RESEARCH

Open Access

Check for updates

Educational WhatsApp-delivered intervention based on social cognitive theory to promote leishmaniosis preventive behavior of health ambassadors: a randomized controlled trial

Monireh Abdollahi[1,2†], Mahmoud Fakhar[1†], Mohammad Tajfard[1,3], Jamshid Jamali[4] and Mehrsadat Mahdizadeh[1,3*]

Abstract

Background Multidimensional strategies can promote preventive behaviors to prevent cutaneous leishmaniosis. WhatsApp, the popular messenger of Iranians, can be used as a platform to provide health education interventions. This study aimed to investigate the effect of using an educational intervention in WhatsApp based on social cognitive theory (SCT) on the preventive behaviors of health ambassadors.

Methods A randomized clinical trial was conducted from September 2020 to April 2021 on 220 people living in endemic areas of leishmaniosis in Mashhad Province, Iran. By the cluster method sampling, the samples were randomly divided into two intervention and control groups. The intervention was performed for the intervention group over two weeks. Data were collected using a researcher-made questionnaire based on the constructs of SCT before and after the intervention. SPSS 16 was implemented to test multiple statistical analyses.

Results Findings from the intervention group compared with the control group showed that the scores of SCT constructs and preventive behaviors were significantly changed ($P < 0.001$) across time during baseline through follow-up. These changes were not significant in the control group.

Conclusions The educational intervention based on the SCT model to promote leishmaniosis preventive behaviors is effective. This intervention module can be tested in other targeted populations in endemic areas to prevent and control leishmaniosis.

Trial registration Iranian Registry of Clinical Trials Registry IRCT20200615047784N1, registered 02/09/2020.

Keywords Health care, Public health, Health promotion

†Monireh Abdollahi and Mahmoud Fakhar contributed equally to this work.

*Correspondence:
Mehrsadat Mahdizadeh
Mahdizadehtm@mums.ac.ir
1Department of Health Education and Health Promotion, School of Health, Mashhad University of Medical Sciences, Mashhad, Iran

2Student Research Committee, Mashhad University of Medical Sciences, Mashhad, Iran
3Social Determinants of Health Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
4Department of Biostatistics, School of Health, Mashhad University of Medical Sciences, Mashhad, Iran

Background

Leishmaniosis is a widespread disease that affects both humans and animals. It is prevalent in various regions around the world, including Africa, the Americas, and Asia. Approximately 350 million people are at risk of contracting leishmaniosis globally [1–3]. According to the World Health Organization (WHO), 92 and 83 countries or territories are considered endemic for cutaneous and visceral leishmaniosis, respectively [4]. Approximately one million new cases of cutaneous leishmaniosis occur annually [5]. Most cases of cutaneous leishmaniosis occur in Afghanistan, Brazil, Algeria, Colombia, Saudi Arabia, Pakistan, Syria, and Peru [6]. Iran is one of the most important regions where cutaneous leishmaniosis is observed in two common forms between humans and animals [6].

Although the death rate caused by leishmaniosis is low, this disease can lead to persistent wounds that take a long time to heal. It causes discomfort and significantly impacts the quality of life of individuals affected by the disease [7]. Due to the lack of success in vaccine production to prevent parasitic diseases such as leishmaniosis and their high prevalence, the WHO introduced health education as one of the most important elements of preventing these diseases [8]. Studies have shown that the behavior, knowledge, and attitudes of people are not suitable for the prevention of leishmaniosis [9–11].

Educational interventions based on empowering factors, which can be individual, interpersonal, and organizational factors, play a vital role in promoting preventive behaviors and controlling leishmaniosis [12]. Social cognitive theory (SCT) is a behavior change model that explains human behavior based on triangular causality derived from behavioral, environmental, and personal factors [9].

Considering that leishmaniosis is affected by individual, interpersonal, and environmental factors, applying SCT as a theoretical framework for intervention seems logical [13]. This theory emphasizes the dynamic interaction between people, their behavior, and their environment [14].

