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Healthcare performance of leprosy management in peripheral health facilities of Dhanusa and Mahottari, Nepal

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Abstract

Background The global elimination of leprosy transmission by 2030 is a World Health Organization (WHO) target. Nepal's leprosy elimination program depends on early case diagnosis and the performance of health workers and facilities. The knowledge and skills of paramedical staff (Leprosy Focal Person, LFP) and case documentation and management by health facilities are therefore key to the performance of health care services.

Methods The performance of health workers and facilities was evaluated through a combined cross-sectional and retrospective study approach of 31 health facilities and their LFPs in Dhanusa and Mahottari Districts in Madhesh Province, Nepal. An average of 6 patients (paucibacillary, PB, or multibacillary, MB) per health facility registered within the 2018/2019 fiscal year were also enrolled in the study. LFP knowledge (e.g., of the three cardinal signs) and skills (e.g., nerve palpation) and facility processes (e.g., record keeping) were scored (e.g., 0, 1) and then rescaled to a proportion, where 1 is perfect. Internal benchmarking was used to guide performance management.

Results Overall LFP knowledge and skill scores of health workers ranged from 0.16 to 0.63 (median 0.53, 95% confidence interval (CI), 0.46–0.6). Case documentation scores ranged from 0.15 to 0.87 (median 0.37, 95% CI 0.36–0.38), case management scores from 0.38 to 0.79 (median 0.54, 95% CI 0.53–0.55) and overall healthcare scores from 0.36–0.62 (median 0.48, 95% CI 0.47–0.49). Leprosy-related training was significantly related to the knowledge and skills of the health workers. All identified cases ($n = 187$) adhered to the complete treatment and release after treatment (RFT) scheme, out of which 84.5% were satisfied with the service they were provided. Leprosy disability and ear hand and feet (EHF) scores were not significantly reduced in treated patients during the study period, but counseling by LFPs significantly improved cases' positive beliefs and practices regarding self-care.

Conclusion Overall leprosy care median performance was low (53%) and can be improved by evidenced-based training, onsite coaching, monitoring, and supervision to facilitate leprosy transmission elimination. The results highlight many of the challenges facing leprosy elimination programs.

Keywords Leprosy focal person, Knowledge and skill scores, Documentation score, Case management scores

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Introduction

Leprosy is an infectious, pathogenic disease of the skin and peripheral nerves caused by *Mycobacterium lepra* [1]. The consequences of leprosy include physical disability and social stigma [2]. The global prevalence and grade 2 disability (i.e. visible deformities) of leprosy were recorded as 22.9 and 1.4 per million population, respectively, in 2019 [3]. In the same period, Nepal recorded 69 cases per million population, of which 5.45% (3.8 per million population) had grade 2 disabilities, despite the elimination of leprosy as a national public health problem by 2009 [4, 5]. Nepal was one of the 16 counties that reported more than 1000 cases at the end of 2019 [6].

Leprosy diagnosis is based on the presence of at least one of three cardinal signs: definite loss of sensation in a pale or reddish skin patch, a thickened or enlarged peripheral nerve with loss of sensation and/or weakness of the muscles supplied by that nerve, and the presence of acid-fast bacilli in a slit-skin smear [7]. Multidrug therapy (MDT) is a key strategy to cure and prevent the transmission of leprosy.

The World Health Organization (WHO) set a target of leprosy transmission elimination by 2030, and the new case detection rate reduced by 44% between 2005 and 2019 [6]. Nepal, in line with the WHO's roadmap to 'zero leprosy' [8], has also set a target to achieve zero new autochthonous cases by 2030 [9, 10]. The elimination rate and early diagnosis of leprosy are associated with the diagnostic and case management skills and attitudes of health service providers [11, 12]. The diagnostic and case management skills of peripheral health workers could be developed and improved by providing them with high-quality training [13].

