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Knowledge, attitudes, preventive practices, and associated factors of cutaneous leishmaniasis among adults of Kandahar city, Afghanistan

Bilal Ahmad Rahimi[1,2]✉, Khoshhal Bakhtialy[1], Ahmad Farshad Rahimi[3] & Walter R. Taylor[4,5]

Kandahar city is highly endemic for cutaneous leishmaniasis (CL) in Afghanistan, caused mostly by *Leishmania tropica*. The objective of this study was to investigate the knowledge, attitudes, prevention practices, and their associated factors to inform control policy. This community-based cross-sectional analytical study included 2,044 adults from three randomly selected districts of Kandahar city (March–August 2024). Data were analysed by descriptive statistics, Chi-squared, and multivariate logistic regression. *P*-value < 0.05 was considered statistically significant. The mean (SD) age was 33.8 (10.2) years, 54.5% were females, 75.7% were unemployed, 77.4% were illiterate, and 88.0% were poor. Among the study participants, only 23.6%, 40.6%, and 33.3% had good knowledge of CL, a positive attitude towards CL, and practiced preventive measures against CL, respectively. Independent factors associated with: (i) poor CL knowledge were being male (adjusted odds ratio [AOR] 2.5, 95% CI 1.9–3.3), being unemployed (AOR 3.4, 95% CI 2.6–4.5), illiterate (AOR 2.4, 95% CI 1.9–3.1), and a confirmed CL case in the family (AOR 1.3, 95% CI 1.0–1.7), (ii) a negative attitude towards CL were aged > 40 years (AOR 4.0, 95% CI 2.9–5.4) and belonging to a middle- or high-income family (AOR 1.6, 95% CI 1.2–2.2), and (iii) poor preventive practices towards CL were aged > 40 years (AOR 1.5, 95% CI 1.3–1.9), being illiterate (AOR 1.3, 95% CI 1.1–1.7), and in a family size of < 5 members (AOR 1.4, 95% CI 1.1–1.7). Most residents in Kandahar city had poor knowledge, a negative attitude towards CL, and lacked enthusiasm to adopt preventative measures against it. These findings highlight the need for targeted health education programs to improve knowledge, attitudes, and preventive practices regarding CL among Kandahar residents, especially males, illiterate individuals, and those aged > 40 years.

Keywords Afghanistan, Kandahar city, Cutaneous leishmaniasis, Attitude, Practice, Knowledge

Cutaneous leishmaniasis (CL) is a widespread parasitic infection caused by a unicellular flagellated parasite belonging to the genus *Leishmania*[1]. Globally, CL is prevalent in 98 countries, notably in the Mediterranean Basin, Western Asia (from the Middle East to Central Asia), and Latin America. Some 350 million people are at risk of contracting CL, and the current prevalence is estimated at approximately12 million people for an annual incidence of 2–2.5 million cases[2–4]. Approximately 70–75% of the global estimated CL incidence occurs in ten countries, namely, Afghanistan, Algeria, Colombia, Brazil, Iran, Syria, Ethiopia, North Sudan, Costa Rica, and Peru[3].

In CL, the clinical manifestations start with a skin lesion at the bite site of sandfly that usually increases in size to form a nodule that is often exposed to secondary bacterial and/or fungal infections[5]. If CL is not treated, it leaves life-long scars, resulting in disfigurement and social stigma[6,7]. Different factors associated with CL include poverty, illiteracy, young age, migration, climate change, deforestation, lack of preventive measures, malnutrition,

[1]Faculty of Medicine, Kandahar University, Kandahar, Afghanistan. [2]Faculty of Medicine, Afghan International Islamic University, Kabul, Afghanistan. [3]Kandahar Tuberculosis Centre, Directorate of Public Health, Kandahar, Afghanistan. [4]Centre for Tropical Medicine and Global Health, Nuffield Department of Medicine, University of Oxford, Oxford, UK. [5]Mahidol Oxford Tropical Medicine Clinical Research Unit (MORU), Mahidol University, Bangkok, Thailand. ✉email: drbilal77@yahoo.com

as well as specific occupations and activities, such as farming, military, mining, and hunting[6,8–11]. Adherence to the treatment and preventive measures is most important for the control of CL. However, treatment adherence in the endemic areas is largely affected by the inhabitants' knowledge about CL and their attitude towards CL[12].

