JOURNAL OF HEALTH AND SOCIAL SCIENCES

Journal of Health and Social Sciences (JHSS)
The Italian Journal for Interdisciplinary Health and Social Development *EDIZIONI FS Publishers*

Original Article in Infectious Diseases and Disaster Emergency

Effect of environmental conditions and preventive behaviors on cutaneous leishmaniasis from the earthquake that hit cities in Western Iran in 2021: A cross-sectional study

Fakhreddin CHABOKSAVAR[1], Arash ZIAPOUR[2], Mozhgan IRANDOST[3], Behzad MAHAKI[4], Francesco CHIRICO[5], Murat YILDIRIM[6], Gabriella NUCERA[7], Lukasz SZARPAK[8], Nicola BRAGAZZI[9], Anvar ASADI[10]

Affiliations:
[1]*Nursing Care Research Center, Health Research Institute, Babol University of Medical Sciences, Babol, I.R. Iran. Email: fchaboksavar@yahoo.com.* ***ORCID:*** *0000-0003-4285-3178.*
[2]*Cardiovascular Research Center, Health Institute, Imam-Ali hospital, Kermanshah University of Medical Sciences, Kermanshah, Iran. Email: arashziapour@gmail.com.* ***ORCID:*** *0000-0001-8687-7484.*
[3]*Research Center for Environmental Determinants of Health, Health Institute, Kermanshah University of Medical Sciences, Iran. Email: mirandoost@gmail.com.*
[4]*Department of Biostatistics, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran. Email: behzadmahaki@gmail.com.* ***ORCID:*** *0000-0001-7062-6971.*
[5]*Post-Graduate School of Occupational Health, Università Cattolica del Sacro Cuore, Rome, Italy. Health Service Department, Italian State Police, Ministry of the Interior, Milan, Italy. Email: francesco.chirico@unicatt.it;* ***ORCID:*** *0000-0002-8737-4368.*
[6]*Department of Psychology, Ağrı İbrahim Çeçen University, Turkey, E-mail: muratyildirim@agri.edu.tr.* ***ORCID:*** *0000-0003-1089-1380.*
[7]*Department of Emergency, Fatebenefratelli Hospital, ASST Fatebenefratelli and Sacco, Milan, Italy. E-mail: gabriellanucera@gmail,com.* ***ORCID:*** *0000-0003-1425-0046.*
[8] *Institute of Outcomes Research, Maria Sklodowska-Curie Medical Academy, Warsaw, Poland. Maria Sklodowska-Curie Bialystok Oncology Center, Bialystok, Poland. Henry JN Taub Department of Emergency Medicine, Baylor College of Medicine Houston, Houston, TX, United States. E-mail: lukasz.szarpak@gmail.com.* ***ORCID****: 0000-0002-0973-5455.*
[9] *Laboratory for Industrial and Applied Mathematics (LIAM), Department of Mathematics and Statistics, York University, Toronto ON, Canada. E-mail: bragazzi@yorku.ca.* ***ORCID:*** *0000-0001-8409-868X.*
[10]*Zoonoses Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran. Department of Environmental Health Engineering, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran. Email: anvarasadi@sbmu.ac.ir.* ***ORCID:*** *0000-0002-5714-0878.*

****Corresponding Author:***
Anvar Asadi, Zoonoses Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran and Department of Environmental Health Engineering, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran. Email: anvarasadi@sbmu.ac.ir.

Abstract

Introduction: To investigate 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 were referred to the health care centers of cities hit by earthquakes, including Sarpol-Zahab and Qasr-Shirin located in Kermanshah province, Western Iran, in 2021.

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

Results*:* Approximately 89.1% of the individuals used urban water supply networks, while 68% of the participants had access to the wastewater collection system. The most influential people in preventive behaviors (control actions) were family members (72.4%). Pearson's correlation test showed that preventive behaviors positively correlated with understudy variables in the BASNEF model ($p<0.001$). Finally, enabling factors and behavioral intention were the most accurate predictors of preventive behaviors against CL.

Conclusion: A combination of environmental, ecological conditions, and behavioral and sanitation factors may influence the distribution of causes of CL. Therefore, control programs should focus on villages and cities with high disease risks.

