Journal of Infectious Diseases and Patient Care

Research Article

WRJIDPC-26-032

Cutaneous *Leishmania*sis in Tigray, North Ethiopia: The Communities' Awareness, Perceptions, Treatment-Seeking and Prevention Practices in Disease Endemic Areas

Shewaye Belay Tessema[1*], **Helen P Price**[2] **and Afework Mulugeta Bezabih**[3]

[1]Department of Parasitology, Mekelle University, Mekelle, Ethiopia
[2]School of Life Sciences, Keele University, Manchester, United Kingdom
[3]School of Public Health, College of Health Sciences, Mekelle University, Mekelle, Ethiopia

***Correspondence:** Shewaye Belay Tessema, Department of Parasitology, Mekelle University, Mekelle, Ethiopia, E-mail: shewayebelay@yahoo.com; DOI: https://doi.org/10.56147/jidpc.3.1.32

Citation: Tessema SB, Price HP, Bezabih AM (2026) Cutaneous *Leishmania*sis in Tigray, North Ethiopia: The Communities' Awareness, Perceptions, Treatment-Seeking and Prevention Practices in Disease Endemic Areas. J Infect Dis & Pati Care 3: 32.

Abstract

Background: Cutaneous *Leishmania*sis (CL) is highly prevalent in Ethiopia, including the Tigray region. However, there is a dearth of information on the levels of knowledge, attitude and health seeking behavior among the communities in CL-endemic areas of Tigray region, northern Ethiopia.

Objective: This study aimed to investigate CL-related knowledge, attitude, treatment-seeking and prevention practices in disease-endemic areas of Tigray.

Methods: Between November and December 2022, a cross-sectional survey was conducted among communities living in seven districts of Tigray. Data were collected using mixed sampling method and a structured questionnaire and analyzed using SPSS 25 (IBM, Chicago).

Results: A total of 512 participants were included. Overall, 43%, 36% and 34% of participants had a 'good' level of knowledge, a 'favorable' attitude and a good treatment-seeking and prevention practices towards CL, respectively. However, very few knew about CL transmission, about 25% perceived CL to be genetically acquired and about 67% believed it to be stigmatizing. Traditional medication was the preferred option over modern treatment for 63.3%. Rural residents (AOR=1.60; 95% CI: 1.00-2.57) and participants living in households with CL episode (AOR=10.19; 95% CI: 6.36-16.30) had good knowledge. However, urban/ semi-urban residents (AOR=2.17; 95% CI: 1.42-3.31) had favorable attitude. Gender (AOR=1.49; 95% CI: 1.01-2.22) and education level (AOR=0.39; 95% CI: 0.24-0.62) were significantly associated with treatment-seeking and prevention practices. Participants living in households with CL episode (AOR=2.99; 95% CI: 1.96-4.57) had good treatment-seeking and prevention practices.

Conclusions: In this study, over one half of participants had poor knowledge about CL, nearly two-third of them had unfavorable attitude and two-third of them had poor treatment-seeking and prevention practices. Previous CL episode in households was a determinant for respondents' knowledge, attitude, treatment-seeking and prevention practices. These findings support for health education focusing on CL transmission and preventive measures.

Keywords: Cutaneous *Leishmania*sis; Knowledge; Attitudes and practice; Tigray; Ethiopia; Disease awareness

Received date: March 31, 2026; **Accepted date:** April 13, 2026; **Published date:** April 21, 2026

 Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

Journal of Infectious Diseases and Patient Care

Introduction

Cutaneous *Leishmania*sis (CL), one of the vector-borne Neglected Tropical Disease (NTDs), is caused by protozoan parasites of the genus *Leishmania* and transmitted *via* the bites of infected female sandflies of over 90 species [1]. The disease is endemic in more than 90 countries worldwide. There are approximately 0.7 to 1.2 million new cases annually across the globe and around 350-430 million people are estimated to be at risk of infection [2-5]. Furthermore, about 40 million people globally are living with CL scars from past infections [6], which is considered to be a leading cause of stigma, depression and anxiety among NTDs [7]. However, there is substantial under reporting of this disease, with only 200,000 cases per annum being reported to the World Health Organization (WHO) [3,8,9].

In Ethiopia, the report of CL dates back at least to the early 1900s, with the first case reported from the northern part of the country and described as "Oriental sore in Agamé (Abyssinia)" [10]. Since then, the disease has been reported from highlands of the country and over 170 districts are suspected to be endemic [11]. In Ethiopia, CL presents in three clinical forms: Localized (LCL), Diffused (DCL) and Mucocutaneous (MCL) of which MCL and DCL present significant therapeutic challenges [12,13]. Studies have estimated that 20,000 to 50,000 people per year are being infected in Ethiopia [2,14]. However, in 2022, only 913 CL cases were reported to the WHO suggesting a gross underreporting of the disease in Ethiopia [8].

An effective way to alleviate the burden of infectious diseases is to improve the communities' awareness and prevention practices [9,15]. Understanding the perceptions and behaviors of the affected community towards CL is valuable for designing control and prevention strategies for the disease [16]. The Knowledge, Attitude, Practice (KAP) evaluation surveys are basic inputs for health promotion campaigns, as the surveys help programs adjust health education messages to build public knowledge and awareness [17]. Several studies indicate a direct relationship between community awareness on CL and effectiveness of control strategies [18,19]. Earlier study reports implicate that the northern part of Ethiopia bears the highest burden of CL relative to the rest part of the country [14,20,21]. The Knowledge, Attitude, Practice (KAP) and treatment seeking behaviors and prevention practices towards CL in Ethiopia are heavily influenced by socio-cultural settings and widely vary among communities across different regions of the country, however, only a small number of KAP studies have been conducted in CL-endemic regions [20-22]. Moreover, community health education towards prevention and control of the disease in Ethiopia is lacking [12]. Furthermore, in the Tigray region, information related to CL endemic communities' KAP and treatment-seeking behavior are very scarce. Therefore, in the present study, we evaluated the Knowledge, Attitude, Practice (KAP) and treatment seeking behaviors and prevention practices of communities located in seven CL-endemic districts of Tigray region, northern Ethiopia.

Methods

Study setting

The Tigray region is located in the Northern part of Ethiopia between 12° 15'N and 14° 57'N latitude and 36° 27'E and 39° 59'E longitude. The Tigray region has 7 administrative zones namely Central, Eastern, Mekelle, North Western, Southern, South Eastern, Western and Mekelle; 52 districts (locally known as woredas); and 799 sub-districts or kebeles (locally, Tabias). A Tabia is the smallest administrative unit in the region which consists of 8 to 10 small villages (called kushets) and a kushet comprises on average from 150-250 households. The topography of Tigray consists of high plateau and mountains with much of the land lying between 1,000 and 3,900 meters above sea level altitude. This study was conducted in seven CL endemic districts found in three zones of Tigray, namely: Ganta Afeshum, Gulomekeda, Hawzen and Saesie Tsaeda-emba located in Eastern zone, Degua Temben and Enderta in South Eastern and Emba-alaje situated in Southern zone.