Several CL KAP surveys have been conducted in a broad spectrum of CL-endemic countries, such as Ethiopia, Ethiopia, Pakistan[13], Iran[14], Saudi Arabia[15], Syria[16], Yemen[17], Algeria[18], and Morocco[19], revealing poor levels of knowledge about the etiology, transmission, treatment, and preventive measures towards the CL in communities[1,17,20]. Moreover, studies have shown that an effective method to control infectious diseases is to increase the knowledge and attitude of a community, as they play a crucial role in the prevention and control of these diseases[17].

CL is focally endemic in Afghanistan, especially in major cities such as Kabul, Herat, and Kandahar[21], where most of the CL cases in Afghanistan are caused by the anthroponotic (human to human transmission) *L. tropica*, the species transmitted by *Phlebotomous segenti*[22,23]. Owing to war and insecurity, very few studies on infectious diseases, including CL, have been conducted in Kandahar[24–27]. A recent community-based tuberculosis KAP study from Balkh province of northern Afghanistan reported that 63.7%, 52.7%, and 51.4% showed good knowledge, attitude, and practice, respectively[28]. This study has clearly revealed that limited community-level evidence on communicable diseases exists in Afghanistan. However, to our knowledge, no CL KAP study has been published from Afghanistan yet. Therefore, we aimed to assess knowledge, attitudes, and preventive practices regarding CL and to identify associated sociodemographic factors among adults in Kandahar city, southwest Afghanistan.

Methods

Study design and setting

This study employed a community-based convenience cross-sectional design and was conducted in Kandahar, Afghanistan, between March–August 2024. Kandahar is the country's second-largest city, located in the southwest of Afghanistan. This city sits at an altitude of 1,010 m above sea level and has a population of approximately 614,118 people[29]. This city is divided into 15 districts. Kandahar city is an endemic area for cutaneous leishmaniasis.

Study participants and sample size justification

Our predefined source population consisted of only adults (> 18 years old), both males and females, who were willing to participate in this study and were permanent residents of Kandahar city. Study exclusions were those who did not give informed consent to take part in this study, returnees, internally displaced, or temporary residents in Kandahar city.

We did the sample size and power calculations using Epi Info version 7.2 (CDC, Atlanta, Georgia, USA). For this study, expected frequency was chosen as 50%, an acceptable margin of error of 3%, and a confidence level of 99%. A 20% non-response rate was added. Our target sample size was 2248 adults living in Kandahar city.

Recruitment strategy for the target population and data collection

From the 15 districts of Kandahar city, three districts were randomly selected using the lottery method of randomization. In each district, participants were selected using a convenience sampling method. From each house, only one adult was selected as a study participant. In this study, we collected the data through face-to-face interviews with the study participants. Responses of the study were systematically recorded on paper. A pilot study with 50 participants confirmed the reliability of KAP (Cronbach's alpha was 0.783).

Questionnaire and scoring system

The questionnaire was first developed in the English language and then translated into Pashto, the local language. Later, the questionnaire was pre-tested in non-selected patients for assessing content validity, appropriateness, and question comprehensibility. The questionnaire was composed of questions regarding participants' sociodemographic characteristics, knowledge about the CL, attitude towards CL, and preventive practices towards CL. The questionnaire was developed based on a literature review of similar studies in different countries of the world[1,17,30], as well as comments from the local Afghan CL experts. The questionnaire consisted of four sections: (i) a sociodemographic Sect. (8 items), including a definition of poverty (Poverty was defined based on The World Bank definition, i.e., a family that earns < 150 Afghanis (< 2.15 USD) per person per day[31]), (ii) a knowledge Sect. (14 items), (iii) an attitude Sect. (12 items), and (iv) a practice Sect. (8 items).

Overall knowledge about CL was measured using the 14-item questions, as follows: (i) identification of CL manifestations using photographs, (ii) ever had CL, (iii) transmission of CL by a mosquito bite, (iv) transmission of CL by a sandfly bite, (v) sign(s) of CL, (vi) location of CL lesions/scars, (vii) habitat of the sandfly, (viii) communicability of CL, (ix) acquiring of CL in traveling, (x) biting time of the sandfly, (xi) seriousness of CL, (xii) preventability of CL, (xiii) prevention measures for CL, and (xiv) curability from CL. Each question had a score of 1 point for a correct response, while 0 for an incorrect and don't know response. The study participants who scored ≥ 8.4 and < 8.4 (the mean score of the knowledge measurement questions) were regarded as having good and poor knowledge about CL, respectively[1].