Take-home message: A combination of environmental, ecological conditions, and behavioral and sanitation factors may influence the distribution of causes of cutaneous leishmaniasis in patients who were referred to the health care centers of cities hit by earthquakes, in Western Iran, in 2021.

Keywords: BASNEF model; control; preventive behaviors; environmental sanitation; leishmania

Cite this paper as: Chaboksavar F, Ziapour A, Irandost M, Mahaki B, Chirico F, Yildirim M, Nucera G, Szarpak L, Bragazzi N, Asadi A. Effect of environmental conditions and preventive behaviors on cutaneous leishmaniasis from the earthquake that hit cities in Western Iran in 2021: A cross-sectional study. J Health Soc Sci. 2023;8(2):132-141. Doi: 10.19204/2023/FFCT5.

Received: 10 February 2023; Accepted: 15 March 2023; Published: 15 June 2023

INTRODUCTION

Leishmaniasis is a tropical zoonotic disease endemic in Iran that the World Health Organization (WHO) has recommended a study [1]. The burden of leishmaniases is vital due to 100 countries being at risk with a population of 350 million. About 500,000 new visceral leishmaniases (VL) cases and 1 to 1.5 million cases of cutaneous leishmaniasis (CL) occur annually [2]. The most common types are CL, mucosal leishmaniasis, and VL. Leishmania is the etiological agent of leishmaniasis and is a parasite of the family Trypanosomatidae. The bite of phlebotomine sand flies: Phlebotomus (Diptera, Psychodidae) and Lutzomyia transmit the parasite [3]. In Iran, Leishmania major and Leishmania tropica cause zoonotic (ZCL) and anthroponotic CL, respectively. Both are endemic in 18 out of 31 provinces, with an average of 20,000 official cases yearly [4].

Cutaneous leishmaniosis 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. The disease is not dangerous but causes high health costs for several reasons, such as prolonged periods of ulceration, ugly scars, and secondary infections, and requires different treatments [5]. Iranian national plans treat CL as a severe problem and aim to eradicate this disease [6]

It is necessary to combine various methods and techniques to prevent and contain CL, such as rodent control, environmental sanitation (improvement in housing and sewage disposal), environmental health measures, and implementation of health education programs [5,6]. Environmental health measures include actions to reduce the carrier population and human exposure through interventions in their place of residence [3]. After a careful ecological study of the location and environmental impact assessment, it should be possible to take environmental health measures. 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 effective measure is to reduce the proliferation of sand flies, *Phlebotomus papatasi*, and eliminate possible shelters [6]. Other actions include the extinction of sand fly breeding sites, such as demolition and construction of waste sites, and environmental management, including local sanitation and improved housing. Some of these programs include applying poisonous rodenticide bait, completing half-constructed buildings, using personal protective equipment to avoid sandflies, and keeping livestock away from human residences [3,5].

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 and focused management planning on the awareness and attitude of residents should be conducted [7].

One of the most critical steps in management planning is selecting the model or the theory based on the conditions in which the problem is identified and program goals are aligned. 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 [8]. Based on this model, a person will take preventive measures to refrain from the onset of diseases. Therefore, money, time, resources, and skills that make preventive behaviors more feasible or easier (enabling factors), should be available [1,7]. Natural disasters such as earthquakes, storms, and floods create a suitable environment for the propagation of sandflies [10]. Since November 2017 earthquake, the frequency of residents visiting health centers has gradually increased in the earthquake-hit cities of Qasr-Shirin and Sarpol-Zahab. No comprehensive studies have been done on the status of CL in these cities since the recent earthquake. Besides, regional authorities consider the control and prevention of CL as a target for further investigation. Considering the different environmental and behavioral conditions in Qasr-Shirin and Sarpol-Zahab following the earthquake and its effect on disease prevalence, a study of CL, its control, and prevention methods is necessary. This study investigates the role of preventive behaviors and environmental factors on CL using the BASNEF model through a modified questionnaire whose validity and reliability were confirmed [9].