Study design and study period

A cross-sectional survey was carried out between November and December 2022, in seven districts located in three zones of Tigray, Northern Ethiopia.

Sample size

The minimum sample size required for this survey was calculated according to the WHO's practical manual for sample size determination in health studies [23]. As previous data towards the level of community awareness and practices related to CL in the study areas were unavailable, we assumed 50% level of awareness and practices in the targeted area study communities. The sample size was calculated using a single population proportion formula, assuming 95% CI with 0.05 margin of error and a 1.3 design effect.

$$N=(Z^2_{\alpha/2}P(1-P)*DE)/e^2=(1.96)^2*0.5(1-0.5)1.2/(0.05)^2=499$$

The minimum sample size required for this study was yielded 499 respondents using the following assumption: N = the number of study subjects (household heads), Z is a critical value (1.96) at 95% confidence level, P: anticipated population proportion (50%), DE (Design Effect) and e: margin of error (5%).

To the calculated minimum sample size (n=499), a 5% of non-response rate was added and the total sample size was determined to be 524 individual participants.

Sampling procedure

Between November and December 2022, a cross-sectional survey was conducted among communities living in seven districts located in three zones of Tigray. In the

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

first stage of sampling, CL endemic districts, namely: Ganta Afeshum, Gulomekeda, Hawzen and Saesie Tsaeda-emba districts (from in Eastern zone), Degua Temben and Enderta (South Eastern zone) and Emba-alaje district from Southern zone were purposively included [24]. In the next stage, utilizing data from Central Statistics Agency (ECSA, 2012), cluster Tabias or Enumeration Areas (EAs) were selected using probability proportionate to size (PPS) [25]. Accordingly, Enumeration Areas (EAs) from *Degua Temben* (n=4), *Emba-alaje* (n=4), Enderta (n=2), *Ganta Afeshum* (n=2), *Gulomekeda* (n=2), *Hawzen* (n=3) and *Saesie Tsaeda-emba* (n=4) were included. Larger population size Tabias or Enumeration Areas (EAs, n=21) were included so as to reach the number of households (HHs, n=25) required to achieve the overall sample size ((21 clusters × 25 households) =524 HHs) needed in this study **(Figure 1)**. Then, a simple random sampling was used to select households and finally, the most knowledgeable family member or the head of a household (one individual per household) was approached for interview. Both male and female adults aged 18 years and above were eligible in this study.

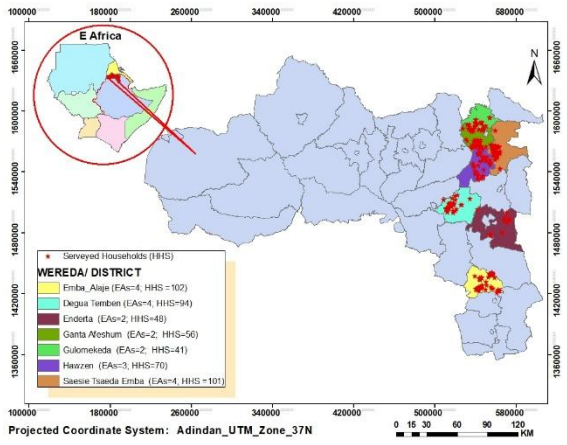

Figure 1: Study districts, number of Enumeration Areas (EAs) and number of surveyed Households (HHs).

Data collection tools and procedures

Data were collected using a structured questionnaire adopted from similar study literatures, pre-tested on 15 individuals recruited from households in the seven study districts [15,17,21]. The questionnaire was designed to obtain information on participants' socio-demographic characteristics; Knowledge, Attitude and Practices (KAP); and treatment seeking behavior towards CL. The questionnaire was developed in English and then translated into the participants' native language (Tigrigna) and the local name for CL (Guzwa, ጉዝዋ) was used to refer to the disease. The questionnaire was comprised of four sections.

Section 1 of the questionnaire consisted of information on participants' socio-demographic characteristics. Section 2 contained questions on knowledge about CL that were designed to identify the primary sources of information used, to understand participants' ability to identify the disease and explore their knowledge of aspects of CL, including signs and symptoms, local name of the disease, transmission mechanisms, treatment options, modern healthcare facilities, the existence of hyrax (the main reservoir host) and its relation with CL and possible prevention measures for CL. Section 3 contained questions designed to determine the participants' attitudes towards CL as a health concern, stigma, whether the disease is curable by treatment, feelings on seeing people with CL, primary care provider choices and attitudes towards use of biomedical treatment for CL. Section 4 consisted of questions designed to evaluate the treatment-seeking and prevention practices of the participants, such as primary healthcare options for active CL, reasons to choose a care provider and distance from healthcare facilities. Additional questions were included to assess potential risk factors, such as: Occupation, time spent working outside (including overnight stays), use of hyrax dung as fertilizer, outdoor sleeping habits and preventive measures.

Questionnaires were administrated by a team of trained and experienced senior health professional data collectors who had previously been involved in *Leishmania*sis related household surveys. Data was primarily collected from the head of a household, when the head was not available, any responsible adult above 18 years selected by the family as the most knowledgeable person of the household was approached by the survey team for participation in the survey.

Scoring methods

Scores for the KAP of respondents were developed using methods described in previous studies [9,15,20]. In brief, from the KAP questionnaire, a composite score of each question or item was calculated for each participant where each correct response was assigned a score of 1 and each incorrect or unsure response was assigned a score of 0. The total scores were further dichotomized based on the overall scores of each item. The total knowledge scores ranged from 0 to 9 and scores between 0 and 4 were categorized as poor knowledge, while scores between 5 and 9 were considered indicative of good knowledge. Similarly, the total attitude scores ranged from 0 to 6, scores between 0 and 3 were categorized as negative attitude, while scores between 4 and 6 were considered to denote a positive attitude. With regards to treatment-seeking behavior and prevention practices, scores were ranged from 0 to 12. Scores between 0 and 6 were considered to indicate poor prevention practices, while scores between 7 and 12 considered to be good prevention practices.

Data analysis

The collected data were entered into EPI Info version 20.1.14 statistical package and exported to SPSS version 25.0 (SPSS, IBM Inc., Chicago) for statistical analysis. Descriptive statistics such as frequency, percentage and

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

mean (standard deviation) were used, where applicable, to describe the KAP components with the explanatory (independent) variables. A chi-square test was used to examine the associations between KAP scores and the explanatory variables such as study area settings, age, gender, education level, occupation and CL infection episode in a household. A multivariate logistic regression analysis was performed to identify the significant predictors of good knowledge on CL, positive attitude and good practices towards CL treatment-seeking behavior and prevention. Variables with a P value of ≤ 0.25 in the chi-square test were included in the logistic regression analyses. Adjusted Odd Ratios (AORs) and their corresponding 95% Confidence Intervals (CIs) were calculated based on the final models. The significance level for all tests was set at $P<0.05$.

