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Original Article

Leprosy Situation in Dadra & Nagar Haveli in 2017 and its Relevance for 2025

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In response to a request from the Director of Medical and Health Services and the Mission Director of the National Health Mission, Union Territory of Dadra and Nagar Haveli (DNH), a committee was constituted by the Indian Council of Medical Research. This committee carried out an assessment of the leprosy epidemiological situation from 27th February to 1st March 2017 to inform targeted recommendations for strengthening leprosy control activities in the region. The assessment included a review of past evaluations (2013 and 2014), case sheet audits, health system functioning, and field examinations across rural and tribal communities. Despite intense leprosy control activities in DNH, certain important gaps in programme functioning were observed such as under-diagnosis of Grade 2 Disability, inconsistent new case detection rates, and a disproportionately high burden among the Warli tribal community. Overall, 82% of cases were single-lesion, and many patients presented late-stage disease, with clustering within households. The results underscore the need for improved diagnostic accuracy, targeted tribal outreach, and standardization of surveillance metrics. Environmental and migratory factors may also sustain transmission and require further epidemiological study. Customized interventions, enhanced training for frontline health workers and regular monitoring are essential to interrupt transmission and reduce hidden prevalence in endemic pockets; and the rapid decline in leprosy prevalence from 6.77 in 2015-16 to <1 case per 10,000 population by January-2023 is surprising and merits further investigation.

Keywords: Leprosy Situation, Annual New Case Detection Rate, Grade 2 Disability, Dadra & Nagar Haveli, India

Introduction

India achieved the goal of leprosy elimination at the national level in 2005, and to accelerate progress towards zero transmission of leprosy by 2027, the Government of India launched National Strategic Plan (NSP) and Roadmap for Leprosy (2023-27) on January 30, 2023; this initiative aims to eliminate leprosy transmission by 2027, three years ahead of the Sustainable Development Goal (SDG) 3.3 (World Health Organization 2015).

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The NSP and Roadmap outline implementation strategies, define specific targets, and provide technical guidance for public health interventions (Central Leprosy Division 2023).

Over the years, the National Leprosy Eradication Programme (NLEP) has introduced multiple interventions to reduce leprosy transmission. The number of newly detected leprosy cases declined from 1,25,785 in 2014-15 to 107,851 in 2023-24 (Fig. 1) (Press Information Bureau 2023). The Annual New Case Detection Rate (ANCDR) decreased to 7.55 per 1,00,000 population in 2023-24, compared to 9.73 in 2014-15. The national leprosy prevalence also declined from 0.69 in 2014-15 to 0.60 per 10000 population in 2023-24. The number of districts with a prevalence below 1 per 10,000 population increased from 542 in 2014-15, to 634 in 2023-24, out of the total of 800 districts (Annual Report, Department of Health and Family Welfare India 2023–24).

Other key indicators of leprosy have also improved over time, and the proportion of new patients with grade 2 disability (G2D) per million population declined from 4.48 in 2014-15 to 1.63 by 2023-24. The proportion of children among new cases decreased from 9.04% in 2014-15 to 5.18% in 2023-24 (Annual Report, Department of Health and Family Welfare 2023–24). The key interventions responsible for these improvements include early case detection, post-exposure prophylaxis to prevent disease transmission, public awareness campaigns to eliminate stigma, and the launch of the web-based information portal Nikusth 2.0 (Press Information Bureau 2023).

Dadra & Nagar Haveli, a small Union Territory has historically reported a high burden of leprosy (UT Administration of Dadra & Nagar Haveli and Daman & Diu 2022, Annual Report, Department of Health and Family Welfare 2023–24). Despite continuous efforts to control the disease, leprosy burden remained at higher levels in the region. Recognizing this challenge, the Director of Medical and Health Services (DMHS) and the Mission Director of the National Health Mission (NHM), DNH, sought support on February 4, 2017, from the Indian Council of Medical Research (ICMR) in conducting comprehensive research to identify factors driving leprosy transmission and develop sustainable strategies to reduce its burden in DNH. The request highlighted persistent high leprosy endemicity despite multiple elimination efforts over the past five years.

In response, the Secretary, Department of Health Research, and Director General, ICMR, constituted a committee to assess the leprosy situation in DNH and to recommend appropriate control measures. The committee members visited DNH from February 27 to March 1, 2017 and assess the situation and identified the factors; this manuscript presents the findings of the committee and discuss the relevance of those findings to leprosy elimination defined as zero leprosy transmission by 2027 and also reflects on the relevance of the findings to that in the present -day context.

