Tadesse et al. BMC Infectious Diseases (2026) 26:206
https://doi.org/10.1186/s12879-025-12324-0

BMC Infectious Diseases

RESEARCH

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Decentralizing care for cutaneous leishmaniasis and other skin diseases to primary health facilities in Southern Ethiopia: What are the needs?

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Abstract

Background Cutaneous leishmaniasis (CL) and other skin diseases impose a high disease burden in Ethiopia, yet access to care is poor due to limited and centralized diagnostics and treatment. Decentralizing care could improve this but may necessitate substantial changes to the healthcare system. This study aimed to assess the available resources and the knowledge and skills of healthcare professionals for decentralizing the diagnosis and care of CL and common skin diseases to lower healthcare facilities.

Methods A cross-sectional study was conducted in South Ethiopia, from May to July 2023, involving 11 health centers, four primary hospitals, and one general hospital. Infrastructure was assessed on-site. Resources, knowledge, and skills of staff members regarding the treatment of CL and other skin diseases were collected using a newly developed questionnaire, comprising 25 knowledge-based and 14 skill-based questions. Skills were assessed via lesion and pathogen images. Descriptive statistics for the different variables studied and inferential statistics based on (confidence) interval estimation were reported.

Results Most facilities had equipment for diagnosis and localized treatment. Adequate hospitalization space and necessary equipment for systemic treatment of CL were found in 3 out of 4 primary hospitals, but none of the health centers. Consumable and drug shortages were common across all facilities. The median score of BSc laboratory technologists was significantly higher than that of diploma technicians (i.e. 29 vs. 15 out of a maximum of 39, $p < 0.001$). Clinical staff scores varied significantly across education levels ($p = 0.007$), with physicians scoring the highest (median 33, IQR 31–36), followed by health officers (median 29, IQR 27–32), BSc nurses (median 28, IQR 16–36), and diploma nurses (median 25, IQR 19–29). Notably, no significant differences in median scores were observed between primary hospitals and health centers for clinical and laboratory staff.

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Conclusions Decentralizing the diagnosis and treatment of common skin diseases and localized CL treatment to health centers appears feasible with facility adjustments, continuous training, and reliable supply chains, while referring CL cases requiring systemic treatment to primary hospitals. Strong strategic efforts to maintain staff knowledge and skills and tackle supply shortages are crucial for successful decentralization.

Clinical trial number Not applicable.

Keywords Cutaneous leishmaniasis, Decentralization, Ethiopia, Primary healthcare facilities, Skin diseases

Background

Cutaneous Leishmaniasis (CL) represents a significant, yet often overlooked, public health burden in low- and middle-income countries, including Ethiopia [1–3]. It is a parasitic infection that manifests with skin lesions that can leave lifelong scarring, leading to severe psychosocial impact on the affected individuals [1, 4]. The World Health Organization (WHO) estimates that there are 600,000 to 1 million new global cases of CL annually, with a substantial number thereof occurring in East Africa [1].

CL mainly affects impoverished communities, especially those residing in remote mountainous regions bordering the Ethiopian Great Rift Valley. Official reports indicate fewer than 1,000 cases annually [1, 4]. However, evidence from several studies in north and south Ethiopia signals severe underreporting [2, 5, 6], suggesting that incidence estimates may reach 20,000 to 50,000 cases per year [2–4].

Underreporting is influenced by the lack of awareness, poor health-seeking behavior, and limited diagnostic and treatment options. In 2022, only 19 CL diagnostic and treatment centers were available country-wide, which may require patients to travel hundreds of kilometers [3]. These centers provide insufficient treatment capacity to manage all CL patients, illustrated by long waiting lists at treatment facilities [7]. Other barriers to visiting these specialized facilities include a lack of knowledge about diseases, available treatments, and economic constraints [8]. Hence, instead of seeking modern treatment for CL, patients often visit traditional healers in their community.

CL is not the only prevalent skin disease in rural Ethiopian communities. Other infectious skin morbidities, such as scabies, podoconiosis, leprosy, mycetoma, and various fungal and bacterial infections, contribute to the overall high burden of skin diseases. The WHO roadmap for Neglected Tropical Diseases (NTDs) 2021–2030 [9] and the Ethiopian 2021–2025 third national NTDs strategic masterplan [3] strongly advocate for integrated and decentralized care as a cornerstone of effective management of skin NTDs. Moreover, the masterplan would enable an optimization of the limited available resources while aiming to significantly expand the number of facilities diagnosing and treating CL. More specifically, a target of 170 diagnostic centers and 30 treatment facilities by 2030 has been set to improve access to CL care [3].

Improving access to healthcare services through decentralization necessitates important changes to the healthcare system. To what extent healthcare facilities currently have the required equipment, knowledge, and skills to diagnose and treat CL and skin disease patients is unknown. As the Ethiopian Federal Ministry of Health and the South Ethiopia Regional Health Bureau were planning to start up new treatment centers in South Ethiopia, this study aimed to assess the available resources and the knowledge and skills of healthcare professionals for decentralizing the diagnosis and care of CL and common skin disease to the lower healthcare facilities in the area. Such information is crucial for understanding at which healthcare level decentralization would be feasible for the local authorities. It also enables the development of a targeted plan for investments and training to achieve successful decentralization.

Methods

Ethical approval

The study was approved by the Arba Minch University Institutional Research Ethics Review Board (194/23), the Institute of Tropical Medicine Institutional Review Board (1680/23), the University Hospital Antwerp Ethics Review Board (5453/23), and the WHO Regional Office For Africa (WHO AFRO) Ethics Review Committee (2023/4.9 [-4/1093]). Approval letters from Zonal and District Health offices were obtained to perform the research. A written administrative authorization letter was sought from the head of each healthcare facility before inspecting the infrastructure. Written informed consent for participation in this study was provided by all healthcare professionals before data collection. All the methods were carried out following the Declaration of Helsinki.

