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Review Article

A Review on Arthropod-Related Health Threats in Qom Province, One of the World's Most Important Religious Destinations of Iran

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Abstract

Background and aims: Arthropod-related health threats (ARHTs), including infectious diseases and non-infectious conditions, pose a significant global health burden. While arthropod-borne diseases (ABDs) represent nearly one-fifth of all communicable diseases worldwide, other arthropod-related injuries (e.g., scorpion stings) and infestations (e.g., myiasis) further increase morbidity. Qom Province, a central Iranian hub for pilgrims and immigrants, faces unique risks due to its population density and climatic conditions. This study compiled data on arthropod-related health threats in Qom Province, assessed their spatial distribution, and underscored the importance of prevention and control measures.

Methods: This narrative review synthesizes published evidence on ARHTs in Qom Province, Iran. The data were retrieved from PubMed, Google Scholar, ScienceDirect, and Web of Science databases, covering studies published between 2011 and 2024.

Results: Of the 31 included studies, reports indicated the presence of infectious diseases, including zoonotic cutaneous leishmaniasis, visceral leishmaniasis, malaria, Crimean-Congo hemorrhagic fever, and West Nile virus infection. Non-infectious arthropod-related conditions and injuries were also reported , including head lice infestation (pediculosis), myiasis, scorpion stings (scorpionism), scabies, and loxoscelism.

Conclusion: This review highlighted the coexistence of ABDs and other ARHTs in Qom Province. Monitoring vectors, reservoirs, and hosts is essential to mitigate risks, particularly in this high-traffic religious destination.

Keywords: Arthropod, Vectors, Threats, Health threats, Iran

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Introduction

Arthropod-related health threats (ARHTs), comprising both arthropod-borne diseases (ABDs) and non-infectious conditions such as envenomation and infestations, represent a substantial global disease burden. Vector-borne diseases alone account for more than 17% of all infectious diseases worldwide and cause hundreds of thousands of deaths annually, with malaria and leishmaniasis remaining among the most severe infections.[1-3] Beyond pathogens, scorpion stings, pediculosis, and myiasis amplify morbidity in many regions.[1]

Iran is endemic for major ABDs, including malaria and leishmaniasis.[4,5] The country also reports arthropod-borne viral diseases such as Crimean-Congo hemorrhagic fever (CCHF),[6-8] dengue fever,[9] West Nile infection,[10] and Chikungunya.[11] At the same time, non-infectious ARHTs such as pediculosis,[12,13] and scorpionism[14] are prevalent. Other documented threats include plague, tularaemia, Q fever,[15] tick-borne relapsing fever,[16] sandfly fever,[17] myiasis,[18] dirofilariasis,[19] scabies,[20] loxoscelism,[21] latrodectism,[22] and *Stomoxys calcitrans* bites.[23] Emerging pathogens such as Rift Valley fever virus,[24] Sindbis infection,[25] midge-borne infections, and eye worm infection[23] have primarily been detected in non-human hosts, highlighting the need for sustained surveillance.

Qom Province, as a major religious destination with intense population mobility and diverse eco-climatic conditions, faces distinctive ARHT risks. Population density, the continuous influx of pilgrims and migrants, and the presence of suitable habitats for vectors/reservoirs collectively create conditions that can shape the dynamics of disease transmission and injury patterns. Accordingly, this study was conducted to review the available literature on ARHTs in Qom Province and summarize their spatial distribution where reported.

Materials and Methods

Study Area

Qom Province, located in central Iran, consists of five districts: Markazi, Salafchegan, Khalajestan, Jafarabad, and Kahak districts, which are the focus of this study (Figure 1). Covering an area of 11,526 km² (0.89% of Iran's total land area), the province has a population of approximately 1,292,000, with around 60,000 people (4.7%) living in rural areas and an urbanization rate of 95.3% as of 2016.[26] The climate ranges from desert and semi-desert to temperate, with the highest rainfall recorded in the high-altitude regions, which account for 25% of the province's area. This geographical and climatic diversity is a key factor in the region's distribution and spread of arthropod-borne diseases.

Study Design

This study is a narrative review, but systematic elements were incorporated to enhance rigor, including predefined search terms, clear inclusion and exclusion criteria, and independent study screening. Persian databases (MagIran, SID, and IranMedex) were searched alongside PubMed, Google Scholar, ScienceDirect, and Web of Science to ensure comprehensive coverage of local studies. The structured search covered the period from 2011 to August 2024. The keywords used were *vector*, *arthropod*, *fever*, *disease*, *threat*, *health*, *Qom*, *Iran*. Additionally, disease-specific terms such as *leishmaniasis*, *malaria*, CCHF, scorpion stings, and West Nile infection were included to ensure comprehensiveness.

Inclusion and Exclusion Criteria

This review included studies focusing on ARHTs in Qom Province, specifically original research articles, case studies, and regional health reports. Observational studies of various designs (e.g., cross-sectional, cohort, and case-control studies), clinical trials, and surveillance reports addressing ARHTs were considered in the region. Only studies published in English or Persian were eligible for inclusion.

Duplicate publications and articles focusing exclusively on laboratory analyses without field relevance were excluded. Additionally, studies were excluded if they lacked essential methodological details, such as clearly specified study design specifications, justification of sample size, defined diagnostic criteria, or appropriate statistical analysis methods.

Data Selection

The initial database search identified 102 English and Persian records. To minimize selection and interpretation bias, two authors independently screened titles, abstracts, and full texts using predefined inclusion criteria. Any discrepancies were resolved through consensus or, if needed, consultation with a third author. Search strategies, data extraction forms, and quality assessment protocols were documented prospectively (Figure 2).

Data Extraction and Quality Assessment

Data were systematically extracted using a predefined extraction sheet that captured details such as study location, disease type, incidence, primary vectors, reservoirs, and key findings. Study quality was assessed using the Newcastle-Ottawa Scale (NOS) for observational studies, with a threshold score of ≥ 6/9 for inclusion. NOS evaluations were conducted independently by two authors. In addition to the NOS, a supplementary quality assessment checklist was used (see Appendix 1). Since not all criteria were equally relevant to descriptive epidemiological studies (e.g., sensitivity analysis), such items were recorded as NA (not applicable) or NR (not reported), as appropriate.