METHODS

Study design and participants

Qasr-Shirin and Sarpol-Zahab are two cities in Kermanshah province, located in western Iran (Figure 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 from 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 and have temperate winters and hot, dry summers.

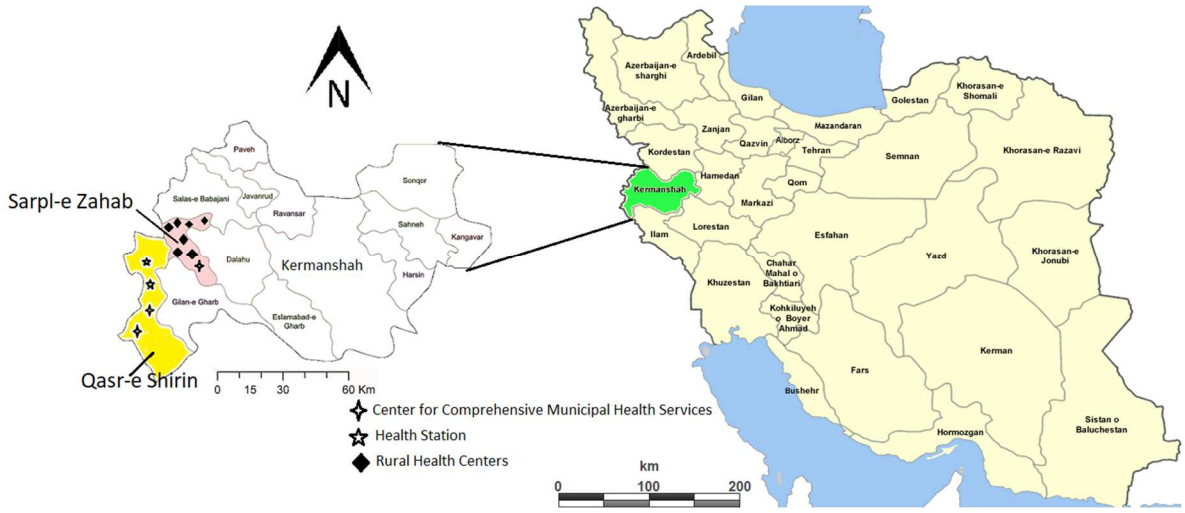

Figure 1. Location of Qasr-Shirin and Sarpol-Zahab cities in Kermanshah province and their positions in Iran, along with sampling points.

Data collection

A descriptive cross-sectional study was performed based on the BASNEF model on patients. This study covered all healthcare centers in both cities, including seven rural health centers, one comprehensive urban health center in Sarpol-Zahab, two small health centers, and two comprehensive health centers in Qasr-Shirin. The purpose of the study was explained to all participants. Written informed consent was obtained from all participants, and they were assured of

anonymity and confidentiality. A simple random sampling method was used so that the BASNEF standard questionnaires were given to individuals and asked to complete the structured questionnaire. It includes 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 (Table 1).

Table 1. Type and number of questions for each variable in the BASNEF standard questionnaire.

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

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 (i.e., "strongly agree", "agree", "undecided", "disagree", and "strongly disagree"). Structural questions about attitude (outcomes evaluation) were similarly couched with a Likert-typed structure and variables of "very important", "important", "moderately important", "little important", and "unimportant". The abstract norms questions (normative beliefs) and motivation used the following terms: very frequently, frequently, occasionally, rarely, and never.

Structural questions about enabling factors and the behavioral structure (control measures) were designed similarly, moving from "very high" to "medium", "low", and "very low". The validity and reliability of this questionnaire were averred by Ghodsi et al [9], 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. Based on the mean and standard deviation of the BASNEF structure (awareness, attitude, abstract norms, enabling factors, and behavior), the sample size was 128. It was calculated by using similar studies and the Cochran sample size formula.

Statistical analysis

Data was collected through questionnaires, analyzed in the SPSS software (Version 16; SPSS Inc., Chicago IL), and, through descriptive statistical analysis, the score of the model components and the demographic and environmental status were determined. Analytical and statistical tests such as ANOVA, regression, and Pearson correlation coefficient obtained the correlation between the BASNEF model components (awareness and attitude, for instance) and preventive behaviors on CL (control measures).