Ethical considerations

Ethical clearance (Ref: ERC 1396/2019 and renewed on 15th November, 2021; MU-IRB 2098/2021) was obtained from the Research Ethics Committee and Institutional Review Board (IRB) of the College of Health Sciences of Mekelle University and a permit letter (Ref: 882/1418/11) was granted by the Tigray Health Bureau (THB). Permissions to conduct the study in all of the study localities were obtained from each district health administrative offices. The purpose and the objectives of the study were clearly explained to all study participants to a level that they comprehended and verbal informed consent was obtained from all adult participants during the door-to-door interviews. During our door-to-door visits, all cases found suspected for non- severe active CL were advised to seek early diagnosis at CL care provider public hospitals in the region. While, those suspected for severe LCL, MCL and DCL cases were referred to Ayder comprehensive specialized hospital and linked with dermatology department staff of the hospital.

Results

Socio-demographic characteristics of the study participants

A total of 512 individuals (52.3% male and 47.7% female) participated in the study with 97.7% response rate. Of these, 70.5% were between 18 and 40 years old. More than half (52.3%) of the participants were from the eastern zone, a majority were rural inhabitants and over three quarters (79.3%) were farmers by occupation. With respect to education level, 69.9% of the participants had attended modern schools and 30.1% of them had not received any formal education. Of the 358 educated participants, 39.4% and 29.1% had completed primary (1^{th}-6^{th} grades) and secondary (7^{th}-10^{th} grades) school levels, respectively. Only 7 (1.4%) respondents had completed college and university education level. From all participants, about 61% acknowledged that one or more CL episodes (at least one case identified through symptoms or diagnosed at health care) had occurred within their household during the period of the last five years **(Table 1)**, showing that this disease is highly endemic in the region.

Table 1: Sociodemographic characteristics of study participants, Tigray, North Ethiopia (n=512).

Variable	Categories	Frequency (n)	Percent (%)
Zone	Eastern	268	52.3
	South eastern	142	27.7
	Southern	102	20.0
Districts	Degua Temben	94	18.4
	Emba-alaje	102	19.9
	Enderta	48	9.4
	Ganta Afeshum	56	10.9
	Gulomekeda	41	8.0
	Hawzen	70	13.7
	Saesie Tsaeda Emba	101	19.7
Household setting	Rural	375	73.2
	Urban/semi-urban	137	26.8
Age group	18-40	361	70.5
	≥41	151	29.5
Gender	Male	268	52.3
	Female	244	47.7
Educational background	Formal school unattended	154	30.1
	Primary school (1- 6)	202	39.4
	Secondary school (7-10)	149	29.1
	College & above	7	1.4
Primary occupation	Daily laborer	34	6.6
	Farmer	406	79.3
	Trade/merchant	26	5.1
	Government employee	20	3.9
	Student	26	5.1
CL episode in household in the last five years?	Yes	312	60.9
	No	200	39.1

Knowledge about cutaneous *Leishmania*sis

In the present study, most participants 97.3% (498/512) had some prior knowledge about the disease. The main sources of information around CL were household family members who had experience of the disease and neighbours. Most participants (96.8%) described the disease using its local name "Guzwa" or ጉዝዋ) (the local name for CL, in Tigrigna language), while only 16 (3.2%) respondents had heard of the term '*Leishmania*sis', the scientific name for the disease. A majority of the participants (71.5%) responded that skin lesion was the main sign of CL and over 95% described that the lesions appear on the face **(Table 2)**.

In this study, very few participants knew the biological cause and transmission route for CL. Only 6 (1.2%) participants were able to name the sand fly vector and 21.1% didn't know any transmission mechanism. While 32.3% and 17.5% of the participants named bats, moths or

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

butterflies as being disease vectors, respectively, 24.9% believed that CL was a genetically acquired disease. A majority of participants (73.6%) had seen rock hyrax in their localities, however, only 12 respondents (3.2%) knew that hyrax was a reservoir host for CL.

In response to questions on treatment priorities, traditional healers (herbalist) were the primary choice for the majority (62.9%) of participants followed by religious healers/faith remedies (14.1%). Over 67% of the participants did not know about biomedical treatments for CL and about two thirds (68.2%) did not know about any CL prevention measures. Based on the overall scoring analysis, 219 (42.8%) participants had a good level of knowledge about CL (with scores of 5-9) while 293 (57.2%) had a poor level of knowledge (scores of 0-4) towards the disease **(Table 2)**.

Table 2: Knowledge about Cutaneous *Leishmania*sis (CL), clinical presentations, its transmission, vector and reservoir hosts among communities in seven disease-endemic districts of Tigray region, 2022.

Questions	Responses	Frequency	Percent (%)
Have you seen or heard about the disease®?	Yes*	498	97.3
	No	14	2.7
Main source of information?	Household family members with experience of CL	256	51.4
	Neighbors with experience of CL	226	45.4
	Mass media (TV, radio)	6	1.2
	Traditional healer	6	1.2
	Health care facility	4	0.8
What do you call the disease?	Local name (Guzwa)	482	96.8
	*Leishmania*sis	16	3.2
Symptoms of CL®	Skin lesions*	356	71.5
	Lasting skin wound	72	14.5
	Skin scar	70	14.0
Mostly affected body parts®?	Face*	474	95.2
	Hands	116	23.3
	Legs	48	9.6
How is CL transmitted®?	Bat (faeces or urine)	161	32.3
	Genetically from family	124	24.9
	Butterfly ("Tsa/ Guzwa")	87	17.5
	Contact with CL infected	8	1.6
	Mosquito bite	7	1.4
	Sand fly bite*	6	1.2
	Don't know	105	21.1
What is the season for peak CL infections®?	In all seasons equally	127	25.5
	Dry season	41	8.2
	Post rainy season*	224	45.0
	Don't know	106	21.3
Where do people seek CL treatment?	Modern health care	45	9.0
	Traditional remedies	313	62.9
	Faith (religious) healer	70	14.1
	Don't know	70	14.1
Do you know about modern CL treatment®?	Yes*	149	29.9
	No	13	2.6
	Don't know	336	67.5
Know or seen rock hyrax in your locality®?	Yes*	376	73.6
	No	135	26.4
Can rock hyrax be agent for CL infection®?	Yes*	12	3.2
	No	20	5.3
	Don't know	344	91.5
Is CL preventable®?	Yes*	140	27.3
	No	9	1.8
	Don't know	349	68.2
Overall knowledge about CL			
Total mean score ± SD		5.3 ± 1.4	
Good knowledge (score 5-9)		219	42.8
Poor knowledge (score 0-4)		293	57.2
®Items included in scoring and; *Correct responses assigned a score of 1 and other responses assigned 0.			

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

Journal of Infectious Diseases and Patient Care

Attitudes towards CL, its treatment and care provider priorities

Most participants (96%) perceived CL to be a serious public health concern in their locality. Over 67% of the participants responded that CL is a stigmatizing disease. However, when participants were asked a subsequent question about their personal feelings when meeting people with a CL lesion, most of the participants (87.1%) responded that they felt uncomfortable.