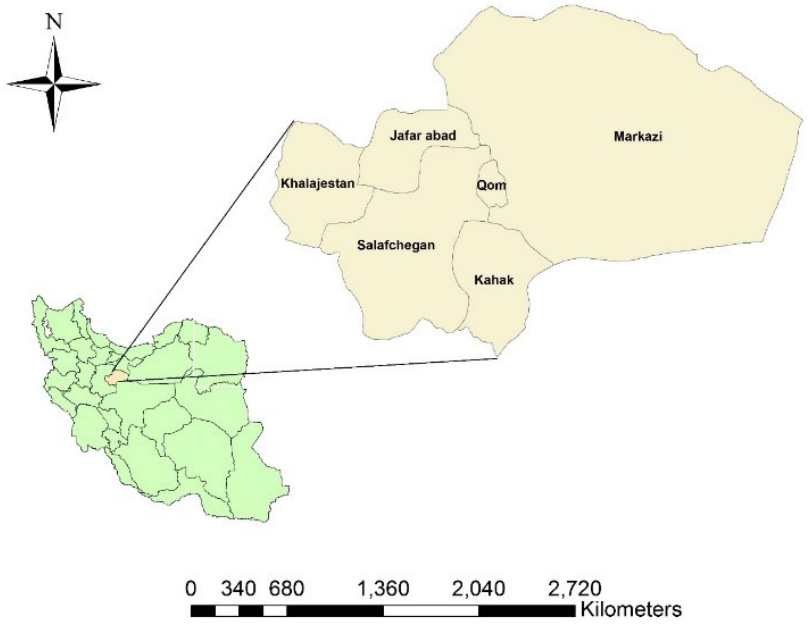

Figure 1. The Study Area: Qom Province, Central Iran

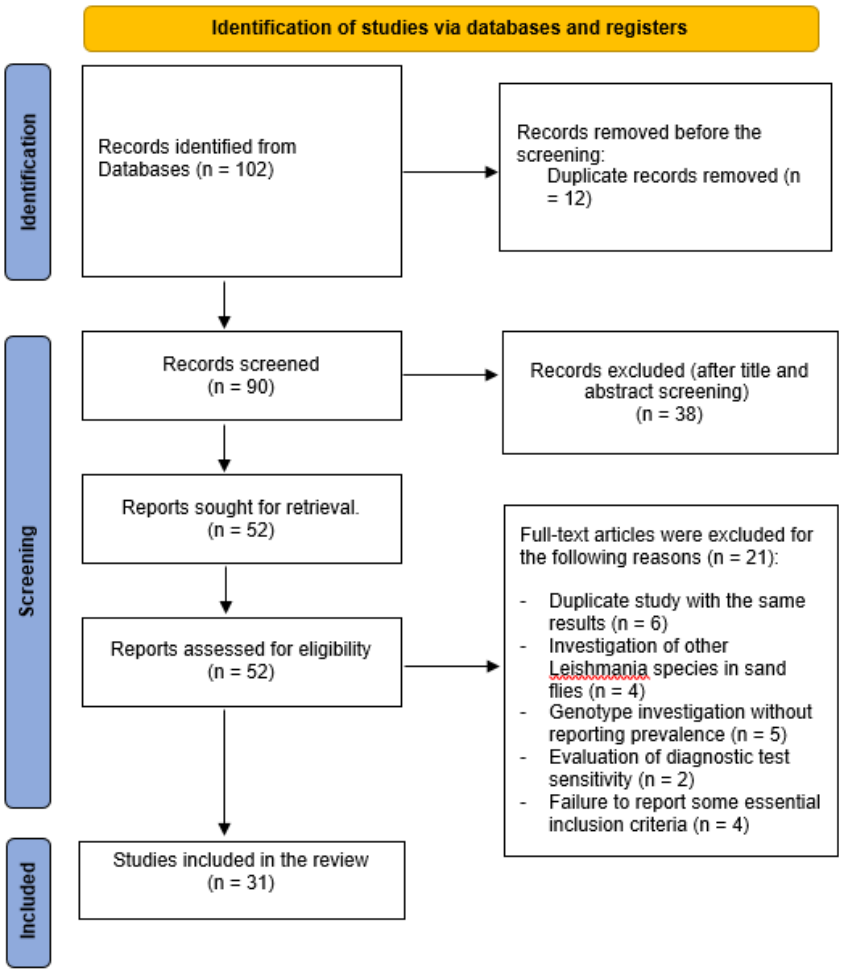

Figure 2. The Flowchart of the Literature Review on ARHTs in Qom Province, Iran
Note. ARHT: Arthropod-related health threats.

Data Synthesis

The data were analyzed thematically and categorized by disease type and spatial distribution across Qom Province. No quantitative meta-analysis was performed; instead, the primary focus was on qualitative synthesis to identify trends, research gaps, and public health implications.

Geographic locations of arthropod vectors, reservoirs, and human/animal cases reported in the included studies were extracted for spatial distribution analysis. These data were then entered into ArcGIS 10.8 (ESRI, Redlands, CA) to generate maps illustrating their occurrence across Qom Province. In cases where coordinates were not explicitly provided, georeferencing was performed using administrative place names.

Results

Cutaneous Leishmaniasis

Incidence

From 2011 to 2024, the cumulative incidence of cutaneous leishmaniasis (CL) in Qom Province was 106 cases per 100,000 people (1,370 cases in a population of 1,292,281). Although CL was reported in all districts of the province, spatial variation maps indicated that Markazi District had the highest incidence, with 14.47 cases per 1000 people (260 cases in a population of 17,980). In contrast, JafarAbad district had the lowest incidence, with 0.047 cases per 1000 people (10 cases in a population of 21,963).[27,28]

Vectors

A total of 14 species of sand flies (Diptera: Psychodidae) have been reported in Qom Province, including *Phlebotomus papatasi*, *Ph. sergenti*, *Ph. alexandri*, *Ph. caucasicus*, *Ph. caucasicus* group, *Ph. kandelakii*, *Ph. tobbi*, *Ph. major*, *Ph. halepensis*, *Ph. brevis*, *Ph. adlerius* group, *Sergentomyia sintoni*, *S. theodori,* and *S. pawlowskii*.[29,30] Among these species, *Ph. papatasi* has been identified as the most frequent species in Markazi and Kahak districts.[31-34] (Figure 3)

The Potential Reservoirs

Epidemiological studies on cutaneous leishmaniasis in Qom province have identified *L. major* as the causative agent and *Meriones libycus* as the primary reservoir host in cutaneous leishmaniasis in Markazi district.[32-34]

Visceral Leishmaniasis

The incidence

While visceral leishmaniasis (VL) is typically focal in Iran, sporadic cases have been reported in Qom Province, mainly localized to Ghahan and Khaveh villages,