Methods

Evaluation Strategy

The committee reviewed reports of previous evaluations and conducted site visits to assess leprosy situation and functioning of NLEP in DNH; important activities included meetings with key officials of DNH to review topographic, demographic data of DNH and the ongoing Leprosy Post Exposure Prophylaxis strategy. The committee also visited tribal museum in Silvassa to gain insights into their cultural practices. Site visits were made at urban and primary health centers to assess case detection, patient registration, and treatment activities. During these visits, the committee examined leprosy

patients to validate diagnoses and interacted with health workers to understand challenges in service delivery. Additionally, field visits to villages were undertaken to assess living conditions and interact with the local population to understand their practices and examine leprosy patients in the community.

Results

Key observations from previous evaluations: Two previous evaluations were conducted in DNH in 2013 and 2014, first was conducted by expert team constituted by ICMR between April 17 and 19, 2013, observed that NLEP services in DNH were integrated with the general health system. House-to-house surveys were conducted annually, but their quality needed improvement in certain areas. Accredited Social Health Activists (ASHAs) and Auxiliary Nurse Midwives (ANMs) performed initial screenings, while medical officers from Primary Health Centers (PHCs) and the district nucleus team confirmed leprosy diagnosis. We identified that more male patients were missed, as female health workers primarily conducted the screening. The review emphasizes the need for better training, monitoring and gender sensitivity.

From April 2012 to February 2013, 329 new cases were initiated on treatment, of which 257 (78%) were paucibacillary (PB) and 72 (22%) were multibacillary (MB). The proportion of MB cases had declined since 2008-09, whereas paediatric cases increased to 25%. Further, 58% of detected cases were females, a trend that had been rising in recent years. Among 63 patients examined by the review team, 11 (16.6%), including one child, had visible disabilities (Grade 2 Disability – G2D) that had not been detected by the health system.

The second evaluation, conducted in November 2014 as part of the mid-term review of the NLEP, documented an upward trend in both prevalence

Table 1: Selected leprosy indicators year wise from 2007 to 2017 in Dadra & Nagar Haveli (UT Administration of Dadra & Nagar Haveli and Daman & Diu 2022).

Indicator	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Prevalence	1.88	2.2	2.47	2.28	2.93	3.6	4.04	4.99	6.77	6.7
	(57)	(70)	(82)	(78)	(105)	(135)	(158)	(204)	(263)	(267)
ANCDR	49.5	38.2	47	60	66	98.3	81.8	77.7	113.06	96.3
	(150)	(121)	(156)	(205)	(237)	(368)	(320)	(318)	(425)	(384)
MB%	26	39.67	42.31	30	36	23.1	30	35.8	26.59	26.3
	(39)	(48)	(66)	(62)	(86)	(85)	(97)	(114)	(113)	(101)
Female%	57	45	56	58	55	58	56	58	60	52
	(86)	(55)	(87)	(119)	(130)	(215)	(178)	(183)	(255)	(198)
Male %	43	55	44	42	45	42	44	42	40	48
	(64)	(66)	(69)	(86)	(107)	(153)	(142)	(135)	(170)	(186)
Child%	17	15	24	19	20	26	24	20.8	23.3	20
	(25)	(18)	(37)	(38)	(48)	(96)	(76)	(66)	(99)	(76)

Prevalence – Prevalence per 10,000 population; ANCDR – Annual new case detection rate per 100,000 population; MB – Multibacillary leprosy; Numbers within brackets indicate number of cases

Table 2 : Prevalence of leprosy among Tribal population in Dadra & Nagar Haveli, 2017.

Area	Percentage of Tribal population	Leprosy Prevalence (per 10,000)
Silvassa	13.22	0.7
Dadra	21.03	0.9
Samarvarni	34.67	0.4
Rakholi	37.01	3.7
Naroli	49.97	8.9
Khanvel	80.62	8.9
Dapada	88.14	12.2
Kilavani	91.56	13.7
Amboli	92.19	17.4
Randha	93.74	6.8

and New Case Detection Rates (NCDR) since 2008-09, with the NCDR having doubled by 2013-14. ASHAs referred approximately 50% of new cases, and the proportion of new MB cases had decreased over years. Child and female cases continued to be high, and unlike the 2013 review, no leprosy-related disabilities were found among the 46 patients examined.

