

## Review Article

# Social Determinants of Health Influencing Leishmaniasis Worldwide: A Systematic Review

Gobad Moradi<sup>1</sup>; \*Bakhtiar Piroozi<sup>2</sup>; Mohammad Zeinali<sup>3</sup>; Hossein Safari<sup>4</sup>; Arshad Veysi<sup>5</sup>; Ebrahim Ghaderi<sup>6</sup>; Farhad Morapour<sup>2</sup>; Yousef Moradi<sup>1</sup>; \*Shoboo Rahmati<sup>2</sup>

<sup>1</sup>Health Metrics and Evaluation Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran

<sup>2</sup>Social Determinants of Health Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran

<sup>3</sup>Zoonoses Department, Centre of Disease Control (CDC), Ministry of Health, Tehran, Iran

<sup>4</sup>Health Promotion Research Center, Iran University of Medical Sciences, Tehran, Iran

<sup>5</sup>Zoonoses Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran

<sup>6</sup>Clinical and Protecting Health Directorate, Public Health Scotland, Glasgow, Scotland

\*Corresponding authors: Dr Shoboo Rahmati, E-mail: shoboorahmati2014@gmail.com, Dr Bakhtiar Piroozi, E-mail: bpiroozi@gmail.com

(Received 05 Dec 2025; accepted 25 Mar 2026)

## Abstract

**Background:** Leishmaniasis is a neglected tropical disease influenced by a complex interplay of biological, environmental, and social factors. This study aimed to review the evidence on social determinants of health SDH associated with leishmaniasis worldwide.

**Methods:** This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A search was carried out in national databases (IranMedex and Magiran), the Google Scholar search engine, as well as international databases (PubMed, Scopus and Web of Science). The quality of the studies was assessed using the Newcastle–Ottawa Scale (NOS).

**Results:** Out of 5538 retrieved articles, 36 studies met the inclusion criteria. The findings indicated that poverty, inadequate housing conditions, residence in rural or marginalized areas, low educational attainment, and limited access to healthcare services were among the influential SDH associated with a risk of leishmaniasis. Analysis within the WHO SDH framework revealed that social determinants, particularly those at the structural level (socioeconomic status) and intermediary level (housing conditions, health behaviors, and access to services), played a critical role in shaping the incidence and spatial distribution of leishmaniasis in the studied populations.

**Conclusion:** The available evidence underscores that leishmaniasis is not solely an infectious disease but also a condition deeply rooted in social and economic inequalities. Strengthening health equity policies, improving living conditions, enhancing educational opportunities, and expanding access to healthcare services can substantially contribute to the global prevention and control of leishmaniasis.

**Keywords:** Leishmaniasis; Social determinants of health; Health inequality; Poverty; Neglected diseases

## Introduction

Leishmaniasis is a parasitic disease caused by protozoa of the genus *Leishmania* and transmitted to mammals, including humans, through the bite of infected phlebotomine sand flies. Depending on the *Leishmania* species, the trans-

mission cycle may be zoonotic (involving animal reservoirs, for example, *L. major*) or anthroponotic (human-to-sand fly-to-human, for example, *L. donovani* and *L. tropica*). The disease is endemic in both the Old World (parts of

Asia, Africa, the Middle East and Southern Europe) and the New World (Central and South America) (1–3). Consequently, the disease now affects more than 98 countries, with an estimated 12 million cases worldwide (4). Approximately 1.5 million new cases of cutaneous and mucocutaneous leishmaniasis occur annually, 90% of which are concentrated in Afghanistan, Brazil, Bolivia, Iran, Peru, Saudi Arabia and Syria (5). Visceral leishmaniasis, the most severe form, is associated with a high fatality rate if left untreated and affects approximately 70,000 individuals each year (4). Leishmaniasis disproportionately affects the poorest populations and perpetuates a vicious cycle of poverty (6–8). Understanding the poverty-driven conditions that reinforce the transmission cycle is essential for planning effective disease elimination strategies (8, 9). Substandard housing and poor living conditions create environmental conditions that favor sand fly breeding and increase the risk of disease transmission (6, 10). Moreover, the burden of leishmaniasis has been linked to various environmental factors, including deforestation, dam construction and irrigation projects, climate change, rapid urbanization, migration of non-immune populations into endemic areas, malnutrition and the breakdown of public health systems (5). Within this context, the social determinants of health (SDH) have emerged as a critical framework for understanding the transmission and persistence of leishmaniasis in vulnerable communities. Living conditions and socioeconomic factors, collectively known as SDH, are closely associated with the sustained transmission of leishmaniasis in low- and middle-income countries (11). Social determinants of health are generally defined as the conditions in which people are born, grow, live, work and age and they exert powerful effects on disease incidence, prevalence and health inequalities (12). The multifactorial nature of leishmaniasis reflects the complex interplay of social, environmental, economic, ecological and public health factors (13–16). Factors such

as increased trade and travel, civil unrest, migration, low socioeconomic status, settlement in peri-urban areas, ecological changes and climate change all play substantial roles in shaping disease risk. Inadequate infrastructure and disruptions in health systems further contribute directly to the occurrence of leishmaniasis in vulnerable populations (16). Accordingly, the sustainable reduction of leishmaniasis prevalence at the global level requires addressing the SDH, including improving environmental and sanitary conditions, enhancing nutritional status and investing in equitable opportunities for marginalized populations living in endemic regions (17). This perspective is grounded in the principle that sustainable control of leishmaniasis cannot be achieved solely through biomedical interventions, but rather necessitates targeting the underlying social and economic factors that perpetuate transmission cycles across diverse geographical settings.

Given the existing knowledge gap regarding a systematic examination of these determinants within a comprehensive review framework, this study aims to provide an integrated overview of all social determinants of health associated with leishmaniasis globally, while examining the SDH influencing the disease.

## Materials and Methods

### Study design

The review protocol was not registered in the International Prospective Register of Systematic Reviews (PROSPERO) or any other prospective registry. However, this systematic review adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines for reporting.

