

Environmental conditions and preventive behaviors' effect on cutaneous leishmaniasis of earthquake hit western cities of Iran in 2018: a cross-sectional study

Mozhgan Irandost

Kermanshah University of Medical Sciences

Behzad Mahaki

Kermanshah University of Medical Sciences

Rokhsareh Akbarzadeh

University of Johannesburg

Meghdad Pirsaeheb

Kermanshah University of Medical Sciences

Anvar Asadi (✉ anvarasadi@sbmu.ac.ir)

Kermanshah University of Medical Sciences <https://orcid.org/0000-0002-5714-0878>

Mojtaba Salimi

Kermanshah University of Medical Sciences

Fakhradin Chaboksavar

Tehran University of Medical Sciences

Research

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Abstract

Background & objectives This study investigates the role of environmental conditions, knowledge, attitudes and control measures of preventive behaviors in cutaneous leishmaniasis (CL) based on the BASNEF model in patients who referred to the health care centers of cities hit by earthquakes including Sarpol-Zahab and Qasr-Shirin in Kermanshah province, western Iran, in 2018.

Method In this descriptive cross-sectional study, 128 individuals who visited rural and urban health centers in the cities under study were randomly selected. They were asked to fill in a structured questionnaire with questions about their demographic information, environmental conditions, their knowledge, attitude and preventive behavior regarding CL.

Results The environmental conditions of participants (i.e. wastewater collection, solid waste disposal, drinking water and...) were at appropriate levels. Approximately 89.1% of the people used urban water supply networks while about 68% of participants had access to the wastewater collection system. About 67% of participants reported that their solid wastes were collected daily and disposed of in sanitary landfill. The most influential people in preventive behaviors (control actions) were family members (72.4%). Pearson's correlation test showed that preventive behaviors had a meaningful correlation with understudy variables in BASNEF model ($p < 0.001$). Preventive behaviors against CL improved as the score of each variable increased. Finally, enabling factors and behavioral intention were the most accurate predictors of preventive behaviors against CL.

Conclusion Distribution of causes of CL is influenced by a combination of environmental ecological conditions as well as behavioral and sanitation factors. Therefore, control programs should be focused on villages and cities with high risks of disease.

1. Background

Leishmaniasis is a zoonotic tropical disease endemic in Iran that world health organization (WHO) has recommended to study [1]. The burden of leishmaniases is important due to 88 countries being at risk with a population of 350 million people. About 500,000 new cases of visceral leishmaniasis (VL) and 1 to 1.5 million cases of CL occur annually [2]. The most common types are CL, mucosal leishmaniasis and VL. The etiological agent of leishmaniasis, *Leishmania*, is a type of protozoan parasite in the family of Trypanosomatidae. This parasite is commonly transmitted by the bite of phlebotomine sandflies, *Phlebotomus* (Diptera, Psychodidae) in the Old World and *Lutzomyia* in the New World [3]. In Iran, zoonotic CL and anthroponotic CL caused by *Leishmania major* and *L. tropica*, respectively are endemic in 18 out of 31 provinces with an average of 20,000 official cases each year [4].

CL is manifest as a volcanic-shaped ulcer with a sunken center, covered with granular tissue. This wound heals itself and after recovery leaves an unpleasant-looking scar. Although the disease is not dangerous, it is important due to several reasons, such as prolonged periods of ulceration, ugly scars, secondary

infections, relatively high health costs and the side effects from different treatments [5]. The fight against CL has always been considered in Iranian national plans [6].

It is necessary to combine various methods and techniques to prevent and control CL, such as rodent surveillance, environmental sanitation (improvement in housing and sewage disposal), environmental health measures and implementing health education programs [6, 7]. Environmental health measures include actions that reduce the carrier population and human exposure through interventions in their place of residence [3]. Environmental health measures should be undertaken after careful ecological study of locality and environmental impact assessment. One of the environmental health activities used to control CL in different parts of the world, including central Asian countries, is the physical control technique. An example of this is to reduce proliferation of sandflies, *Phlebotomus papatasi*, through elimination of potential shelters, which has been recognized as an effective measure [6]. Other actions include eliminating sandflies breeding sites, such as demolition and construction of waste sites and environmental management including local sanitation and improved housing. Some of these programs include application of poisonous rodenticide bait, completion of half constructed buildings, using personal protective equipment to avoid sand fly bites, and keeping livestock away from human residence [3, 6]. One of the proper methods to study and identify people's needs in afflicted areas is to create appropriate awareness related to effective measures that can prevent diseases and promote health. Therefore, a series of studies along with focused management planning about awareness and attitude of residents should be conducted [8].