Overall attitude about CL was measured using the following 12-item questions: (i) CL is a problem in the area, (ii) treatability of CL, (iii) the outcome of CL, (iv) effects due to the occurrence of CL, (v) high incidence season of CL, (vi) CL transmission via direct contact, (vii) the importance of environmental sanitation, (viii) feeling informed about CL, (ix) breeding places of the sandfly, (x) spirituality of CL, (xi) a relation of CL with rodents, and (xii) impression about CL. Answers for the attitude questions were designed with a five-point Likert scale, i.e., (i) strongly disagree, (ii) disagree, (iii) neutral, (iv) agree, and (v) strongly agree. Each respondent could have a minimum of 12 points and a maximum of 60 points. The study participants who scored ≥ 30.86

and < 30.86 (the mean score of attitude measurement questions) were regarded as having positive and negative attitudes towards CL, respectively[1].

Overall Preventive Practices towards CL was measured using the 8-item questions, as follows: (i) bed net use, (ii) work time preference, (iii) sleeping outdoors, (iv) repellent utilization, (v) proper garbage disposal, (vi) indoor residual spray in the last 12 months, (vii) participation in CL control, and (viii) preference of treatment method for CL. The study participants who scored ≥ 5.0 and < 5.0 (the mean score of practice measurement questions) were regarded as good and poor preventive practices towards CL, respectively[1].

Data analysis and ethical considerations

Data from the standardised case report forms were double-entered into Microsoft Excel 2021 and cleaned and validated before data analysis in Statistical Product and Service Solutions (SPSS) version 26 (Chicago, IL, USA). Descriptive analyses, including frequency, percentage, mean, standard deviation (SD), and range, were used to summarize the socio-demographic characteristics. Frequency and percentage were used to summarize categorical variables. Chi-square test (using crude odds ratio [COR]) was performed to assess the binary association between various categorical variables. All statistically significant variables (p-value < 0.05) in univariate analyses and/or known confounders (age, sex, literacy) were assessed for independence in a multivariate logistic regression (using adjusted odds ratio [AOR]) to identify the significant, independent relationships of socio-demographic characteristics with the study participants' CL knowledge, their attitudes towards CL, and prevention practices to counter CL. For all the tests, a two-sided p-value of < 0.05 was considered statistically significant.

The study was approved by the Institutional Review Board of Kandahar University (code number KDRU-EC-2024.02) on January 5, 2024 (code number KDRU-EC-2024.02). All participants provided written informed consent before participating in the study. The confidentiality and privacy of the participants were protected throughout the study, following the Declaration of Helsinki and the ethical principles of research involving human subjects. For data collection, only the participants' initials were used, and before entering the data into the computer for analysis, the collected data were coded and de-identified.

Results

A total of 2248 individuals were approached, and 204 declined to participate for a response rate of 90.9% (n = 2044).

Socio-demographic characteristics

The mean (SD) age in our adult cohort was 33.8 (10.2) years, and 54.5% (1114/2044) were females. Among the study participants, 33.5% were single, 75.7% were unemployed, 77.4% were illiterate, 88.0% and 63.0% were from poor or large families, respectively, and 36.4% had at least one confirmed CL patient in their family members (Table 1).

Knowledge about CL

The majority of the study participants, 76.4%, had poor knowledge of CL; only 11.8% and 15.9% believed that CL is transmitted by rodents and sandflies, respectively. Similarly, 18.7%, 29.9%, and 31.7% knew that CL is a serious disease that could be cured and prevented, respectively (Table 2).

Variable	Frequency (n)	Percentage (%)
Age 18–40 years > 40 years	 1672 372	 81.8 18.2
Gender Male Female	 930 1114	 45.5 54.5
Marital status Single Married/Divorced/Widow	 684 1360	 33.5 66.5
Occupation Employed Unemployed	 496 1548	 24.3 75.7
Literacy level Literate Illiterate	 462 1582	 22.6 77.4
Family economic status Poor Not poor	 1799 245	 88.0 12.0
Family size < 5 people ≥ 5 people	 757 1287	 37.0 63.0
Presence of confirmed CL in the family Yes No	 743 1301	 36.4 63.6

Table 1. Socio-demographic and other characteristics of the study participants (n = 2044). CL, Cutaneous Leishmaniasis; n, Number.

Attitude towards CL

Overall, more than half, 59.4%, had a negative attitude towards the CL: 47.9% agreed/strongly agreed CL was a health problem in the area and 56.5% agreed/strongly agreed it could be treated whilst sizeable minorities, 44.2 and 40.8% agreed/strongly agreed that CL is transmitted by direct contact from person to person, and is a spiritual disease, respectively. By contrast, 65.2%, 50.2%, 45.2%, and 59.3% disagreed/strongly disagreed that disability is a CL outcome if treated late, the highest CL incidence is in autumn, environmental sanitation is important for the prevention of CL transmission, and they think they are well informed about CL, respectively (Table 3).