### Search strategy

A systematic search was performed in reputable national databases, including IranMedex, Magiran and the Persian Google Scholar search engine, as well as international databases such as PubMed/MEDLINE, Scopus, Web of Sci-

ence (ISI) and Google Scholar search engine to identify relevant studies published from January 1, 2000, to March 31, 2025. A combination of disease-related keywords (zoonotic cutaneous leishmaniasis (ZCL), anthroponotic cutaneous leishmaniasis (ACL), anthroponotic visceral leishmaniasis (AVL), zoonotic visceral leishmaniasis (ZVL), mucocutaneous leishmaniasis) and SDH-related terms (“Social Determinants of Health,” “Socioeconomic Factors,” “Poverty,” “Education,” “Housing,” “Employment”) was used with appropriate Boolean operators (AND, OR) for each database.

### Inclusion and exclusion criteria

**Inclusion criteria:** 1-Human studies with various study designs (cohort, case-control, cross-sectional), 2-Studies explicitly examining the association between at least one SDH factor and the incidence, prevalence, or severity of leishmaniasis and 3-Articles published in English or Persian.

**Exclusion criteria:** 1-Animal studies, purely qualitative studies, case reports, review articles, editorials and conference abstracts and 2-studies for which full-text access was not available.

### Study selection and screening process

Following the initial search, all records were imported into EndNote reference management software, and duplicates were removed. The screening process was performed in two stages by two independent reviewers (“Sh.R.” and “B.P.”): 1. Title and abstract screening: Articles were screened based on the preliminary inclusion and exclusion criteria. 2. Full-text review: Articles that passed the first stage were reviewed in full to assess their relevance and alignment with the study objectives. Any discrepancies between reviewers were resolved through discussion or consultation with a third reviewer.

### Data extraction

Data from eligible studies were extracted using a standardized data extraction form de-

veloped before the study's initiation. Extracted information included: 1-Study identification details: article title, first author, year of publication and the country. 2-Methodological characteristics: study design. 3-SDH-related data: Social Determinants of Health were categorized according to the WHO's conceptual framework (2010) (18), which classifies determinants into two levels: structural determinants, encompassing socioeconomic-political context and axes of inequality; and intermediary determinants, including material conditions, behavioral and psychosocial factors, and health system characteristics.

### Quality assessment

The methodological quality of the included studies was assessed using appropriate tools. The Newcastle-Ottawa Scale (NOS) was used for cohort and case-control studies (19, 20). For cross-sectional studies, an adapted version of the NOS was used. Studies were categorized based on NOS scores as high quality (7–9 stars), moderate quality (4–6 stars), or low quality (0–3 stars). For ecological studies, due to the lack of a specific standard tool, a checklist based on key methodological criteria was developed and used by researchers (21). Quality assessment was performed independently by two reviewers, with disagreements resolved by a third reviewer. The results of the quality assessment are presented in Table 1.

### Data analysis

After finalizing the eligible studies (n= 36), a thematic synthesis approach was used to analyze the extracted data. The following steps were undertaken:

**Codebook development:** A preliminary codebook was developed a priori based on the WHO conceptual framework for SDH (18). This initial codebook included predefined codes corresponding to structural and intermediary determinants.

**Coding process:** Two independent reviewers (Sh.R. and B.P.) performed line-by-line

coding of the extracted findings from each included study. The coding was iterative, allowing new codes to emerge inductively from the data. Codes that were not covered by the initial framework were discussed and added to the codebook.

**Inter-rater reliability:** To ensure coding consistency, inter-rater reliability was assessed using Cohen's kappa on a random sample of 20% of the studies. The kappa value was 0.85, indicating almost perfect agreement.

**Disagreement resolution:** Any disagreements between the two reviewers were resolved through discussion. When consensus could not be reached, a third reviewer (A.H.) was consulted.

**Theme development:** Codes with similar meanings and characteristics were grouped into broader categories. Through an iterative process of review and refinement, these categories were synthesized into five overarching thematic domains, which are presented in the Results section.

This process ensured a transparent, reproducible and rigorous qualitative synthesis of the extracted SDH factors.

## Results

Due to significant heterogeneity in study designs, populations, and measured outcomes across the included studies, a meta-analysis was not feasible. Findings are therefore presented as a narrative and thematic synthesis.

A total of 5,538 articles were retrieved from the databases. After removing duplicates, 1,974 unique records remained. These records were then forwarded to the title-screening stage. During title screening, 982 articles were deemed irrelevant and excluded, leaving 992 records for abstract screening. In the abstract screening stage, an additional 694 articles were excluded. Consequently, 298 articles were selected for full-text assessment, of which 36 met the inclusion criteria and were included in the final synthesis. The overall selection pro-

cess is illustrated in Fig. 1. Also, quality assessment of the 36 included studies revealed that 23 studies (63.9%) were of high quality. Common limitations included a lack of adjustment for confounding variables in case-control studies and insufficient reporting of exposure assessment in cross-sectional studies.

### Social determinants of health influencing leishmaniasis

Table 2 summarizes the included studies by country, study design and the most prominent SDH factor reported. For a more detailed description, including all extracted SDH factors and complete study characteristics, please see Supplementary Table S1.

### Frequency of social determinants of health factors extracted from the included studies

According to the present systematic review, the most frequently reported factors were poverty, poor housing conditions, personal protective measures, low educational attainment, limited access to healthcare services and residence in rural areas. These were clearly identified as the primary social determinants of health influencing the incidence of leishmaniasis (Table 3).

As shown in Table 3, economic factors such as low income were the most frequently reported SDH (n=27 studies), underscoring their central role in leishmaniasis risk. Housing conditions (n=13), low awareness of disease and prevention (n=11) and limited access to health services (n=10) were also prevalent determinants.

Interestingly, some factors such as "wealth" or "disease awareness" were unexpectedly associated with a higher risk of disease, reflecting the complexity of causal relationships and the potential presence of mediating and confounding variables. As illustrated in Table 3, these factors are interconnected within a network. For instance, poverty can lead to inadequate housing, malnutrition and reduced access to healthcare and education, all of which contribute to an increased risk of leishmaniasis.

### Framework for assessing social determinants of health influencing leishmaniasis

Connecting the frequency analysis (Table 3) to the WHO conceptual framework (Table 4) reveals that the most frequently reported SDH factors, such as low income (n=27), poor housing conditions (n=13), low awareness of disease and prevention (n=11), and limited access to healthcare services (n=10), align predominantly with the structural (socioeconomic position) and intermediary (material conditions, behavioral factors and health system) levels of the WHO framework. This alignment empirically validates the relevance of the WHO model for understanding leishmaniasis and demonstrates how structural inequalities translate into immediate risk factors at the individual level.