RESULTS

Analysis of the demographic data showed that the male-to-female ratio was approximately equal to one. People between 20 and 29 were the most frequent age group (36.7%). 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%).

Considering the analysis of environmental condition data: 20.3% of the sample population lived in newly built apartments, 16.4% in temporary residences, 14.8% in villas, 11.7% in old apartments, and 7% in tents. Regarding residential livestock, 87.5% of the population did not keep any. 68% of the sample area had municipal sewage collection networks, 22.7% of the population discharged their wastewater into absorbent wells or nearby pits, and 8.6% used non-sanitary disposal in the environment. The drinking water situation showed that 89.1% of the population used the urban water supply, and 9.4% used tank trucks. Regarding solid waste, about 67.2% used a sanitary landfill collected daily, 23.4% was dumped, and 9.4% burned. Regarding the residential area, 64.1% lived in the city's center.

Analysis of the BASNEF model data on the disease status of the sample group of patients showed that of the 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 family members affected by the disease. In Table 2, the mean and standard deviation of the BASNEF model is presented in preventive behaviors (control measures) of the disease. According to these data, the highest score of subjects in preventive behaviors (control measures) on CL disease was related to the awareness component (47.08%) and the lowest (28.33%) to attitude structure.

Table 2. Mean and standard deviation of model structures BASNEF in preventive behaviors (measures) against leishmaniasis.

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

Analysis of the participants' knowledge data revealed that 39% believed the disease was contagious, and 78% believed that the disease was preventable. Furthermore, approximately 82% of the participants believed that cutaneous leishmaniosis was treatable, and 79% stated that sandflies transmit it. Data analysis of attitude questions (behavioral beliefs) concerning the prevention of CL showed that 67% of participants agreed that Leishmania would not have infected them if they had followed the preventive measures. About 60.9% of participants admitted that the risk of CL would be reduced if they improved their practice of preventive behaviors, and 58.6% of participants admitted that they would avoid the appearance of diseases in the body if they adopted preventive measures. Approximately 86% of respondents in this study who answered the attitude questions (outcome assessment) stated that it is vital for them not to get infected by this pathogen. More than 80% of the participants stated that preventing ulcerative lesions is very important. In addition, 71.9% indicated that it is essential for them not to have the stress of being infected.

Regarding the participants' response to questions about abstract norms constructs (normative beliefs) related to CL prevention, it revealed that the most influential people in preventive behaviors (control measures) were family members (72.4%), health professionals (68.8%), and the least effective 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 were other people. Regarding instructive behavioral intention questions related to the prevention of CL, the most prevalent behavior was the referral to the doctor (62.5%) if there were suspected cases of CL. The least likely intention was to apply insecticides to remove sandflies from the home (50.8%).

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

Table 3. Frequency distribution of participants' answers to the behavioral structure questions (control measures) concerning leishmaniasis prevention.

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 pesticides 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 sandfly 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

The frequency of distribution of participants in questions of structure on factors that contribute to disease prevention revealed that, among the facilitating factors, access to health personnel to learn disease prevention methods (64.1%) is the priority. The second is the availability of funds to purchase bed nets, repellents, insecticides (41.4%), and access to a dermatologist (37.5%).

Table 4 shows the correlation between the 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) should be improved.

Table 4. Correlation matrix coefficient between preventive behaviors (Controls) and BASNEF model structures concerning leishmaniasis.

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 shows data analysis based on a linear regression model. Moreover, it shows a positive relationship between behavioral structure (control measures) as an independent variable and attitude, gender, abstract norms, and enabling factors as dependent variables. The model was significantly viable ($P>0.05$). As the standard deviation in control measures increases, the score for intentional behavior, abstract norms, and enabling factors increases. Among the components of the BASNEF model, the most substantial predicting factor with regression coefficient ($\beta=0.179$) was the facilitating factors and then the intentional behavioral structure with regression coefficient ($\beta=177.7$). From the BASNEF model, the facilitating factors (19%) and deliberate behavior (17%) predict control measures for preventing CL.