SCT is an interpersonal theory that emphasizes the dynamic interplay among personal factors, the environment, and behavior. The theory considers the influence of environmental factors, cognitive factors, and behavioral factors on each other, a concept known as reciprocal determinism. Environmental factors are seen as physically external to the person and provide opportunities and social support, including social factors such as family, friends, and observational learning, as well as physical factors such as weather and the availability of certain products [14]. The main constructs of SCT that are relevant to behavior change include behavioral ability (knowledge and skill), outcome expectancy (prediction of possible outcomes of a behavior), outcome evaluation (the value a person places on the possible outcomes of a particular behavior), observational learning, environment (the family or physical or social conditions surrounding the person), self-efficacy (confidence in one's ability to pursue one's behavior), and self-control (setting goals and planning for their chosen behaviors) [15].

Training using appropriate and modern methods can be more effective in improving the health community. Web-based educational interventions can be used to promote healthy lifestyles. Among web-based interventions, virtual social networks are considered a potential tool for health education [16]. Studies show that people can easily obtain health information related to a healthy lifestyle through Web-based interventions, such as social media platforms [17, 18].

WhatsApp is indeed one of the most downloaded programs in the world and is also very popular among Iranian users [19]. Interventions using WhatsApp are more attractive because users do not need to learn and adapt to new tools for interventions and install any additional programs on their phones. Additionally, users can freely send feedback and reminders without the need for additional time and effort. This makes it convenient for users to stay engaged with the intervention. A previous pilot randomized controlled trial (RCT) conducted in Malaysia used WhatsApp as an intervention to increase Pap smear performance in postpartum women. The study found that a three-month intervention via WhatsApp increased self-reported performance [20]. Additionally, an intervention in 2017 showed that education through WhatsApp is effective in increasing physical activity and controlling high blood pressure in adults and the elderly [21].

The health ambassador's project was developed by the health education and promotion department of the Iranian Ministry of Health with a peer education approach. Health ambassadors in this program are people interested in participating in programs to promote physical, mental, social, and spiritual health. They receive voluntary training and use what they have learned to care for their health, family members, and society. They act as an interface between the health care system and the community to develop community health [22, 23]. Employing health ambassadors in health programs can impact the community by improving the effectiveness, quality, and impact of health programs, as well as strengthening the responsibility of families towards the health systems of the national community [24]. According to the mentioned study, education based on the SCT model through virtual social networks, such as WhatsApp Messenger, can empower individuals to make informed decisions and engage in preventive behaviors, ultimately improving the health of society.

Health ambassadors play a crucial role in promoting healthy behaviors by identifying risk factors and educating individuals. They are a key group for improving health literacy and lifestyles. However, existing studies are limited in providing actionable insights for policymakers. This study aimed to investigate the effect of educational intervention based on the Social Cognitive Theory (SCT) model using WhatsApp messenger for health ambassadors. The goal is to enhance their ability to promote healthy behaviors and improve health literacy among their families.

Methods

Study design and participants

This randomized controlled trial was conducted from September 2020 to April 2021 on 110 health ambassadors and 110 of their family members in the rural areas of Mashhad, Iran. The study was conducted and reported according to the Consolidated Standards of Reporting Trials (CONSORT) [25], (Additional file 1).

Based on Monfared's study [26], the mean difference formula, a confidence interval of 95% ($\alpha=0.05$), and a test power of 80% estimated the minimum sample size required for each group to be 47. By accounting a 10% sample dropout rate, 55 individuals selected for each group.

$$n = \frac{\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2 \left(\sigma_1^2 + \sigma_2^2\right)}{\left(\mu_2 - \mu_1\right)^2} = \frac{(1.96 + 0.84)^2 (12.4 + 7.5)}{(94.5 - 88.5)^2} = 47$$