Review of both evaluations highlighted that active case detection efforts contributed to the decline in MB patients, an increase in PB patients, and a higher proportion of child leprosy patients among newly detected patients. However, several concerns remained, including incomplete examination of male patients, underreporting of new patients with G2D, uncertainty in diagnosing single-lesion patients, more than 60% of the newly detected cases fell into this category.

Recommendations included strengthening survey quality, ensuring comprehensive screening, particularly for male patients, enhancing training for healthcare workers, and ensuring diagnostic accuracy for single-lesion cases.

Observations from the 2017 Committee's evaluation

Geography and climate: Dadra & Nagar Haveli is a Union Territory at the Western foothills of the Western Ghats, between Gujarat and Maharashtra, covering an area of 491 square km. Silvassa is the capital city of DNH (Fig. 2). Due to its proximity to the coast, most of the territory, except for the sparsely inhabited easternmost parts, experiences a typical Indian Ocean maritime climate. The climate is classified as tropical wet and dry or savanna, characterized by relatively small seasonal variations and high atmospheric moisture content (Gopalakrishna et al 2024). Maximum precipitation occurs in August, with the lowest levels recorded in October; there is no distinct dry season, as drizzle or rainfall can be observed throughout the year, and from May to September, humidity remains above 70%, peaking at 85% in July and August.

Demographics and tribal population: Total population of DNH was 342,853 in 2011, comprising large proportion of male, 193,178 (56.3%) and rural populations was 183,024 (53.4%). Sex ratio was higher in rural areas 863 vs 684 females per 1,000 males in urban areas. Literacy rates varied widely between urban

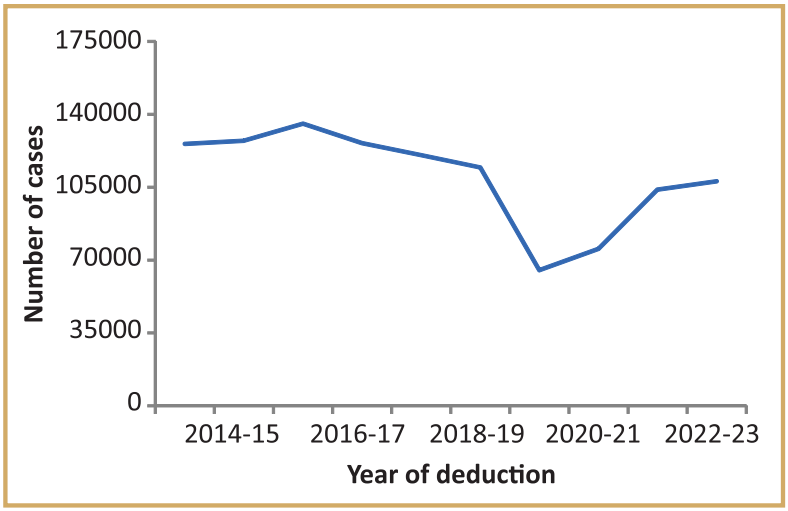

Fig. 1 : New leprosy case detection, India, 2014-24 (Ministry of Health and Family Welfare India 2024).