Table 5. Results of preventive behaviors (controls) and BASNEF model components concerning leishmaniasis based on a linear regression model.

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

DISCUSSION

Considering the effectiveness of the 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: the precede and the behavioral intentional, and studies behavior, determines influential factors in behavior, and facilitates behavior alteration [10]. The transmission of CL is highly dependent on climate conditions and the ecology of vector/reservoir hosts [11]. The level of education has an essential and undeniable effect on the health of individuals, which has been emphasized in several studies [12]. Families' Specific characteristics, such as education level and income, influence their perceptions of illness, severity, treatment, health status, and health services [13].

Environmental factors (such as unacceptable 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 may be the cause of the spread of CL in tropical regions [14]. Furthermore, economic situation or social factors and climate variability may substantially affect the epidemiology of CL. Given CL control, ecological and environmental factors that disseminate the disease and thus improve preventive and control measures are of utmost importance [15, 16]. Regarding society's economic situation, the highest income was between 10 and 30 million Rial. Leishmaniasis occurs more often in poor economic and social conditions because poverty often contributes to low environmental conditions (lack of sewage and waste disposal systems), which increase the potential of contagious diseases [17,18]. Discharging sewage and animal waste in villages provides a suitable environment for propagating sand flies and accumulating 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 the abundance of CL carriers [6]. 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 increases the incidence of CL. Implementing new collaborative-innovative activities, such as wastewater treatment systems based on families' needs, can prevent the disease [17].

In this study, 23.43% of patients disposed of waste via dumping, which requires serious intervention to control vector sandflies. Easy preparation and low-cost waste bags and bins for proper daily waste collection by families for sanitary landfill disposal in remote areas are required [19,20]. Factors such as accumulation of waste, construction waste around the habitat, accumulation of sludge on the grounds of residential properties, and keeping animals and sand flies in the area may 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 the case of canine leishmaniasis (CanL), the use of topical pyrethroids (deltamethrin, permethrin, or flumethrin), with or without other insecticides, such as Caneline, one of the 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 concerning other structures in the BASNEF model investigation. These results are consistent with similar studies in this field [21]. The mean attitude score of participants was low. Increasing knowledge and correcting false beliefs in individuals can be considered one reason for raising the mean score of participant attitude in the study group [19]. The difference in the impact of education on people's attitudes in various studies

shows that attitude and practice, more than consciousness, are usually influenced by multiple environmental and social factors. Therefore, education and informative programs alone are not able to correct them. Thus, it can be stated that increasing knowledge is insufficient to improve the attitude [9]. Pearson correlation and linear regression investigated the relationship between BASNEF model constructs. 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 vital role of enabling factors and intention to behave in the prediction of control measures [23, 24]. One of the most critical factors influencing behavior in any society is the abstract norms (influential individuals). In this study, family members were the most significant in preventing CL. Therefore, focusing on families' education is necessary to obtain the best results for these behaviors [9, 21]. In the behavioral structure and behavior involving control measures, the least frequent preventive behavior was using insecticides, installing nets, and using bed nets impregnated with insecticide because most households stated inappropriately in an economic situation to purchase a net and the improper installation (because some people were living in dwellings and tents). This was confirmed by a study of people's socioeconomic status in earthquake-affected areas. To promote this preventive behavior, cooperation, and participation of other institutions, such as health centers, are necessary [25,26]. Regarding the level of preventive behaviors and the importance of factors contributing to these behaviors, providing enabling factors, primarily through educating family members as the most influential individuals, can effectively prevent seizures [27].

The availability of financial resources to buy mosquito nets and insecticides had the slightest effect on enabling factors. Therefore, intervention is needed to convert the intention to behave in this vital part of the structure. For example, purchasing appropriate insecticides or mosquito nets, free distribution by health centers in sensitive areas, and providing subsidies for mosquito nets could improve health status [28]. Measures such as inter-sectoral cooperation and inter-organizational collaboration can somehow effectively control 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].

CONCLUSION

Our research investigated 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 using the BASNEF model. Our study showed that out of 128 participants, 32 (25%) were infected by CL, and 13 (10.2%) 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 and stabilizing behavior. In this model, educational programs are most effective through attitudes, abstract norms, and enabling factors. Through the results demonstrated in this study and the adverse effects of the disease, it is recommended that the authorities consider educational programs for the population and measures that improve the environmental condition.