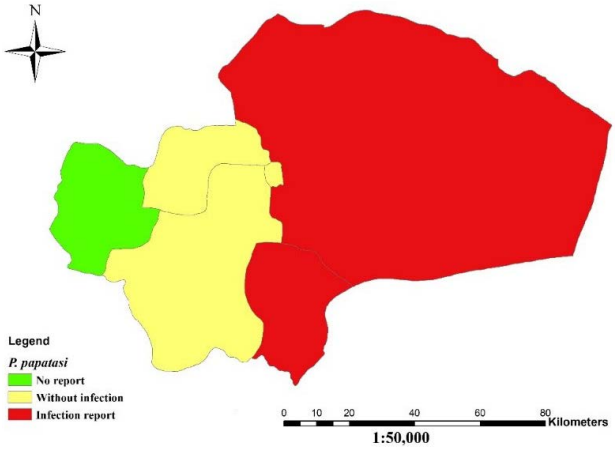

Figure 3. Spatial Distribution of *Ph. papatasi* Populations and Reported CL Cases in Qom Province, Central Iran
Note. Ph. papatasi: *Phlebotomus papatasi;*CL: Cutaneous leishmaniasis.

suggesting possible local transmission. However, further studies are needed to rule out imported cases from neighboring endemic regions . Between 2002 and 2017, 12 VL cases were reported in Qom Province: eight in Ghahan Village (Khalajestan district), three cases in Khaveh and Fordo Vllages (Kahak district), and one in Qom.[35-37]

Vectors

Farzinnia et al and Saghafipour et al have reported six species of phlebotominae sand flies in Ghahan village (Khalajestan District) and villages in Kahak District, including *Ph. major, Ph. alexandri, Ph. kandelakii, Ph. tobbi, Ph. brevis,* and *Ph. halepensis*. Previous studies in neighboring regions have identified *Ph. major* as a probable vector of VL, supporting its potential role in Qom Province.[32,38] (Figure 4)

The Agents and Reservoirs

Fakhar et al isolated *Leishmania infantum* from infants and dogs in Khalajestan District, providing the necessary evidence that supports the likelihood of local transmission of VL in Qom Province.[35]

Malaria

Incidence

No autochthonous malaria cases have been reported in Qom Province.[4] All 197 malaria cases identified between 2011 and 2024 were classified as imported and detected in hospitals, comprehensive health service centers, and the malaria reference laboratory in Qom.

Vectors

All registered malaria cases in Qom Province were imported (Figure 5). According to previous research, four *Anopheles* species have been found in various districts of Qom Province: *Anopheles claviger, An. marteri, An. Turkhudi,* and *An. superpictus. An. claviger* was collected in three districts: Khalajestan, Kahak, and Salafchegan, while *An. Superpictus* was reported in Kahak and Khalajestan districts. Additionally, *An. marteri* and *An. turkmen* were recorded exclusively in Khuzestan Province. No *Anopheles* species have been reported in the Markazi and Jafarabad districts.[39-41]

Head Lice Infestation as a Vectors of Pediculosis

Incidence

Pediculosis is prevalent throughout Qom Province, imposing a significant economic burden on residents and health service organizations. A 2020 study estimated the annual financial burden of pediculosis at approximately $11.58 per case, based on total healthcare costs. In 2016, 11,223 cases (29.35%) of head lice infestation were confirmed out of 38,237 suspected cases in the province.[12,42,43]

Head Lice Species as Vectors of Pediculosis

Human head lice infestation, caused by *Pediculus humanus capitis*, has been reported across all districts of the province.[12]

Myiasis

Incidence

Previous studies have documented only animal myiasis in Qom Province. Dehghani et al reported infections in sheep and goats caused by several fly species, including *Hypoderma lineatum, Oestrus ovis, Hypoderma bovis,* and *Wohlfahrtia magnifica*.[44]

Flies Associated With Myiasis

Previous studies have recorded 15 fly species in Qom Province. Five forensically important species, with the potential to cause human and animal myiasis, include: *Calliphora vicina*, *Lucilia sericata*, *Musca domestica*, *Wohlfahrtia nuba*, and *Chrysomya albiceps*. All species have a provincial distribution, except *W. nuba*, which has not been recorded in the Khalajestan District.[45,46]

Crimean Congo Hemorrhagic Fever

Incidence

Between 2001 and 2011, 34 suspected cases of CCHF were investigated, of which 9 cases (26.5%) were laboratory-confirmed. All confirmed cases occurred among residents of Markazi District (Figure 6).[7] No CCHF cases have been reported in Qom since 2012.

Ticks Related to Crimean Congo Hemorrhagic Fever

Telmadarraiy et al reported that medically important ticks in Qom Province belong to two families, Argasidae and Ixodidae, and three genera: *Hyalomma*, *Rhipicephalus*, and *Argas*. Six species have been recorded, including *Hyalomma dromedarii*, *Hy. Schulzei*, *Hy. marginatum*, *Hy. anatolicum*, *Rhipicephalus sanguineus*, and *Argas persicus*.[8,47] The CCHFV genome has also been detected in *Hyalomma* sp. and *Hy.marginatum* in the Markazi District.[8] (Figure 6)

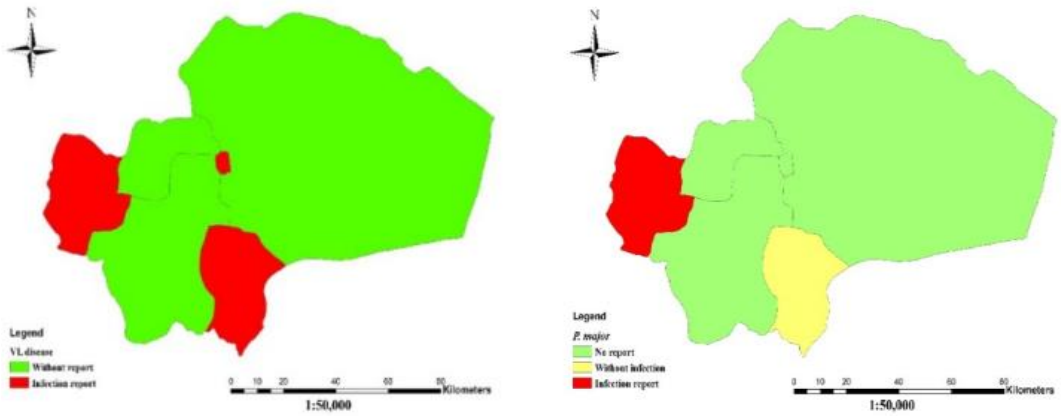

Figure 4. Spatial Distribution of Visceral Leishmaniasis (left) and Its Probable Vector *Ph. major* (right) in Qom Province, Central Iran
Note. Ph. major: *Phlebotomus major*.