Randomization and recruitment

One of the five health care service centers of Mashhad city was selected by cluster sampling method. This selected city health center is home to 42 health houses. Within these 42 health centers, a total of 25,848 health ambassadors are actively engaged. To conduct a study, the health houses were categorized based on similar housing conditions, income levels, and access to social and support resources. Subsequently, one health house was randomly assigned to the intervention group and another to the control group. Both selected health houses have more than 55 health ambassadors. From the list of health ambassadors in each health house, 55 health ambassadors were randomly selected based on eligibility criteria. Following this selection, each health ambassador's role in disseminating information to their families was considered, leading to the selection of a family member from each ambassador's family. This method ensures that through the training of health ambassadors in the intervention group, indirect training is also provided for their family members. Also, constant follow-up from the researcher was conducted to ensure that none of the samples were excluded from the study.

The inclusion criteria were as follows: Completing the health ambassador form, being over 15 years of age, not having cognitive disorders, having and being able to use a smartphone, participating in training classes, and voluntary agreement to participate in the research. Participants who did not complete the questionnaires and educational sessions were excluded from the study. The study flow is illustrated in Fig. 1.
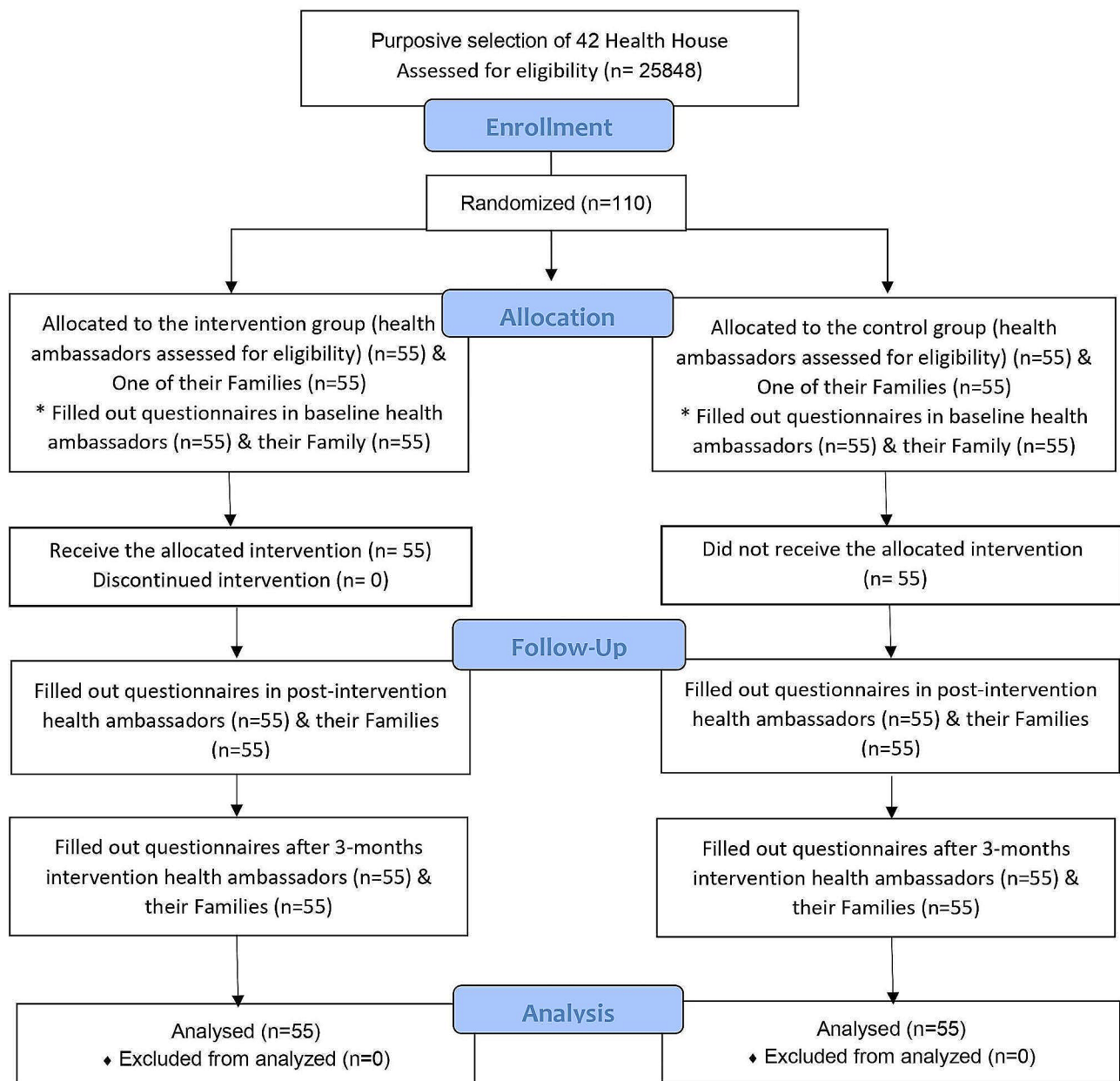
Data gathering tool