Study setting

The study was conducted in the Gamo Zone, South Region, Ethiopia, from May to July 2023. Ethiopia follows a three-tier healthcare system with primary, secondary, and tertiary levels of care [10, 11]. The primary healthcare level itself consists of three levels, of which the first level entails primary hospitals, mostly situated in *woreda* (district) towns, in which general practitioners and a few specialists are found. These are equipped with tools to diagnose and treat patients. Second, there are health centers in the *woreda* periphery, where nurses, health officers, and sometimes a general physician are found. Basic laboratory and clinical infrastructure are present here. Each health center is linked to five satellite health posts in *kebeles* (villages), the third and lowest level of the primary healthcare system, managed by a health extension worker (HEW). These HEWs receive a short training and reside in the community where they provide basic health services. The secondary healthcare system includes a general hospital in zonal (regional) cities, which has sophisticated equipment and skilled medical specialists, and acts as a referral center for primary hospitals. The tertiary healthcare system includes specialized hospitals and referral centers for general hospitals.

Staff working at these different healthcare levels exhibit distinct educational backgrounds. Nurses, laboratory personnel, and pharmacy professionals either have obtained a Bachelor of Science (BSc, undergraduate) requiring four years for nurses and laboratory personnel, and five years for pharmacy programs, or a diploma (certificate) with three years of education at a lower level [12]. Overall, healthcare workers with the highest qualifications, such as physicians and laboratory technologists, were primarily stationed at the hospital levels in our study area (Additional file S1). At health centers, the highest level of clinical staff are health officers, with a few exceptions in health centers where physicians work. Healthcare workers with a diploma certificate were evenly distributed across primary hospitals and health centers.

A purposive sampling technique was employed to select healthcare facilities. The selection was based on two primary criteria: first, documented endemicity for CL determined based on previous studies and regional reports [5, 13], and second, accessibility of such health centers. From a total of 64 primary healthcare facilities (one general, five primary hospitals, and 58 health centers) in the study area, the selection process led to the inclusion of 16 facilities, comprising one general hospital, four primary hospitals, and 11 health centers, which collectively represent the spectrum of primary care services in the region (Fig. 1).

Study design

A cross-sectional study was performed between May and July 2023, including two components: *(i)* a healthcare facility resource assessment and *(ii)* a laboratory and clinical staff assessment to investigate knowledge and skills for diagnosing and treating CL and other common skin diseases.

Study population

Comprehensive sampling included all clinical and laboratory professionals at the 16 selected healthcare facilities who *(i)* worked there for over six months regardless of their experience with skin disease diagnosis and management, *(ii)* were available during the visit of the study team, and *(iii)* provided written informed consent for participation.

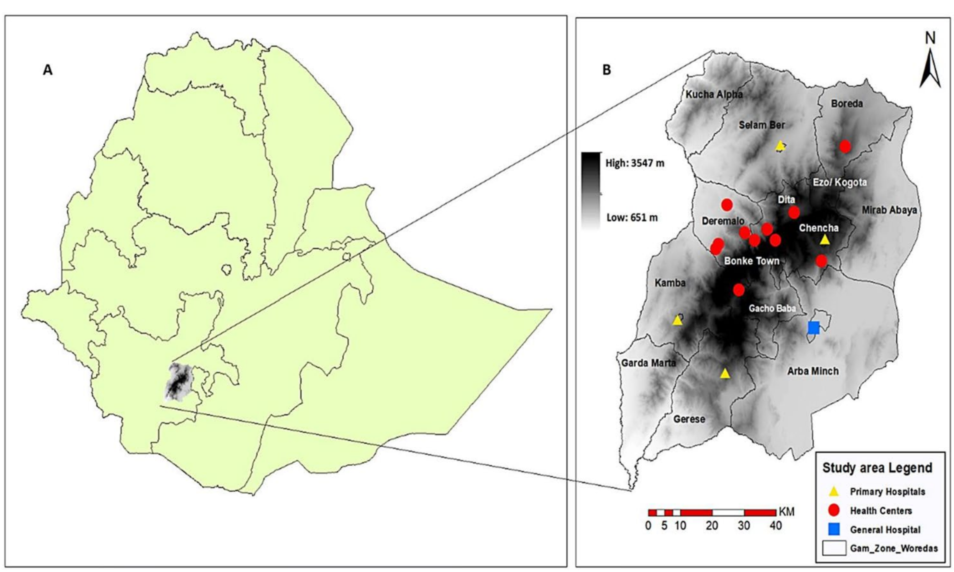

Fig. 1 Map showing the healthcare facilities included in the study. (**A**) Map of Ethiopia with the study site indicated in the Southern region [14]. (**B**) Zoom map of the study sites on an altitude gradient [15]. A blue square displays Arba Minch General Hospital (AMGH); primary hospitals (Chancha, Gerese, Kemba, and Selam Ber) are depicted by yellow triangles; and district health centers (Deramalo (Wacha, Guge Boyre, Dara Dime, and Shalladida), Dita (Woyiza, Andiro Giglio, Sulisse, and Zara), Chencha (Dorze), Boreda (Zefine), and Bonke (Gezoso)) are indicated by the red circles

Resource assessment

The selected healthcare facilities were visited by the principal investigator (DT) and a trained data collector (SB). Information on the catchment population and health insurance was gathered from *woreda* (district) health offices and each facility's District Health Information System (DHIS). Accompanied by facility staff members and using a predesigned questionnaire, the laboratories, clinical facilities, and pharmacies were visited. The availability of resources such as consumables, permanent infrastructure/tools, and treatments needed to diagnose and manage CL and other common skin diseases was observed. Furthermore, the functionality of equipment (complete blood count (CBC) and chemistry machines, electrocardiograms, beds, etc.) needed for the management of systemic treatment of CL was checked. The quality of microscopes was assessed using Giemsa-stained slides from CL patients with a known parasite load by a skilled technologist. Moreover, the availability of laboratory consumables (scalpels, microscopy slides, staining reagents, CBC and chemistry reagents, etc.) used for the diagnosis of CL and other skin diseases, such as Giemsa and Gram stains, and potassium hydroxide (KOH), was also recorded.