Multidrug therapy (MDT) is one of the WHO's effective strategies to prevent transmission, cure leprosy infection, and limit and reverse patients' disability status [14, 15]. Leprosy elimination programs therefore need high-quality documentation to track the progress of cases and the program [16, 17]. The Nepali National Leprosy Control Programme sets recording standards and provides reporting tools in every health facility in a municipality. To record a case of leprosy, a health worker completes a Health Service Card (HMIS 1.2), Referral Form (HMIS 1.4), Laboratory Forms and Register (HMIS 5.1/5.2), Leprosy Diagnosis and Treatment Card (HMIS 5.4), Leprosy Treatment Register (HMIS 5.5), Defaulter Form (HMIS 1.5) and Reporting Form (HMIS 9.3) [18].

Finally, patient self-care is one of the main interventions to improve patient disability over time [19]. Client satisfaction is a key performance indicator that improves self-care, drug adherence and recovery [20]. Much of the information regarding care provided to leprosy cases is provided by paramedical staff LFP in Nepal.

This operational research was carried out in the Nepali context in Dhanusa and Mahottari districts, Nepal, to assess the knowledge and skills of LFPs and overall health facility performance. The metrics assessed include documentation in health facilities, case diagnosis and management status, improvement in disability post-MDT, self-care practices in disabled people and client satisfaction, which reflect overall leprosy elimination performance. Gaps pertaining to knowledge, skills, documentation, and case management were identified.

Material and methods

Subjects and type of study

Location

This study was performed in Dhanusa and Mahottari districts from Madhesh Province, Nepal. Madhesh Province was chosen because it represents 40% of the notified leprosy cases in Nepal from the seven provinces, with Lumbini Province the next highest with 18% of cases, and these districts chosen because of their historically high leprosy case prevalence.

Study design

A cross-sectional study to assess the knowledge and skills of LFPs was undertaken in 31 health facilities. A retrospective study of documentation and case management performance was undertaken to assess the overall performance of the respective health facilities. Thirty-one health municipalities were selected (17 from Dhanusha and 14 from Mahottari) based on convenience sampling, with just one municipality not sampled from each district (total health municipalities are 18 for Dhanusha and 15 for Mahottari); one health facility was then chosen randomly from each municipality to ensure the sample was representative. An LFP from each selected peripheral health facility was interviewed and assessed for their knowledge and skills pertaining to leprosy case management.

On average, six patients (paucibacillary, PB, or multibacillary, MB) per health facility registered within the fiscal year 2018–19 and who had completed the treatment by the end of fiscal year 2019–20 were enrolled conveniently (i.e., without randomisation) in the study. These cases may have been initially diagnosed elsewhere in other clinics. These patients were invited to enroll in the study by LFPs of respective health facilities. MB patients registered within the fiscal year 2018/2019 who had completed MB-MDT (12 blister packs) within 18 months, i.e., by the end of fiscal year 2019–20, were included. Similarly, PB patients registered within the fiscal year 2018–2019 and completed PB-MDT (6 blister packs) within 9 months before and by the fiscal year 2019/20 were included. This enabled us to assess patient progress,

including each patient having three disability and ear hand and feet (EHF) scores (but see analysis). In total, 187 patients were selected to assess the case management performance of the health facilities based on a sample size estimated to detect and improve performance (see below) among health facilities of 50%, with a precision of 1/7th of 50% (± ~ 7%) with 95% confidence.

Leprosy focal person skills and knowledge assessment

LFP knowledge of the 3 cardinal signs and capability to differentiate leprosy and non-leprosy patches was assessed through interviews by giving 12 patches (8 leprosy patches and 4 non-leprosy patches) from the leprosy atlas to all LFPs to identify correctly. The specificity and sensitivity of these approaches varies [21] m with sensitivity approximately 63–89% and specificity approximately 85% [22–24], reaching highs of up to 97% if all three cardinal signs are present [25]. An LFP was given 0.25 for correctly identifying up to 3 patches, 0.5 for 4–6 patches, 0.75 for 7–9 patches and 1 for 10–12 patches. The capability to palpate peripheral nerves (4 peripheral nerves: radial, ulnar, tibial, and perineal nerves) was assessed by observation by a leprosy expert. A combined score of knowledge and skills was then given by providing equal weight to all variables, each given 1 mark and rescaled and converted again to between 0 and 1. Greater or lesser than median scores were used to classify skills and knowledge into high and low categories.