Variable	Frequency (n)	Percentage (%)
Recognition of CL using photographs Able to identify as CL Unable to identify as CL	 845 1199	 41.3 58.7
Have you heard about CL? Yes No	 1670 374	 81.7 18.3
Have you ever had CL? Yes No	 744 1300	 36.4 63.6
Is CL transmitted by rodents? Yes No I don't know	 241 441 1362	 11.8 21.6 66.6
Is CL transmitted by sandflies? Yes No I don't know	 325 668 1051	 15.9 32.7 51.4
Is a skin lesion a sign of CL? Yes No I don't know	 497 368 1161	 24.3 18.9 56.8
Is CL transmitted by sandflies? Yes No I don't know	 650 153 1241	 31.8 7.5 60.7
Are rock crevices, caves, rodent burrows, and vegetation the habitats of sandfly? Yes No I don't know	 174 601 1269	 8.5 29.4 62.1
Is CL transmitted from an infected to a healthy person? Yes No I don't know	 650 846 548	 31.8 41.4 26.8
Can CL be acquired by travelling to endemic areas? Yes No I don't know	 536 482 1026	 26.2 23.6 50.2
Are dawn and dusk the preferred biting times of the vector? Yes No I don't know	 519 881 644	 25.4 43.1 31.5
Is CL a serious disease? Yes No I don't know	 382 965 697	 18.7 47.2 34.1
Is CL a preventable disease? Yes No I don't know	 648 576 820	 31.7 28.2 40.1
Are health education, hygiene, and sanitation preventive measures of CL? Yes No I don't know	 732 196 1116	 35.8 9.6 54.6
Is there complete cure from CL? Yes No I don't know	 611 341 1092	 29.9 16.7 53.4
Overall knowledge about CL		
Good knowledge (score ≥ 8.4)	483 (23.6)	
Poor knowledge (score < 8.4)	1561 (76.4)	

Table 2. Participant knowledge of cutaneous leishmaniasis in Kandahar city ($n = 2044$). CL, Cutaneous Leishmaniasis; n, Number.

Prevention practices towards CL
Most study participants, 66.7%, did not practice good prevention measures against CL but there was variation in the proportions for certain measures, e.g., almost 70% used bed nets and just under 60% disposed of garbage properly whilst only 35% had their house sprayed with insecticide, 20% used repellents and < 2% had ever participated in a CL prevention program. Just over half preferred both modern and traditional treatment for CL (Table 4).

Factors associated with poor CL knowledge
By univariate analysis, the statistically significant factors associated with poor CL knowledge were being aged > 40 years (COR 1.3), male (COR 4.0), single (COR 1.8), unemployed (COR 4.8), illiterate (2.5), poor (COR 1.1), and presence of at least one confirmed CL case in family members (COR 1.4). However, based on multivariate logistic regression, the statistically significant factors associated with poor CL knowledge were being male (AOR 2.5, 95% CI 1.9–3.3), unemployed (AOR 3.4, 95% CI 2.6–4.5), illiterate (2.4, 95% CI 1.9–3.1), and presence of at least one confirmed CL case in family members (AOR 1.3, 95% CI 1.0–1.7). Factors that did not retain significance by logistic regression analysis were age, marital status, and family poverty (Table 5).

Factors associated with a negative attitude towards CL
In univariate analysis, six factors were associated with a negative attitude: being aged > 40 years (COR 4.7), female (COR 1.6), married/divorced/widow (COR 1.3), employed (COR 4.7), literate (COR 1.3), and not poor (COR 1.6). However, based on multivariate logistic regression, the statistically significant factors associated with negative attitude towards CL were being aged > 40 years (AOR 4.0, 95% CI 2.9–5.4), and not poor (AOR 1.6, 95% CI 1.2–2.2). Factors that did not retain significance by logistic regression analysis were being female, married/divorced/widow, employed, and literate (Table 6).

Factors associated with poor preventive practices towards CL
In univariate analysis, four factors were significantly associated with poor prevention: being aged > 40 years (COR 1.5), unemployed (AOR 1.8), illiterate (COR 1.3), and in a family of < 5 members (COR 1.3). Of these, age > 40 years (AOR 1.5, 95% CI 1.3–1.9), being illiterate (AOR 1.3, 95% CI 1.1–1.7), and family size < 5 people (AOR 1.4, 95% CI 1.1–1.7) were statistically significant by multivariate logistic regression. The only factor that did not retain significance by logistic regression analysis was being unemployed (Table 7).