Knowledge and skill assessment

At each site, healthcare professionals' knowledge and skills in diagnosing and treating patients with CL and other skin diseases were assessed, with a primary focus on CL. Novel questionnaires were developed for clinical and laboratory staff separately, based on expert knowledge and discussion within the study team, thereby consisting of a total of 39 multiple-choice questions in each of the questionnaires. The tools were pre-tested at AMGH by asking the questions to two experienced dermatologists and two laboratory technologists who did not take part in the development of the questionnaire. The experts evaluated the tool for clarity, comprehensibility, relevance, and flow. Based on their feedback, ambiguous terms were rephrased to enhance clarity, and internal validity was checked. The questions were presented on a tablet to each staff member separately in a private room (Additional file Table S2).

More specifically, each questionnaire consisted of 25 knowledge-based and 14 skill-based questions. Clinical staff received knowledge questions about the signs, symptoms, and treatment of skin diseases. Additionally, they were asked to provide a clinical diagnosis based on lesion pictures to assess their skills (Additional file Figure S1).

Laboratory staff knowledge was evaluated through questions about the appropriate diagnostic modalities for different skin diseases. Their skills were assessed by asking them to identify infectious skin diseases based on microscopic images (Additional file Figure S2). The images employed in both questionnaires were from patients who had previously consented to the anonymized use of their pictures in secondary research, or from the WHO Skin NTD App, or the Centers for Disease Control and Prevention (CDC) [16, 17].

Data analysis

Data collection was performed using RedCap version 13.8.0 [18], and subsequent cleaning and data analyses were carried out utilizing R, version 4.3.2 [19], with the 'ggplot2' package version 3.5.1 [20] for data visualization. The normality of the continuous data distribution was assessed using the Shapiro-Wilk test. Absolute and relative frequencies (expressed as percentages) were reported for categorical variables, while medians with corresponding interquartile ranges (IQRs) were computed for continuous variables. When comparing different proportions, corresponding 95% confidence intervals (CIs) were constructed and presented. In the knowledge and skill tests, each question received a numerical score for a correct (1 point), partially correct (0.5 points), incorrect (0 points), or *"does not know"* (0 points) response (Additional file Table S2). The total score based on the questionnaire was computed for each participant by summing the item-specific scores mentioned previously. Wilcoxon rank sum tests were performed to compare the median total scores between two independent groups of participants. When comparing the median scores across three or more groups, Kruskal-Wallis tests were used. In the presence of a significant difference between medians at a 5% significance level (i.e., two-sided exact p-values < 0.05), pairwise comparisons were performed using Dunn's post-hoc test in combination with a Bonferroni correction for multiple testing.

Results

Description of health facilities and available resources

The distance of healthcare facilities from Arba Minch General Hospital (AMGH) varies greatly, reaching up to 239 km (Fig. 1 and Additional file Table S3). There was a 10-fold difference in the catchment population between the general hospital, primary hospitals, and health centers. Moreover, about half of the population had health insurance (Additional file Table S3).

Diagnosis of common skin diseases like CL, scabies, eczema, and fungal and bacterial infections was done in most healthcare facilities. Treatment for these common skin diseases (Additional file Table S4) was available in most facilities, albeit with interruptions. However, rare skin morbidities require referral for diagnosis and treatment to higher-level healthcare facilities. CL treatment was available only at the general hospital. While sodium stibogluconate (SSG) for intralesional CL treatment was present in only one health center, it was used only for participants enrolled in an ongoing clinical trial.

For the diagnosis of CL, most facilities had a good microscope in place to examine Giemsa-stained skin slit smears; however, supplies of required consumables were unreliable (Table 1).

For example, scalpels were available in only one of the 11 health centers (9.1%) and none of the primary hospitals. Giemsa staining was available in about half of the health centers (i.e., 6 out of 11 health centers; 54.5%) and primary hospitals (2 out of 4; 50%).

Table 1 Laboratory and clinical capacity availability per healthcare facility level for CL diagnosis and treatment

Variable	Availability	General Hospital N = 1	Primary Hospital N = 4	Health Center N = 11
Laboratory diagnosis				
Microscopy space	Available	1 (100.0%)	4 (100.0%)	10 (90.9%)
Enough staining space	Available	1 (100.0%)	4 (100.0%)	10 (90.9%)
Microscopy slides	Supply interrupted	-	4 (100.0%)	6 (54.5%)
	Continuous supply	1 (100.0%)	-	5 (45.5%)
Scalpels	Supply interrupted	-	1 (25.0%)	8 (72.7%)
	Continuous supply	1 (100.0%)	-	1 (9.1%)
Giemsa	Supply interrupted	-	2 (50.0%)	2 (18.2%)
	Continuous supply	1 (100.0%)	2 (50.0%)	6 (54.5%)
Microscope	Available, but of poor quality	-	-	2 (18.2%)
	Good microscope	1 (100.0%)	4 (100.0%)	9 (81.8%)
Systemic treatment for CL				
Hospitalization room	Available	1 (100.0%)	4 (100.0%)	8 (72.7%)
Functional CBC machine	Available	1 (100.0%)	4 (100.0%)	1 (9.1%)
Functional Chemistry machine	Available	1 (100.0%)	3 (75.0%)	-
Functional ECG machine	Available	1 (100.0%)	3 (75.0%)	-
CBC reagents	Supply interrupted	-	2 (50.0%)	-
	Continuous supply	1 (100.0%)	2 (50.0%)	1 (9.1%)
Chemistry reagents	Supply interrupted	-	3 (75.0%)	-
	Continuous supply	1 (100.0%)	-	-