After presenting and elucidating the study's goals, the participants proceeded to fill out the questionnaires. Data was collected using a self-administered multidimensional questionnaire like demographic information and items related to SCT constructs, and leishmaniosis preventive behaviors. Demographic items include age, gender, marital status, occupation status, education level, family income level, housing status of ambassadors, and their family members.

The SCT questionnaire included 37 items with 9 constructs, which were evaluated on a Likert scale (strongly agree to completely disagree), except for the awareness construct. The scoring system for the questions in the knowledge section is based on the participants' responses to each item, with a maximum score of 3 points for a correct answer, 2 points for an "I don't know" response, and 1 point for no response. The constructs of the SCT questionnaire include awareness (7 items), outcome expectation (5 items), outcome value (3 items), Task self-efficacy (3 items), self-efficacy to overcome obstacles (3 items), environment (3 items), situational understanding (4 items), self-control (4 items) and emotional adaptation (5 items).

The validity and reliability of the SCT questionnaire were measured in the study. The content validity of the questionnaire was assessed using the content validity ratio (CVR) and content validity index (CVI) with the input of 10 health education and health promotion specialists and 1 infectious disease specialist. The calculated CVI was 0.87, and the CVR was 0.89. The reliability of the SCT questionnaire was evaluated by administering the questionnaire to 15 health ambassadors who did not participate in the trial. The reliability was calculated using Cronbach's alpha coefficient for each construct and overall. The results showed that Cronbach's alpha coefficients ranged from 0.73 to 0.87 for the different constructs, indicating good reliability of the questionnaire.

The questionnaire related to measuring the health behavior regarding the prevention of leishmaniosis was measured with ten questions on a five-point Likert scale. The total score in this questionnaire was between 10 and 50, and higher scores indicated higher levels of leishmaniosis preventive behavior. Cronbach's alpha coefficient in our study was 0.76.

```
                    ┌─────────────────────────────────────┐
                    │  Purposive selection of 42 Health    │
                    │  House Assessed for eligibility       │
                    │  (n= 25848)                           │
                    └─────────────────────────────────────┘
                              ( Enrollment )

                         ┌──────────────────────┐
                         │  Randomized (n=110)   │
                         └──────────────────────┘
```

	(Allocation)	
Allocated to the intervention group (health ambassadors assessed for eligibility) (n=55) & One of their Families (n=55) * Filled out questionnaires in baseline health ambassadors (n=55) & their Family (n=55)		Allocated to the control group (health ambassadors assessed for eligibility) (n=55) & One of their Families (n=55) * Filled out questionnaires in baseline health ambassadors (n=55) & their Family (n=55)
Receive the allocated intervention (n= 55) Discontinued intervention (n= 0)		Did not receive the allocated intervention (n= 55)

(Follow-Up)