One of the most important steps in management planning is the model or theory selection which is based on the conditions, problem identification and its alignment with program goal. The BASNEF model, presented by Jane Hubble in 1998, is instructive. The components of this model include belief, attitude, subjective norms, and enabling factors, rendering the acronym BASNEF [9]. Based on this model, a person will take preventive measures to refrain from the onset of diseases. This person should believe in the outcome of preventive behavior (beliefs) and that the important people surrounding that individual expect him/her to adopt preventive behaviors (abstract norms). Factors such as money, time, resources and skills, which make preventive behaviors more feasible or easier (enabling factors), should be available [1, 8]. The occurrence of natural disasters such as earthquakes, storms and floods leads to the creation of a suitable environment for the propagation of sandflies [10]. Since November 2017 earthquake, the frequency of local residents visiting health centers has gradually increased in the earthquake-hit cities of Qasr-Shirin and Sarpol-Zahab. No comprehensive studies have so far been done on the status of CL in these cities since the recent earthquake. Control and prevention of CL are now considered by regional authorities and are targeted for more investigation in this area. Considering the different environmental and behavioral conditions in Qasr-Shirin and Sarpol-Zahab following the earthquake and its effect on disease prevalence, study of CL, its control and prevention methods is necessary. The aim of this study is to investigate the role of preventive behaviors and environmental factors on CL using the BASNEF model through a modified questionnaire whose validity and reliability was confirmed [10].

2. Materials And Methods

2.1. Study areas

Qasr-Shirin and Sarpol-Zahab are two cities in Kermanshah province, located in western Iran (Fig. 1). Qasr-Shirin city is located 30 km away from Sarpol-Zahab city between 45°35'E, and 34°32'N. Sarpol-Zahab city lies at 45°52'E, and 34°28'N, about 210 km to the capital city of Kermanshah, in this province, which abuts the Zagros mountain range. Both these cities are next to the western borders of Iraq. These cities have temperate winters and hot dry summers.

Fig. 1

2.2. Data collection

This study was performed as a descriptive cross-sectional study based on BASNEF model on patients. This study covered all health care centers in both cities including seven rural health centers and one comprehensive urban health center in Sarpol-Zahab as well as two small health centers and two comprehensive health centers in Qasr-Shirin. A simple random sampling method was used in a way that the BASNEF standard questionnaires were given to individuals and asked to complete the structured questionnaire. It included the following sections: the first part solicits demographic information, the second part addresses the environmental profile and the third part contains the model's 36 questions (see Table 1).

Table 1

Awareness questions were designed as multiple-choice questions with true, false, and unknown supplied as possible answers. Questions regarding attitude (behavioral beliefs) and the structure of intentional behavior are phrased using a 5-point Likert scale with variables of strongly agree, agree, undecided, disagree, and strongly disagree. Structural questions about attitude (outcomes evaluation) are similarly couched with a Likert-typed structure and variables of very important, important, moderately important, little importance, and unimportant. The abstract norms questions (normative beliefs) and motivation to follow use the terms of very frequently, frequently, occasionally, rarely and never.

Structural questions about enabling factors and the behavioral structure (control measures) are designed in the same way, moving from very high, to medium, low, and very low. The validity and reliability of this questionnaire were averred by Ghodsi *et al.*, [10] who reported that Cronbach's alpha was 0.86 and the average content validity index and content validity ratio were 0.98 and 0.9 respectively. Sample size, based on the mean and standard deviation of the BASNEF structure (awareness, attitude, abstract norms, enabling factors, and behavior), was 128 which was calculated by using similar studies and the Cochran sample size formula.