Author Contributions: Conceptualization: FC, AZ and MI. Methodology: BM, AA Validation: BM, AA. Formal analysis: BM, AA, MS, and MI. Investigation: FC, MS and AZ Resources: AZ. Data curation: BM and AA. Writing-original draft preparation: AZ, FC, MS. Review & Editing: FC, LS, NB, GN. Supervision: AZ, FC.

Funding: the authors gratefully acknowledge the Research Council of Kermanshah University of Medical Sciences (Grant Number: 980932) for the financial assistance.

Institutional Review Board Statement: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Kermanshah University Medical Sciences Ethics Committee under number IR.KUMS.REC.1398.1047. All participants were informed about the study, and only those providing written informed consent were enrolled in the study.

Informed Consent Statement: All participants provided informed written consent.
Acknowledgments: None.
Conflicts of Interest: The authors declare no conflict of interest. The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request. This paper has been posted as preprint on Researchsquare and is available from: https://www.researchsquare.com/article/rs-13999/v1 (doi: https://doi.org/10.21203/rs.2.23431/v1).
Publisher's Note: Edizioni FS stays neutral with regard to jurisdictional claims in published maps and institutional affiliation.

References

1. Ponrovsky E, Strelkova M, Zavoikin V, Tumolskaya N, Mazmanyan M, Baranets M, et al. The epidemiological situation of leishmaniasis in the Russian Federation: the first valid cases of local transmission. Med Parazitol I Parazitarnye Bolezni. 2015(3):3-7.
2. Desjeux P. Leishmaniasis: current situation and new perspectives. Com Immunol Microbiol Infect Dis. 2004;27(5):305-318.
3. Mohebali M, Javadian E, Yaghoobi Ershadi M, Akhavan A, Hajjaran H, Abaei M. Characterization of Leishmania infection in rodents from endemic areas of the Islamic Republic of Iran. East Mediterr Health J. 2004 Jul-Sep;10(4-5):591-599.
4. Askari A, Sharifi I, Aflatoonian MR, Babaei Z, Ghasemi Nejad Almani P, Mohammadi MA, et al. A newly emerged focus of zoonotic cutaneous leishmaniasis in South-western Iran. Microb Pathog.. 2018;121:363-368.
5. World Health Organization. Report of a meeting of the WHO Expert Committee on the Control of Leishmaniases, Geneva, Switzerland, 22-26 March 2010. WHO Technical Report Series. 2010(949): 1-6.
6. Brockerhoff M, Derose LF. Child survival in East Africa: The impact of preventive health care. World Dev. 1996;24(12):1841-1857.
7. Freitas-Junior LH, Chatelain E, Kim HA, Siqueira-Neto JL. Visceral leishmaniasis treatment: what do we have, what do we need and how to deliver it? Int J Parasitol Drugs Drug Resist. 2012; 2:11-19.
8. Saghafipour A, Mirheydari M, Abolkheirian S, Arsang Jang S. Effectiveness of Educational Intervention Based on BASNEF Model to Promote Preventive Behaviors of Cutaneous Leishmaniasis among Students in Qom Province. J Health. 2017;8(2):170-181.
9. Ghodsi M, Mehri A, Joveyni H, Rakhshani MH. Development and Psychometric of Assessment Tool of Students' Preventive Behaviors of Cutaneous Leishmaniosis Based on BASNEF Model. J Neyshabur Univ Med Sci. 2017;5(2):32-46.
10. Hazavehei SMM, Heshmati H, Hasanzadeh A, Pourmazar SA, Maghsoodlou D. The Effect of Volunteer Health Workers Educational Program on the Basis of BASNEF Model on Promotion of Their Practices about Cutaneous Leishmaniasis. Zahedan J Res Med Sci. 2014;16(5):16-21.
11. Rostami MN, Saghafipour A, Vesali E. A newly emerged cutaneous leishmaniasis focus in central Iran. Int J Infect Diseases. 2013;17(12):e1198-e206.
12. Jayrvnd AA, Vaziri F. Epidemiology of cutaneous leishmaniasis in the city of Hawizeh in 2014-2015. J Health Field. 2017;4(3).
13. Ribeiro RR, Michalick MSM, da Silva ME, dos Santos CCP, Frézard FJG, da Silva SM. Canine Leishmaniasis: An Overview of the Current Status and Strategies for Control. BioMed Res Int. 2018;2018:1-13.
14. Schlein Y, Jacobson RL, Müller GC. Sand fly feeding on noxious plants: a potential method for the control of leishmaniasis. Am J Trop Med Hygiene. 2001;65(4):300-303.
15. Cardenas R, Sandoval CM, Rodriguez-Morales AJ, Franco-Paredes C. Impact of climate variability in the occurrence of leishmaniasis in northeastern Colombia. Am J Trop Med Hyg. 2006;75(2):273-277.
16. Jacobson RL. Leishmania tropica (Kinetoplastida: Trypanosomatidae)-a perplexing parasite. Folia Parasitol. 2003;50(4):241-250.
17. Judith Ann Allender, Spradley BW. Community Health Nursing: Promoting and Protecting the Public's Health (Community Health Nursing (Allender)). North American LWW; Sixth edition; 2004.
18. Dora Feliciangeli M, Mazzarri MB, Campbell-Lendrum D, Maroli M, Maingon R. Cutaneous leishmaniasis vector control perspectives using lambdacyhalothrin residual house spraying in El Ingenio, Miranda State, Venezuela. Transac Royal Soc Trop Med Hyg. 2003;97(6):641-646.
19. Gurel MS, Ulukanligil M, Ozbilge H. Cutaneous leishmaniasis in Sanliurfa: epidemiologic and clinical features of the last four years (1997–2000). Int J Dermatol. 2002;41(1):32-37.