Equipment and consumables were split up for CL diagnosis and systemic treatment. For consumables, three categories were possible: continuous supply, interrupted supply, or no supply (not shown). A dash (-) means no supply (or zero supply) of resources in the healthcare facilities. CBC, complete blood count; ECG, electrocardiogram

AMGH and the four primary hospitals had the required space for inpatient treatment of patients needing systemic treatment. Although eight out of 11 health centers had a room for patient hospitalization, the bed capacity and overall quality of the admission spaces were considerably lower at health centers compared to primary hospitals. Chemistry, Complete Blood Count (CBC), and Echocardiographic (ECG) machines - vital for monitoring patients getting systemic treatment for CL - were present in AMGH and in three out of four primary hospitals, but were nearly absent within health centers. CBC reagents and especially chemistry supplies were found to be frequently interrupted for most of the primary hospitals.

Description of the interviewed study population

A total of 110 healthcare professionals participated in the knowledge and skill assessment. Out of these interviewees, 61 (55.5%) were clinical professionals and 49 (44.5%) were laboratory professionals (Additional file Table S1). Despite making up approximately 60% of the clinical staff in primary hospitals and health centers, only a few diploma nurses were interviewed because of their minor role in direct care for patients with CL and other skin diseases. In primary hospitals, more physicians (60.0%) were enrolled, while in health centers, predominantly health officers (64.5%) were included in the study.

The median years of experience were lower for higher educational levels of clinical staff, except for specialists (Additional file Table S5). Physicians had a median of 2 years of experience (IQR 1–3), health officers had 3 years of experience (IQR 2–5), while BSc nurses showed a median of 4 years of experience (IQR 1–12). On the other hand, BSc technologists had a median of 6 years of experience (IQR 2–10) while diploma technicians exhibited a median of 5 years (IQR 2–8). No significant differences in median years of experience were found between laboratory professionals in primary hospitals and health centers ($p = 0.378$) or between diploma and BSc holders ($p = 0.144$; Additional file Figure S3, panels A and B). Clinical staff at health centers had more experience (median 3 years, IQR 2–7) than those in primary hospitals (median 2 years, IQR 1–3, $p = 0.007$). There was no overall difference in median experience across professions ($p = 0.072$; Additional file Figure S3, panels C and D) at a 5% significance level. The difference in experience between primary hospital and health center staff may be influenced by the sample composition, although nonetheless representative of the facilities' healthcare workers population.

Questionnaire findings for laboratory and clinical professionals on CL

Among the 49 laboratory professionals, the proportion of correct responses to specific knowledge questions varied significantly. In general, the probability of a correct answer to questions on CL sample collection and examination was below 60%. Although most laboratory professionals could correctly identify the type of staining used for CL diagnosis, less than 30% recognized *Leishmania* parasites based on a Giemsa-stained slide (Additional file Table S2).

Among the 61 clinical professionals, the majority answered knowledge questions about the clinical diagnosis of CL correctly, except for questions on the duration of symptoms. For questions on CL treatment, only around 40% of the participants knew when to request laboratory tests. Slightly more than 50% of them correctly indicated whether to provide localized or systemic treatment for the different types of CL. Remarkably, over 80% of the clinical professionals provided a correct clinical diagnosis for the skill questions, as illustrated through the set of pictures related to CL patients (Additional file Table S2).

Description of questionnaire findings for skin diseases other than CL

Among the 49 laboratory professionals interviewed, the proportion of correct responses to specific knowledge questions varied by morbidity. For instance, laboratory professionals showed the lowest correct response rate for the diagnosis of leprosy and microfilaria, while higher scores were obtained for diagnostic methods for bacterial and fungal infections. Unfortunately, none of the laboratory professionals identified scabies parasites, 2% identified tungiasis, and 14.3% identified fungal elements, whereas about 69% correctly identified bacterial species for the skill questions, as illustrated through the set of pictures related to skin disease patients (Additional file Table S2).

Among the 61 clinical professionals, the proportion of correct responses showed substantial variation. For knowledge-based questions, a low number of correct answers was observed for topics such as leprosy and the causes of lower limb swelling, while a higher probability of a correct answer was seen for scabies diagnosis, with 60 (98.0%) participants answering this question correctly. For skill-based questions, clinical professionals scored higher (Additional file Table S2). For example, the laboratory knowledge of skin disease diagnosis was notably poor, while clinical knowledge was excellent, questioning the extent to which laboratory diagnosis can complement clinical decision-making at the current level of training.

Comparison of knowledge and skill by facility and by health profession

Overall, BSc laboratory technologists outperformed diploma laboratory technicians, with a median total score of 29 (IQR 24 – 31) and 15 (IQR 9 – 20) out of a maximum achievable score of 39, respectively ($p < 0.001$, Fig. 2A). Subset analysis showed significant differences in both median knowledge and skills ($p < 0.001$) sub-scores (Additional file Figure S4, panels A and C) between laboratory professionals' education levels. The median total scores in primary hospitals (median 20, IQR 14 – 24)