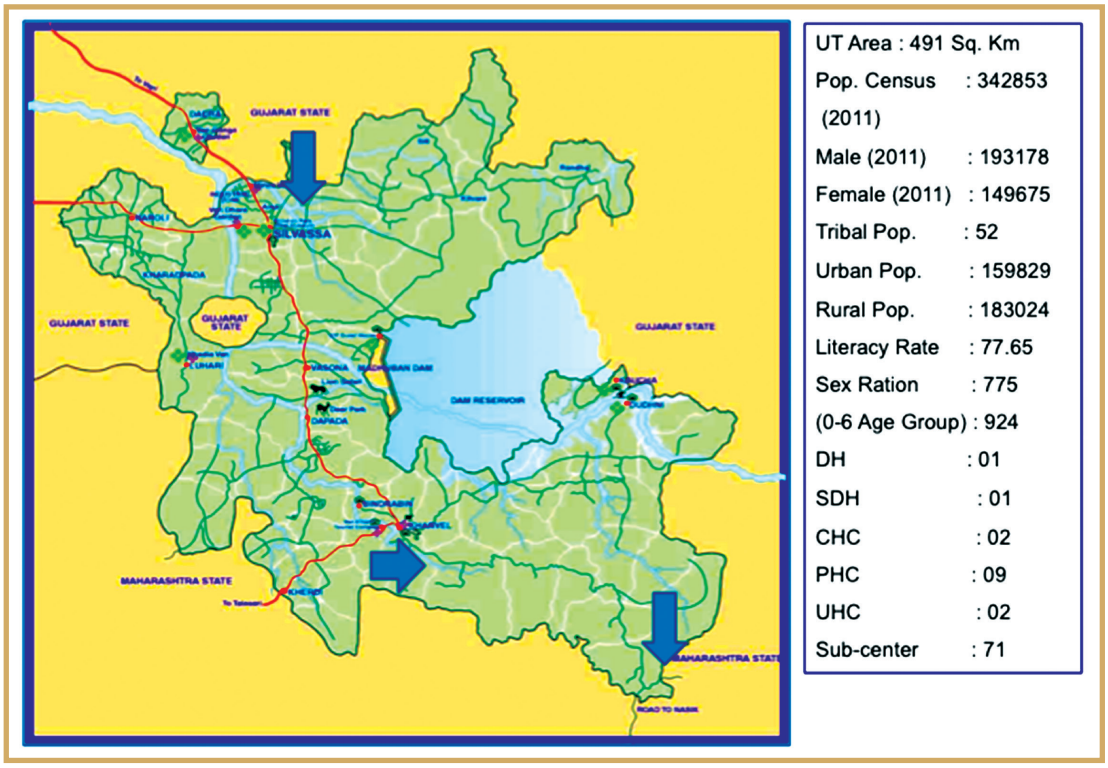

Fig. 2 : Geography, health facilities and demographic characteristics of Union Territory of Dadra & Nagar Haveli, India.

(89.8%) and rural (64.8%) areas. In both areas literacy rate was higher among the females. The tribal population constituted 52% of the total population and majority (82%) resided in rural areas (Census of India 2011). Leprosy prevalence was also higher in rural areas, prompting us to explore the potential link between tribal settlement patterns and disease transmission.

DNH is home to approximately 140,000 people belonging to three major tribes, Warli (63%), Dhodia (17%), and Kokana (17%). These tribes also inhabit neighbouring districts such as Valsad and Dang in Gujarat, as well as Thane, Palghar, and Nashik in Maharashtra. During our field visits, most of the leprosy patients encountered belonged to the Warli tribe.

The Warli's are primarily non-vegetarian, and their staple grains are nagli (finger millet) and rice. Their diet also includes wild roots, tubers, spinach, leafy vegetables, and seasonal forest fruits, and due to limited milk availability, tea is rarely prepared with milk. Agriculture remains primitive, and their livelihoods are supplemented by agricultural labor, casual wage work, and domestic servitude. Many migrate to nearby districts such as Nashik, Valsad, Navsari, Chikhli, and Pardi in search of work. Some work as forest laborers, collecting honey, gum, mahua flowers, and timroo leaves, while others engage in charcoal production or river fishing using nets and traditional fish traps. Warli children often graze cattle, hunt small birds, fish, and help protect crops from pests.

Their homes are windowless, spacious structures made of wood, bamboo, reeds, earth, and cow dung, with thatched roofs of straw and dried leaves. The interiors are dark and sparsely furnished, with only a few possessions. Despite sharing their living spaces with domestic animals such as dogs, goats, hens, and cows, the homes

Fig. 3 : A typical house of Warli Tribes, Dadra & Nagar Haveli Union Territory.

are generally clean (Fig. 3).

The combination of dark and humid indoor conditions and heavy monsoon seasons may enhance the survival of *Mycobacterium leprae*. However, the extent to which these environmental factors contribute to sustained leprosy transmission requires further epidemiological studies.

Health facilities: the Union Territory had a well-equipped district hospital in Silvassa, along with two Community Health Centers (CHCs) and nine Primary Health Centers (PHCs), and an additional, two Urban Health Centers (UHC-A and UHC-B) were designated to serve the public health needs of their respective urban wards (Fig. 2).

Reported leprosy situation from the state leprosy officer's presentation: The presentation by the State Leprosy Officer (SLO) provided key insights into the leprosy program and operational activities in the Union Territory (UT) from 2007-08 to 2016-17 (Table 1). Both prevalence and NCDR showed an increasing trend from 2007-08 onward, largely due to intensified case detection efforts, particularly after 2012-13, and a consistently high proportion of child patients (20% or more) was likely a consequence of these active case-finding initiatives.