Discussion

In this large KAP survey of 2044 male and female adults in Kandahar, a city with a high CL burden, most had poor knowledge of CL, a negative attitude towards it, and undertook few preventative measures against it. Factors associated with: (a) poor CL knowledge about CL were being male, being unemployed, illiterate, and a confirmed CL case in the family, (b) a negative attitude towards CL were aged > 40 years, and belonging to a middle- or high-income family, and (c) poor preventive practices towards CL were aged > 40 years, being illiterate, and in a family size of < 5 members.

Less than a quarter of individuals had a good knowledge of CL, and substantial numbers of individuals reported "don't know" to many questions. Although approximately 80% had heard of CL, only 40% were able to identify it from clinical photographs. Younger, illiterate, unemployed individuals (being a single man was not quite significant) who lived in a household with a CL had poor CL knowledge. Similar results were reported in a

Variable	Measurements for attitude towards CL				
	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)
CL is a health problem in the area	523 (25.6)	456 (22.3)	233 (11.4)	640 (31.3)	192 (9.4)
CL can be treated	507 (24.8)	648 (31.7)	632 (30.9)	243 (11.9)	14 (0.7)
If not treated early, disability is the outcome of CL	90 (4.4)	121 (5.9)	501 (24.5)	991 (48.5)	341 (16.7)
CL in one family member affects the economy of the whole family	239 (11.7)	358 (17.5)	607 (29.7)	644 (31.5)	196 (9.6)
Highest CL incidence is in autumn season	182 (8.9)	343 (16.8)	493 (24.1)	644 (31.5)	382 (18.7)
CL is transmitted by direct contact from person to person	446 (21.8)	458 (22.4)	450 (22.0)	435 (21.3)	255 (12.5)
Environmental sanitation is important for the prevention of CL transmission	525 (25.7)	386 (18.9)	209 (10.2)	652 (31.9)	272 (13.3)
You think you are well informed about CL	345 (16.9)	458 (22.4)	29 (1.4)	568 (27.8)	644 (31.5)
Vegetation area, rock cracks, and animal manures are the major breeding places of sandflies	74 (3.6)	294 (14.4)	840 (41.1)	585 (28.6)	251 (12.3)
CL is a spiritual disease	431 (21.1)	403 (19.7)	374 (18.3)	636 (31.1)	200 (9.8)
CL has a relationship with rodents	117 (5.7)	166 (8.1)	1555 (76.1)	190 (9.3)	16 (0.8)
Worrying is the impression of CL	16 (0.8)	321 (15.7)	1210 (59.2)	386 (18.9)	111 (5.4)
Overall attitude status					
Positive attitude (score ≥ 30.86)	829 (40.6)				
Negative attitude (score < 30.86)	1215 (59.4)				

Table 3. Participants' attitudes towards cutaneous leishmaniasis in Kandahar city ($n = 2044$). CL, Cutaneous Leishmaniasis; SD, Standard Deviation; n, Number.

Variable	Frequency (n)	Percentage (%)
Used bed nets Yes No	 1427 617	 69.8 30.2
Use of repellants for CL prevention Yes No	 392 1652	 19.2 80.8
Work time preference Day time Night Both day and night	 1727 284 33	 84.5 13.9 1.6
Sleeping outdoor Yes No	 288 1756	 14.1 85.9
Properly performing garbage disposal Yes No	 1200 844	 58.7 41.3
Indoor residual spray in the last 12 months Yes No	 717 1327	 35.1 64.9
Ever participated in CL control activities Yes No	 33 2011	 1.6 98.4
CL treatment method preference Modern treatment Traditional treatment Both modern and traditional treatments	 595 382 1067	 29.1 18.7 52.2
Overall prevention practices towards CL		
Good prevention practices (score ≥ 5.0)	680 (33.3%)	
Poor prevention practices (score < 5.0)	1364 (66.7%)	

Table 4. Prevention practices against cutaneous leishmaniasis (n = 2044). CL, Cutaneous Leishmaniasis; SD, Standard Deviation; n, Number.