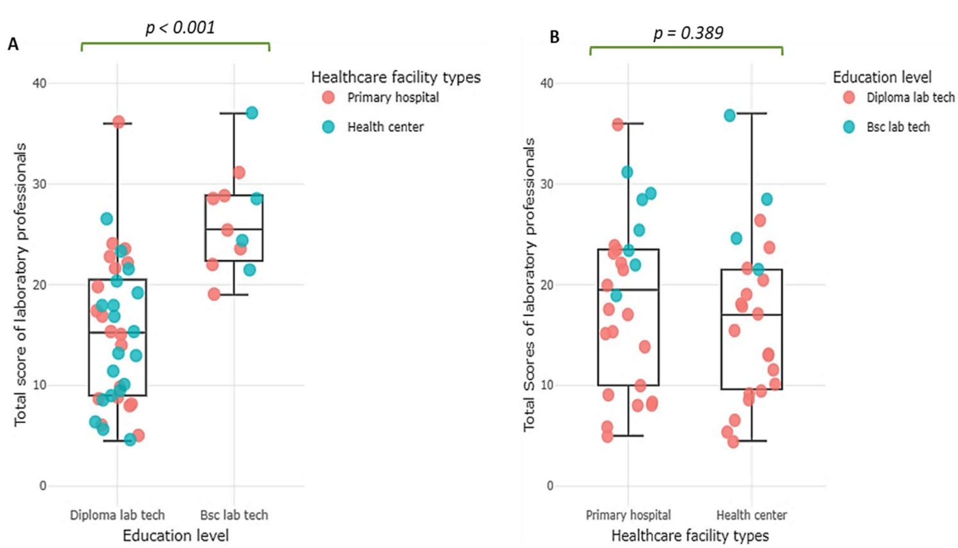

Fig. 2 Boxplots showing laboratory professionals' total knowledge and skill assessment scores. Maximum scores were 39. The scores were compared using Wilcoxon-Mann-Whitney U tests. (**A**) Comparisons of the total scores between educational levels of laboratory professionals showed statistically significant differences in median scores (p < 0.001); (**B**) comparison of the median total scores of laboratory professionals in the different healthcare facilities showed no significant difference (p = 0.389)

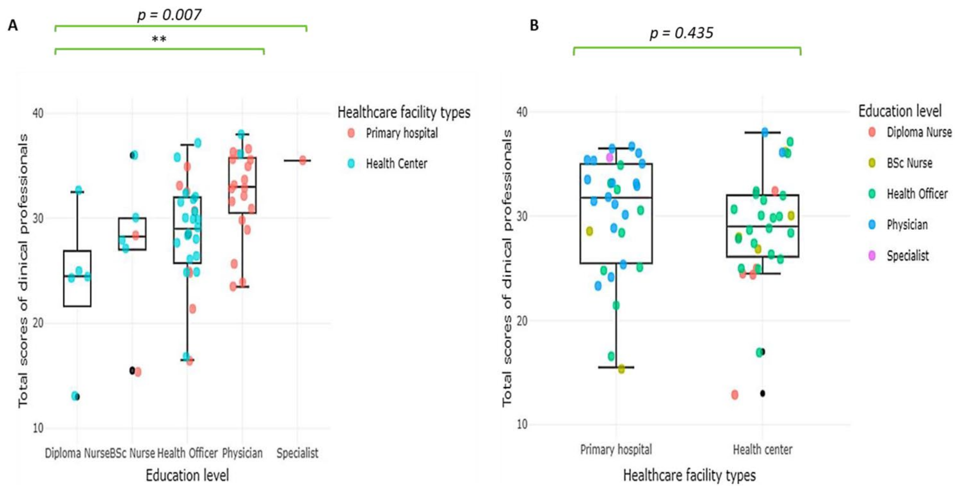

Fig. 3 Boxplots showing clinical professionals' total knowledge and skill assessment scores. Maximum scores were 39 points. The scores were compared using Groupwise (Kruskal-Wallis) and pairwise (Dunn) tests. (**A**) Comparisons of the total questionnaire scores showed a significant difference ($p = 0.007$) in the level of education of clinical professionals (Kruskal-Wallis test). Pairwise (Dunn tests) comparisons with Bonferroni correction showed a significant difference between diploma nurses vs. physicians (adjusted $p = 0.026$). However, there were no significant differences between health officers vs. physicians ($p = 0.079$), BSc nurses vs. physicians ($p = 0.499$), diploma nurses vs. BSc nurses ($p = 1.000$), diploma nurses vs. health officers ($p = 1.000$), and BSc nurses vs. Health officers ($p = 1.000$). (**B**) Kruskal-Wallis test comparing the total scores of clinical professionals by healthcare facility showed no significant difference ($p = 1.000$). ** significance level at $p<0.05$

and health centers (median 17, IQR 10 – 22) did not significantly differ ($p = 0.410$, Fig. 2B). Likewise, there was no notable difference in median knowledge ($p = 0.284$) and skills ($p = 0.769$) scores of laboratory professionals between both settings (Additional file Figure S4, panels B, D). Notably, two health centers (Zefine and Wacha) had high-scoring BSc lab technicians with median scores of 29 and 37, respectively.

Median total scores on knowledge and skill assessments combined were significantly different across different educational levels of clinical professionals ($p = 0.007$, Fig. 3A). Diploma nurses had a median score of 25 (IQR 19–29), BSc nurses had a median total score of 28 (IQR 16 – 36), health officers 29 (IQR 27 – 32), and physicians 33 (IQR 31 – 36) (see Fig. 3A and Additional file Table S5). Physicians scored significantly better than diploma nurses (adjusted $p = 0.026$) (Fig. 3A), and no differences in median total scores were observed between other groups. Additionally, in skill questions with lesion pictures (Additional file Figure S1), physicians scored in median terms significantly better than diploma nurses (adjusted $p = 0.030$), and no significant pairwise differences in medians were observed between other groups. In terms of knowledge, no significant differences in median knowledge scores were observed across groups (Additional file Figure S5, panels A, C).

Notably, there was no significant difference ($p = 0.435$) in the median total scores, as well as for knowledge ($p = 0.989$) and skill sub-scores ($p = 0.076$) of clinical professionals between primary hospitals (median 32, IQR 29 – 33) and health centers (median 29, IQR 27 – 32) (Fig. 3B and Additional file Figure S5, panels B, D). Interestingly, in four health centers (Dorze, Andiro, Zefine, and Wacha), there were clinical staff with total scores of 36 or above, amongst which were two health officers and two physicians.

