75 (8.67%) had a claw hand followed by foot drop 20

Table 1: Patients Characteristics (n=865)

Year	New case	Types of Patients		Sex		Mode of Detection		Deformity		Smear Positive	Reactions		
		PB	MB	Male	Female	Active	Passive	Grade 1	Grade 2		RR	ENL	Neuritis
2004	94	46	48	63	31	10	84	11	12	24	21	4	11
2005	65	28	37	50	15	6	59	6	12	8	17	1	8
2006	82	42	40	57	25	9	73	7	12	11	24	2	6
2007	78	28	50	59	19	7	71	9	7	15	18	7	13
2008	81	19	62	54	27	8	73	21	11	11	16	7	10
2009	93	23	70	71	22	7	86	16	21	19	20	9	9
2010	73	25	48	55	18	6	67	7	18	10	20	3	16
2011	27	5	22	22	5	2	25	3	3	12	9	4	4
2012	50	9	41	32	18	1	49	6	15	12	16	6	3
2013	28	6	22	25	3	1	27	5	8	14	5	6	5
2014	25	5	20	18	7	4	21	3	4	12	6	3	3
2015	22	3	19	17	5	1	21	4	4	7	11	1	1
2016	36	8	28	26	10	5	31	10	3	18	6	5	4
2017	29	4	25	25	4	1	28	6	2	10	9	3	4
2018	49	4	45	31	18	3	46	8	10	20	9	6	2
2019	33	4	29	26	7	2	31	8	7	15	5	7	3
Total	865	259	606	631	234	73	792	130	149	218	212	74	102
Percentage	100	29.95	70.05	72.95	27.05	8.44	91.56	15.02	17.22	25.20	24.50	8.55	11.79

Table 2: Distribution of Patients According to Type of Leprosy

Year	Clinical type of leprosy						Total patient
	TT	BT	BB	BL	LL	PN	
2004	2	66	5	5	10	6	94
2005	2	39	2	10	6	6	65
2006	3	58	3	9	7	2	82
2007	1	53	0	8	10	6	78
2008	1	52	0	8	16	4	81
2009	3	47	0	16	15	12	93
2010	5	51	0	6	4	7	73
2011	2	11	0	7	7	0	77
2012	4	26	1	10	5	4	50
2013	0	14	1	5	6	2	28
2014	3	11	0	5	5	1	25
2015	1	13	0	4	4	0	22
2016	0	20	0	8	6	2	36
2017	0	18	0	3	8	0	29
2018	3	22	2	7	13	2	49
2019	1	14	1	6	10	1	33
Total	31	515	15	117	132	55	865
Percentage	3.59	59.54	1.73	13.52	15.26	6.36	100

TT= Tuberculoid, BT= Borderline tuberculoid, BB= Borderline, BL= Borderline lepromatous, LL= Lepromatous, PN= Pure neural.

Table 3: Distribution of Deformities (n= 865)

Deformity	Presentation	Frequency	Percentage
Limb deformity	Claw hand	75	8.67
	Wrist drop	17	1.96
	Foot drop	20	2.31
	Nerve abscess	3	0.35
Ocular complications	Lagophthalmos	7	0.80
	Keratitis	8	0.92
	Pain or discomfort	7	0.80
	photophobia	7	0.80
Ulcers	Primary ulcer	30	3.49
	Secondary ulcer	31	3.58

(2.31%), wrist drop 17 (1.96%) and nerve abscess 3 (0.35%) (Table 3).

DISCUSSION

The aim of this study was to find out the pattern, prevalence and complications of leprosy patients in the post-elimination era. For understanding the current magnitude of the problem will be helpful in redesigning

NLP and to reduce the deformity rate among the newly detected leprosy patients. We carefully went through the registered records of patients. The results of the study were analyzed and compared with other previous studies.