Data analysis within the framework of the SDH model (WHO, 2010) indicates that the incidence and distribution of leishmaniasis in the studied population are a function of complex interactions between structural and intermediary factors.

At the structural level, socioeconomic positions are the main determinants of individuals' risk exposure. For example, residence in marginalized areas, deteriorated urban neigh-

borhoods, or proximity to mountains and barren lands, where lower-income populations are often concentrated, was directly associated with higher disease incidence. Additionally, occupations such as agriculture increased the likelihood of exposure to the disease vector. Inequality-related variables, such as educational attainment, played a key role in shaping awareness levels and consequently, preventive behaviors.

At the intermediary level, living conditions contributed most significantly to the formation of disease hotspots. Inadequate building materials, the presence of construction debris, open waste and sewage created an ideal physical environment for sand fly breeding and biting (the disease vector). Simultaneously, behavioral and psychosocial factors, such as misconceptions about the disease (for example, perceiving lesions as simple pimples) and delays in seeking treatment, directly affected disease outcomes. Finally, access to healthcare, particularly the financial ability to cover treatment costs and the distance to the nearest health facility, served as a key determinant of individuals' ability to utilize diagnostic and treatment services (Table 4).

**Table 1.** Methodological quality assessment of included studies

| Author (year)         | Selection<br>(out of 4) | Comparability<br>(out of 2) | Outcome/Exposure<br>(out of 3) | Total<br>score (/9) | Quality<br>level* |
|-----------------------|-------------------------|-----------------------------|--------------------------------|---------------------|-------------------|
| Kassiri H (2019)      | 3                       | 2                           | 3                              | 8                   | High              |
| Fernando S (2010)     | 3                       | 1                           | 3                              | 7                   | High              |
| Arroub H (2012)       | 3                       | 0                           | 3                              | 6                   | Moderate          |
| Sheets D (2010)       | 3                       | 0                           | 2                              | 5                   | Moderate          |
| Talbi FZ (2010)       | 3                       | 1                           | 3                              | 7                   | High              |
| Ramezankhani R (2017) | 4                       | 1                           | 3                              | 8                   | High              |
| Kumar N (2017)        | 3                       | 2                           | 3                              | 8                   | High              |
| Boelaert M (2009)     | 3                       | 1                           | 2                              | 6                   | Moderate          |
| Ximenes R (2009)      | 3                       | 2                           | 2                              | 7                   | High              |
| Younis LG (2020)      | 3                       | 2                           | 2                              | 7                   | High              |
| Sudarshani K (2019)   | 3                       | 1                           | 2                              | 6                   | Moderate          |
| Moya-Salazar J (2021) | 3                       | 2                           | 3                              | 8                   | High              |
| Ahmad S (2022)        | 2                       | 1                           | 3                              | 6                   | Moderate          |
| Shahryari A (2023)    | 4                       | 2                           | 3                              | 9                   | High              |
| Nayakarathna N (2022) | 3                       | 2                           | 3                              | 8                   | High              |
| Silva DM (2022)       | 4                       | 2                           | 3                              | 9                   | High              |



**Table 1.** Continued ...

|                              |   |   |   |   |          |
|------------------------------|---|---|---|---|----------|
| De Carvalho AG (2020)        | 3 | 1 | 2 | 6 | Moderate |
| Gonçalves AFLdS (2020)       | 2 | 1 | 3 | 6 | Moderate |
| Carvalho CDP (2023)          | 2 | 1 | 3 | 6 | Moderate |
| Shaheen R (2025)             | 2 | 1 | 2 | 5 | Moderate |
| El Omari H (2020)            | 3 | 1 | 2 | 6 | Moderate |
| Mashayekhi-Ghoyonlo V (2015) | 3 | 2 | 2 | 7 | High     |
| Heidari A (2025)             | 3 | 2 | 2 | 7 | High     |
| Wijerathna T (2020)          | 4 | 1 | 3 | 8 | High     |
| Dos Reis ES (2022)           | 4 | 1 | 3 | 8 | High     |
| Salomón OD (2022)            | 2 | 1 | 3 | 6 | Moderate |
| Kaya K (2024)                | 2 | 1 | 2 | 5 | Moderate |
| dos Santos LR (2025)         | 2 | 1 | 2 | 5 | Moderate |

\*Quality levels based on NOS scores: 7–9= High quality, 4–6= Moderate quality, 0–3= Low quality

| Ecological studies      |                    |                                     |
|-------------------------|--------------------|-------------------------------------|
| Author                  | Score (out of 100) | Quality level (based on proportion) |
| Rodrigues MGdA (2019)   | 86/100             | High                                |
| Nunes BEBR (2019)       | 76/100             | High                                |
| Gutierrez JD (2017)     | 76/100             | High                                |
| Hernández AM (2019)     | 75/100             | High                                |
| Valero NNH (2021)       | 80/100             | High                                |
| Maia-Elkhoury AN (2021) | 78/100             | High                                |
| de Freitas NDA (2024)   | 76/100             | High                                |
| Tapias Rivera J (2025)  | 78/100             | High                                |

**Table 2.** Summary of included studies: country, study design, and the most important social determinants of health factors associated with leishmaniasis

| Author (year)         | Country       | Study design                  | Most important SDH factor(s) identified                                |
|-----------------------|---------------|-------------------------------|------------------------------------------------------------------------|
| Ramezankhani R (2017) | Iran          | Cross-sectional (spatial)     | Temperature, humidity, vegetation density                              |
| Shahryari A (2023)    | Iran          | Population-based case-control | Housing roof type, animal contact                                      |
| Younis LG (2020)      | Nepal         | Case-control                  | Bamboo walls, cracks in walls, and outdoor toilets                     |
| Moya-Salazar J (2021) | Peru          | Retrospective                 | Poverty level                                                          |
| Boelaert M (2009)     | India (Bihar) | Cross-sectional               | Severe poverty, caste discrimination                                   |
| Ahmad S (2022)        | Pakistan      | Cross-sectional               | Low education, low income, poor housing                                |
| Ximenes R (2009)      | Brazil        | Case-control                  | Low income, poor housing, proximity to forest                          |
| Kassiri H (2019)      | Iran          | Descriptive-analytical        | Agricultural occupation, rural residence, lack of access to healthcare |
| dos Santos LR (2025)  | Brazil        | Descriptive-analytical        | Low education, mixed race, geographic region                           |
| Sudarshani K (2019)   | Sri Lanka     | Cross-sectional               | Rural residence, poor housing, lack of awareness                       |
| Kaya K (2024)         | Turkey        | Prospective                   | Low income, lack of access to healthcare                               |
| Kumar N (2017)        | India         | Case-control                  | Grain storage inside the house, poor drainage                          |
| Fernando S (2010)     | Sri Lanka     | Descriptive-observational     | Delay in seeking treatment, inability to pay, stigma                   |
| Arroub H (2012)       | Morocco       | Cross-sectional               | Poor waste management, poor housing, and                               |