Discussion

Access to care for skin diseases, particularly CL, is poor in Ethiopia. Providing treatment closer to patients could alleviate several significant barriers. Recently, a new treatment center was established in a hospital in Lay Gayint, an area in which patients had to travel more than 200 km to Gondar before. Following its establishment, over 200 CL patients visited the hospital within 20 months [21]. According to its strategic plan [3], Ethiopia plans to expand activities to 30 treatment centers by 2030, making it crucial to understand the necessary human resource and facility investments for sustainability. This study, the first of its kind in East Africa, provides critical data on the current status of available resources at primary healthcare facilities and the knowledge and skills of their staff for the diagnosis and treatment of CL and other common skin conditions within Southern Ethiopia. This information is essential for understanding the feasibility of decentralizing the diagnosis and care for CL and other skin diseases and for identifying the investments required to make this decentralization successful.

Feasibility of decentralization at different healthcare levels

Our findings highlight a tenfold increase in the catchment population at each higher healthcare level (Additional file

Table S3). A study conducted at Boru Meda Hospital in the Amhara region of Ethiopia demonstrated that due to high endemicity of CL patients in the catchment area, long waiting lists of patients exist at referral centers, leading to delays in receiving systemic treatment of CL [22]. Given the high estimated number of CL and skin disease patients in the country, decentralization should occur at various lower healthcare levels, supported by an efficient referral system. This approach should prevent higher-level facilities from being overwhelmed by patients.

The overall scores on the knowledge and skills assessments indicate a significant need for further training of both clinical and laboratory healthcare professionals. Scores of clinical staff for the diagnosis of CL were fairly good, in contrast to scores for laboratory staff. Hence, the latter should be well-trained to be of added value for clinical diagnosis. Training for the treatment of CL is required and should focus on the procedures to (safely) administer drugs. For other skin diseases, the emphasis of training should be on skin diseases with a low prevalence rather than bacterial and fungal infections.

Although median knowledge and skills scores were considerably higher for those with increasing educational levels, no significant differences in median scores were observed between professionals in primary hospitals and health centers. Even though we included all available healthcare professionals involved in the diagnosis and treatment of skin diseases, our study population was not equally selected from the sampled healthcare facilities compared to the source population, which would not have influenced this non-effect. Therefore, our results showed that the presence of professionals with higher degrees, rather than the facility level, is crucial for effective decentralization of the diagnosis and treatment of CL and other skin diseases. Of note, both Zefine and Wacha health centers had high-scoring clinical and laboratory professionals. Therefore, in terms of staff, decentralization can be technically implemented at both primary hospitals and health centers, provided sufficient training is given.

For the diagnosis of CL, laboratory rooms for staining and good microscopes were available at almost all primary hospitals and health centers. Thus, clinical diagnosis combined with microscopy for CL could be conducted at both healthcare levels without major resource investments. Once diagnosed, treatment for uncomplicated CL cases can be managed through localized treatments, such as intralesional injections with SSG or cryotherapy. Of note, there were two health centers with knowledgeable lab and clinical staff where skincare could be decentralized, although better availability of skin treatments, as well as supplies for diagnosing CL, needs to be guaranteed.

However, many CL patients require systemic treatment, which is currently only available in the form of SSG, which can cause severe renal, cardiac, and hepatotoxicity. Hence, equipment is needed to closely monitor patients before and during treatment. Our study found that chemistry, CBC, and ECG machines, as well as the capacity to hospitalize patients, were present in most primary hospitals but nearly absent in health centers. This indicates that while localized treatment could be provided at both healthcare levels, offering systemic treatment at health centers would require extensive investments in infrastructure and does not currently seem feasible. Rather, systemic treatment appears more suitable for primary hospitals, where maintenance of the available equipment would still be necessary, and stable supplies (currently not available) need to be guaranteed.

Addressing challenges

Our study identifies several challenges that need to be addressed to successfully provide care for CL and other skin diseases at lower healthcare levels.

Firstly, there are frequent stock-outs of reagents for CBC and organ function tests, as well as treatments for various skin diseases and supplies for diagnostic tests such as scalpels. Another study conducted in Ethiopia indicated that the supply of SSG is often interrupted [21]. Resource shortages were identified as a primary factor affecting the quality of laboratory services in both public and private health facilities in Ethiopia [23]. To prevent worsening availability issues if care is extended to additional lower healthcare facilities, it is essential to establish a robust supply management system. Close collaboration between researchers, healthcare providers, and decision-makers will be critical to co-create a strategy for regular staff training and a reliable supply system, making the decentralization of care for skin diseases sustainable.

Another challenge is that about half of the households in Southern Ethiopia have health insurance, which was introduced in 2011 for people living in remote areas (Additional file Table S3). While this is slightly higher than documented previously (i.e., less than a third of the population being insured [24]), it still poses challenges in the context of CL. Although SSG is provided for free by the Ministry of Health, patients still need to pay for laboratory tests and hospitalization, creating a substantial barrier to accessing healthcare. Given that only 50% of patients are cured after one treatment cycle [22, 25–27], these costs can accumulate quickly. Increasing insurance coverage to make treatment affordable for all patients and ensuring that hospitals are reimbursed for prefinanced costs is crucial for successful decentralization. This effort will then contribute to achieving WHO Sustainable Development Goal (SDG) 3 (equitable access to healthcare) [10].

Furthermore, there is a high turnover of healthcare staff, which is reflected by the low number of years of experience, particularly among clinical professionals in primary hospitals. Physicians often leave after a short tenure to pursue residency programs or leave as a result of inadequate compensation for duty shifts. A recent meta-analysis confirms a high turnover intention among healthcare providers nationwide [28]. Frequent retraining and retention of qualified healthcare professionals and effective knowledge transfer to newly hired professionals will be necessary to ensure sustainable and accurate diagnosis and quality care of CL and other skin disease patients at lower healthcare levels.