Health facility documentation performance assessment

For the documentation performance, information on the completion and accuracy status of HMIS forms 5.4, 5.5, and 9.3 for the 187 patients from 31 facilities in Dhanusa and Mahottari was collected. Regarding part 1 of HMIS 5.4, scores were given based on the charting and availability of the data (hereon, performance), where, for example, a score was given as 0 for no charting at all and unavailability of the forms, 0.33 for a performance score of less than 1/3rd, 0.67 for a performance less than 2/3rd and 1 for 80% correctly and completely done charting. From parts 2 to 8 of HMIS 5.4, HMIS 5.5, and HMIS 9.3, the score was calculated after assessing how accurately the variables were filled against the total variables. Similarly, randomly selected 3-month reports for each patient enrolled in the study were examined and given an average score for the documentation performance for each health facility. Total score documentation was averaged and rescaled to between 0 and 1.

Case management performance assessment

For the case management performance of 187 patients from 31 health facilities, information on diagnosis accuracy, accuracy in classification of leprosy, treatment completion in time, number of doses taken as per the required treatment regime, disability and EHF score (pre- and post-treatment), number of follow-up visits, and counseling provided by the LFP with respect to treatment, self-care, attitude and practice of self-care, treatment outcome, and reaction management by the LFP were collected. Three disability and EHF assessments were taken during the study but only pre-and post-treatment used for analyses because of the small sample sizes. For all the patients, variables such as accuracy in diagnosis, treatment completion in time, correct classification of disability, counseling provided by LFPs, practice of self-care by leprosy affected persons, reaction managed by LFP, completion of follow-up visit, and treatment outcome were treated as binomial variables; for the true value (i.e., correct classification, completed treatment, etc.), 1 mark was given, and for the "not true" value, 0 was given. For post-treatment disability and EHF scores, 1 was given for improving, 0.5 for the same performance and 0 for worsening disability and EHF scores, with disability and EHF scores given separately. All post-treatment disability and EHF scores were summed, averaged and rescaled to between 0 and 1. Treated leprosy cases were asked if they were fully satisfied, satisfied or not satisfied with the services provided by the health system (health institution and health worker or LFP).

Performance summary

Finally, overall health facility performance of leprosy was calculated by averaging the documentation scores and case management performance scores of respective health facilities and analyzing the data as above. All scores should be considered where 0 is the lowest and 1 is the maximum possible score.

Statistical analysis

The knowledge and skills of LFPs were analyzed by regression (see below) with predictors comprising their job (Community Medical Assistant (1 year training), Auxiliary Nurse Midwifery (1.5 years training course), Health Assistant (3-year academic course)), any training such as basic leprosy training (BLT) and comprehensive leprosy training (CLT), and time since training. Similarly, pre- and post-disability and EHF scores of leprosy treatment were analyzed.

Scores for the knowledge and skills of LFPs, documentation completion, and case management performance of health facilities were calculated in Microsoft® Excel. Means with 95% CIs were calculated by using IBM SPSS 2022. Chi-squared (χ^2) values, p values and odds ratios with 95% CIs were also calculated in SPSS and R version 4.2.0 to determine the association between the knowledge and skill scores of LFPs and their leprosy training

(BLT or CLT) and for the working designation compared with the knowledge and skill score of LFPs. Mean differences in disability and EHF scores related to leprosy were calculated pre- and post-leprosy treatment to determine the impact of an MDT discussion on disability. Odds ratios and χ^2 with 95% CIs were calculated for the association between the status of regular counseling provided to leprosy cases and attitudes and practices of self-care. Case treatment satisfaction was calculated in terms of simple percentages of each satisfaction score for the service received from peripheral health facilities. Due to small sample sizes, univariate analyses are presented. However, beta regression (R^2) was used to find predictors of variation in the knowledge and skill scores of LFPs due to duration gaps after training and other factors. Specifically, knowledge and skill scores of LFPs were regressed against training, qualification type and district, and separately, knowledge and skill scores of LFPs were regressed against time from training. These regressions were performed on raw data, not quantiles.