Table 2. Continued ...

|                              |                               |                                         |                                                          |
|------------------------------|-------------------------------|-----------------------------------------|----------------------------------------------------------|
| Sheets D (2010)              | India (Bihar)                 | Cross-sectional                         | Low education, poor housing, and population density      |
| Lu C (2024)                  | Pakistan                      | Cross-sectional (spatial)               | Clay houses, Afghan refugees, large households           |
| Talbi FZ (2020)              | Morocco                       | Cross-sectional                         | Rural residence, poverty, population density             |
| Nayakarathna N (2022)        | Sri Lanka                     | Cross-sectional                         | Low awareness, bush/forest areas                         |
| De Carvalho AG (2021)        | Brazil                        | Cross-sectional                         | Low SES, low knowledge among dog owners                  |
| Gonçalves AFLdS (2020)       | Brazil                        | Cross-sectional and ecological          | Poverty index, infrastructure index                      |
| Rodrigues MGdA (2019)        | Brazil (Amazonas)             | Ecological                              | Deforestation, unplanned urbanization                    |
| Carvalho CDP (2023)          | Brazil                        | Cross-sectional                         | Low income, treatment costs                              |
| Shaheen R (2025)             | Pakistan                      | Cross-sectional                         | Mud houses, livestock inside the home, delay in care     |
| El Omari H (2020)            | Morocco                       | Cross-sectional                         | Urbanization, population density                         |
| Mashayekhi-Ghoyonlo V (2015) | Iran                          | Prospective cohort                      | Low SES, poor housing, limited healthcare access         |
| Heidari A (2025)             | Iran                          | Case-control                            | Outdoor sleeping, low SES, animal proximity              |
| Gutierrez JD (2017)          | Colombia                      | Ecological                              | Forest cover, agricultural areas                         |
| Wijerathna T (2020)          | Sri Lanka                     | Cross-sectional with case-control       | Being a housewife, low income, low awareness             |
| Hernández AM (2019)          | Colombia                      | Ecological                              | Deforestation, distance to cities, and armed conflict    |
| Valero NNH (2021)            | Brazil                        | Cross-sectional-longitudinal ecological | Poor housing, lack of waste/sewage services              |
| Maia-Elkhoury AN (2021)      | Multi-country (Latin America) | Ecological                              | Illiteracy, crowded housing, and agricultural activities |
| Dos Reis ES (2022)           | Brazil                        | Retrospective spatio-temporal           | Inadequate housing, low income, low education            |
| Nunes BEBR (2020)            | Brazil                        | Ecological                              | Low income, low education, fragile housing, unemployment |
| Salomón OD (2022)            | Americas                      | Cross-sectional                         | Poverty, inadequate housing, and environmental changes   |
| de Freitas NDA (2024)        | Brazil                        | Ecological                              | Open sewage, trees around the house                      |
| Tapias Rivera J (2025)       | Colombia                      | Ecological                              | Multidimensional Poverty Index, housing deficits, mi     |

Table 3. Frequency of social determinants of health (SDH) factors for leishmaniasis in the included studies

| Dimensions of SDH                      | SDH Factors                                                                  | Frequency |
|----------------------------------------|------------------------------------------------------------------------------|-----------|
| Socio-economic factors                 | Income status                                                                | 27        |
|                                        | Educational level                                                            | 14        |
|                                        | Employment status                                                            | 15        |
|                                        | Marginalized ethnicity/race                                                  | 3         |
| Housing and living environment factors | Poor housing conditions (lack of window/door screens)                        | 13        |
|                                        | Inadequate personal protection (sleeping outdoors, not using bed nets, etc.) | 9         |
|                                        | Type of building materials (mud, thatch,                                     | 8         |

Table 3. Continued ...