Traditional healers (herbalists) were the primary choices for 73.6% of the participants and faith healers (religious remedies) were named as the first choice by 70 (16.4%). Modern healthcare (hospitals and clinics) was the first point of contact for only 45 (10%) respondents. Based on the scoring analysis, 187 (36.5%) participants had a positive attitude toward CL health concern, stigma and discrimination, treatment and care provider priorities while 325 (63.5%) had a negative attitude **(Table 3)**.

Table 3: Attitudes toward Cutaneous *Leishmania*sis (CL), its treatment and care provider priorities of community members in seven districts of Tigray region, northern Ethiopia, 2022.

Questions/responses		Frequency	Percent (%)
Is CL a serious health concern in your locality®?	Yes*	478	96.0
	No	20	4.0
Can CL genetically have acquired from family?	Yes	124	24.9
	No*	247	49.6
	Don't know	127	25.5
Is CL a stigmatizing disease®?	Yes	335	67.3
	No*	13	2.6
	Don't know	150	30.1
Do you feel bad when meeting people with CL lesion®?	Yes	446	87.1
	No*	52	10.2
	Not sure	14	2.7
Is CL curable by treatments®?	Yes*	437	87.8
	No	10	2.0
	Don't know	51	10.2
Is it possible to prevent CL infection®?	Yes*	140	27.3
	No	9	1.8
	Don't know	349	68.2
Where is your best care provider choice?	Modern health care	43	10.0
	Traditional healer (herbalist)	315	73.6
	Faith healers (Religious)	70	16.4
Do you want to seek a modern care for CL?	Yes	149	29.9
	No	62	12.4
	Not sure	287	57.6
Overall attitude status			
Total mean score ± SD		3.2 ± 1.1	
Positive attitude (score 4-6)		187	36.5
Negative attitude (score 1-3)		325	63.5
®Items included in scoring and; *Correct responses assigned a score of 1 and other responses assigned 0			

Treatment seeking behaviors and practices

Most participants, (83%) stated that people used homemade herbal remedies as the primary method of care, while 63.3% used traditional remedies from a healer (herbalist), 13.7% used religious healing (faith remedies) and 17.4% of the participants used cauterization of lesions using very hot metal.

About 27.3% (136/498) of the participants stated that they had used CL treatments at modern health care facilities, either for themselves or members of their household/families. Of those (n=136) who had used a modern CL care facility, about 85% had used one or more traditional remedies before receiving a treatment in modern health care facility, 66.9% had delays of 1-6 months and 14.7% had delays longer than 6 months before receiving this form of treatment. Regarding the nearest modern CL care facility, 60.4% of participants stated this was 61-90 km away from home and 26.8% responded 30-60 km away.

Participants were asked about situations where people prefer to seek modern healthcare for CL treatment; interestingly, this question revealed a concept of gendered lesions: 237 participants (47.6%) stated that they would seek healthcare when the CL lesion is "male" type, wording used to describe a more severe type of lesion that does not heal easily. Besides, 78 (15.7%) indicated they would seek healthcare when the wound failed to heal using traditional treatments **(Table 4)**. Based on the scoring analysis outcome, while 173 participants (33.8%) had a good level of treatment seeking behavior and practices towards CL, 339 (66.2%) had a poor level of practices **(Table 5)**.

Table 4: Treatment-seeking behaviors and practices of community members in seven districts of Tigray region, northern Ethiopia, 2022 (n=512).

Questions	Responses	Frequency	Percent (%)
Communities' primary care used for active CL	Homemade herbals	425	83.0
	Traditional healer (herbalist)	315	63.3
	Using hot iron (Cauterization)	89	17.4
	Religious faith healer	70	13.7
	Modern healthcare (hospital/clinic)	45	9.0
	Do nothing (self-curable)	12	2.3
Main reason to choose care provider?	Proximity to home	243	48.8
	Perceived (good) reputation	148	29.7
	Availability of CL drugs	37	7.4
	Other reasons	70	14.1
Have your HH ever used a modern CL	Yes	136	27.3
	No	362	72.7

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

care facility?			
During the last CL episode in your HH, how was the lesion finally managed (n=312)?	Using modern treatment in hospital	136	43.6
	using traditional remedies	67	21.5
	Self-cured (did nothing)	95	30.4
	Lesion persisted, has not cured yet	14	4.5
How many days later received modern care (n=136)	<30 days	13	9.6
	31-180 days	91	66.9
	181-365 days	12	8.8
	>365 days	20	14.7
Distance to modern care facility (Km) from home?	<30 km	11	7.4
	31-60 km	40	26.8
	61-90 km	90	60.4
	>91 km	8	5.4
When do people seek modern treatment for CL?	For "male" type CL	237	47.6
	For "runner" type CL	37	7.4
	When traditional care failed to resolve the lesion	78	15.7
	Don't know	146	29.3

Almost half, (45.3%) of the participants reported that they were commonly engaged working in fields from early morning until late evening and 23.1% of the participants worked in fields during both daytime and at night, potentially increasing the risk of sand fly bites. Over half (58.2%) of the participants had outdoor sleeping habits and over one third (37.9%) of them used hyrax dung as fertilizer, potentially attracting sand flies.

Over 71% of the participants didn't apply any known CL preventive measures, however, about 28.6% (140/489) of the participants stated one or more mechanisms. Of those, 28%, 10.6% and 7.4% of the participants mentioned using bed nets, improving environmental hygiene and wearing long sleeves/trousers, respectively, as preventive measures for the disease. Based on the scoring analysis outcome, while 173 (33.8%) participants had a good level of prevention practices towards CL, 339 (66.2%) had a poor level of prevention practices **(Table 5)**.

Table 5: Common activities and prevention practices of community members in seven districts of Tigray region, northern Ethiopia, 2022 (n=512).

Field work habit in both day and night?	Yes	118	23.1
	No*	394	76.9
Morning up-to late evening field work habit?	Yes	232	45.3
	No*	280	54.7
Outdoor / field/ sleeping habit	Yes	298	58.2
	No*	214	41.8
Use of hyrax dung as fertilizer	Yes	194	37.9
	No*	318	62.1
Did your HH ever received a modern CL care?	Yes*	136	27.8
	No	353	72.2
Before receiving a modern CL care, did your HH used other care options (n=136)?	Yes	115	84.6
	No*	21	15.4
Use prevention methods (n=489)?	Yes*	140	28.6
	No	349	71.4
Sleep under a bed net	Yes*	138	28.2
	No	351	71.8
Environmental hygiene	Yes*	52	10.6
	No	437	89.4
Wear long sleeves/trousers	Yes*	36	7.4
	No	453	92.6
Insecticide spray in house	Yes*	34	7.0
	No	455	93.0
Use of insect repellents	Yes*	11	2.2
	No	478	97.8
Overall treatment-seeking behaviors and prevention practices level			
Total mean score ±SD	-	4.48±2.02	
Good (score 7-12)	-	173	33.8
Poor (score 0-6)	-	339	66.2
*Correct responses assigned a score of 1 and other responses assigned 0			

Factors associated with knowledge about CL

Males were less likely to have good knowledge of CL as compared to female counterparts (p=0.004). Likewise, farmers were less likely to have good knowledge as compared to those who were non-farmers (*e.g.,* students and employees) in occupation (p=0.021). Rural dwelling participants were 1.6 times more likely to have good level of knowledge towards CL compared to those living in urban and semi-urban resident areas(p=0.049). Participants who lived in a household with a previous CL case were over ten times (P<0.001) more likely to have a good knowledge of the disease relative to those dwelling in households with no previous CL episodes.