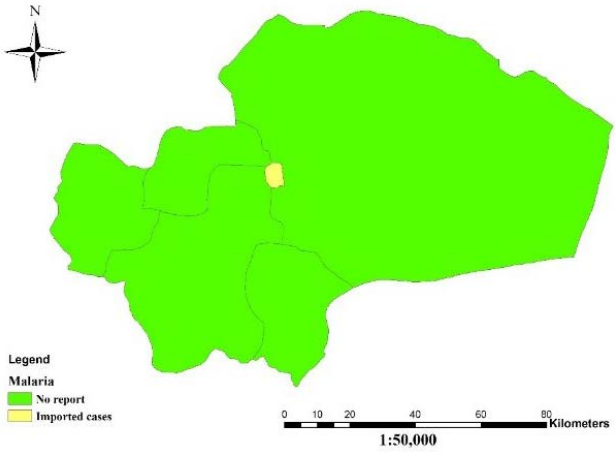

Figure 5. Spatial Distribution of Malaria in Qom Province, Central Iran

West Nile Virus

Incidence

Based on previous studies, West Nile Virus (WNV) has been detected in Qom Province.[10,48] In a study by Chinikar et al, out of 69 samples, one case (1.4%) was serologically positive for WNV.[10]

Vectors

WNV is primarily transmitted by mosquitoes, mainly *Culex* species. Seven *Culex* species have been reported in Qom Province: *Culex arbieeni, Cx. hortensis, Cx. mimeticus, Cx. modestus, Cx. pipiens, Cx. territans,* and *Cx. theileri.*[40]

Scorpionism

Incidence

Scorpionism, caused by venomous scorpions, is a major ARHT in Qom Province. Between 2009 and 2014, 1,481 scorpion-stung cases were recorded in the province. The highest frequencies occurred in Markazi, Jafarabad, Kahak, and Salafchegan, while the lowest were observed in the mountainous Khalajestan District.[14,49]

Scorpion Species

To date, seven species of the family *Buthidae* (C. L. Koch, 1837) have been identified in Qom Province: *Mesobuthus eupeus, Odontobuthus doriae, Androctonus crassicauda, Odontobuthus odontobotus*, *Orthochirus scrobiculosus, Compsobuthus matthiesseni*, and *Hottentotta (Buthotus) saulcyi*.[14,49]

Scabies

3.9.1. Incidence

Between 2005 and 2013, the incidence of scabies in Qom Province ranged from 0.5 to 0.9 cases per 100,000 people annually.[50]

Mites as Agents of Scabies

No study specifically identified the mite agents of scabies in Qom Province.

Loxoscelism

The incidence

In June 2018, a single case of loxoscelism was reported in the city of Qom.[51] (Figure 7). Due to the rarity of loxoscelism, incidence data are not available.

Spiders as Agents of Loxoscelism

Following this case, a brown recluse spider (Loxosceles *sp*.) was also recorded in the same area of Markazi District.[51]

A summary of arthropod-related health threats in Qom Province is presented in Table 1.

Discussion

Several studies have been conducted on ABDs in Iran, and numerous review articles have been published. However, none have specifically focused on a region with significant religious tourism. This review study, conducted for the first time in one of the main religious tourism destinations of Iran and the Shiite world, examined the occurrence and incidence of ABDs in Qom Province.

The distribution patterns of VBDs vary across different provinces of Iran. Previous studies have indicated that some VBDs, such as CCHF and leishmaniasis, are reported in most provinces.[52] In contrast, others, like malaria, are largely confined to the southern and southeastern regions

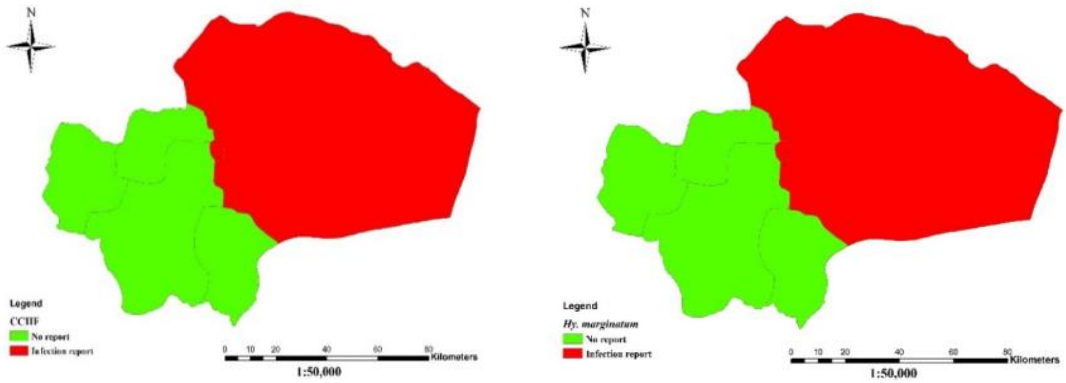

Figure 6. Spatial Distribution of CCHF (left) and Its Main Vector, *Hy. marginatum*, (right) in Qom Province, Central Iran
Note. CCHF: Crimean congo hemorrhagic fever; *Hy. Marginatum*: *Hyalomma marginatum*.

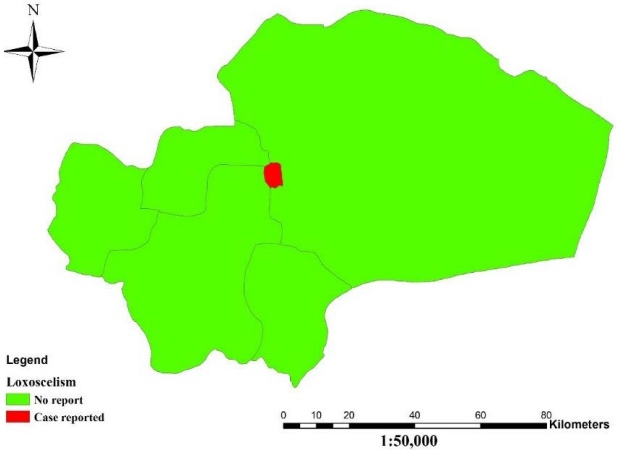

Figure 7. Location of Reported Loxoscelism Case in Qom Province, Central Iran

of the country.[53] Despite the overall declining trend in the incidence of certain VBDs, cases have risen again in recent years. Malaria, in particular, has shown a sudden resurgence, posing a serious challenge to the country's goal of elimination by 2025. Additionally, the emergence of indigenous cases of new diseases, such as dengue in 2024, has further complicated Iran's health system.[9]

Malaria has also been reported in Qom Province. Farzinnia et al documented 553 malaria cases over ten years, with *An. superpictus* and *An. claviger* identified as the primary vectors of *Plasmodium* spp. Most infections occurred in urban areas and among young males, particularly Afghan immigrants, with *Plasmodium vivax* as the main causative agent.[39] The impact of immigrants on malaria foci classification has been demonstrated in various studies.[54] Given the large number of pilgrims and immigrants in Qom Province, it is essential to prioritize the early detection of malaria cases to prevent a shift in classification from "Cleared Up" or "Potential" to "Residual Active".[55] Failure to do so could seriously threaten both malaria elimination efforts and the health of pilgrims.