20. Maran N, Gomes PS, Freire-de-Lima L, Freitas EO, Freire-de-Lima CG, Morrot A. Host resistance to visceral leishmaniasis: prevalence and prevention. Expert Rev Anti Infect Ther. 2016;14(4):435-442.
21. Tolossa D, Medhin G, Legesse M. Community knowledge, attitude, and practices towards tuberculosis in Shinile town, Somali regional state, eastern Ethiopia: a cross-sectional study. BMC Public Health. 2014;14(1):804.
22. Heshmati H, Rahaei Z, Hazavehei S, Dehnadi A, Hasanzadeh A. Related factors to educational behaviors of health volunteers about cutaneous leishmaniasis on the basis of BASNEF model in Yazd. J Health. 2010;1(3):48-56.
23. Zhong X, Tanasugarn C, Fisher EB, Krudsood S, Nityasuddhi D. Awareness and practices of self-management and influence factors among individuals with type 2 diabetes in urban community settings in Anhui Province, China. Southeast Asian J Trop Med Public Health. 2011;42(1):184.
24. Kabodi S, Hazavehei MM, Rahimi M, Roshanaei G. Application of BASNEF Model in Analyzing Self-Treatment Behavior among Type 2 Diabetic Patients in 2014. J Educ Community Health. 2015;2(1):38-49.
25. Wolday D, Berhe N, Akuffo H, Desjeux P, Britton S. Emerging Leishmania/HIV co-infection in Africa. Med Microbiol Immunol. 2001;190(1-2):65-67.
26. Jain K, Jain N. Vaccines for visceral leishmaniasis: A review. J Immunol Methods. 2015 Jul;422:1-12. doi: 10.1016/j.jim.2015.03.017
27. Mangesho P, Shayo E, Makunde W, Keto G, Mandara C, Kamugisha M, et al. Community knowledge, attitudes, and practices towards tuberculosis and its treatment inMpwapwa district, central Tanzania. Tanzania J Health Res. 2007;9(1):38-43.
28. Alten B, Caglar S, Kaynas S, Simsek F. Evaluation of protective efficacy of K-OTAB impregnated bednets for cutaneous leishmaniasis control in Southeast Anatolia-Turkey. J Vector Ecol. 2003;28(1):53-64.