There was male preponderance with a male: female sex ratio of 2.70:1. This is similar to Indian studies where Mangala HC *et al.* reported males 63.71%, females 36.28% and Sankar A *et al.* found male 69%,

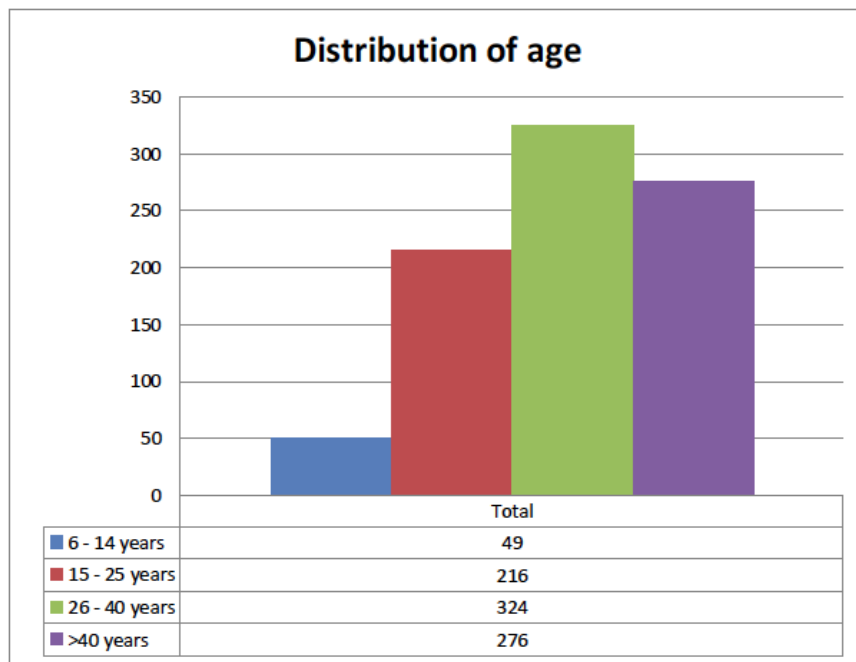


Figure 1: Distribution of age of leprosy patients (n=865).

females 31% [15, 16]. This is explained by the assumption that women in general are poorly represented in hospital statistics due to socioeconomic and cultural difficulties. If this is true the lack of recruitment of women is a cause for concern. The majority of patients 324 (37.46%) were in 26- 40 years group (Figure 1). Two Indian studies reported that the majority of their patients were in the 31-40 years group [15, 16]. The incidence was found to be increase with age. This may be related to the actual prevalence of the disease, to the length of exposure to *M. leprae* before diagnosis, thus the time before diagnosis.

Of the patients 141 (17.87%) were Slit Skin Smear (SSS) positive. Skin smears were mostly taken from 3 or 4 sites, tested as per standard procedure and positive smears were graded as per Ridley scale [13]. The observation on smear positivity, type of leprosy points at the persisting infection pool. Leprosy problem of urban pockets which indicate the persisting infection pool can be detected only by the smear report. But the role of direct smears may be more beneficial in determining the spectrum of disease and degree of infectiousness, especially in those patients with a positive nasal smear, in addition to its role in mass leprosy control programs [17].

The new case detection rate is declining (Figures 2, 3). It is alarming to note that MB cases are increasing than PB. MB percentage is more among new cases, also reported in Indian study of Norman G *et al.* where

MB cases are 131.3/10,000 in comparison to PB are 41/10,000 [18]. Other studies also support these findings [19, 20]. The possible explanation for increasing MB cases with grade 2 deformities are due to long incubation period of leprosy, transmission by sub clinical cases and delayed in diagnosis. Diagnostic delay is possibly due to lack of awareness among the community for voluntary reporting, social stigma and lack of field staff and lack of coordination among the service providers and the community. Anil Kumar *et al.* has opined that any delay in detection or reporting of these cases could have resulted in the disease progressing to MB type and or increased occurrence of deformities in a proportion of cases [19]. The higher proportion of MB cases alerts to the possible increase in patients in the future as a result of continuous transmission of the disease. Findings ways and research into reducing transmission of leprosy and prevention of nerve damage is essential [1].

In all, 865 leprosy patients 149 (17.22%) patients had a grade 2 deformity. Common limb deformity was 75 (8.67%) had claw hand. Indian studies reported also the claw hand highest 32.74%, 38% and 60% [21, 22]. The high prevalence of deformities may reflect a failure of the leprosy services to detect new patients timely, inadequate patient management due to resource constrains and patient's non-compliance to MDT also. There may be a delay in seeking treatment and even after identifying symptoms due to lack of health education and hygiene and sometimes the patients rely