Results

Leprosy focal person backgrounds

The study assessed the knowledge and skills of 31 LFPs of selected peripheral health facilities of Dhanusa and Mahottari districts in Nepal. Among the selected 31 LFPs, 18 (58%, 39–75%) were community medical assistants (CMA), auxiliary nurse midwives (ANM) and auxiliary health workers (AHW), and 13 (42%, 25–61%) were health assistants (HA). CMAs, ANMs and AHWs are qualified after a one and a half-year training course, whereas HAs are qualified after 3 years of an academic course. The study showed that more than half of the LFPs (16, 52%, 33–70%) had not undergone any specific training. Very few LFPs (6, 19%, 7–37%) had graduate degrees of any discipline (Table S1).

Leprosy focal person cardinal sign knowledge and palpation of peripheral nerve skills

Nine (29%, 14–48%) LFPs knew all 3 cardinal signs, 8 (26%, 12–45%) knew two cardinal signs, 13 (42%, 25–61%) knew just one cardinal sign and 1 (3%, 0.1–17%) had no knowledge of the cardinal signs of leprosy (Table S2). Furthermore, 25 (81%, 63–93%) of the LFPs could not palpate any of the targeted 4 peripheral nerves, 4 (13%, 4–30%) of the LFPs could palpate one peripheral nerve, 1 (3%, 0.1–17%) LFP could palpate 2 peripheral nerves, and just 1 (3%, 0.1–17%) could palpate all targeted peripheral nerves.

Leprosy focal person knowledge and skill scores

Overall knowledge and skill scores ranged from 0.16 to 0.63 (median 0.53, 95% CI, 0.46–0.6; interquartile range 0.36–0.59), and the data were not normally distributed, with some higher performances and then a spread below 0.5 (Fig. 1).

Predictors of leprosy focal person knowledge and skills

Those who had taken any of the leprosy training courses (BLT or CLT) had significantly higher levels of knowledge and skills (OR = 8.1, 95% CI 1.4–66.3, p value = 0.01; Table S3). The level of knowledge and skills of LFPs was not significantly different with respect to their education level, i.e., a one-year training course (CMA or ANM or AHW) versus a 3-year academic course (HA) (p value = 0.16). Neither 3-year HA qualifications (p value = 0.82) nor receiving training (p value = 0.46) significantly increased LFP knowledge and skills in multivariate regression, whereas Mahottari had significantly higher knowledge and skills than Dhanusa ($\beta = 0.63$, standard error (SE) = 0.21, p value = 0.002) (Fig. 2). Furthermore, the time interval since the training was taken was not identified as a predictor of knowledge and skills (Table S3; Figure S1, beta regression $\beta = -0.007$, SE = 0.024, p value = 0.78).

Place of leprosy case diagnosis

More than three quarters (145, 78%, 71–83%) of the cases were diagnosed in Lalgadh Leprosy Hospital in Dhanusa (Table S4). Less than one fifth (32, 17%, 12–23) of the cases were diagnosed in government peripheral health facilities. Only nine (5%, 2–9%) of the leprosy cases were diagnosed through active case detection, i.e., a contact survey by the Leprosy Post-Exposure Prophylaxis (LPEP) service. One case (< 1% cases, < 0.1–3%) was diagnosed in India, to which Dhanusa and Mahottari are bordering districts.

Health facility performance

All correctly diagnosed cases ($N = 187$) completed treatment in time ($N = 184$) and were released after the treatment (RFT, $N = 184$), as per treatment guidelines. Three cases were under treatment, so they were excluded from the study when appropriate below, specifically the treatment analyses, and included in general analyses (i.e., case documentation and management analyses).

Case documentation

Case documentation scores ranged from 0.15 to 0.87 (Fig. 1). The median score was 0.37 (95% CI 0.36–0.38; IQR 0.32–0.38), and the data were not normally distributed, with 75 (40%, $n = 187$) considered outliers and many scores much higher or lower than this median (Fig. 1).