Another important observation was the usually high proportion of single-patch leprosy patients, raising concerns about the diagnostic accuracy. The design of case detection activities also contributed to potential gaps in surveillance. During household visits by ASHAs and ANMs, children and women were more frequently available for screening, while adult males were either absent or only briefly examined by female health workers. Additional factors, such as stigma, reluctance to disclose symptoms, treatment-seeking from private practitioners, cultural influences, and religious "bhagats" further contributed to under reporting. It was noted that consistently there was low or no reporting of G2D among newly detected patients.

Data from PHCs showed an uneven distribution of leprosy across different areas. PHCs in Dadra and Masat, along with the two Urban Health Centers (UHCs), generally had lower prevalence and NCDRs, reflecting their urban/semi-urban settings; however, PHC-wise analysis from 2009 to 2016 showed considerable year-to-year variation in prevalence and NCDR. It remained unclear whether these fluctuations were due to actual changes in transmission dynamics or operational inconsistencies in case detection. Very clearly, leprosy problem in DNH was concentrated both, among the rural and tribal population (Table 2).

Review of Case Sheets and Patient Examinations

Case sheet review: To assess case characteristics and detection trends, we reviewed 410 case sheets of leprosy patients detected over the past two years from four PHCs with a high caseload (Kilvani, Amboli, Mandoni, and Dapada); and of these, 324 (79%) were paucibacillary (PB), with 82% presenting as single-lesion leprosy patients. Males accounted for 182 (44%), while 102 (25%) were children. Case detection primarily occurred through surveys and health camps (196 cases, ~50%) or referrals by ASHAs (186 cases, 45%). Additionally, 25% of newly detected cases had a history of contact with leprosy patients. The proportion of G2D among newly detected patients was low (n=4; 1%). Leprosy reactions were observed in 3.4% (13 of 410) of patients.

Patient examinations and field observations: During field visits to villages under these PHCs, we examined 29 patients (19 PB and 10 MB) in their localities; and of these, 21 belonged to the Warli tribal community. Although their case sheets recorded no disabilities (grade 0), our clinical assessments revealed G2D in 8 patients and grade 1 disability in one patient. This finding contrasted with the case record

review, suggesting definite under-reporting of a disability. However, all 29 patients reported full compliance with their treatment. A sizeable number of patients had late-stage disease manifestations, including nodules and infiltration over the ears, along with G2D. Notably, ten of the examined patients belonged to multiple-case families, highlighting the importance of contact tracing in leprosy control.

ASHAs played a crucial role in case identification and referrals, supported by incentive-based motivation. While their involvement has improved case detection, the accuracy and quality of their assessments warrant further evaluation. Primary healthcare staff were actively engaged in case detection and treatment compliance monitoring, underscoring the importance of strengthening their training and supervision to improve early diagnosis and disability prevention.

Discussion

In response to concerns from the DNH administration regarding leprosy situation, ICMR Committee did the assessments in 2017 and documented that the intensified leprosy control activities had indeed helped in bringing down the leprosy burden. The committee further identified critical gaps in programme functioning such as diagnostic accuracy, under-reporting of G2D, and the incomplete examination of adult males during surveys. Higher proportion of cases was observed among the Warli community, with recent assessments revealing previously undetected disabilities and clustering of cases within families which was a cause of concern. Nevertheless, the situation offered a distinct opportunity to understand and reflect on the possible effect of several interventions in the present-day context of “zero Leprosy transmission” at the national and local levels.

In DNH during the period from 2007-08 to 2015-16 prevalence of leprosy was showing increasing trend. New case detection rate also followed the same trend with a sudden jump to 113.06 per 100,000 population in 2015-16, and the drop in prevalence from 6.77 in 2015-16 to 1 per 10,000 population in 2023 was dramatic. It followed the targets determined by DNH Health and Family Welfare Department for the period 2019 to 2022 (UT Administration of Dadra & Nagar Haveli and Daman & Diu 2022). The rapid decline in prevalence in contrast to increased new case detection rate requires further examination. Notably, there was no specific pattern or trend in new case detection rates during the recent 10-year period from 2014 to 2024.