Table 6: Demographic factors compared with participants' knowledge about Cutaneous *Leishmania*sis (CL), in Tigray, northern Ethiopia, 2022.

Variables and categories	Knowledge about CL		COR (95% CI)	AOR (95% CI)	P value AOR
	Good	Poor			
Gender					
Male	124(46.3%)	144(53.7%)	0.74 (0.52, 1.05)	0. 55(0.36, 0.83)	0.004
Female	95(38.9%)	149(61.1%)	1	1	
Age group (year)					
18-40	155(42.9%)	206(57.1%)	1.02 (0.70, 1.50)	0.85(0.52, 1.38)	0.507
>40	64(42.4%)	87(57.6%)	1	1	
Educational background					

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

Educated	70(45.5%)	84(54.5%)	1.17 (0.80, 1.71)	0.79 (0.48, 1.29)	0.354
Formal school unattended	149(41.6%)	209(58.4%)	1	1	
Primary occupation					
Farmer	183(45.1%)	223(54.9%)	1.60 (1.02, 2.50)	0.53 (0.31, 0.91)	0.021
Non-farmer	36(34.0%)	70(66.0%)	1	1	
Household setting					
Rural	155(41.3%)	220(58.7%)	0.80 (0.54, 1.19)	1.60 (1.00, 2.57)	0.049
Urban or semi-urban	64(46.7%)	73(53.3%)	1	1	
Previous or current CL episode in household					
Yes	190(69.9%)	122(39.1%)	0.11 (0.07, 0.17)	10.19(6.36,16.30)	<0.001
No	29(14.5%)	171(85.5%)	1	1	

Factors associated with participants' attitude towards CL

These results showed that participants' occupation and household settings were significant factors associated with attitude towards CL disease (P<0.05). Participants who engaged in farming activities as their primary occupation were 60% times more likely to have unfavorable attitude towards CL compared to those who were not farmers (*e.g.,* students and employees) in occupation. Participants from urban and semi-urban areas were about 2.2 times (P<0.001) more likely to have favorable attitude related to CL infected individuals compared to those rural-dwelling counterparts **(Table 7)**.

Table 7: Factors associated with study participants' attitudes towards cutaneous *Leishmania*sis (CL), among community members in seven districts of Tigray region, northern Ethiopia, 2022.

Variables and categories	Attitude about CL		COR (95% CI)	AOR (95% CI)	P value for AOR
	Negative	Positive			
Gender					
Male	92 (34.3%)	176(65.7%)	1.22 (0.85, 1.77)	1.18 (0.81, 1.7 1)	0.392
Female	95(38.9%)	149(61.1%)	1	1	
Age group (year)					
18-40	136 (37.7%)	225 (62.3%)	1.18 (0.79, 1.76)	0.73 (0.47, 1.14)	0.165
>40	51(33.8%)	100(66.2%)	1	1	
Educational background					
Educated	128 (35.8%)	230 (64.2%)	1.12 (0.75, 1.65)	0.79(0.50, 1.24)	0.310
Formal school unattended	59(38.3%)	95 (61.7%)	1	1	
Primary occupation					
Farmer	155(38.2%)	251(61.8%)	1.43 (0.90, 2.26)	0.60 (0.36, 0.99)	0.048
Non-farmer	32(30.2%)	74(69.8%)	1	1	
Household setting					
Rural	122(32.5%)	253(67.5%)	0.53 (0.36, 0.80)	2.17 (1.42, 3.31)	<0.001
Urban/semi-urban	65(47.4%)	72(52.6%)	1	1	
Previous or current CL episode in household					
Yes	123(39.4%)	189(60.6%)	0.72 (0.50, 1.05)	1.37 (0.94,2.01)	0.102
No	64(32.0%)	136(68.0%)	1	1	

Factors associated with treatment-seeking and prevention practices

While male participants were about 1.5 times (P=0.044) more likely to follow poor treatment-seeking and prevention practices compared to female counterparts, educated participants were 39% times less likely to have poor practices compared to those participants with no formal education (P<0.001). The frequency of good treatment-seeking and prevention practices was also increased by about 3 times (P<0.001) among participants who lived in households with previous/current CL cases compared to those households with no previous CL episodes **(Table 8)**.

Table 8: Factors associated with participants' treatment-seeking and prevention practices for cutaneous *Leishmania*sis (CL), in Tigray region, northern Ethiopia, 2022.

Variables and categories	Treatment-seeking and prevention practices		COR (95% CI)	AOR (95% CI)	P value for AOR
	Good	Poor			
Gender					
Male	79(29.5%)	189(70.5%)	1.22 (0.85, 1.75	1.49 (1.01, 2.22)	0.044
Female	94(38.5%)	150(61.5%)	1	1	
Age group (year)					
18-40	112(31.0%)	249 (69.0%)	1.18 (0.79, 1.76)	1.01 (0.63, 1.59)	0.982

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

>40	61(40.4%)	90(59.6%)	1	1	
Educational background					
Educated	73(47.4%)	81(52.6%)	1.12 (0.75, 1.65)	0.39 (0.24, 0.62)	<0.001
Formal school unattended	100(27.9%)	258(72.1%)	1	1	
Primary occupation					
Farmer	139(34.2%)	267(65.8%)	1.43 (0.90, 2.26)	1.52 (0.91, 2.54)	0.112
Non-farmer	34(32.1%)	72(67.9%)	1	1	
Household setting					
Rural	136(36.3%)	239(63.7%)	0.53 (0.36, 0.80)	0.67 (0.42, 1.06)	0.086
Urban/semi-urban	37(27.0%)	100(73.0%)	1	1	
Previous/current CL episode in household					
Yes	132(42.3%)	180(57.7%)	0.72 (0.50, 1.05)	2.99 (1.96, 4.57)	<0.001
No	41(20.5%)	159(79.5%)	1	1	

Discussion

In this study, about 61% of the participants stated that one or more CL episodes had occurred within their household during the last five years, showing that this disease is highly endemic and a serious public health challenge in the region. The findings also revealed that the study participants had poor level of knowledge related to CL transmission and poor level of attitudes towards people with CL lesion, where over 67% of the participants believed that CL is a stigmatizing disease and over 87% acknowledged that they felt uncomfortable when meeting people with active lesion, indicating that CL stigma is common. Besides, the study findings shown that participants had poor level of treatment seeking and prevention practices. The participants' overall poor level of KAP and treatment seeking behavior and prevention practices revealed in this study could most likely be deeply rooted in the neglected nature of the disease in government health policies and a lack of information on disease control measures.