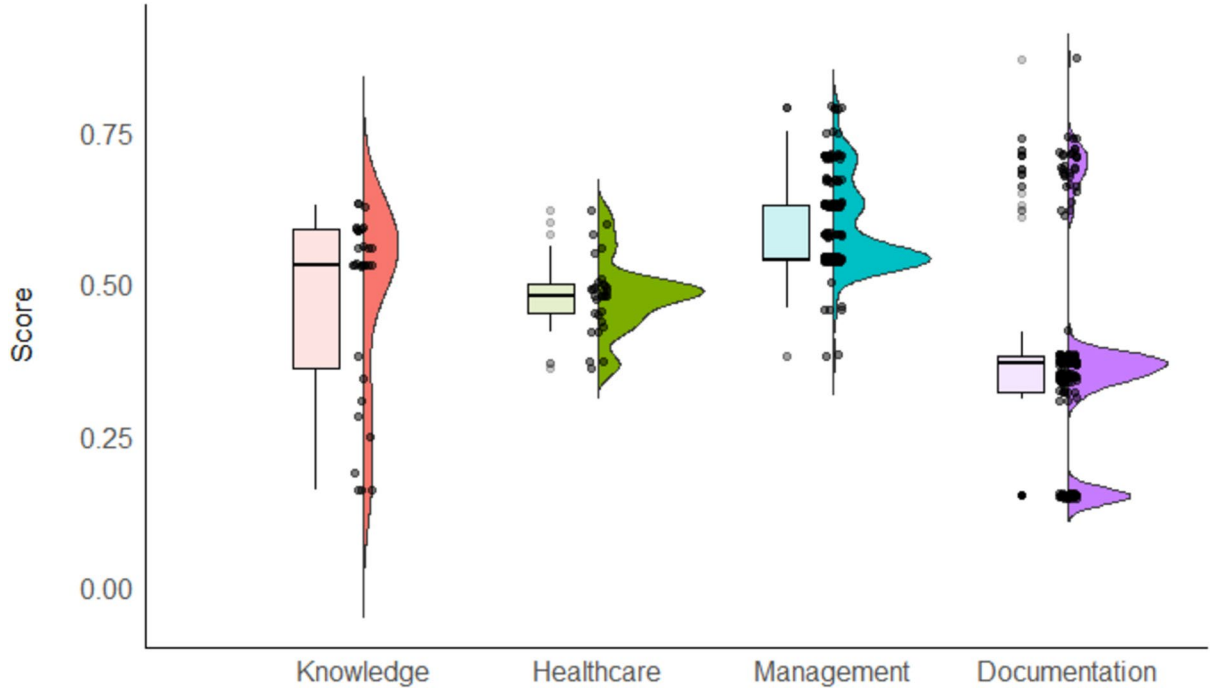

Fig. 1 The leprosy focal persons' knowledge and skills and facility healthcare performance scores. Knowledge is the leprosy local person knowledge and skill scores; Healthcare is the overall healthcare scores; Management is the case management scores; and Documentation is the case documentation scores. Box plots with outliers are shown with density plots with overlaid raw data to show the nonnormal distributions