Variable	Knowledge about CL					
	Poor n (%), *n* = 1561	Good n (%), *n* = 483	COR (95% CI)	*p*-value	AOR (95% CI)*	*p*-value
Age 18–40 years > 40 years	 1345 (80.4) 216 (58.1)	 327 (19.6) 156 (41.9)	 Ref 1.3 (1.2–1.4)	 < 0.001	 Ref 0.7 (0.5–0.9)	 0.053
Gender Male Female	 825 (88.7) 736 (66.1)	 105 (11.3) 378 (33.9)	 4.0 (3.2–5.1) Ref	 < 0.001	 2.5 (1.9–3.3) Ref	 < 0.001
Marital status Single Married/Divorced/ Widow	 568 (83.0) 993 (73.0)	 116 (17.0) 367 (27.0)	 1.8 (1.4–2.3) Ref	 < 0.001	 1.2 (1.0–1.6) Ref	 0.100
Occupation Employed Unemployed	 259 (52.2) 1302 (84.1)	 237 (47.8) 246 (15.9)	 Ref 4.8 (3.9–6.1)	 < 0.001	 Ref 3.4 (2.6–4.5)	 < 0.001
Literacy level Literate Illiterate	 287 (62.1) 1274 (80.5)	 175 (37.9) 308 (19.5)	 Ref 2.5 (2.0–3.2)	 < 0.001	 Ref 2.4 (1.9–3.1)	 < 0.001
Family economic status Poor Not poor	 1391 (77.3) 170 (69.4)	 408 (22.7) 75 (30.6)	 1.1 (1.0–1.1) Ref	 0.006	 0.7 (0.5–1.0) Ref	 0.071
Family size < 5 people ≥ 5 people	 575 (76.0) 986 (76.6)	 182 (24.0) 301 (23.4)	 Ref 1.0 (0.8–1.2)	 0.737	 –	 –
Presence of confirmed CL case among family members Yes No	 598 (80.5) 963 (74.0)	 145 (19.5) 338 (26.0)	 1.4 (1.2–1.8) Ref	 0.001	 1.3 (1.0–1.7) Ref	 0.029

Table 5. Factors associated with poor knowledge about cutaneous leishmaniasis (n = 2044). AOR, Adjusted Odds Ratio; CL, Cutaneous Leishmaniasis; CI, Confidence Interval; COR, Crude Odds Ratio; n, number; Ref, Reference. *Variables with non-significance in the Chi-square analysis were not included in the logistic regression model.

Variable	Attitude towards CL					
	Negative n (%), $n=1215$	Positive n (%), $n=829$	COR (95% CI)	*p*-value	AOR (95% CI)*	*p*-value
Age 18–40 years >40 years	900 (53.8) 315 (84.7)	772 (46.2) 57 (15.3)	Ref 4.7 (3.5–6.4)	<0.001	Ref 4.0 (2.9–5.4)	<0.001
Gender Male Female	432 (46.5) 783 (70.3)	498 (53.5) 331 (29.7)	Ref 1.6 (1.5–1.8)	<0.001	Ref 0.6 (0.5–0.7)	0.050
Marital status Single Married/Divorced/ Widow	329 (48.1) 886 (65.1)	355 (51.9) 474 (34.9)	Ref 1.3 (1.2–1.4)	<0.001	Ref 0.6 (0.5–0.8)	0.071
Occupation Employed Unemployed	433 (87.3) 782 (50.5)	63 (12.7) 766 (49.5)	4.7 (3.7–6.0) Ref	<0.001	0.2 (0.2–0.3) Ref	0.062
Literacy level Literate Illiterate	306 (66.2) 909 (57.5)	156 (33.8) 673 (42.5)	1.3 (1.1–1.6) Ref	0.001	0.7 (0.6–0.9) Ref	0.051
Family economic status Poor Not poor	1046 (58.1) 169 (69.0)	753 (41.9) 76 (31.0)	Ref 1.6 (1.2–2.1)	0.001	Ref 1.6 (1.2–2.2)	0.002
Family size <5 people ≥5 people	441 (58.3) 774 (60.1)	316 (41.7) 513 (39.9)	Ref 0.9 (0.8–1.1)	0.402	–	–
Presence of confirmed CL case among family members Yes No	434 (58.4) 781 (60.0)	309 (41.6) 520 (40.0)	Ref 0.9 (0.8–1.1)	0.473	–	–

Table 6. Factors associated with a negative attitude towards CL ($n=2044$). AOR, Adjusted Odds Ratio; CL, Cutaneous Leishmaniasis; CI, Confidence Interval; COR, Crude Odds Ratio; n, number; Ref, Reference. *Variables with non-significance in Chi-square analysis were not included in the logistic regression model.