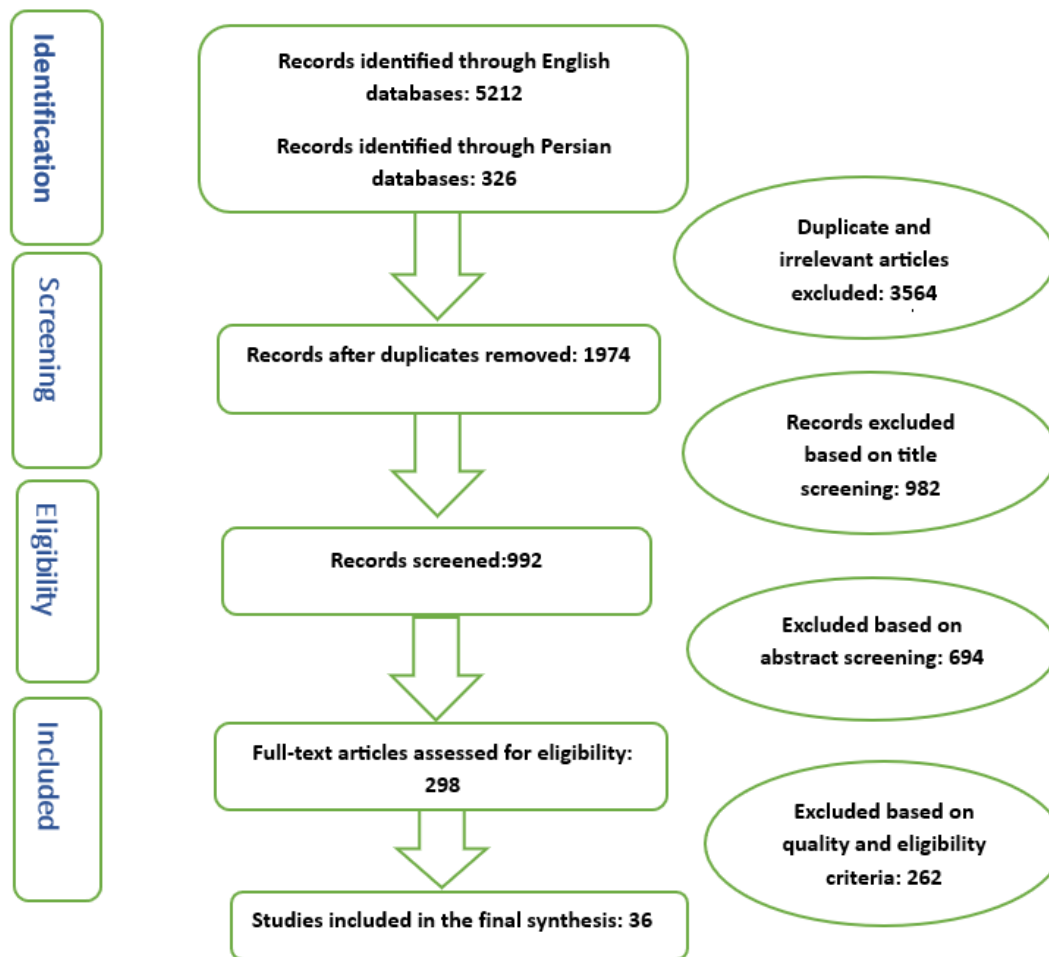
|                                                     |                                                                   |    |
|-----------------------------------------------------|-------------------------------------------------------------------|----|
|                                                     | cracked walls)                                                    |    |
|                                                     | Presence of and contact with animals inside or around the house   | 7  |
|                                                     | Lack of access to safe drinking water                             | 5  |
|                                                     | Inadequate sewage and drainage system                             | 5  |
|                                                     | Insufficient household lighting                                   | 3  |
|                                                     | Indoor grain storage                                              | 2  |
|                                                     | Use of solid fuels (wood/dung)                                    | 2  |
|                                                     | Asbestos-cement roofing                                           | 1  |
|                                                     | Outdoor latrines with dirt floors                                 | 1  |
| <b>Access to health services</b>                    | Lack of / delay in accessing to health services                   | 10 |
|                                                     | Delay in diagnosis and treatment                                  | 4  |
|                                                     | Treatment and transportation costs                                | 3  |
|                                                     | Low satisfaction with health services                             | 2  |
| <b>Demographic factors</b>                          | Visiting traditional healers                                      | 1  |
|                                                     | Residence in rural areas                                          | 9  |
|                                                     | Gender (male)                                                     | 8  |
|                                                     | Age (children and youth)                                          | 8  |
|                                                     | High population density / large households                        | 6  |
|                                                     | Residence in urban areas                                          | 4  |
|                                                     | Migration and population mobility                                 | 5  |
|                                                     | Age (middle-aged and elderly)                                     | 2  |
| <b>Environmental and geographical factors*</b>      | General environmental factors (temperature, wind, humidity, etc.) | 8  |
|                                                     | Vegetation cover (trees, bushes, forests)                         | 7  |
|                                                     | Agricultural and farming areas                                    | 5  |
|                                                     | Altitude above sea level                                          | 4  |
|                                                     | Living in endemic areas                                           | 3  |
|                                                     | Deforestation                                                     | 6  |
|                                                     | Wet and water-logged soils                                        | 3  |
|                                                     | Termite mounds                                                    | 2  |
|                                                     | Decaying waste / improper waste management                        | 2  |
|                                                     | Proximity to forests                                              | 1  |
| <b>Knowledge, awareness, and behavioral factors</b> | Low awareness of the disease and prevention                       | 11 |
|                                                     | Contact with infected individuals/family members                  | 4  |
|                                                     | Not using protective measures (bed nets, etc.)                    | 3  |
|                                                     | Misinterpretation of lesions (considering them pimples)           | 2  |
|                                                     | Outdoor activities (night-time, recreational)                     | 2  |
| <b>Disease outcome-related factors</b>              | Psychological impact and social stigma                            | 3  |
|                                                     | Catastrophic treatment costs                                      | 2  |
|                                                     | Malnutrition and comorbidities                                    | 2  |

\*Note: Factors such as temperature, humidity, and vegetation cover are primarily biophysical/environmental variables, not social determinants of health (SDH) according to the WHO definition. They are included here only because some original studies reported them alongside SDH factors. They should not be interpreted as SDH in the conceptual framework.



**Table 4.** Classification of social determinants of health (SDH) influencing leishmaniasis based on the WHO conceptual framework

| Main theme                  | Sub-theme                                  | Extracted Factor                                                                                                                                                                                                                                                                                                                                                                                          | Leishmaniasis-related Explanation/Justification                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Structural factors</b>   | Socio-economic and political context       | Monthly household income / per capita income<br>Employment status of household head (farmer, laborer, housewife, unemployed)<br>Ownership of basic assets (car, refrigerator,...)<br>Recipients of social assistance                                                                                                                                                                                      | These factors determine the overall socio-economic position of the household, which shapes inequalities in exposure to the disease (e.g., living in high-risk neighborhoods) and access to preventive resources.<br>These variables define the social position of individuals and expose them to varying levels of risk (e.g., certain occupations or ethnic groups are predominantly located in endemic regions). |
|                             | Social inequality axes                     | Educational level of the household head and the infected individual<br>Age and gender of the infected person<br>Ethnicity<br>Nationality<br>Place of residence (urban, rural, peri-urban/slum)<br>History of migration or residence in endemic areas                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Intermediary factors</b> | Financial circumstances                    | Building materials (type of walls, roof, floor)<br>Physical condition of the house (use of screens on doors/windows, cracks or holes in walls)<br>Environmental hygiene (presence of waste, open sewage, abandoned lands)<br>Keeping livestock and poultry near the house                                                                                                                                 | These conditions directly create a physical environment favorable for the breeding and biting activity of sandflies (vectors of leishmaniasis).                                                                                                                                                                                                                                                                    |
|                             | Behavioral and psychosocial factors        | Presence of animals inside the house<br>Personal protection practices (sleeping outdoors, not using bed nets)<br>Knowledge about the disease (transmission, prevention, symptoms)<br>Awareness of the time and place of sand fly biting<br>Misconceptions about the disease (perceiving lesions as simple pimples)<br>Main source of health information<br>Delay in seeking treatment after symptom onset |                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                             | Health system                              | Financial ability to afford treatment costs (direct and indirect)<br>Distance to the nearest health facility<br>Access barriers (need for male accompaniment, mobility constraints for women)<br>Satisfaction with received services (staff attitude, quality of care)                                                                                                                                    | These factors determine the ability to benefit from prevention, diagnosis, and treatment services, which are directly linked to disease outcomes.                                                                                                                                                                                                                                                                  |
|                             | Social-demographic factors (as background) | Household size and crowding per room<br>Duration of residence<br>History of infection among other family members                                                                                                                                                                                                                                                                                          | These factors create conditions that either facilitate or intensify exposure to the vector and disease transmission.                                                                                                                                                                                                                                                                                               |
|                             |                                            |                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                    |