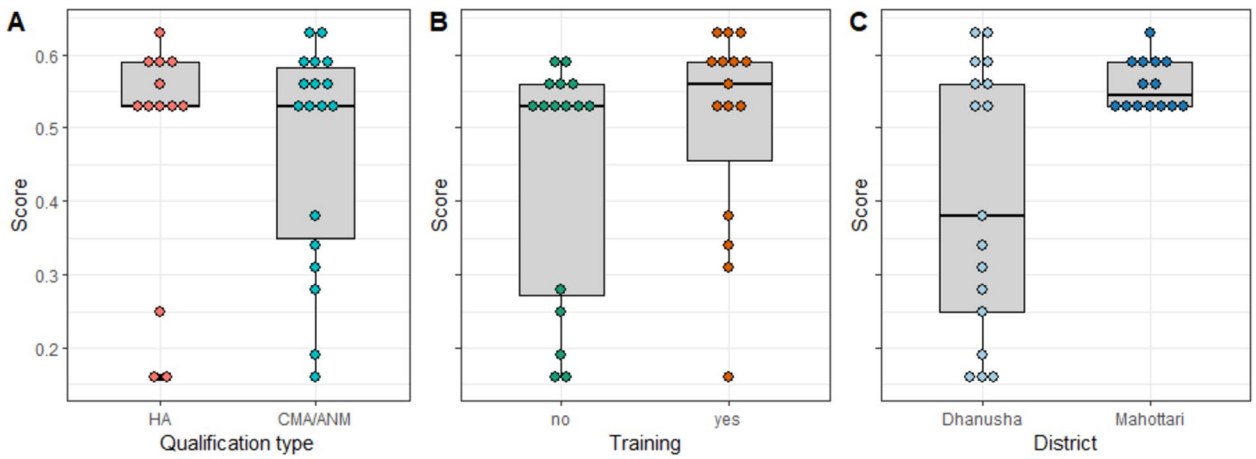

Fig. 2 Distribution of leprosy focal persons' knowledge and skills scores by qualification type, training, and district. HA is a health assistant (3 years of training); CMA is a community medical assistant; and ANM is an auxiliary nurse, a midwife and an auxiliary health worker (1 year of training)

Case management scores

Case management scores ranged from 0.38 to 0.79 (Fig. 1). The median score was 0.54 (95% CI 0.53–0.55; IQR 0.54–0.63), and again, the data were not normally distributed with 5 outliers.

Overall healthcare scores

Overall healthcare scores ranged from 0.36–0.62 (Fig. 1). The median score was 0.48 (95% CI 0.47–0.49; IQR 0.45–0.5), and again, the data were not normally distributed with 5 outliers.

Pre- and post-disability status of MDT-treated patients

No statistical improvement in the disability status or EHF score at the time of study in MDT-treated patients compared to the disability and EHF score recorded at the time of registration or before the treatment was measurable (95% CI −6 to 12) (Table 1; Figure S2).

The role of counseling for self-care after RFT in improving disability

Overall, self-care did not significantly improve disability (β = 0.25, SE = 0.26, *p* value = 0.34) or EHF (β = 0.45, SE = 0.35, *p* value = 0.21) scores (Figure S3). However, patients who have been provided counseling for self-care know that self-care can improve disabilities significantly better than those who have not been provided counseling for self-care (OR 7.9, 95% CI, 1.3–89.1, *p* value = 0.01). Moreover, those patients who have not been provided with counseling practice self-care significantly less than those who have been provided with counseling (OR = 46 (95% CI, 2.5–867%), *p* value < 0.001) (Table S5).

Lepra reaction status in leprosy-treated patients

Most of the patients (172, 92%, 87–95%) had no lepra reaction, whereas only 5 (2.7%, 1–6%) had a type 1 reaction, and 10 (5.4%, 3–10%) had a type 2 reaction. Of the 15 people with a positive lepra reaction, just one (6.7%, 0.2–32%) was managed by an LFP.

Client satisfaction status in leprosy-treated patients

Only 20 (11%, 7–16%) of the leprosy-treated patients were fully satisfied with the health services, yet more than 4/5 (158, 85%, 78–89%) of the patients were satisfied with the services. Similarly, only a few (9, 5%, 2–8%) were not satisfied with the services.

Discussion

The Nepal country roadmap to zero leprosy recommends high levels of expertise to facilitate the early detection and reduction in transmission of leprosy [9, 26]. In contrast, the median score of knowledge and skills of LFPs in Dhanusa and Mahottari was just 0.53. The low documentation score of 0.37 in the study districts is a challenging issue because high-quality documentation is required to assess the progress and validate the elimination of leprosy [27]. The exact situation of leprosy elimination in Dhanusa and Mahottari was therefore likely uncertain, as the median case management and median overall performance were just 0.54 and 0.48, respectively.