Variable	Prevention practices against CL					
	Poor n (%), $n=1364$	Good n (%), $n=680$	COR (95% CI)	*p*-value	AOR (95% CI)*	*p*-value
Age 18–40 years >40 years	1090 (65.2) 274 (73.7)	582 (34.8) 98 (26.3)	Ref 1.5 (1.2–1.9)	0.002	Ref 1.5 (1.3–1.9)	0.002
Gender Male Female	609 (65.5) 755 (67.8)	321 (34.5) 359 (32.2)	Ref 0.9 (0.7–1.1)	0.274	–	–
Marital status Single Married/Divorced/ Widow	444 (64.9) 920 (67.6)	240 (35.1) 440 (32.4)	Ref 0.9 (0.7–1.1)	0.216	–	–
Occupation Employed Unemployed	390 (78.6) 974 (62.9)	106 (21.4) 574 (37.1)	1.8 (1.5–2.2) Ref	<0.001	0.4 (0.3–0.6) Ref	0.061
Literacy level Literate Illiterate	290 (62.8) 1074 (67.9)	172 (37.2) 508 (32.1)	Ref 1.3 (1.0–1.6)	0.040	Ref 1.3 (1.1–1.7)	0.010
Family economic status Poor Not poor	1212 (67.4) 152 (62.0)	587 (32.6) 93 (38.0)	0.8 (0.6–1.0) Ref	0.097	–	–
Family size <5 people ≥5 people	535 (70.7) 829 (64.4)	222 (29.3) 458 (35.6)	1.3 (1.1–1.6) Ref	0.004	1.4 (1.1–1.7) Ref	0.001
Presence of confirmed CL in family Yes No	492 (66.2) 872 (67.0)	251 (33.8) 429 (33.0)	Ref 1.0 (0.8–1.2)	0.709	–	–

Table 7. Factors associated with poor prevention practices (n = 2044). AOR, Adjusted Odds Ratio; CL, Cutaneous Leishmaniasis; CI, Confidence Interval; COR, Crude Odds Ratio; n, number; Ref, Reference. *Variables with non-significance in Chi-square analysis were not included in the logistic regression model.

descriptive cross-sectional study in 195 Iranian adults living in three endemic areas of Kerman city in southeast Iran; only 25% had good knowledge of anthroponotic CL[32]. Contrary to our results, a study conducted among 612 Ethiopians (Kutaber district, northeast Ethiopia) revealed that almost half (47.5%) had good CL knowledge, and significant factors associated with poor knowledge were belonging to a poor family, not knowing someone with CL, and not using media; only illiteracy concurred with our study[1]. Similar to the Ethiopian study, a little

over half of 289 Yemenis from the Utmah district, western Yemen, had good knowledge of CL. All of the study participants had heard about CL, some 42% thought it was preventable, vs. 32% in our study, but only ~ 9% could say that it is caused by sandflies, similar to our 16%. Moreover, significant factors associated with poor knowledge were being female, a farmer, the absence of confirmed CL cases in the family, and being of < 40 years[5].

In neighboring Pakistan, mixed results are reported compared to our study. Just over a quarter of 844 individuals from Khyber Pakhtunkhwa province (KPP) had complete knowledge of CL symptoms, approximately16% knew about the CL vector, and about a third had never seen a case of CL[13]. In Quetta, a Pakistani city endemic for *L. tropica* and located approximately 200 km southeast of Kandahar city, 64 of 102 suspected or confirmed cases of CL had poor knowledge about CL, but 59 correctly identified sandflies as the CL vector, while less than half (42) believed that winter is the season with a higher incidence of CL[33].

We observed that ~ 40% of our study population had a positive attitude towards the CL, found in older (> 40y) individuals in middle- or high-income families. This rate is similar to the Yemeni study (38%), which, in contrast to us, found an association with the absence of CL in the family[5]. Our rate is less than the 66% and 55% reported from Iran[32] and Ethiopia, respectively[1]. Similar factors related to a negative attitude that concurred with our findings included older age (> 54.5 years) in Ethiopia. In Quetta, 80% of the study participants thought that CL is a major public health vs. < 50% in our study, 37% did not think that CL is dangerous vs < 20% in our study, and 88% agreed that CL causes social discomfort due to its disfigurement, while 47% believed that living with CL infected person increases the risk of getting CL vs. our 32% our study[33]. In KPP, almost all (99.2%) of the study participants lived near wild animal reservoirs, and 97% had domestic animals in the household[13].

Only 1 in 3 reported good prevention practices, and poor practices were associated with older age, being illiterate, and having a family size of < 5 members. These findings are essentially the same as data from Kerman city in Iran (32%)[32] and Kutaber in Ethiopia (35%)[1]. Contrasting to our findings, younger age (< 44.5 years) and not knowing a CL patient were associated with poor practices; key environmental factors they identified were cracks/holes in the external house walls, living close to the creeks/waterways, and defaecating in the open[1]. Some 45% of our participants recognised that environmental sanitation was important, and open defecation in urban areas of Afghanistan is not uncommon.