Undoubtedly, early detection is crucial not only for malaria but also for emerging dengue cases. According to the National Guide for Dengue Prevention and Control, public spaces such as mosques and pilgrimage sites can serve as major transmission foci in the presence of vectors. Although dengue vectors have not yet been reported in Qom Province, continuous monitoring of larval habitats and ensuring adequate infrastructure and resources for dengue fever vector prevention and control are particularly important.

Sand fly infections with *Leishmania* parasites, responsible for CL, have been reported in Qom, confirming its endemicity through various investigations. Over the past decades, 17 provinces in Iran, along with neighboring countries such as Afghanistan, have been affected by *Leishmania* parasites. Zoonotic cutaneous leishmaniasis (ZCL) in sand fly species has also been documented in nearby provinces such as Tehran and Isfahan. Most cases of VL occur in the northwestern regions of Iran, particularly in Ardabil and East Azerbaijan Provinces, which border Armenia and Azerbaijan, both known as endemic areas for this disease. Recently, Qom Province has been identified as a new endemic focus of VL in Iran, with reported cases in the villages of Anjile and Nevis, located in the Qahan district.[39]

The provision of safe and healthy meat is crucial, given the large number of pilgrims visiting Qom. CCHF has been reported in 26 provinces of Iran, with the highest burden in Sistan and Baluchestan, Isfahan, Fars, Tehran, Golestan, and Khuzestan. This virus has also been detected in ticks collected in Qom Province, with similar findings reported in neighboring provinces such as Isfahan and Tehran. The detection of infected ticks serves as an important warning signal for the potential endemicity of CCHF in this region.[7] In such circumstances, raising community awareness about preventive measures and supervising the implementation of health guidelines in slaughterhouses and butcheries are strongly recommended.[56]

Scabies and pediculosis are common infestations in high-density populations, particularly in settings such as inns, schools, barracks, and other crowded environments. Studies have reported a relatively high incidence of both health problems in Qom Province. The incidence of scabies has been estimated at 0.7 per 100,000 population,[50] while head lice infestation rates have reached as high as

Table 1. Summary of Arthropod-Related Health Threats in Qom Province, Iran

Arthropod-Borne Disease/Health Threat	Key Findings	Sample Size/Data Source	Study Type	References
Cutaneous Leishmaniasis	Cumulative incidence: 106 cases/100,000 (2011-2024); Highest in Markazi district (1,447/100,000)	1,370 cases in a population of 1,292,281	Spatial analysis, Epidemiological study	27,28,32
	14 sand fly species identified; *Phlebotomus papatasi* was the most frequent vector species in Markazi/Kahak districts	Multiple entomological surveys	Entomological survey	29-31,34
	Leishmania major and *Meriones libycus* confirmed as agent and reservoir	Animal/human case studies	Case-control study	32,34
Visceral Leishmaniasis	12 cases reported (2002-2017); Ghahan village identified as hotspot (8 cases)	12 human cases	Case series	35-37
	Phlebotomus major probable vector; *Leishmania infantum* identified in dogs and infants	6 sand fly species identified	Molecular/ and entomological study	32,35,38
Malaria	197 imported cases (2011-2024); no autochthonous transmission recorded	Hospital surveillance data	Surveillance report	4,39
	4 *Anopheles* species present (*claviger*, *superpictus* most widespread)	Entomological collections	Entomological survey	40,41
Pediculosis	11,223 confirmed cases (29.35% positivity) in 2016; economic burden estimated at 11.58$ per case	38,237 suspected cases	Cross-sectional study	12,42,43
	Pediculus humanus capitis confirmed throughout the province	Clinical samples	Clinical study	12
Myiasis	Animal cases only (*Hypoderma*, *Oestrus*, *Wohlfahrtia* spp.)	Livestock surveys	Veterinary reports	44
	15 fly species recorded; 5 medically important species identified	Entomological collections	Entomological survey	45,46
Crimean-Congo Hemorrhagic Feve	9 confirmed cases (2001-2011); all in Markazi district	34 suspected cases	Epidemiological study	7,8
	Hyalomma marginatum carrying the CCHFV genome identified	Tick collections	Molecular study	8,47
West Nile Virus	1.4% seroprevalence (1/69 samples)	69 human samples	Serological survey	10
	Only 7 out of 388 water birds revealed positive results	Water bird collections	Serological study	48
	1,481 cases (2009-2014); highest incidence in Markazi district	Hospital records	Retrospective study	14,49
Scorpionism	7 *Buthidae* species identified (*Androctonus crassicauda* most dangerous)	Specimen collections	Taxonomic study	14,49
	Incidence: 0.5-0.9 cases/100,000 annually (2005-2013)	Health center records	Surveillance data	50
Scabies	Single case reported (2018); *Loxosceles* species identified	Case report	Case study	51
Loxoscelism	Due to rarity, the incidence data not available	-	-	51

14%. The majority of scabies cases (85.3%) were reported in urban areas. In a study conducted across rural and urban districts of Qom, 7.6% of students were found to be infected with *Pediculus humanus capitis*. Another study reported infestation rates of 13.73% in urban areas and 10.22% in villages. The high incidence of head lice among children in Qom Province has been attributed to limited access to health education and hygiene facilities.[12] Targeted interventions, such as improved health education programs and access to hygiene facilities, especially for pilgrims, are essential to reduce the burden of these preventable health conditions in Qom Province.

Iran experiences a high rate of scorpionism due to its arid climate and diverse scorpion fauna. The desert environment covering much of Qom Province provides favorable conditions for the presence of numerous venomous scorpion species. According to previous studies, twelve scorpion species are responsible for stings in Iran. Seven species from the family *Buthidae* have been reported in Qom Province, including *A. crassicauda*, which poses the greatest public health concern.[14,49] Various investigations highlight scorpion stings as a significant health issue in the province, highlighting the necessity of personal protection measures and public awareness programs.[14]

Conclusion

Qom Province is a major pilgrimage destination, welcoming approximately twenty million visitors annually. This creates significant public health challenges related to ARHTs. These threats include infectious diseases, such as arboviruses and parasitic infections, and non- infectious risks, including scorpion stings and infestations, all of which demand urgent attention. The public health situation is further complicated by the presence of travelers and immigrants from malaria-endemic regions, who influence local disease transmission patterns, particularly for malaria and dengue. The large number of visitors, combined with the province's diverse environments, creates ideal conditions for the spread of diseases and injuries caused by arthropods.

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Authors' Contribution

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Writing–review & editing: Jalil Nejati.

Competing Interests
The authors declare no conflict of interests.

Ethical Approval
The authors confirm that all ethical issues were completely observed, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, and the like. This study was funded by the Research and Technology Center of Qom University of Medical Sciences (IR.MUQ.REC.1399.157).