Limitations

For this study, we utilized newly developed questionnaires to assess healthcare staff's knowledge and skills, as no standard instruments were available. Although developed specifically for this study context, the tools were pretested and demonstrated strong internal validity for identifying key gaps in the diagnosis and care of CL and other skin diseases. Following further formal validation, they could serve as a basis for standardized national assessment tools. Another limitation of the current study is that the generalizability of our findings to northern Ethiopia remains uncertain due to differences in infrastructure and healthcare systems. For a larger-scale decentralization intervention across the country, a similar study should be conducted in northern Ethiopia. Lastly, although our study population is not representative of the overall source population of staff in primary hospitals and health centers in southern Ethiopia, it precisely reflects the different staff level proportions involved in CL diagnosis and is well-suited to the study objectives.

Conclusions

This study demonstrated that decentralizing the diagnosis and treatment of common skin diseases and localized CL treatment to health centers appears feasible with minor facility adjustments, continuous (re)training, and reliable supply chains, while referring cases requiring systemic treatment of CL to primary hospitals. Strong strategic efforts from policymakers and stakeholders are essential to address challenges such as maintaining staff knowledge and skills, low insurance coverage, staff turnover, and stock-outs of reagents and drugs for successful decentralization. The effective implementation of this integrated care package is a critical step toward reducing the burden of CL and other common skin diseases by significantly improving healthcare access and patient outcomes in the region.

Abbreviations

AMGH	Arba Minch General Hospital
BSc	Bachelor of Science
CDC	Centers for Disease Control and Prevention
CBC	Complete Blood Count
CL	Cutaneous Leishmaniasis
DHIS	District Health Information System
ECG	Echocardiographic
HEW	Health Extension Worker
IQR	Interquartile range
KOH	Potassium Hydroxide
NTD	Neglected Tropical Diseases
WHO	World Health Organization

Supplementary information

The online version contains supplementary material available at https://doi.org/10.1186/s12879-025-12324-0.

Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

Supplementary Material 5

Supplementary Material 6

Supplementary Material 7

Supplementary Material 8

Supplementary Material 9

Supplementary Material 10

Acknowledgements

We would like to thank all healthcare professionals who volunteered to participate in this study. We thank the zonal and district health offices and healthcare facilities for their cooperation. We are also grateful to the University of Antwerp biostatisticians Mahdi Safar Pour, Geoffrey Manda, and Tafadzwa Maseko for their support with R Studio software training and data analysis.

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Conceptualization: D.T., M.P., S.vH., J.vG., and J.PvG. Data curation: D.T., M.P., S.vH., J.vG., J.PvG., S.B., and M.T.W. Formal analysis: D.T., M.P., S.vH., J.vG., J.PvG., S.A., and A.H. Funding Acquisition: D.T., M.P., S.vH., and J.vG. Investigation: D.T., M.P., S.vH., J.vG., J.PvG., S.B., and M.T.W. Methodology: D.T., M.P., S.vH., J.vG., J.PvG., A.H., and S.A. Project Administration: D.T., M.P., S.vH., J.vG., J.PvG., T.S.D., and B.M. Supervision: D.T., M.P., S.vH., J.vG., J.PvG., T.S.D., A.H., and B.M. Validation: D.T., M.P., S.vH., and J.vG. Visualization: D.T., M.P., S.vH., J.vG., J.PvG., and S.A. Writing—original draft: D.T., M.P., S.vH., J.vG., and J.PvG. Writing—review & editing: D.T., M.P., S.vH., J.vG., J.PvG., A.H., S.B., M.T.W., S.A., T.S.D., and B.M. All authors read and approved the final manuscript.

Funding

The Flemish Inter-University Council VLIR-UOS, Belgium, supported the project and DT's PhD fellowship in collaboration with Arba Minch University (http://www.vliruos.be, AMU ET2017IUC035A101). Additionally, the project received financial support from ITM's SOFI program, supported by the Flemish Government, Science & Innovation, 2023, & from WHO AFRO small grant Reference 2024/1474218-0, Unit Reference P23-00912; 2023.

Data availability

This manuscript and its supplementary information files include the data used and/or analyzed during this study. Data containing participant identifiers remain anonymous and are not included in this paper. However, any additional data can be available from the corresponding author upon reasonable request. Additionally, future requests to access the datasets after publication should be directed to the ITM Research Data Access Committee at ITMresearchdataaccess@itg.be.

Declarations

Ethics approval and consent to participate
The study was approved by the Arba Minch University Institutional Research Ethics Review Board (194/23), the Institute of Tropical Medicine Institutional Review Board (1680/23), the University Hospital Antwerp Ethics Review Board (5453/23), and the World Health Organization Regional Office For Africa (WHO AFRO) Ethics Review Committee (2023/4.9 [4-1093]). All participants (who were aged > 18 years) provided full written informed consent using a form prepared in the local Amharic language. They were informed that all provided information would remain confidential and that personal identifiers, such as names, would not be disclosed. Participant privacy and confidentiality were ensured by storing all data on a password-protected computer and within secured folders, accessible only to authorized members of the study team. Participants were also informed of the right to decline participation. All methods were carried out in accordance with the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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Received: 20 February 2025 / Accepted: 8 December 2025
Published online: 26 December 2025