The discrepancy between the recorded and observed proportion of G2D (1% vs 28%) shows deficiencies in the initial clinical assessment and documentation at the time of diagnosis needs urgent attention and immediate action to improve programme performance. A systematic review has documented delayed case detection to correlate with increased disability and reiterates that the interventions should focus on determinants of delayed case detection such as health-seeking behavior, and should consider relevant individual, socioeconomic, and community factors, including stigmatization (Dharmawan et al 2021).

Although single-lesion leprosy is considered by some as an indicator for evaluating the progress of leprosy elimination, the proportion documented in this evaluation was much higher than reported in other studies in India and other parts of the world (Mandal et al 2000, Ignotti et al 2007). This could reflect a combination of intensified active case detection, diagnostic ambiguity and effect of reward money for case detection and possible epidemiological transitions in disease transmission patterns (Naafs 2006, Feenstra et al 2012, World Health Organization 2016). The gaps identified during the case sheet review justify the

need for quality improvement in documentation, appropriate training for the staff and periodic monitoring at various levels.

This variability is unlikely to reflect true changes in disease transmission dynamics and could be attributed to variations in case detection strategies, the involvement of inadequately trained general health staff and ASHAs and the pressure to meet programmatic targets. Such operational factors could have led to over or under-detection, diagnostic errors, and inconsistencies in reporting. Similar findings have been reported in other leprosy-endemic settings where target-driven active case finding and task-shifting to front line workers without adequate supervision has resulted in variable detection rates and diagnostic inaccuracies, especially in cases with subtle clinical signs (Lockwood et al 2014, Rao & Suneetha 2018). These inconsistencies limit the interpretability of NCDR as a reliable epidemiological indicator and highlight the need for standardized and verifiable surveillance methods to better understand the true burden and transmission patterns of leprosy (The International Federation of Anti-Leprosy Associations 2001, Saunderson 2022, World Health Organization 2023).

In DNH, we did observe concentration of leprosy in tribal and rural population. In contrast the national sample survey in 2010-11 which covered urban population in DNH, recorded the highest new cases detection of 277.4 per 100,000 population (Katoch et al 2017).

In addition to leprosy indicators, the specific demographic and climatic context of DNH demands further studies for developing specific strategies. The DNH setting could provide opportunities to explore the potential role of climate, customs of tribal population and their living conditions on leprosy endemicity. Viability of *M. leprae* has been demonstrated in the environment where active patients reside (Turankar et al 2012). The tribal community of DNH predominantly living in rural, forest-adjacent habitats and traditional housing structures, which are dark and humid may create micro-environments favorable for prolonged survival of *Mycobacterium leprae* (Sterne et al 1995, Desikan & Sreevatsa 1997, Job et al 2008). While the exact contribution of environmental factors to transmission remains speculative, the consistent detection of cases in these settings warrants targeted interventions. Additionally, the migratory nature of tribal laborers could contribute to spread within and beyond the UT, suggesting the need for cross-jurisdictional coordination and tailored outreach.

Limitations

Our assessment had certain limitations. First, due to time and logistical constraints, we were able to visit only a few PHCs, review records and conduct interviews with a subset of leprosy patients and health workers, which may not fully represent the programme implementation in DNH. Further, we could not independently verify the completeness of household survey during the Leprosy Case Detection Campaign (LCDC), which limits our ability to assess the extent of case finding activities. Nevertheless, we reviewed findings from previous assessments, periodic reports from NLEP, and held discussions with the stakeholders, which may help contextualize and reflect the broader leprosy scenario in DNH.

Conclusions and recommendations

India has made substantial progress in controlling leprosy. However, the continued detection of a high number of new cases and rapid decline in leprosy prevalence in DNH highlights the need for independent assessments of programme performance, and such unbiased evaluations are essential to identify gaps, suggest corrective actions, and set evidence-based targets.

Further, DNH presents a valuable opportunity to evaluate the implementation and impact of post-exposure prophylaxis introduced nationally. Additionally, the region offers a unique setting to study how climatic factors, tribal customs, and living conditions influence leprosy endemicity, especially among the Warli tribal community, which spans across neighbouring States of Maharashtra (districts of Palghar, Thane, Nashik) and Gujarat (districts of Valsad, Dang). A focused, tribal-belt-wide joint strategy for leprosy control is warranted, as any piecemeal approach targeting DNH alone may never meet the situation.

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