2.3. Statistical analysis

Data were collected by questionnaires, analyzed using the SPSS software (Version16; SPSS Inc., Chicago IL) and using descriptive statistical analysis, the model's component score, as well as demographic and environmental status were determined. The correlation between the BASNEF model components (awareness and attitude for instance) and preventive behaviors on CL (control measures) was obtained by analytical statistical tests such as ANOVA, regression and Pearson correlation coefficient.

3. Results

Demographic data analysis showed that male to female ratio approximately equaled one. People between the ages of 20 and 29 were the most frequent (36.7%) age group. Groups with 4 to 6 family members had the highest percentage (46.1%). The highest income was between 10 and 30 million Rials (Iranian currency exchange) (48.4%). The most abundant education level was high school and diploma (34.4%).

The analysis of data on environmental condition showed that 20.3% of the sample population resided in newly built apartments, 16.4% in temporary residential dwellings, 14.8% in villas, 11.7% in old apartments and 7% in tents. In terms of residential livestock, 87.5% of the population kept none. 68% of the sample area had municipal sewage collection systems, 22.7% of the population disposed their wastewater in nearby absorbing wells or cesspools and 8.6% used non-sanitary disposal in the environment. The status of drinking water showed that 89.1% of the population use the urban water supply and 9.4% use mobile tankers. In terms of solid waste status, about 67.2% used sanitary landfill which was collected daily, 23.4% was dumped and 9.4% burnt. In terms of residential area, 64.1% lived in the center of the city.

The analysis of the BASNEF model's data on the disease status of the sample group of patients showed that out of 128 people, 32 (25%) were currently infected with CL, six of them had a previous history of the disease, and 13 people (10.2%) had one or more members of their family affected with disease. According to Table 2, the mean and standard deviation of the BASNEF model in preventive behaviors (control measures) of the disease are shown. According to this data, the highest score that subjects obtained from preventive behaviors (control measures) on CL disease was related to awareness component (47.08%) and the least (28.33%) to attitude structure.

Table 2

Data analysis of the participants' awareness revealed that 39% of the participants were believed that the disease is contagious and 78% was believed that the disease is preventable. Moreover, approximately 82% of the participants' believed that cutaneous leishmaniosis is treatable and 79% awarded that it is transmitted by sandflies. Analysis of data on attitude questions (behavioral beliefs) in relation to the prevention of CL showed that 67% of participants agreed that they would not have been infected with

Leishmania if they had followed the preventive behaviors. About 60.9% of participants admitted that risk of CL would be reduced if they improved their practice on preventive behaviors of CL, and 58.6% of participants conceded that they would prevent onset of disease on the body if they took preventive measures. Approximately, 86% of respondents in this study who answered the questions of attitude (outcome evaluation) stated that it is very important for them not to get infected by this pathogen. Also, 71.9% stated that it is very important for them not to have the stress of being infected. More than 80% of the participants stated that preventing ulcerative lesions is very important for them. Regarding the response of participants to questions of constructs of abstract norms (normative beliefs) related to prevention of CL, it revealed that the most important influential people in preventive behaviors (control measures) were family members (72.4%), health workers (68.8%) and the least influential people were others. The most important influencers in motivating respondents to follow preventive behaviors (control measures) were family (69.5%), health workers (51.6%) and the least influential was other people. The frequency distribution of respondents' answer to the behavioral intention instructing questions related to prevention of CL indicates that the most popular behavior is referral to a doctor (62.5%) if they have suspected cases of CL. The least likely intention was to apply insecticides to remove sandflies from residence (50.8%).

Table 3 shows the frequency of responses of participants in this study to the behavioral structure questions (control measures) regarding CL prevention. According to Table 3, the most and the least preventive behaviors (control measures) that participants identified were: waste spillage in their habitat (68.8%) and the use of insecticide to eliminate sandflies at home (49.2%), respectively.

Table 3

Frequency distribution of respondents in structures questions on factors contributing to the prevention of disease revealed that among enabling factors, access to health care personnel to learn disease preventive methods (64.1%) is the first priority and the availability of funds to purchase mosquito nets, repellent and insecticides (41.4%) along with access to a dermatologist (37.5%), are next.