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References
1. World Health Organization (WHO). Vector-Borne Diseases. Geneva: WHO; 2020. Available from: https://www.who.int/news-room/fact-sheets/detail/vector-borne-diseases.
2. World Health Organization (WHO). Malaria. Geneva: WHO; 2021. Available from: https://www.who.int/news-room/fact-sheets/detail/malaria.
3. Cecílio P, Cordeiro-da-Silva A, Oliveira F. Sand flies: basic information on the vectors of leishmaniasis and their interactions with *Leishmania* parasites. Commun Biol. 2022;5(1):305. doi: 10.1038/s42003-022-03240-z.
4. Vatandoost H, Raeisi A, Saghafipour A, Nikpour F, Nejati J. Malaria situation in Iran: 2002-2017. Malar J. 2019;18(1):200. doi: 10.1186/s12936-019-2836-5.
5. Sharifi I, Khosravi A, Aflatoonian MR, Salarkia E, Bamorovat M, Karamoozian A, et al. Cutaneous leishmaniasis situation analysis in the Islamic Republic of Iran in preparation for an elimination plan. Front Public Health. 2023;11:1091709. doi: 10.3389/fpubh.2023.1091709.
6. Sadeghi H, Nikkhahi F, Maleki MR, Simiari A, Bakht M, Gholamzadeh Khoei S. Status of Crimean-Congo haemorrhagic fever virus in ticks in Iran: a systematic review with meta-analysis. Microb Pathog. 2023;181:106153. doi: 10.1016/j.micpath.2023.106153.
7. Saghafipour A, Norouzi M, Sheikholeslami N, Mostafavi R. Epidemiologic status of the patients with Crimean-Congo hemorrhagic fever and its associated risk factors. J Mil Med. 2022;14(1):1-5. [Persian].
8. Telmadarraiy Z, Saghafipour A, Farzinnia B, Chinikar S. Molecular detection of Crimean-Congo hemorrhagic fever virus in ticks in Qom province, Iran, 2011-2012. Iran J Virol. 2012;6(3):13-8. [Persian].
9. Nejati J, Bueno-Marí R. Malaria and dengue outbreaks: a double health threat in southeastern Iran. J Vector Borne Dis. 2024;61(3):501-2. doi: 10.4103/jvbd.Jvbd_186_23.
10. Chinikar S, Shah-Hosseini N, Mostafavi E, Moradi M, Khakifirouz S, Jalali T, et al. Seroprevalence of West Nile virus in Iran. Vector Borne Zoonotic Dis. 2013;13(8):586-9. doi: 10.1089/vbz.2012.1207.
11. Bakhshi H, Mousson L, Moutailler S, Vazeille M, Piorkowski G, Zakeri S, et al. Detection of arboviruses in mosquitoes: evidence of circulation of chikungunya virus in Iran. PLoS Negl Trop Dis. 2020;14(6):e0008135. doi: 10.1371/journal.pntd.0008135.
12. Saghafipour A, Nejati J, Zahraei Ramazani A, Vatandoost H, Mozaffari E, Rezaei F. Prevalence and risk factors associated with head louse (*Pediculus humanus capitis*) in central Iran. J Pediatr Perspect. 2017;5(7):5245-54. doi: 10.22038/ijp.2017.23413.1967.
13. Nejati J, Keyhani A, Tavakoli Kareshk A, Mahmoudvand H, Saghafipour A, Khoraminasab M, et al. Prevalence and risk factors of pediculosis in primary school children in south west of Iran. Iran J Public Health. 2018;47(12):1923-9.
14. Nejati J, Saghafipour A, Mozaffari E, Keyhani A, Jesri N. Scorpions and scorpionism in Iran's central desert. Acta Trop. 2017;166:293-8. doi: 10.1016/j.actatropica.2016.12.003.
15. Heydari AA, Mostafavi E, Heidari M, Latifian M, Esmaeili S. Q fever endocarditis in northeast Iran. Case Rep Infect Dis. 2021;2021:5519164. doi: 10.1155/2021/5519164.
16. Khoobdel M, Jafari AS, Telmadarraiy Z, Sedaghat MM, Bakhshi H. Tick-borne pathogens in Iran: a meta-analysis. Asian Pac J Trop Med. 2021;14(11):486-504. doi: 10.4103/1995-7645.329009.
17. Dehghani R, Kassiri H, Khodkar I, Karami S. A comprehensive overview on sand fly fever. J Acute Dis. 2021;10(3):98-106. doi: 10.4103/2221-6189.316673.
18. Hazratian T, Dolatkhah A, Akbarzadeh K, Khosravi M, Ghasemikhah R. A review of human myiasis in Iran with an emphasis on reported cases. Malays J Med Health Sci. 2020;16(2):269-74.
19. Khamesipour F, Nezaratizade S, Basirpour B, Chelgerdi Dehkordi B, Afzal SS, Kheyri P, et al. Review of *Dirofilaria* spp. infection in humans and animals in Iran. Res Vet Sci Med. 2021;1(5):1-12. doi: 10.25259/rvsm_3_2020.
20. Khoobdel M, Azari-Hamidian S, Hanafi-Bojd AA, Bakhshi H, Jafari A, Moradi M. Scabies as a neglected tropical disease in Iran: a systematic review with meta-analysis, during 2000-2022. J Arthropod Borne Dis. 2022;16(3):180-95. doi: 10.18502/jad.v16i3.12034.
21. Zamani A, Mirshamsi O, Marusik YM. 'Burning violin': the medically important spider genus *Loxosceles* (Araneae: Sicariidae) in Iran, Turkmenistan, and Afghanistan, with two new species. J Med Entomol. 2021;58(2):666-75. doi: 10.1093/jme/tjaa257.
22. Nejati J, Bueno-Marí R, Salehi M, Akbari MR, Shahi M. First record of black widow spider bite *Latrodectus cinctus* (Araneae: Theridiidae) from Iran. J Med Entomol. 2022;59(3):1086-9. doi: 10.1093/jme/tjac026.
23. Soltan-Alinejad P, Soltani A. Vector-borne diseases and tourism in Iran: current issues and recommendations. Travel Med Infect Dis. 2021;43:102108. doi: 10.1016/j.tmaid.2021.102108.
24. Fakour S, Naserabadi S, Ahmadi E. A serological and hematological study on Rift valley fever and associated risk factors in aborted sheep at Kurdistan province in west of Iran. Comp Immunol Microbiol Infect Dis. 2021;75:101620. doi: 10.1016/j.cimid.2021.101620.
25. Paquette SJ, Simon AY, Xiii A, Kobinger GP, Shahhosseini N. Medically significant vector-borne viral diseases in Iran. Microorganisms. 2023;11(12):3006. doi: 10.3390/microorganisms11123006.
26. Mohammadbeigi A, Saghafipour A, Jesri N, Tarkhan FZ, Karami Jooshin M. Spatial distribution of vaccine-preventable diseases in central Iran in 2015-2018: a GIS-based study. Heliyon. 2020;6(9):e05102. doi: 10.1016/j.heliyon.2020.e05102.
27. Saghafipour A, Jesri N, Fakhar M. Spatial analysis of rural cutaneous leishmaniasis foci in Qom province using geographic information system. Tolooebehdasht. 2015;13(5):37-46. [Persian].
28. Javanbakht M, Saghafipour A, Ezimand K, Hamta A, Zanjirani Farahani L, Soltani N. Identification of climatic and environmental factors associated with incidence of cutaneous leishmaniasis in central Iran using satellite imagery. Asian