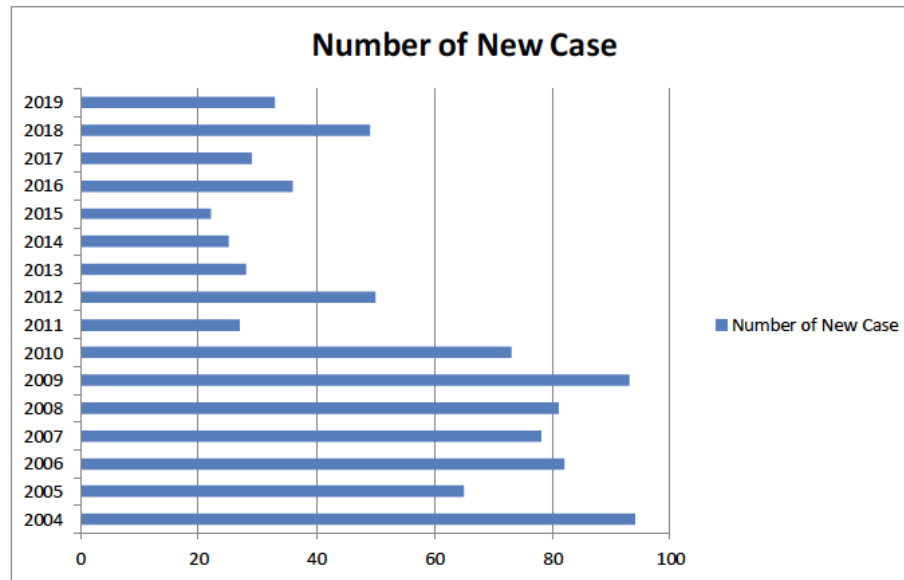


Figure 2: Year-wise distribution of new patients (n= 865).

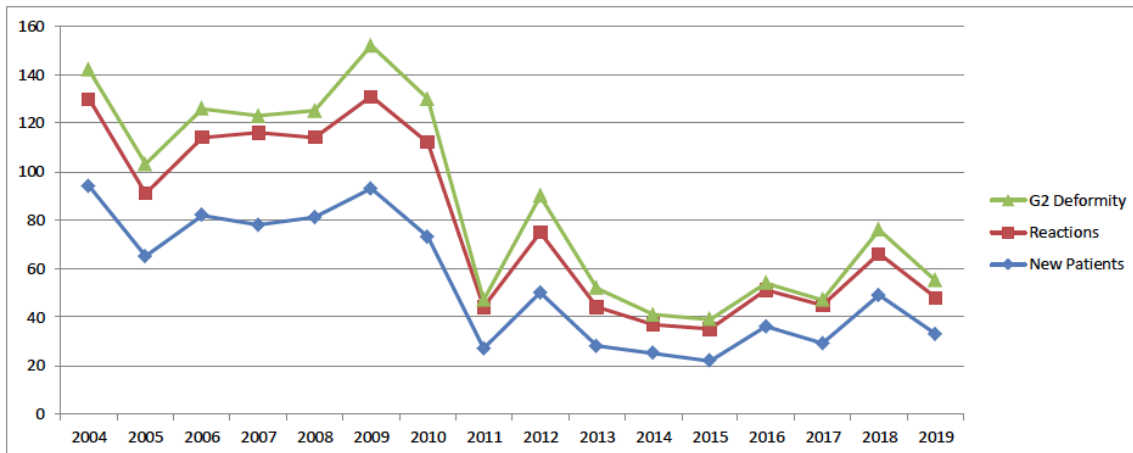


Figure 3: Year-wise trends in new patients, reactions and grade 2 deformities (n= 865).

on non-medical, herbal and traditional healers. Most of the patients belong to the lower socio-economic class. It is highly possible that new cases are being detected late owing to inadequate community awareness of consequences with the disease and lack of possibilities to attend the leprosy services. A good surveillance is required to detect leprosy and to ensure good patients compliance with treatment to prevent deformity and disability. Information campaign about leprosy in high risk areas are crucial, so that patients and their families who are historically ostracized from their communities are encouraged to come forward to receive treatment [12].

A total of 29 (3.35%) patients had presented with ocular complication. Among the eye complications keratitis 8 (0.92%), lagophthalmos 7 (0.80%),

photophobia 7 (0.80%) and eye pain 7 (0.80%). Other studies from India reported 2 (1.76%), 3 (6%) patients respectively with lagophthalmos [16, 21]. A study from UK found highest diminished lid closure (19%) and mild corneal opacity (13.5%) [23]. Ocular morbidity and blindness can be a devastating complication for leprosy patients who may rely on their eyes to protect their anesthetic limbs. The patient should be explained to promptly seek ophthalmological care for any new eye symptoms to prevent avoidable blindness, due to the life-long risk of sight-threatening ocular complications.