Table 4 shows the correlation between BASNEF model (with factors such as knowledge and attitude) with CL preventive behaviors (control measures). The Pearson correlation test showed that between behavioral constructs (control measures) and other components, such as abstract norms ($P<0.05$), behavioral intention ($P<0.05$), and enabling factors ($P<0.05$), there was a significant correlation ($P<0.05$). By increasing the score of each variable, the disease preventive behaviors (control measures) will be improved.

Table 4

Table 5 shows data analysis based on a linear regression model. This analysis showed that there is a meaningful relationship between behavioral structure (control measures) as independent variable and attitude, gender, abstract norms and enabling factors as dependent variables. The model was significantly viable ($P>0.05$). This test showed that, with increase in standard deviation in control

measures, the score of intentional behavior, abstract norms and enabling factors increases. Among the BASNEF model components, the strongest predicting factor with regression coefficient ($b=0.179$) was the enabling factors and after that, the intentional behavioral structure with regression coefficient ($b=177.7$). Of the BASNEF model, the enabling factors (19%) and intentional behavior (17%) are predictive of control measures in the prevention of CL.

Table 5

4. Discussion

Considering the effectiveness of BASNEF training model, factors associated with CL in the earthquake-affected areas (Qasr-Shirin and Sarpol-Zahab) were surveyed to provide comprehensive information on the status of these factors. The BASNEF model is derived from two models (precede and behavioral intention model) and was designed to study behavior and program to determine effective factors in behavior and facilitated behavior alteration [11]. The transmission of CL is highly dependent on climate conditions and on the ecology of vector/reservoir hosts [12]. The level of education has an important and undeniable effect on the health of individuals, which has been emphasized in several studies [5]. Certain characteristics of families, such as level of education and income influence their perceptions of illness, severity, treatment, health status and the use of health services [13]. Furthermore, economic situation or social factors and climate variability may have substantial effects on the epidemiology of CL. In view of CL control, it seems that ecological and environmental factors that spread the disease and thus improve preventive and control measures are of utmost importance [14, 15]. Environmental factors (such as inappropriate sanitary conditions), inadequate environmental health measures (namely landfill and dumping of construction and demolition wastes), environmental changes (namely agricultural development), natural disasters (such as floods and earthquakes) and the construction of residential areas close to rodent nests can be the cause of spread of CL in tropical regions [16]. In terms of the economic situation of the society, the highest income was between 10 and 30 million Rial. Leishmaniasis more often occurs in areas that are poor in terms of economic and social conditions, because poverty often contributes to poor environmental conditions (lack of sewage and waste disposal systems), which increase the potential of contagious diseases such as CL spreading [17, 18]. The discharge of waste, sewage and animal waste in villages provides a suitable environment for propagation of sandflies and the accumulation of rodents. Therefore, control measures such as environmental sanitation, improvement in human and animal living conditions, collection of animal manure and construction waste from the rural environment and separation of human and livestock living places can reduce abundance of CL carriers [7]. Most families participating in the study discard excess water and sludge (all wastewater generated in households without fecal contamination) on the surface of the yard and alley, which gradually penetrates the courtyard, creates a shelter for sand flies and thereby increases the incidence of CL. By implementing new and collaborative-innovative activities such as wastewater treatment systems based on families' needs, the disease can be prevented [17].

Based on this study, 23.43% of patients disposed of waste via dumping, which requires serious intervention in order to control vector sand fly. Easy preparation and low cost waste bags and bins for a proper daily waste collection by families for sanitary landfill disposal in a remote area are required [19, 20]. Factors such as accumulation of waste, construction waste around habitat, accumulation of sludge on the grounds of residential properties as well as keeping animals and also sandflies in the area can make the disease endemic in the region [17]. Effective fight against rodents, use of personal protection methods such as insecticide-treated nets (usually permethrin), chemical barriers (repellents) and toxic bait are among other ways of controlling the disease [20]. For example, in case of canine Leishmaniasis (CanL) the use of topical pyrethroids (deltamethrin, permethrin, or flumethrin), with or without other insecticides, such as Caneline, one of local-commercial insecticides, was one of the best preventive control measures because of their synergistic effect on insects [13].