References

1. World Health Organization [Internet]. 2018. [cited 2018 Aug 29]. Leishmaniasis. Available from: http://www.who.int/leishmaniasis/disease/en/.
2. Seid A, Gadisa E, Tsegaw T, Abera A, Teshome A, Mulugeta A, et al. Risk map for cutaneous leishmaniasis in Ethiopia based on environmental factors as revealed by geographical information systems and statistics. Geospatial Health. 2014, May;8(2):377–87.
3. Ethiopian Federal Ministry of Health. The third national neglected tropical diseases strategic plan 2021–2025 (2013/14 - 2017/18 E.C.). 2021. Available from: November. https://espen.afro.who.int/system/files/content/resources/Third%20NTD%20national%20Strategic%20Plan%202021-2025.pdf.
4. Symptoms, transmission, and current treatments for cutaneous leishmaniasis | DNDi [Internet]. 2020. https://dndi.org/diseases/cutaneous-leishmaniasis/facts/. cited 2025 Oct 26]. Available from.
5. Bugssa G. The current status of cutaneous leishmaniasis and the pattern of lesions in Ochollo primary School students, Ochollo, southwestern Ethiopia. Sci J Clin Med. 2014;3(6):111.
6. Merdekios B, Pareyn M, Tadesse D, Getu S, Admassu B, Girma N, et al. Detection of cutaneous leishmaniasis foci in South Ethiopia. Am J Trop Med Hyg. 2021, May, 10;105(1):156–58.
7. Alvar J, Vélez ID, Bern C, Herrero M, Desjeux P, Cano J, et al. Leishmaniasis worldwide and global estimates of its incidence. PLoS One. 2012;7(5):e35671.
8. Zewdu FT, Tessema AM, Zerga AA, van HS, Lambert SM. Effectiveness of intralesional sodium stibogluconate for the treatment of localized cutaneous leishmaniasis at Boru Meda general hospital, Amhara, Ethiopia: pragmatic trial. PLoS Negl Trop Dis. 2022, Sep, 9;16(9):e0010578.
9. Tamiru HF, Mashalla YJ, Mohammed R, Tshweneagae GT. Cutaneous leishmaniasis a neglected tropical disease: community knowledge, attitude and practices in an endemic area, Northwest Ethiopia. BMC Infect Dis. 2019, Oct, 16;19(1):855.
10. WHO. A road map for neglected tropical diseases 2021-2030. 2020. https://www.who.int/teams/control-of-neglected-tropical-diseases/ending-ntds-together-towards-2030/targets.
11. The Ethiopian health care system [Internet]. [. cited 2024 Mar 3]. Available from: https://bio-protocol.org/exchange/minidetail?type=30%26id=8778625.
12. Zebre G, Gizaw AT, Tareke KG, Lemu YK. Implementation, experience, and challenges of urban health extension program in Addis Ababa: a case study from Ethiopia. BMC Public Health. 2021, Jan, 19;21:167.
13. Pareyn M, Kochora A, Van Rooy L, Eligo N, Vanden Broecke B, Girma N, et al. Feeding behavior and activity of phlebotomus pedifer and potential reservoir hosts of Leishmania aethiopica in SouthWestern Ethiopia. PLoS Negl Trop Dis. 2020;14(3).
14. [Internet]. [cited 2024 May 23]. Available: https://open.africa/dataset/2018-ethiopia-shapefiles.
15. ArcMap resources for ArcGIS desktop | documentation, tutorials & more [Internet]. [cited 2024 May 23]. Available from: https://www.esri.com/en-us/arcgis/products/arcgis-desktop/resources.
16. WHO -. Skin NTDs app | InfoNTD [Internet]. [cited 2024 Mar 5]. Available from: https://www.infontd.org/practical-material/who-skin-ntds-app.
17. Search Results | CDC [Internet]. 2022. [cited 2024 Mar 5]. Available from: https://www.cdc.gov/search/index.html.
18. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)-a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inf. 2009, Apr;42(2):377–81.
19. Download R-4.3.2 for windows. The R-project for statistical computing. [Internet]. [cited 2023 Dec 12]. Available from: https://cran.r-project.org/bin/windows/base/.
20. Villanueva RAM, Chen ZJ. ggplot2: elegant graphics for data analysis. In: Meas Interdiscip Res Perspect. 2nd. Vol. 17(3): 2019 Jul 3. p. 160–67.
21. Yizengaw E, Nibret E, Yismaw G, Gashaw B, Tamiru D, Munshea A, et al. Cutaneous leishmaniasis in a newly established treatment centre in the Lay Gayint district, Northwest Ethiopia. Skin Health Dis. 2023, Aug;3(4):e229.
22. van Henten S, Bialfew F, Hassen S, Tilahun F, van Griensven J, Abdela SG. Treatment of cutaneous leishmaniasis with sodium stibogluconate and allopurinol in a routine setting in Ethiopia: clinical and patient-reported outcomes and operational challenges. Trop Med Infect Dis. 2023, Aug, 14;8(8):414.
23. Mesfin EA, Taye B, Belay G, Ashenafi A, Girma V. Factors affecting quality of laboratory services in Public and private health facilities in Addis Ababa, Ethiopia. EJIFCC. 2017, Oct;28(3):205–23.
24. Merga BT, Balis B, Bekele H, Fekadu G. Health insurance coverage in Ethiopia: financial protection in the era of sustainable cevelopment goals (SDGs). Health Econ Rev. 2022, Aug, 3;12(1):43.
25. Fikre H, Mohammed R, Atinafu S, van Griensven J, Diro E. Clinical features and treatment response of cutaneous leishmaniasis in North-West Ethiopia. Trop Med Int Health. 2017, Oct, 1;22(10):1293–301.
26. Tesfa D, Manaye N, De Vries HJ, Van Griensven J, Enbiale W. Clinical pattern and treatment outcome of cutaneous leishmaniasis in two hospitals in Bahir Dar, Ethiopia (2017-2021). J Infect Dev Ctries. 2022, Aug;31;16(8.1): 26S–34S.
27. van Henten S, Tesfaye AB, Abdela SG, Tilahun F, Fikre H, Buyze J, et al. Miltefosine for the treatment of cutaneous leishmaniasis-a pilot study from Ethiopia. PLoS Negl Trop Dis. 2021, May, 28;15(5):e0009460.
28. Gebrekidan AY, Enaro EY, Azeze G, Adella GA, Kassie GA, Haile KE, et al. Turnover intention among healthcare workers in Ethiopia: a systematic review and meta-analysis. BMJ Open. 2023, May, 1;13(5):e067266.

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