**Fig. 1.** Study selection process based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol

## Discussion

The findings of this systematic review indicate that leishmaniasis is strongly influenced by SDH, which can act as both structural drivers and mediators in disease transmission. Consistent with global literature, the present study highlights poverty, inadequate housing, low educational attainment, residence in rural or marginalized areas, and limited access to healthcare services as key factors associated with an increased risk of leishmaniasis.

Multiple studies have demonstrated that poverty increases disease risk through various mechanisms, including reduced financial capacity to improve housing conditions, limited access to diagnostic and treatment services, malnutrition

and increased exposure to vectors (sand flies), resulting in a disproportionate burden of leishmaniasis among low-income populations (8, 22–24).

This finding has important implications for intervention design. The cyclical relationship between poverty and leishmaniasis suggests that biomedical interventions alone (for example, free diagnosis and treatment) are insufficient. Sustainable control requires breaking the poverty-disease cycle through economic empowerment programs, conditional cash transfers and livelihood support for affected households. Without addressing the economic vulnerabilities that force families to live in high-

risk environments, reinfection and persistent transmission are likely to occur.

Poor housing conditions emerged as another critical determinant. Dwellings lacking proper roofing, with wall cracks, high humidity, or proximity to vector breeding sites provide ideal environments for sand fly proliferation and shelter (23, 24). Research in Brazil and Iran has similarly shown that low construction quality and the absence of protective measures (for example, window screens) are directly associated with higher disease incidence (11, 25).

This suggests that vector control programs focused solely on insecticide spraying may have limited success if the fundamental architecture of human dwellings provides refuge for sand flies. Therefore, integrating housing improvement subsidies or material support (for example, provision of window screens, plaster for wall cracks) into public health programs could yield synergistic benefits. Such structural interventions address the root causes of exposure rather than merely mitigating vector populations.

Low educational attainment and limited health literacy were also identified as important risk factors, as insufficient education may limit awareness of preventive measures, protective behaviors and timely health-seeking. Evidence suggests that enhancing health literacy may serve as a key tool in controlling disease transmission (24, 26).

The implication is clear: educational interventions should not be an afterthought but a core component of leishmaniasis control programs. School-based health education, community awareness campaigns using local languages, and integration of leishmaniasis prevention into routine primary health education can empower at-risk populations. Moreover, addressing gender-specific barriers to education (particularly in regions where women have lower literacy rates) could have cascading effects on household-level prevention behaviors.

This limitation leads to delayed diagnosis. In anthroponotic forms of leishmaniasis (for

example, ACL and AVL), where humans serve as the main reservoir, delayed diagnosis can expand the human reservoir and consequently increase transmission. In zoonotic forms (ZCL and ZVL), although delayed diagnosis does not expand a human reservoir, it still contributes to individual disease burden and may delay timely public health interventions (24, 27–29).

From a health systems perspective, these findings highlight the need for decentralized diagnostic services. In many endemic regions, the distance to the nearest health facility (often >10 km) and the direct and indirect costs of treatment (transport, lost wages, medication) are prohibitive for low-income households. Therefore, interventions such as mobile clinics, community health worker training for early case detection, and elimination of user fees for leishmaniasis treatment could dramatically reduce diagnostic delays and interrupt transmission cycles, particularly for anthroponotic forms.

Socio-demographic factors, such as age, sex, employment status and daily activities, were also considered in the included studies. For example, men engaged in agricultural or construction work outdoors are more exposed to sand fly bites than others (30–32). Additionally, seasonal or forced migration can expose individuals to endemic areas or place them in temporary settlements with inadequate living conditions (24, 30).

The WHO framework (Table 4) provides a powerful analytical lens for understanding why isolated interventions often fail. As shown in Table 4, structural determinants (for example, low income, low education) do not act directly on disease risk. Instead, they manifest through intermediary determinants, material conditions (inadequate housing, lack of screens), behavioral and psychosocial factors (misconceptions about lesions, low awareness) and health system barriers (distance to facilities, treatment costs).

For example, poverty (a structural determinant) increases leishmaniasis risk not through

a direct biological pathway, but because it forces families into poorly constructed housing (material condition), limits their ability to afford bed nets or screens (material condition), reduces health literacy (psychosocial factor), and constrains their ability to pay for transportation to health facilities (health system barrier). This explains why providing free treatment alone without addressing transportation costs, housing conditions, or misconceptions that lesions are "just pimples," will not interrupt the transmission cycle. Effective interventions must simultaneously target multiple intermediary pathways through which structural inequalities operate.

The findings indicate that controlling leishmaniasis without addressing the underlying social determinants, such as improving living conditions, alleviating poverty, enhancing education and strengthening healthcare systems, will neither be sustainable nor effective.

Finally, this study underscores the necessity of inter-sectoral approaches and equity-oriented health policies. Leishmaniasis control programs should combine health interventions, such as vector control and patient treatment, with social and structural measures. Future research in this area could focus on multilevel studies, advanced ecological analyses and evaluations of health policy interventions aimed at reducing inequalities and controlling disease.

### **Interpretation of counterintuitive findings**

A notable finding of this review was that some studies reported unexpected associations, where factors such as higher wealth or greater disease awareness were paradoxically linked to increased leishmaniasis risk (Table 3). Several explanations may account for this.