There was no meaningful difference in the knowledge structure in relation to other structures in the BASNEF model investigation. These results are consistent with similar studies in this field [21]. The mean of attitude score in participants was low. Increasing knowledge and correcting false beliefs in individuals can be considered as one of the reasons for raising mean score of participant attitude in the study group [19]. The reason for difference in the impact of education on people's attitudes in various studies may be that attitude and practice more than consciousness are usually influenced by various environmental and social factors. Therefore, education and informative programs alone are not able to correct them. Thus, it can be stated that solely increasing knowledge is not enough to improve the attitude [10]. To investigate the relationship between BASNEF model constructs, Pearson correlation and linear regression were used. There was a direct correlation between behavioral constructs (control measures) with intentional behavior, enabling factors, and abstract norms which was statistically meaningful ($P < 0.05$) [22].

The roles of enabling factors and intentional behavior with regression coefficients of 0.179 and 0.177 were the most accurate predictors of CL preventive behaviors, respectively, which is consistent with the results reported by Zhang et al., and other studies regarding the important role of enabling factors and intention to behave in the prediction of control measures [23, 24]. One of the most important factors influencing behavior in any society is the abstract norms (influential individuals). In this study, family members were the most influential people in preventing CL. Therefore, it is necessary to have the highest attention on education of families in order to obtain the best results for these behaviors [10, 21]. In the behavioral structure and behavior that involves control measures, the least frequent preventive behavior was the use of insecticides, the installation of nets and using bed-nets impregnated with insecticide. The reason for this is that most households stated inappropriate economic situation to purchase a net and the improper installation (because some people were living in dwellings and tents). This was confirmed by study of socioeconomic status of people in the earthquake affected areas. To promote this preventive behavior, the need for cooperation and participation of other institutions, such as health centers, is necessary [25, 26]. Regarding the level of preventive behaviors and the importance of factors contributing to these behaviors, provision of enabling factors, especially through educating family members, as the most influential individuals, can be effective in preventing seizures [27].

The availability of financial resources to buy mosquito nets and insecticides had the least effect in enabling factors. Therefore, in this important part of structure, intervention is needed to convert intention to behavior. For example, the purchase of appropriate insecticides or mosquito nets, or their free distribution by health centers in sensitive areas, as well as providing subsidies for the purchase of mosquito nets could improve health status [28]. Measures such as inter-sectoral cooperation and inter-organizational collaboration can somehow be effective in controlling the disease. Providing financial support and equipment by researchers and experts can improve health status and subsequently, to some extent, reduce the burden of the disease [21].

5. Conclusion

In this study, the role of environmental factors and preventive behaviors on cutaneous leishmaniasis for patients who visited the health care centers of earthquake hit cities in Kermanshah province was investigated using the BASNEF model. The results of this study showed that out of 128 participants, 32 cases (25%) were infected by CL and 13 (10.2%) of them had one of their family members infected with CL. This study showed that the educational program based on the BASNEF model has all the necessary aspects for changing the behavior and stabilizing it. In this model the presence of attitudes, abstract norms, and enabling factors makes educational programs more effective. Considering the results of the study and the adverse effects of the disease, it is recommended that suitable programs for educating people as well as measures to improve the environmental condition should be taken into higher consideration by the authorities.

Abbreviations

CL	cutaneous leishmaniosis
VL	visceral leishmaniasis
L. tropica	leishmania tropica
BASNEF	awareness, attitude, abstract norms, enabling factors, and behavior
WHO	world health organization

Declarations

Ethics declarations

Ethics approval and consent to participate

Ethics approval was obtained from the University of Alberta's Health Research Ethics Board (Etic code # IR.KUMS.REC.1398.1047).

Consent for publication

Not applicable.

Availability of data and material

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Anvar Asadi conceived the study, its protocols, received ethics approval and funding. Mozghan Irandost and Meghdad Pirsahab actively contributed to the study design. Mozghan Irandost, Behzad Mahaki, Mojtaba Salimi and Fakhradin Chaboksavar led the qualitative research design, data collection, and data analysis. All authors read and approved the final manuscript.