Pac J Trop Biomed. 2021;11(1):40-6. doi: 10.4103/2221-1691.300730.
29. Vatandoost H, Nejati J, Saghafipour A, Zahraei-Ramazani A. Geographic and ecological features of phlebotomine sand flies (Diptera: Psychodidae) as leishmaniasis in central Iran. J Parasit Dis. 2018;42(1):43-9. doi: 10.1007/s12639-017-0962-y.
30. Saghafipour A, Vatandoost H, Zahraei-Ramazani AR, Yaghoobi-Ershadi MR, Rassi Y, Shirzadi MR, et al. Spatial distribution of phlebotomine sand fly species (Diptera: Psychodidae) in Qom province, central Iran. J Med Entomol. 2017;54(1):35-43. doi: 10.1093/jme/tjw147.
31. Salimi M, Jesri N, Javanbakht M, Zanjirani Farahani L, Shirzadi MR, Saghafipour A. Spatio-temporal distribution analysis of zoonotic cutaneous leishmaniasis in Qom province, Iran. J Parasit Dis. 2018;42(4):570-6. doi: 10.1007/s12639-018-1036-5.
32. Saghafipour A, Vatandoost H, Zahraei-Ramazani AR, Yaghoobi-Ershadi MR, Karami Jooshin M, Rassi Y, et al. Epidemiological study on cutaneous leishmaniasis in an endemic area, of Qom province, central Iran. J Arthropod Borne Dis. 2017;11(3):403-13.
33. Nateghi Rostami M, Saghafipour A, Vesali E. A newly emerged cutaneous leishmaniasis focus in central Iran. Int J Infect Dis. 2013;17(12):e1198-206. doi: 10.1016/j.ijid.2013.07.003.
34. Rassi Y, Saghafipour A, Abai MR, Oshaghi MA, Rafizadeh S, Mohebail M, et al. *Phlebotomus papatasi* and *Meriones libycus* as the vector and reservoir host of cutaneous leishmaniasis in Qomrood district, Qom province, central Iran. Asian Pac J Trop Med. 2011;4(2):97-100. doi: 10.1016/s1995-7645(11)60045-x.
35. Fakhar M, Mohebali M, Barani M. Identification of endemic focus of Kala-azar and seroepidemiologcial study of visceral *Leishmania* infection in human and canine in Qom province, Iran. Armaghane Danesh. 2004;9(1):43-52. [Persian].
36. Zanjirani Farahani L, Mohebali M, Akhoundi B, Saghafipour A, Kakooei Z. Seroepidemiological study on visceral leishmaniasis in an endemic focus of central Iran during 2017. J Parasit Dis. 2019;43(1):22-7. doi: 10.1007/s12639-018-1049-0.
37. Zanjirani Farahani L, Saghafipour A, Mohebali M, Akhoundi B, Raufi H. Visceral leishmaniasis (Kala-azar) in Qom province, Iran: report of two cases. F1000Res. 2018;7:1371. doi: 10.12688/f1000research.15805.3.
38. Farzinnia B, Hanafi-Bojd AA. The sand fly fauna of an endemic focus of visceral leishmaniasis in central Iran. Iran J Arthropod Borne Dis. 2007;1(2):48-52.
39. Farzinnia B, Saghafipour A, Abai MR. Malaria situation and anopheline mosquitoes in Qom province, central Iran. Iran J Arthropod Borne Dis. 2010;4(2):61-7.
40. Saghafipour A, Abai MR, Farzinnia B, Nafar R, Ladonni H, Azari-Hamidian S. Mosquito (Diptera: Culicidae) fauna of Qom province, Iran. J Arthropod Borne Dis. 2012;6(1):54-61.
41. Abai MR, Saghafipour A, Ladonni H, Jesri N, Omidi S, Azari-Hamidian S. Physicochemical characteristics of larval habitat waters of mosquitoes (Diptera: Culicidae) in Qom province, central Iran. J Arthropod Borne Dis. 2016;10(1):65-77.
42. Karami Jooshin M, Izanloo H, Saghafipour A, Ghafoori Y. Study on efficacy of 1% permethrin shampoo and 4% dimethicone lotion as pediculicide products used in Iran: a clinical trial. Tehran Univ Med J. 2019;77(1):41-6. [Persian].
43. Salimi M, Saghafipour A, Hamidi Parsa H, Khosravi M. Economic burden associated with head louse (*Pediculus humanus capitis*) infestation in Iran. Iran J Public Health. 2020;49(7):1348-54. doi: 10.18502/ijph.v49i7.3589.
44. Dehghani R, Sedaghat MM, Esmaeli N, Ghasemi A. Myiasis among slaughtered animals in Kashan, Iran: descriptive a veterinary entomological problem in the tropics. Iran J Vet Sci Technol. 2012;4(1):19-28. doi: 10.22067/veterinary.v4i1.17890.
45. Akbarzadeh K, Saghafipour A, Jesri N, Karami Jooshin M, Arzamani K, Hazratian T, et al. Spatial distribution of necrophagous flies of infraorder muscomorpha in Iran using geographical information system. J Med Entomol. 2018;55(5):1071-85. doi: 10.1093/jme/tjy098.
46. Mozaffari E, Saghafipour A, Arzamani K, Jesri N, Kababian M, Hashemi SA. Geographical distribution, biodiversity, and species richness of medically important necrophagous flies in central Iran. J Med Entomol. 2020;57(2):377-81. doi: 10.1093/jme/tjz203.
47. Farzinnia B, Saghafipour A, Telmadarraiy Z. Survey of tick species distribution in sheep and camel in Qom city, Iran, 2010-2011. J North Khorasan Univ Med Sci. 2012;4(3):391-8. doi: 10.29252/jnkums.4.3.391. [Persian].
48. Fereidouni SR, Ziegler U, Linke S, Niedrig M, Modirrousta H, Hoffmann B, et al. West Nile virus monitoring in migrating and resident water birds in Iran: are common coots the main reservoirs of the virus in wetlands? Vector Borne Zoonotic Dis. 2011;11(10):1377-81. doi: 10.1089/vbz.2010.0244.
49. Firoozfar F, Saghafipour A, Jesri N. Scorpions and their human mortality report in Iran: a review article. Iran J Public Health. 2019;48(12):2140-53.
50. Saghafipour A, Arsang S, Mohammadbaygi A, Shamsodini S. Determining the prevalence rate of scabies and its associated social and demographic factors among patients attending health centers in the Qom province (2005-2013). J Mil Med. 2022;17(1):41-5. [Persian].
51. Baniardalani M, Saghafipour A, Kababian M, Abai MR. Cutaneous necrosis following brown recluse spider bite. Iran J Dermatol. 2020;23(1):40-2. doi: 10.22034/ijd.2020.108069.
52. Hanafi-Bojd AA, Jafari S, Telmadarraiy Z, Abbasi-Ghahramanloo A, Moradi-Asl E. Spatial distribution of ticks (Arachniada: Argasidae and Ixodidae) and their infection rate to Crimean-Congo hemorrhagic fever virus in Iran. J Arthropod Borne Dis. 2021;15(1):41-59. doi: 10.18502/jad.v15i1.6485.
53. Salahi-Moghaddam A, Turki H, Yeryan M, Fuentes MV. Spatio-temporal prediction of the malaria transmission risk in Minab district (Hormozgan province, southern Iran). Acta Parasitol. 2022;67(4):1500-13. doi: 10.1007/s11686-022-00598-2.
54. Nejati J, Ansari-Moghaddam A, Keyhani A, Tabatabai SM. Effects of immigration on malaria incidence and its foci classification. Hormozgan Med J. 2012;16(4):283-91. [Persian].
55. Okati-Aliabad H, Ansari-Moghaddam A, Mohammadi M, Nejati J, Ranjbar M, Raeisi A, et al. Access, utilization, and barriers to using malaria protection tools in migrants to Iran. BMC Public Health. 2022;22(1):1615. doi: 10.1186/s12889-022-13913-3.
56. Nejati J, Mohammadi M, Okati-Aliabad H. Knowledge, attitudes, and practices regarding Crimean-Congo hemorrhagic fever in a high-prevalence suburban community, southeast of Iran. Heliyon. 2024;10(1):e23414. doi: 10.1016/j.heliyon.2023.e23414.