Bed net use was high in our cohort, ~ 70%, but lower than in KPP (~ 83%) and Quetta (~ 90%, although these are not insecticide-treated). Insect repellent use was also high in KPP but low in our group, 20%, and in Quetta, 40%[13,33]. Overall, in Quetta, 75% were aware that CL could be prevented. The situation in Utmah province in Yemen was considerably worse, with only 16% following good prevention practices and only 9% either using bed nets or repellents due to low income[5]. There are variations in our findings compared to those of others that can be explained by different epidemiological settings (e.g., although L. aethiopica is an Old World CL, it has different clinical and epidemiological characteristics compared to the common Old World species in our region, *L. tropica* and *L. major*), differences in health systems, health education, literacy rates, weather, economic status, levels of security situation and the culture of the people.

Limitations

Although our study was large and conducted in a highly endemic CL city, there were several limitations in our study. First, owing to the unavailability of funding, we conducted a cross-sectional study, which provided only a snapshot of knowledge, attitudes, and practices at one point in time. Although a longitudinal study design would have captured data over time, our baseline data provide a basis for future intervention studies. Second, we relied on self-reported data that could have introduced recall and social desirability biases. Third, we collected data only from three districts of Kandahar city. So, we cannot generalize these data to the entire population of Kandahar city and Afghanistan. A multicenter study would be most useful for setting national control policy. Fourth, in each district, participants were selected using a convenience sampling method. So, this might have affected the generalizability of the data. Fifth, we conducted multiple analyses, and some statistically significant results could have occurred by chance. Sixth, because we sampled only three districts and did not account for clustering in the analysis, confidence intervals may be slightly underestimated. Seventh, the cut-offs used in our study for good knowledge, attitude, and practice were based on the sample mean, which is somewhat arbitrary and may not correspond to a clinically meaningful level. Eighth, we excluded internally displaced persons and returnees, who may have different KAP profiles and potentially higher vulnerability to CL.

Conclusion

This study found that most of the adult urban population of Kandahar city had poor knowledge of CL, a negative attitude towards it, and did not adopt prevention practices against it. Of the three aspects, poor knowledge was associated with the most associated factors (5 of 8, including single men that was a trend), followed by poor prevention practices, and a negative attitude for a total of 7 of 8 associated factors and with some overlap of these factors: illiteracy linked poor knowledge and poor prevention practices and older age linked a negative attitude with poor prevention practices but the univariate analysis suggested older age was associated with better knowledge. More research is needed in Kandahar to ascertain the interplay between these factors as is greater community engagement to increase awareness of CL and, crucially, how it can be prevented.

Given that we identified 7 important factors, community engagement activities should be broad and target both single and married men and women (who also have high rates of poor knowledge, negative attitude, and poor prevention practices) who are illiterate and of low socioeconomic standing. It is reassuring that the majority use bed nets, but repellent use is dismally but unsurprisingly low, given that this is an expense that is unaffordable for a poor population. Indoor residual spraying is low, and this is a programme responsibility requiring resources that are currently stretched in a country currently under economic sanctions.

Our findings could be generalisable to the other cities in our region (we are in the WHO EMRO region), allowing local and regional policy-makers, healthcare planners, WHO, and UNICEF to design and implement

appropriate health messaging. Climate change is likely to expand the geographic range of sandfly vectors, potentially increasing the risk of CL transmission, emphasising the need for good prevention through vector control and health education that includes sandfly breeding places, biting times, seasonal peaks, and prevention measures to reduce human-vector contact. Another approach could be to integrate the CL control programme with the malaria control programme in Afghanistan. To address the root causes of CL transmission, intersectoral collaboration should be strengthened between health and other sectors, such as agriculture, local government, education, environment, and the media.

Data availability

All data generated or analysed during this study are included in this published article [and its Supplementary SPSS analysis file 1].

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Author contributions
Conceptualisation: BAR, WRT. Data curation: BAR, KB. Formal analysis: BAR, AFR. Investigation: BAR, KB, AFR. Methodology: BAR, WRT. Project administration: BAR, KB. Resources: BAR. Software: BAR. Supervision: BAR, KB, AFR. Validation: BAR. Visualisation: BAR, KB. Writing—original draft: BAR. Writing—review and editing: BAR, KB, AFR, WRT. All authors have read and approved the manuscript[21].

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Declarations

Competing interests
All the authors do not have any competing interests.

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Correspondence and requests for materials should be addressed to B.A.R.

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