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Tables

Table 1

Variables	Type	Number of questions
Awareness		4
Attitude structure	Behavioral beliefs	3
	Outcome evaluation	3
Abstract norms	Normative beliefs	4
	Amount of motivation for follow up	4
Behavioral intention		8
Enabling factors		5
Behavioral structure	Control measures	5

Table 2

Variable	Mean \pm SD	Mean percentage of total score
Awareness	5.65 \pm 2.35	47.083
Attitude	8.50 \pm 2.68	28.33
Abstract Norms	14.85 \pm 5.87	37.12
Intentional Behavior	15.27 \pm 6.42	38.52
Enabling factors	9.86 \pm 4.47	39.44
Behavior	9.65 \pm 6.20	38.6

Table 3

Variable	Answer	Frequency	Percent
Proper waste collection	very much	88	68.8
	much	17	13.3
	medium	14	10.9
	low	3	2.3
	Very low	4	3.1
Using pesticide in habitat	very much	63	49.2
	much	35	27.3
	medium	19	14.8
	low	8	6.3
	Very low	2	1.6
Installing door and window screens to prevent sand fly entry	very much	68	53
	much	30	23.4
	medium	14	10.9
	low	7	5.5
	Very low	8	3.6
Seeking medical services	very much	74	57.8
	much	27	21.1
	medium	9	7
	low	6	4.7
	Very low	11	8.6
Lesion care and dressing in case of disease	very much	75	58.6
	much	24	18.8
	medium	11	8.6
	low	5	3.9
	Very low	13	10.2

Table 4

BASNEF component	Attitude	Abstract norms	Intentional behavior	Enabling factors	Behavior
Attitude	1	r=0.175 p=0.049			
Abstract norms		1	r=0.35 p=0.001	r=0.290 p=0.001	r=0.271 p=0.033
Intentional behavior	r=0.175 p=0.001	r=0.382 p=0.002	1	r=0.271 p=0.001	r=0.320 p=0.049
Enabling factor		r=0.290 p=0.001	r=0.32 p=0.001	1	r=0.265 p=0.002
Behavior		r=0.183 p=0.03	r=0.271 p=0.002	r=0.265 p=0.002	1

Table 5

BASNEF variable	Regression coefficient	standard error	significance level	t
Behavior		2.479	0.010	2.627
Attitude	-0.094	0.207	0.283	-1.078
Intentional Behavior	0.177	0.091	0.064	1.868
Abstract norms	0.068	0.102	0.472	0.726
Enabling factors	0.197	0.130	0.033	2.156

Figures

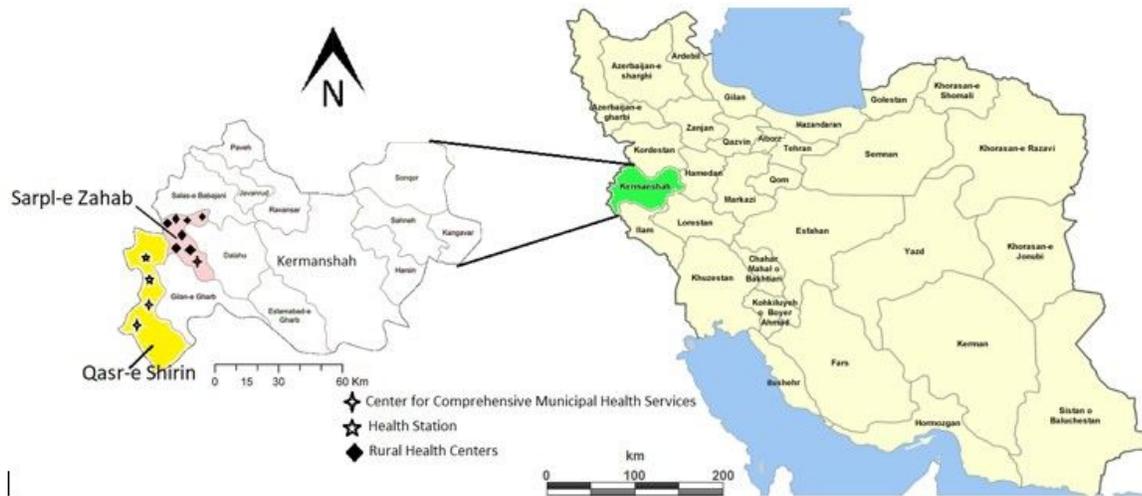


Fig. 1

Figure 1

Location of Qasr-Shirin and Sarpol-Zahab cities in Kermanshah province and their positions in Iran along with sampling points.