In overall, 42.8% of the current participants had good level of knowledge about cutaneous *Leishmania*sis. This finding was higher than studies carried out in Delanta district, Northeast Ethiopia, in Wolaita zone, Southern Ethiopia, Kutaber District, Northeast Ethiopia and in Shara'b district, Southwestern Yemen [15,20,22,26]. However, the current result was lower than studies conducted in Gamo Gofa zone, Southern Ethiopia and a study among communities in hyperendemic areas in western Yemen [9,17]. This knowledge level discrepancy could be attributed to variations in magnitudes of CL prevalence among investigated countries, differences in specific studied area settings and due to socio-demographic and sociocultural variations of each studied population. However, the poor levels of knowledge towards CL revealed in this study could show adequate awareness creation activities about this disease were not in place and the neglected nature of the disease still continues in Ethiopia including in the current study communities [5].

When we examine specifically beyond the overall knowledge level, most participants were familiar with the disease and described it using a common local term 'Guzwa' (a name for CL in Tigrigna language); while only very few had heard the scientific name of the disease, '*Leishmania*sis'. In the current study, 96.8% of participants had seen CL cases within the study communities, either from infected household family or neighbors and considered a skin lesion on the face to be a symptom of CL. The participants' high awareness of the signs and symptoms of CL is most likely due to the high prevalence of the disease in the study areas. Awareness of these aspects was higher than earlier studies carried out in Amhara region, Ethiopia, where 85.6% of participants had seen cases of CL in their localities [22]. Similarly, in the Volta region of Ghana and southwestern Yemen, 82.0% and 76% of the study participants, respectively had seen CL cases either among family members or other people in the study localities [15,27]. However, in contrast with the present findings, in a KAP study carried out in a non-endemic area of Alexandria, Egypt, most participants (90%) had never seen CL infected person [28]. This difference is likely a reflection of variation in CL prevalence between these geographical regions.

In the present study, although most of participants showed encouraging knowledge about symptoms of CL, they had an overall poor level of knowledge towards its transmission mechanisms. Only six participants (1.2%) were mentioned the sand fly vector by name. This finding is comparable with a similar study carried out in Wolaita zone, southern Ethiopia, where none of the participants had heard of the sand fly [20]. The current finding is also consistent with other similar studies carried out in different regions of Ethiopia [17,21]. Moreover, the current study participants had high level of misconceptions towards transmission mechanisms of the disease and the causal agents. About one quarter of the current participants considered CL to be a genetically acquired disease, about one third considered bats as being the disease vector and about one fifth of the participants believed that butterflies or moths could be responsible for spreading the disease. These findings are similar to previous studies conducted in Ethiopia. For example, 61.6% of study participants in Kutaber District had misconceptions on the mode of transmission [22], 19.5% of participants in a study in Delanta District responded that CL is transmitted *via* bat urine [26]. However, unlike to current study findings, a similar KAP study in central Iran found that 97.9% of the participants had a theoretical

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

knowledge of the sand fly vector [29]. The differences could be due to variations in sociodemographic factors, including the study settings and education level of participants. The study in Iran was institution-based and conducted with student participants [29] whereas the current study was conducted in CL-endemic community settings where 30% of participants had not received formal education.

In overall, 36.5% of the current participants had a favorable attitude towards CL infected individuals. This finding was comparable with earlier studies undertaken in Northeast Ethiopia and studies in western Yemen, where 34.5% and 38.1% of the participants respectively, had a favorable attitude towards people with CL infections [9,26]. On the other hand the present finding is higher than a study result found in Kutaber district of Ethiopia, where only 18.2% of the study participants had a favorable attitude towards CL infections [22]. The discrepancy with later report could be due to variation in beliefs and cultural differences towards the disease, where there could be higher fear of CL infection among Kutaber district community relative to the study communities in Tigray. Besides, about two-third of the participants in this study demonstrated an unfavorable attitude towards people with CL infections; this could be due to lack of scientific information about the disease transmission mechanisms.

Looking at perceptions in the community towards CL infected individuals, over two-third of the participants perceived CL to be a stigmatizing disease, which is higher than previous studies in southern Ethiopia and in western Yemen [9, 20]. The high level of stigma revealed in this study could be associated with poor understanding on the mode of disease transmission. For example, a considerable number of our participants believed that CL is a genetically acquired disease. The actual level of CL stigma among the study communities could be even higher than the current findings as when our participants were being asked a subsequent question about their feelings, over three-fourth of participants acknowledged that they felt uncomfortable when looking at people with CL. The stigma associated with CL can result in social discrimination, isolation and rejection and may also exacerbate health outcomes and influence the educational attainment of children [30-32].

In this study, about 34% of participants only had a good level of treatment-seeking behaviour and prevention practices. This finding is about equivalent to a similar study carried out in southern Ethiopia, where about 37.5% of the study participants had good levels of practices [17]. On the other hand, the present finding is higher than a recent KAP study undertaken in western Yemen, where only 16.3% of the study participants had good levels of treatment-seeking and prevention practices [9]. This discrepancy could be due to the prolonged civil war in Yemen, which brought the public health system to collapse, which could be contributed for reduction of patients' healthcare utilization status in the country [9,33].

Likewise, over two-third of the present study participants had a poor level of treatment-seeking behaviour. This could be due to the war in the Tigray region of northern Ethiopia, erupted in November 2020, has brought unimaginable humanitarian crisis and enormous damage to the health system in the region, which is similar to the war-crisis in Yemen [34]. As a result of the war in Tigray, the health system in Tigray had been almost collapsed; about 80% of the primary hospitals and 86% of the secondary and tertiary hospitals including the CL care provider hospitals were fully or partially damaged and/or vandalized/looted and hence the majority of the health facilities went non-functional [35]. Therefore, the war associated health system damage in Tigray could be one of the reasons for the poor level of treatment-seeking behaviour revealed among the vast majority of the current study participants.

Our findings showed that over sixty three percent of participants preferred to seek remedies from traditional healers (herbalists) rather than formal CL healthcare facilities. This could be due to several factors, including local beliefs, lack of awareness about biomedical treatments available and poor access to facilities. These findings are consistent with many community-based studies in Ethiopia: Traditional remedies were the primary choice for 67.6% of participants in Gamo-Gofa zone, 68.3% of participants in Amhara region and about 77% of participants in Wolaita zone [17,20,21]. A study in Nigeria also found that participants preferred to seek CL treatments with traditional healers rather than formal healthcare services [36].

The current findings revealed that religious/faith healers (locally named "Tsebel") offered traditional treatments specifically called "Tsebel Senbet Senabti", which were among the most common traditional methods used to treat CL in the study sites. These findings are consistent with previous studies in southern Ethiopia [20]. Moreover, over sixty percent of the current participants acknowledged that the nearest formal CL healthcare facility is located approximately 61 to 90 kilometers away from home. Most formal CL healthcare in Ethiopia, including in Tigray, is centralized and located in regional or zonal capital cities, a long distance from endemic areas [37]. Towards this, decentralization of the current CL treatment facilities to the disease endemic localities could be one of the crucial measures needed to improve the treatment access.