A total 30 (3.49%) patients had a primary ulcer and 31 (3.58%) had secondary ulcer. Ulcers may also be considered as serious or potentially serious impairments, in view of their propensity to further cripple the person. As with the other impairments,

reliable information is not easily available about the prevalence and incidence of plantar and palmar ulcers. A primary impairment is a direct consequence of the causative disorder (e.g. madarosis, collapse of nasal bridge) and secondary impairment is not directly from the original disorder (e.g. trophic ulcer) [24]. The impairments seen in leprosy-affected persons range from mild such as a small area of anesthesia on the hand, to a very severe degree such as shortening of fingers and thumbs in both hands, claw hands, bilateral wrist drop, ulceration and fixed deformities of both feet rendering them useless for walking, and loss of vision in both eyes. The milder ones are more common. However, grade 2 impairments do not arise de novo, and it is usually the patients with grade 1, with only anesthesia, who develop grade 2 impairments. The earliest detection of sensory loss might reduce these secondary deformities. Timely diagnosis of grade 1 deformity is required for disability limitation and mitigation. Therefore deformity is a preventable complication in the majority of patients. Many patients can develop deformity after being diagnosed or after starting treatment, post-reactions or even after release from treatment. In the post-elimination period, there is a lack of training to assess deformity and progressively monitor patients for further deformity post-treatment. These are issues that need to be addressed if released from treatment (RFT) meaningful to address quality of life and not only just completion of treatment. One must realize that leprosy infected person does not die, the consequences of the damage will stay with the patient all his life. It will contribute to his or her disability, will diminish the quality of life and will increase the fear in his or her surroundings. We need to diminish this fear and turn it into cooperation because only then we will be able to achieve zero disability in girls and boys [25].

Episodes of lepra reaction are witnessed in 388 (44.85%) patients. The type of LRs are similar to an Indian study where the prevalence of T1R and T2R are 43 (8.09%) and 25 (4.7%) respectively but in China there are 13 (14.6%) and 13 (14.6%) patients developed T1R and T2R with a total leprosy reaction rate of 29.2% [26, 27]. A Brazilian study has also reported 328 (29.2%) patients with lepra reaction, where 192 (58.5%) cases presented with ENL [28]. Leprosy reaction is a major cause of significant morbidity, disability and deformity patients with leprosy. It can occur before, during and after the MDT and can be difficult to manage patients with severe reactions. These reactions are most likely the predominant cause of permanent nerve damage and follow up of leprosy

patients is often interrupted by recurrent episode of lepra reactions that interfere with the course of the disease.

The major limitation of the study is the fact that nearly all the prevalence and case finding figures are derived from a leprosy clinic of a tertiary care hospital. The single prevalence rate does not reflect the real situation. Therefore, a multicenter study across the country in concurrence with large population based survey is recommended. Although it is hospital-based and large number of patients over a long period of study involved, it provides a rough indicator which can serve as a baseline upon which future studies can be built, to enable effective planning of patient oriented leprosy services and prudent allocation of scarce resources.

CONCLUSION

The study shows that new case detection rate is declining but burden of leprosy in the community has not changed significantly. MB (70.05%) patients with grade 2 deformities (17.22%) are still high. Although leprosy has been eliminated globally on paper, the disease continues to be significant cause of peripheral neuropathy, deformity, disability and disfigurement in some developing countries like Bangladesh. Community-based surveillance could help to improve early detection, treatment, case holding and prevention of deformities and stigma. Domiciliary treatment and community-based surveillance could help to improve early detection, contact tracing and prevention of deformities and stigma.

DISCLOSURE

All the authors declared no competing interests.

ACKNOWLEDGEMENTS

The authors thankfully acknowledge the assistance of Mr. Sultan Md. Elias Uddin. Program Manager, Leprosy control project, Chittagong.

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Received on 07-05-2021

Accepted on 12-05-2021

Published on 12-06-2021

<https://doi.org/10.12970/2310-998X.2021.09.03>© 2021 Mowla *et al.*; Licensee Synergy Publishers.

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