First, detection bias may play a role: greater healthcare access and awareness among wealthier individuals can lead to higher diagnosis and reporting rates, which may not correspond to a genuine increase in disease risk. Second, confounding by occupation or behavior is plausible in some settings; higher education or

awareness may be associated with outdoor occupations (for example, farmers, construction workers, military personnel) that increase exposure to sand fly bites, as observed in studies from Iran and Colombia. Third, reverse causality cannot be ruled out: individuals who develop leishmaniasis may become more aware of the disease through their illness experience, creating a spurious association between awareness and disease.

Regarding education, the relationship appears context-dependent. While low educational attainment was associated with higher risk in most studies ( $n=14$ ), a few studies reported that higher education increased risk, likely due to confounding by outdoor occupational activities rather than education itself being a risk factor. This highlights the importance of considering local social and occupational contexts when interpreting SDH factors.

These nuanced findings underscore the complexity of causal pathways in leishmaniasis epidemiology and the need for longitudinal studies to disentangle true risk factors from biases and confounders.

### **Limitations**

This systematic review has several limitations. First, the included studies exhibited considerable heterogeneity in study designs (cross-sectional, case-control, cohort, ecological), populations, geographic settings and outcome measurements. This heterogeneity limits the direct comparability of findings and precludes a meta-analysis. Second, most studies were cross-sectional in design, which precludes establishing causal relationships between SDH factors and leishmaniasis. Third, the majority of studies were conducted in Brazil, Iran, and India, which may limit the generalizability of findings to other endemic regions. Fourth, publication bias may exist, as studies reporting significant associations are more likely to be published. Finally, the quality assessment revealed that some studies had methodological

limitations, particularly in adjusting for confounding variables.

Additionally, although we searched both English and Persian databases, the inclusion of only these two languages may have introduced language bias, potentially excluding relevant studies published in Spanish, Portuguese, French, or other languages, particularly from Latin American and African endemic regions. Furthermore, social determinants of health can change over time (for example, income, housing conditions and educational attainment) and the predominance of cross-sectional designs cannot account for such temporal dynamics. Despite these limitations, the consistency of findings across diverse settings strengthens confidence in the key conclusions of this review.

## Conclusion

The results of this systematic review indicate that the incidence and spread of leishmaniasis are substantially influenced by a range of social determinants of health. Factors related to poverty, poor housing conditions, residence in rural or marginalized areas, low literacy and educational attainment, and limited access to healthcare were identified as the most frequently reported variables associated with an increased risk of infection. Beyond these, demographic and occupational factors, including male gender, young age (children and young adults) and high-risk occupations such as farming, construction work, and military service, also consistently shaped disease risk across studies.

However, the relationships between SDH and leishmaniasis are not always linear or deterministic. Notably, a small number of studies reported counterintuitive findings, where higher wealth or greater educational attainment were paradoxically associated with increased risk. These unexpected associations may reflect complex causality, confounding by outdoor occupational activities (for example, ed-

ucated individuals may work in agriculture or field-based jobs), or surveillance/detection bias (wealthier individuals have better access to diagnosis and reporting). This nuance underscores that poverty reduction alone, while essential, may not be sufficient and that context-specific pathways must be understood.

Analysis of the existing studies highlights that leishmaniasis control and prevention cannot rely solely on biomedical and medical interventions but require serious attention to structural and social determinants of health. Accordingly, the adoption of inter-sectoral policies aimed at reducing social inequalities, improving living conditions, enhancing health literacy and strengthening healthcare delivery systems can play a critical role in reducing the global burden of this disease. Furthermore, the conceptual framework presented in this study can serve as a guide for future research and for designing interventions based on social determinants of health, while recognizing that local occupational, demographic and behavioral contexts must be carefully considered.

## Acknowledgements

This research project was supported by Kurdistan University of Medical Sciences/ Social Determinants of Health (SDH) Research Center.

## Ethical considerations

All ethical principles, including avoidance of plagiarism, data falsification, and duplicate publication, were fully observed in this study. This systematic review was conducted based on previously published literature and did not involve direct participation of human subjects or animals. The study protocol was approved by the Ethics Committee of Kurdistan University of Medical Sciences, with the ethical approval code IR.MUK.REC.1404.288.

## Conflict of interest statement

The authors declare there is no conflict of interest.

## References

1. Najafi S, Ghafle Marammazi B, Feiz Haddad MH, Farhadi E, Rafiei Asl S (2025) Study on medical students' knowledge, performance and understanding of parasitic diseases, with a focus on Leishmania. *J Parasitol Res.* 1: 2660508.
2. Abadías-Granado I, Diago A, Cerro P, Palma-Ruiz A, Gilaberte Y (2021) Cutaneous and mucocutaneous leishmaniasis. *Actas Dermo-Sifiliogr (Engl Ed).* 112(7): 601–618.
3. Mann S, Frasca K, Scherrer S, Henao-Martínez AF, Franco-Paredes C (2021) A review of leishmaniasis: current knowledge and future directions. *Curr Trop Med Rep.* 8(2): 121–132.
4. World Health Organization (2024) Leishmaniasis. Fact sheet. WHO, Geneva.
5. Löscher T, Prüfer-Krämer L (2009) Emerging and re-emerging infectious diseases. In: Krämer A, Kretzschmar M, Krickeberg K (eds) *Modern infectious disease epidemiology: concepts, methods, mathematical models, and public health.* Springer, New York, pp 39–67.
6. Bamorovat M, Sharifi I, Agha Kuchak Afshari S, Ghasemi Nejad Almani P (2023) Mutual role of patients and the healthcare system in the control of cutaneous leishmaniasis. *Transbound Emerg Dis.* 2023: 7814940.
7. Bamorovat M, Sharifi I, Khosravi A, Aflatoonian MR, Agha Kuchak Afshari S, Salarkia E, Sharifi H, Bamorovat S, Alijani N, Firoozabadi AD (2024) Global dilemma and needs assessment toward achieving sustainable development goals in controlling leishmaniasis. *J Epidemiol Glob Health.* 14(1): 22–34.
8. Grifferty G, Shirley H, McGloin J, Kahn J, Orriols A, Wamai R (2021) Vulnerabilities to and the socioeconomic and psychosocial impacts of the leishmaniasis: a review. *Res Rep Trop Med.* 12: 135–151.
9. Selvapandian A, Croft SL, Rijal S, Nakhasi HL, Ganguly NK (2019) Innovations for the elimination and control of visceral leishmaniasis. *PLoS Negl Trop Dis.* 13(10): e0007616.
10. Bamorovat M, Sharifi I, Aflatoonian MR, Sharifi H, Karamoozian A, Sharifi F, Sharifi I, Khosravi A, Agha Kuchak Afshari S, Salarkia E (2018) Risk factors for anthroponotic cutaneous leishmaniasis in unresponsive and responsive patients in a major focus, southeast of Iran. *PLoS One.* 13(2): e0192236.
11. Nunes BEBR, Leal TC, Paiva JPS, Silva LF, Carmo RF, Machado MF, Araújo FZ, Mello GS, Santos FA (2019) Social determinants of mortality due to visceral leishmaniasis in Brazil (2001–2015): an ecological study. *Rev Soc Bras Med Trop.* 53: e20190262.
12. World Health Organization (2025) Social determinants of health. WHO, Geneva.
13. Salam N, Al-Shaqha WM, Azzi A (2014) Leishmaniasis in the Middle East: incidence and epidemiology. *PLoS Negl Trop Dis.* 8(10): e3208.
14. Maia-Elkhoury AN, Magalhães Lima D, Salomón OD, Puppim Buzanovsky L, Saboyá-Díaz MI, Valadas SY, Silva AR, Santos LL, Oliveira MR (2021) Interaction between environmental and socioeconomic determinants for cutaneous leishmaniasis risk in Latin America. *Rev Panam Salud Publica.* 45: e83.
15. Canché-Pool EB, Panti-May JA, Ruiz-Piña HA, Torres-Castro M, Escobedo-Ortegón FJ, Tamay-Segovia P, Canto-Lara SB, Puerto-Manzano FI (2022) Cutaneous leishmaniasis emergence in southeastern Mexico: the case of the state of Yucatan. *Trop Med Infect Dis.* 7(12): 444.