Our findings showed that most participants did not know about CL prevention mechanisms. A very small proportion stated that bed nets or mentioned different preventive methods. These findings are consistent with similar studies conducted in southern Ethiopia and western Yemen, where most of the study participants had poor level of knowledge about the insect vector and its preventive measures [9,20]. About three quarters of the current participants had seen rock hyraxes in their localities and over one third of them also responded that they used hyraxes' dung as a fertilizer in their farm plots.

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

Hyrax species have been shown to be the primary reservoir hosts of CL parasites in Ethiopia and a study carried out in eastern Tigray has also indicated that the presence of hyraxes close to resident houses was significantly associated with CL infections [38,39]. However, only a very small number of our participants were informed regarding hyraxes as potentially involved in CL transmission. Considering the present findings, the communities living in CL endemic areas of Tigray do not have adequate information towards prevention and control of the disease. Providing more education on CL transmission, the insect vector (sandfly), the reservoir hosts (hyrax) and activities/times that are riskier would help communities to take preventive measures against the disease.

Strengths and Limitations of the Study

This study included wider geographic coverage (seven districts from three zones) of Tigray; hence, the overall findings could represent the entire communities' knowledge, attitude, treatment-seeking behavior and prevention practices towards CL in the region. Given the above strength, this study has the following limitations. First, this study was done in a single region, Tigray, that the findings may not be generalized to the overall population in Ethiopia. The second limitation could be related to the nature of cross-sectional study design used, which may influence participants for recall bias. The third limitation could be related to the participants' responses for some questions, especially related to treatment-seeking behavior of the respondents, which may predispose them for social desirability biases. Hence, the findings of this study should be interpreted with caution.

Conclusion and Recommendations

In this study, more than one half of the study participants had poor level of knowledge about CL and nearly all participants didn't know about the disease transmission mechanism, the insect vector (sand fly) and reservoir hosts. Besides, more than two-third of participants had unfavorable attitude towards the disease and majority (67%) perceived CL to be a stigmatizing disease. Moreover, about two-third of the participants had poor understanding towards CL treatment in formal healthcare facilities; instead, traditional methods were the primary choices for most participants. The majority of the participants had very low scores for questions around practices related to prevention and control of the disease. More than half of respondents didn't apply any known prevention measures and a significant proportion of respondents didn't know about any mechanism of CL prevention. Occupation and rural household settings were determinants significantly associated with participants' attitude. While gender, education level and previous CL episode in the households were significant predictors associated with treatment seeking behavior and prevention practices. These findings are reflective of the absence of adequate awareness creations towards prevention and control efforts in disease-endemic areas of Tigray. This is in contrast to the perception of communities who responded that CL is a major health problem and is stigmatizing to those individuals affected. These findings give strong support for an integrated intervention through community mobilization and health education campaigns in these disease-affected populations focusing on the CL causal agents, disease transmission mechanisms and its prevention measures.

Acknowledgements

The authors would like to acknowledge all participants who voluntarily accepted the data collection team and served as respondents in the study for their valuable time and information; the data collectors who contributed their invaluable time and energy during data collection and all those who in one way or another contributed their thoughts in this study are highly appreciated.

Authors' Contributions

This report is part of a dissertation by SBT who conceived the project idea, wrote the draft proposal, applied for ethical clearance, collected data, analyzed data and wrote the manuscript. AMB and HPP supervised SBT during inception of the proposal, reviewed and edited the proposal, assisted in interpretation of the results and writing the manuscript. All three of the authors have critically read and reviewed and approved the manuscript for publication reviewed and edited the manuscript.

Funding

The authors received no specific funding to conduct this study.

Availability of Data and Materials

The datasets used in this study are available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

References

1. Burza S, Croft SL, Boelaert M (2018) *Leishmania*sis. Lancet 392: 951-970.
2. Alvar J, Velez ID, Bern C, Herrero M, Desjeux P, et al. (2012) *Leishmania*sis worldwide and global estimates of its incidence. PLoS One 7: e35671. [Crossref] [Google Scholar] [Indexed]
3. World Health Organization (WHO) (2023) *Leishmania*sis 2023: Key facts.
4. CDC (2020) *Leishmania*sis: Epidemiology & risk factors.
5. Shita EY, Semegn EN, Wubetu GY, Abitew AM andualem BG, et al. (2022) Prevalence of *Leishmania* RNA virus in *Leishmania*

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

parasites in patients with tegumentary *Leishmania*sis: A systematic review and meta-analysis. PLoS Negl Trop Dis 16: e0010427. [Crossref] [Google Scholar] [Indexed]

6. Bailey F, Mondragon-Shem K, Hotez P, Ruiz-Postigo JA, Al-Salem W, et al. (2017) A new perspective on cutaneous *Leishmania*sis-Implications for global prevalence and burden of disease estimates. PLoS Negl Trop Dis 11: e0005739. [Crossref] [Google Scholar] [Indexed]

7. Okwor I, Uzonna J (2016) Social and economic burden of human *Leishmania*sis. Am J Trop Med Hyg 94: 489-493. [Crossref] [Google Scholar] [Indexed]

8. World Health Organization (2022) Global health observatory data repository. World Health Organization: Geneva, Switzerland.

9. Al-Ashwal M, Al-Adhroey A, Atroosh W, Alshoteri S, Al-Subbary A, et al. (2024) Knowledge, attitude, practices and treatment seeking behaviour concerning cutaneous *Leishmania*sis among rural hyperendemic communities in western Yemen. Nature Portfolio 14: 12662. [Crossref] [Google Scholar] [Indexed]

10. Poggi I (1937) Oriental sore in Agamé (Abyssinia). Arch Ital Sci Med Trop Parasitol 18. [Google Scholar]

11. Ethiopian Federal Ministry of Health (2013) National master plan for neglected tropical disease (2013-2015), Addis Ababa.

12. van Henten S, Adriaensen W, Fikre H, Akuffo H, Diro E, et al. (2018) Cutaneous *Leishmania*sis due to *Leishmania aethiopica*. E Clin Medi 8: 69-81. [Crossref] [Google Scholar] [Indexed]

13. Doni S, Yeneneh K, Hailemichael Y, Gebremichael M, Skarbek S, et al. (2023) Health-related quality of life of adults with cutaneous *Leishmania*sis at ALERT Hospital, Addis Ababa, Ethiopia. PLoS Negl Trop Dis 17: e0011196. [Crossref] [Google Scholar] [Indexed]

14. Shita EY, Nibret E, Munshea A, Gashaw B (2022) Burden and risk factors of cutaneous *Leishmania*sis in Ethiopia: A systematic review and Meta-Analysis. Int J Dermatol 61: 1336-1345. [Crossref] [Google Scholar] [Indexed]

15. Alharazi TH, Haouas N, Al-Mekhlafi HM (2021) Knowledge and attitude towards cutaneous *Leishmania*sis among rural endemic communities in Shara'b district, Taiz, southwestern Yemen. BMC Infect Dis 21: 269. [Crossref] [Google Scholar] [Indexed]