Appendix 1. Quality Assessment of the 31 Included Studies: Detailed Criteria and Scores

First Author, Year (Ref. No*)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Quality (Score)
Vatandoost, 2019[4]	✓	NR	✓		✓	NR	NR	✓		✓		Good
Saghafipour, 2012[7]	✓	NA	✓		✓	NR	NR	✓	NR	✓	NR	Fair
Telmadarraty, 2012[8]	✓	NA	✓		✓	NR	NR	✓	NR	NR	NR	Fair
Chinikar, 2013[10]	✓	NR	✓		✓		NR	✓	NR	✓		Good
Saghafipour, 2017[12]	✓	NA	✓		✓		NR	✓		✓		Good
Nejati, 2017[14]	✓	NA	✓		✓	NR	NR	✓	NR	NR	NR	Fair
Saghafipour, 2015[27]	✓	NR	✓		✓	NR	NR	✓	NR	NR	NR	Fair
Javanbakht, 2021[28]	✓	NR	✓		✓		NR	✓		✓		Good
Vatandoost, 2018[29]	✓	NA	✓		✓	NR	NR	✓		✓	NR	Good
Saghafipour, 2017[30]	✓	✓		✓		✓	NR	✓		✓		Good
Salimi, 2018[31]	✓	✓		✓		✓	NR	✓		✓		Good
Saghafipour, 2017[32]	✓	NA	✓		✓	NR	NR	✓		✓	NR	Good
Nateghi Rostami, 2013[33]	✓		✓		✓		NR	✓		✓		Good
Rassi, 2011[34]	✓	✓		✓		NR	NR	✓		✓	NR	Good
Fakhar, 2004[35]	✓	✓		✓		NR	NR	✓	NR	NR	NR	Fair
Zanjirani Farahani, 2019[36]	✓	NR	✓		✓	NR	NR	✓	NR	NR	✓	Fair
Zanjirani Farahani, 2019[37]	✓		✓		✓	NR	NR	✓	NR	✓	NR	Good
Farzinnia, 2007[38]	✓	✓		✓		NR	NA	✓	NA	NR	✓	Fair
Farzinnia, 2010[39]	✓	NA	✓		✓	NR	NR	✓	NA	✓	NR	Fair
Saghafipour, 2012[40]	✓	✓		✓		✓	NR	✓	NA	NR	✓	Good
Abai, 2016[41]	✓	NR	✓		✓		NR	✓		✓	NR	Good
Karami Jooshin, 2019[42]	✓	✓		✓		✓	NR	✓		✓		Good
Salimi, 2020[43]	✓	NR	✓		✓		NR	✓		✓		Good
Dehghani, 2012[44]	✓	NA	✓		✓	NR	NR	✓	NR	✓	NR	Fair
Akbarzadeh, 2018[45]	✓	NR	✓		✓	NR	NR	✓		✓	NR	Good
Mozaffari, 2020[46]	✓	NR	✓		✓		NR	✓	NR	✓		Good
Farzinnia, 2012[47]	✓	NA	✓		✓	NR	NR	✓	NR	NR	NR	Fair
Fereidouni, 2011[48]	✓	NR	✓		✓		NR	✓	NR	✓		Good
Firoozfar, 2019[49]	✓	NA	✓		✓	NR	NR	✓		✓		Good
Saghafipour, 2015[50]	✓	✓		✓		NR	NR	✓	NR	✓	NR	Fair
Baniardalani, 2020[51]	✓	NA	✓		✓	NR	NA	✓	NR	✓	NR	Fair

Q1: Is the target population of the study clearly defined and described? **Q2:** Are competing alternatives clearly described? **Q3:** Is the research question clearly formulated and well-structured?
Q4: Does the chosen study design align appropriately with the research objective? **Q5:** Is the selected time frame suitable for the context and aims of the study? **Q6:** Is the analytical perspective adopted in the study relevant and justified? **Q7:** Are all important variables, including uncertain ones, appropriately subjected to sensitivity analysis? **Q8:** Do the study's conclusions logically follow from the reported data and findings? **Q9:** Does the article address the potential generalizability of the results to other populations or settings? **Q10:** Is there a clear disclosure regarding the absence of conflicts of interest between researchers and funders? **Q11:** Are ethical considerations and equity-related issues thoughtfully discussed?
Note. Some criteria (e.g., sensitivity analysis) are less relevant for purely descriptive epidemiological studies and were therefore scored as NA or NR, where appropriate. Quality scoring: Good: Meets 7–9 criteria, Fair: Meets 4–6 criteria, Poor: Meets 0–3 criteria; NA: Not Applicable; NR: Not Reported; *Ref. No: Reference Number.