16. Khosravi A, Sharifi I, Bamorovat M, Parizi MH, Aflatoonian MR, Sharifi F, Agha Kuchak Afshari S, Salarkia E, Borhani Zarandi M, Mostafavi E (2025) The impact of anthropic and natural events on leishmaniasis burden, control measures, and public health importance. *Transbound Emerg Dis*. 1: 7588132.
17. Vlassoff C, Giron N, Vera Soto MJ, Maia-Elkhoury ANS, Lal A, Castellanos LG, Alvar J, Yadon ZE (2023) Ensuring access to essential health products: lessons from Colombia's leishmaniasis control and elimination initiative. *PLoS Negl Trop Dis*. 17(12): e0011752.
18. Solar O, Irwin A (2010) A conceptual framework for action on the social determinants of health. *Social Determinants of Health Discussion Paper 2 (Policy and Practice)*. World Health Organization, Geneva.
19. Carra MC, Romandini P, Romandini M (2025) Risk of bias evaluation of cross-sectional studies: adaptation of the Newcastle-Ottawa Scale. *J Periodontal Res*. 60(1): 1–8.
20. Stang A (2010) Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. *Eur J Epidemiol*. 25(9): 603–605.
21. Moermond CT, Kase R, Korkaric M, Ågerstrand M (2016) CRED: Criteria for reporting and evaluating ecotoxicity data. *Environmental Toxicology and Chemistry*. 35(5): 1297–1309.
22. Alemayehu B, Alemayehu M (2017) Leishmaniasis: a review on parasite, vector and reservoir host. *Health Sci J*. 11(4): 1–6.
23. Calderon-Anyosa R, Galvez-Petzoldt C, Garcia PJ, Carcamo CP (2018) Housing characteristics and leishmaniasis: a systematic review. *Am J Trop Med Hyg*. 99(6): 1547–1555.
24. Valero NNH, Uriarte M (2020) Environmental and socioeconomic risk factors associated with visceral and cutaneous leishmaniasis: a systematic review. *Parasitol Res*. 119(2): 365–384.
25. Shahryari A, Charkazi A, Rajabi A (2023) Environmental factors and building conditions for risk of cutaneous leishmaniasis in the northeast of Iran: a population-based case-control study. *Trans R Soc Trop Med Hyg*. 117(5): 375–382.
26. Jahromi AS, Jokar M, Abdous A, Soleimanpour S, Rahmanian K, Askari H, Sharifi I, Bamorovat M, Agha Kuchak Afshari S (2025) Knowledge, attitudes, and practices toward cutaneous leishmaniasis as a neglected tropical disease among the general population: a systematic review and meta-analysis. *J Epidemiol Glob Health*. 15(1): 97.
27. Wenning B, Price H, Nuwangi H, Reda KT, Walters B, Ehsanullah R, Sharifi I, Bamorovat M (2022) Exploring the cultural effects of gender on perceptions of cutaneous leishmaniasis: a systematic literature review. *Glob Health Res Policy*. 7(1): 34.
28. Dahal P, Singh-Phulgenda S, Olliaro PL, Guerin PJ (2021) Gender disparity in cases enrolled in clinical trials of visceral leishmaniasis: a systematic review and meta-analysis. *PLoS Negl Trop Dis*. 15(3): e0009204.
29. Buzanovsky LP, Sanchez-Vazquez MJ, Maia-Elkhoury ANS, Werneck GL (2020) Major environmental and socioeconomic determinants of cutaneous leishmaniasis in Brazil: a systematic literature review. *Rev Soc Bras Med Trop*. 53: e20190291.
30. Kassiri H, Khodkar I, Ahmad Jalali A, Lotfi M (2019) Sociodemographic, clinical, laboratory, diagnostic, therapeutic and public health aspects of cutaneous leishmaniasis in southwestern Iran. *J Clin Diagn Res*. 13(8): 1–5.
31. Sudarshani K, Eswaramohan T, Murugananthan A, Wegiriya H, Liyanage P (2019) Socio-demographic profile of cu-

- taneous leishmaniasis patients in Hambantota District, Sri Lanka. Ceylon J Sci. 48 (4): 345–351.
32. Khan ZI, Syed F, Yasmin S, Khan F, Bibi S, Ullah I, Ali S, Hussain M (2020) Socioeconomic factors on the prevalence of cutaneous leishmaniasis in Dir, Upper Dir, Pakistan. J Pak Assoc Dermatol. 30(2): 245–250.