Fifty percent of LFPs had less than 53% knowledge and skills, which is low and is in contrast to Mohite et al.'s study in Bangladesh, where 88% of health workers had good knowledge of leprosy [20], perhaps representing training gaps. The highest scores were just 63%. Similarly, most peripheral health facilities had poor performance scores, posing a serious concern for the elimination of leprosy transmission by 2030. Ninety-six percent of the LFPs knew at least 1 cardinal sign, a more satisfactory result compared to a study in Bangladesh (72%) [28]. However, only 19% of LFPs could palpate at least one peripheral nerve, revealing gaps in leprosy diagnosis in Nepal that need to be addressed. Only 19% (6 out 31) of health facilities achieved a 50% aggregate performance regarding leprosy management, which is crucial for achieving the goal of eliminating transmission by 2030. The finding that > 80% of the LFPs could not palpate any peripheral nerves is comparable to the study conducted by Roy et al. that showed that 83% of health workers in parts of India were poorly skilled [13].

Those workers who had taken any of the leprosy trainings (BLT or CLT) had significantly higher levels of knowledge and skill (OR = 8.1, 95% CI, 1.4–66.3, *p* value = 0.01), highlighting the importance of training since leprosy is either not included or not prioritized in the academic courses for paramedical staff. Other variables, including education level and duration of experience, were not significant markers of increased knowledge and skills. However, in multivariate regression of the raw scores, Mahottari had significantly higher

Table 1 Disability and ear hand and feet (EHF) score in multidrug therapy-treated patients

Score at the time of treatment		Score at the time of study		Statistics
Disability (grade 1 or 2)				
None	**Present**	**None**	**Present**	
143 (76%, 70–82%)	44 (23%, 18–31%)	148 (79%, 73–85%)	39 (21%, 15–27%)	$\chi^2 = 0.25$, df = 1, *p* value = 0.62; 95% CI change: −6 to 12%
EHF				
0	> 1	0	> 1	
143 (76%, 70–82%)	44 (23%, 18–31%)	149 (80%, 73–85%)	38 (20%, 15–27%)	$\chi^2 = 0.39$, df = 1, *p* value = 0.53; 95% CI change: −6 to 12%

knowledge and skills than Dhanusa (β = 0.63, standard error (SE) = 0.21, p value = 0.002; Fig. 2) but not training. This needs to be explored further to understand if this is due to better staff training, lower staff turnover or some other meaning. Larger study sizes allowing for multivariate analyses [29] and in-depth interviews with staff would both help identify potential causes and, therefore solutions.

Less than 5% (4.8%) of cases were diagnosed through active case detection, and the majority of cases (78%) were diagnosed through Lalgadh Leprosy Hospital, which drew the governments' attention to hidden cases in the community. The cases are diagnosed at specialty hospitals only after the leprosy cases reach the advanced stage. This means that the proportion of cases diagnosed at peripheral health facilities should be greater, as people in the early stages of leprosy visit these facilities. In this study, few leprosy cases were diagnosed in peripheral health facilities. Therefore, early cases could be hidden in the community due to the inefficient performance of health workers, unavailability of diagnosis and/or the stigma associated with the disease.

Both the disability score and EHF score were not significantly improved after full treatment and compliance with MB MDT treatment, which was surprising, as comparable studies conducted by Kumar et al. showed that the disability prevalence in noncompliant cases was significantly greater than that in fully treated patients [15]. This may, however, be due to the very small sample size and time frame and requires further investigation. Further, the study was designed to assess the variation in disability and EHF scores (Figure S2), however, because of the low numbers of patients and little variation in scores, with many patients scoring zero, we only tested pre- and post-treatment score changes (rather than the three time points) (Table 1), meaning many patients could not score the maximum. That all cases have completed treatment in time and were released after treatment indicates a well-performing health system for those recruited. Moreover, counseling of patients by an LFP significantly changed the belief of the patient who self-care can improve disability (OR = 7.9, 95% CI, 1.3–89.1, p value = 0.01). The result was comparable with the studies conducted by Lusli et al. and Devkota et al. [30, 31], where counseling has a significant role in changing the belief and attitude toward health behaviors. Similarly, counseling significantly improved self-care practice (OR = 46, 95% CI, 2.5–867%, p value = < 0.001).

Among the cases monitored, only 8% developed lepra reactions, of which 2.7% (5 patients) and 5.4% (10 patients) were type 1 and type 2 reactions, respectively. Other studies found that 17.9% of leprosy cases developed type 1 reactions, and between 1.2% and 15.4% of leprosy cases developed type 2 reactions [32, 33]. These are similar trends but lower than some studies and might be limited by sample sizes and/or case treatment [34].