16. Alidosti M, Heidari Z, Shahnazi H, Zamani-Alavijeh F (2021) Behaviors and perceptions related to cutaneous *Leishmania*sis in endemic areas of the world: A review. Acta Trop: 106090. [Crossref] [Google Scholar] [Indexed]

17. Kebede N, Worku A, Ali A, Animut A, Negash Y, et al. (2016) Community knowledge, attitude and practice towards cutaneous *Leishmania*sis endemic area Ochello, Gamo Gofa Zone, South Ethiopia. Asian Pac J Trop Biomed 6: 562-567. [Crossref] [Google Scholar]

18. Akram A, Ali Khan HA, Qadir A, Sabi AM (2015) A cross-sectional survey of knowledge, attitude and practice related to cutaneous *Leishmania*sis and sand flies in Punjab, Pakistan. PLoS One 10: e0130929. [Crossref] [Google Scholar] [Indexed]

19. Pardo RH, Carvajal A, Ferro C, Davies CR (2006) Effect of knowledge and economic status on sandfly control activities by householders at risk of cutaneous *Leishmania*sis in the sub-Anden region of Huila Department, Colombia. Biomedica 26: 167-169. [Google Scholar] [Indexed]

20. Alemayehu B, Kelbore AG, Alemayehu M, Adugna C, Bibo T, et al. (2023) Knowledge, attitude and practice of the rural community about cutaneous *Leishmania*sis in Wolaita zone, southern Ethiopia. PLoS ONE 18: e0283582. [Google Scholar]

21. Tamiru H, Mashalla Y, Mohammed R, Tshweneagae G (2019) Cutaneous *Leishmania*sis a neglected tropical disease: community knowledge, attitude and practice in an endemic area, Northwest Ethiopia. BMC Infect Dis 19: 1-9. [Crossref] [Google Scholar] [Indexed]

22. Berhanu A, Dugassa S, Maru M, Animut A, Erko B, et al. (2023) Cutaneous *Leishmania*sis in Kutaber District, Ethiopia: Prevalence, sand fly fauna and community knowledge, attitude and practices. Heliyon 9: e18286. [Crossref] [Google Scholar]

23. Lwanga SK, Lemeshow S (1991) Sample size determination in health studies: A practical manual. WHO: Geneva, Switzerland.

24. Tessema SB, Hailu BG, Embaye TH, Debes BF, Nigus GK, et al. (2026) Cutaneous *Leishmania*sis in Tigray, Ethiopia: Clinical patterns, environmental drivers and public health implications. PLoS Negl Trop Dis 20: e0013994. [Crossref] [Google Scholar] [Indexed]

25. Central Statistical Agency (Ethiopia), ICF International (2012) Ethiopia demographic and health survey 2011. Addis Ababa, Ethiopia and Calverton. Central Statistical Agency and ICF International: Maryland, USA.

26. W, Ademe S (2022) Determinants of cutaneous *Leishmania*sis among students in Delanta district, Northeast Ethiopia: A case-control study. Health Sci Rep 5: e917. [Crossref] [Google Scholar] [Indexed]

27. Doe ED, Egyier-Yawson A, Kwakye-Nuako G (2019) Knowledge, attitude and practices related to cutaneous *Leishmania*sis in endemic communities in the Volta region of Ghana. Int J Healthcare Sci 7: 33-43. [Crossref] [Google Scholar] [Indexed]

28. Ali RM, Loutfy NF, Awad OM (2015) Attitude and knowledge of primary health care physicians and local inhabitants about *Leishmania*sis and sand fly in West Alexandria. Int J Hum Soc Sci 9: 2167-2178. [Crossref] [Google Scholar] [Indexed]

29. Saberi S, Zamani A, Motamedi N, Nilforoushzadeh MA, Jaffary F, et al. (2012) The knowledge, attitude and prevention practices of students regarding cutaneous *Leishmania*sis in the hyperendemic region of the Shahid Babaie Airbase. Vector Borne Zoonotic Dis 12: 306-309. [Crossref] [Google Scholar] [Indexed]

30. Nuwangi H, Agampodi TC, Price HP, Shepherd T, Weerakoon KG, et al. (2023) Stigma associated with cutaneous and mucocutaneous *Leishmania*sis: A systematic review. PLoS Negl Trop Dis 17: e0011818. [Crossref] [Google Scholar] [Indexed]

31. Grifferty G, Shirley H, McGloin J, Kahn J, Orriols A, et al. (2021) Vulnerabilities to and the socioeconomic and psychosocial impacts of the *Leishmania*ses: A systematic Review. Res Rep Trop Med 12: 135-151. [Crossref] [Google Scholar] [Indexed]

32. Al-Kamel MA (2017) Stigmata in cutaneous *Leishmania*sis: Historical and new evidence-based concepts. Our Dermatol

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1

Online: 81-90. [Crossref] [Google Scholar]

33. Torbosh A, Al-Amad MA, Al-Serouri A, Khader Y (2019) The impact of war in Yemen on immunization coverage of children under one year of age: Descriptive study. JMIR Public Health Surveill 5: e14461. [Crossref] [Google Scholar] [Indexed]

34. Gesesew H, Berhane K, Siraj ES, Siraj D, Gebregziabher M, et al. (2021) The impact of war on the health system of the Tigray region in Ethiopia: An assessment. BMJ Global Health 6: e007328. [Crossref] [Google Scholar] [Indexed]

35. Tessema SB, Hagos T, Kehasy G, Paintain L, Adera C, et al. (2024) The economic burden of visceral *Leishmania*sis and barriers to accessing healthcare in Tigray, North Ethiopia: A field-based study. PLoS Negl Trop Dis 18: e0012423. [Crossref] [Google Scholar] [Indexed]

36. Okeke TA, Okafor HU, Uzochukwu BS (2006) Traditional healers in Nigeria: Perception of cause, treatment and referral practices for severe malaria. J Biocos Sci 38: 491-500. [Crossref] [Google Scholar] [Indexed]

37. Bantie B, Kassaw G, Demelash AT, Abate MW, Nigat AB, et al. (2024) Magnitude and associated factors of cutaneous *Leishmania*sis among patients visiting Nefas Mewcha primary hospital, Northern Ethiopia, 2022: An institution-based Cross sectional study. BMJ Open 14: e075549. [Crossref] [Google Scholar] [Indexed]

38. Jemberie W, Animut A, Dugassa S, Gebresilassie A, Melkamu R, et al. (2024) Ecology and infection status of sand flies in rural and urban cutaneous *Leishmania*sis endemic areas in Northwest Ethiopia. Trop Med Infect Dis 9: 52. [Crossref] [Google Scholar] [Indexed]

39. Bsrat A, Berhe N, Balkew M, Yohannes M, Teklu T, et al. (2015) Epidemiological study of cutaneous *Leishmania*sis in Saesie Tsaeda-emba district, eastern Tigray, northern Ethiopia. Parasit Vectors 8: 149. [Crossref] [Google Scholar] [Indexed]

Copyright © 2026 | https://infectiousdiseases-patientcare.wren-research-journals.com/1