Regarding satisfaction from services provided by health facilities, 95.2% of leprosy cases were satisfied with the services, which is comparable to a study in Brazil, where between 92–100% of patients were satisfied at some level [35].

Weaknesses of our study are the convenience sampling of the districts, although this was deliberate due to disease burden, and patient enrollment by the LFPs of respective health facilities. This might have biased the sample, and future prospective and randomized control studies might improve this. Moreover, the sample size was small due to low case numbers, potentially preventing more detailed analyses [29]. For example, we used univariate count data analyses where continuous data and multivariate analyses would be beneficial, but we had too many variables for the small sample size. Similarly, we had a large, zero-inflated sample, with many patients having zero disability or EHF scores. Zero-inflated beta regression tools exist and could be used but failed to fit our data, even using a Bayesian framework (not shown), likely due to too many zeros and prior distribution specification sensitivity. Further, for our work we only included patients who had completed treatment, so despite the low scores our analyses may be best case scenarios. Future work should include more extensive investigation of other patients, including from case identification through the treatment process and try to include cases who do not complete treatment programs, and further investigate study components such as satisfaction for which there was only one questions. These factors limit some of the conclusions that can be made, highlighting the need for more comprehensive study.

However, the work highlighted key gaps and necessary interventions such as strategic basic or refresher training, regular monitoring and supervision and onsite coaching were recommended.

Conclusion

The overall performance of health care services for leprosy patients was 0.48 (95% CI, 0.47–0.49), and the median knowledge and skill scores of LFPs, documentation scores and case management scores of health facilities were 0.53 (0.46–0.60), 0.37 (0.36–0.38) and 0.54 (0.53–0.55), respectively. These low scores likely hinder the elimination of leprosy transmission targets, despite all cases utilizing treatment and being released after treatment and 95.2% of cases being satisfied with the service they were provided. Leprosy-related training was significantly related to the knowledge and skills of health workers, which provides an evidence base for further

training. Disability and EHF scores were not significantly reduced in treated patients in the study period, but counseling by LFP has significantly improved positive belief and practices regarding self-care, again offering evidence that training can help cases and potentially will contribute to reducing onward transmission. As the overall performance of leprosy care services was 48%, it should be improved by intense evidence-based training, onsite coaching, monitoring and supervision to facilitate the elimination of leprosy transmission by 2030. Compliance should be maintained regularly, and this study provides a benchmark against which progress can be assessed.

Abbreviations

AHW	Auxiliary health worker
ANM	Auxiliary nurse midwives
BLT	Basic leprosy training
CI	Confidence Interval
CLT	Comprehensive leprosy training
CMA	Community medical assistant
EHF	Ear hand and feet
HMIS	Health Management Information System
LFP	Leprosy focal person
LPEP	Postexposure prophylaxis
MB	Multibacillary
PB	Paucibacillary
RFT	Release after treatment
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Author's contributions
R.K.M conceived and designed the manuscript; R.K.M, U.G, D.G, D.B, and B.K.C managed and collected the data; R.K.M and D.T.S.H analyzed the data; R.K.M and B.B wrote the original draft; and K.P.P, C.L.D, U.R.P, D.T.S.H, and B.D.P reviewed the manuscript. All the authors have read, reviewed, and approved the final manuscript. D.T.S.H is supported by the Percival Carmine Chair in Epidemiology and Public Health and by the Royal Society Te Apūrangi RDF-MAU1701.

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Data availability
The datasets generated and/or analyzed during the current study are not publicly available because the individual privacy of patients could be compromised but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The data were primarily collected in the field as part of regular surveillance and monitoring activities of the Epidemiology and Diseases Control Division (EDCD), Department of Health Services, Ministry of Health and Population, as per EDCD guidelines. Permission to analyze and publish these data was obtained from Nepal Health Research Council (ethical approval no 349/2022 P and approval date: 21 July 2022) on the request of EDCD. Nepal Health Research Council has an institutional ethical review board which has waived the informed consent (also 349/2022 P) for the study. The human data for this study were anonymized.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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