Filled out questionnaires in post-intervention health ambassadors (n=55) & their Families (n=55)		Filled out questionnaires in post-intervention health ambassadors (n=55) & their Families (n=55)
Filled out questionnaires after 3-months intervention health ambassadors (n=55) & their Families (n=55)		Filled out questionnaires after 3-months intervention health ambassadors (n=55) & their Families (n=55)

(Analysis)

Analysed (n=55) ♦ Excluded from analyzed (n=0)		Analysed (n=55) ♦ Excluded from analyzed (n=0)

Fig. 1 CONSORT flow diagram of study sample

Educational intervention

We used the Template for the Intervention Description and Replication checklist to conduct the intervention program [27, 28] (Additional file 2).

The application of SCT for the training of health ambassadors involved several stages: including a review of literature studies (conducting a comprehensive review of literature on SCT and its application in health ambassador training), field studies (to determine the most effective implementation method for the training) and a training model designed by a research team including researchers, health center doctors, and an expert on monitoring diseases and healthcare providers in health centers (to design the pilot training to evaluate the feasibility of the intervention).

After obtaining informed consent, the health ambassadors completed the first stage questionnaire, and their inclusion in the WhatsApp group was confirmed. The method of informing, providing training, and participating in the training process was explained to them. Furthermore, they were provided with the educational materials in print. The control group was enrolled in the waiting list and received standard health care exclusively.

The intervention group received educational interventions based on the principles of SCT. The interventions

focused on promoting emotional adaptation, self-control, and self-efficacy in overcoming obstacles in twelve training sessions (Table 1). The interventions were delivered through WhatsApp. They also participated in mobile-based online group discussions for two weeks.

The health ambassadors extended the training they received to their family members. The training materials used were assessed in alignment with the course objectives. The evaluators of the outcomes were distinct from the researchers who administered and oversaw the interventions. The efficacy of the training program was assessed immediately post-intervention and three months later through a re-administration of the questionnaire to both the intervention and control groups.

Data analysis

To analyze the data, the Kolmogorov-Smirnov test was used to check the normality of the variables. Since the data was nonparametric, the following tests were used for different groups: Mann-Whitney tests for independent groups, and Friedman's test for dependent groups. Demographic variables were analyzed on qualitative variables. The following methods were used: mean and standard deviation for continuous variables, Chi-square test for categorical variables, and frequency and percentage for countable variables. Data analysis was performed in three stages of data collection using IBM SPSS version 26.0. The significance level for the analysis was set at 0.05.

Table 1 Summary of education based on the SCT model constructs

Sessions	SCT model constructs	Content	Training Method
1	Emotional adaptation	Stating the educational goals of the program, and conducting the pretest Exercise: The health ambassador visits all the covered households and neighbors, greets them, and establishes more communication to raise awareness of their healthy and unhygienic behaviors regarding leishmaniosis.	Upload educational text, posters, tracts, educational pamphlets, Practical training, and home visits
2	Self-efficacy to overcome obstacles	Expressing the problems related to the disease and its treatment and control.	Upload educational text and videos
3	Self-control	Determining of short-term and long-term goals of the participants	Practical training and home visits
4	Self-efficacy to overcome obstacles	Proposing nonstandard treatments for leishmaniosis in the region and its problems for patients	Uploading educational text and images, participation in the discussion
5	Self-control	planning to prepare and use the repellent spray, prepare a net, and install it on the door and window of the house	Practical training
6	Self-efficacy to overcome obstacles	Getting to know the types of leishmaniosis treatment (local, systemic, etc.)	Upload educational text
7	Self-efficacy to overcome obstacles	Preparation of a list of problems and limitations to perform preventive behavior against contracting leishmaniosis preparing a list of prevention measures that are carried out in the village and measures that need to be corrected	Practice training and visit the village
8	Behavior change	Learning the use of sleeved clothes, mosquito nets, nets, etc. Taking measures to prevent leishmaniosis	Upload educational text and videos
9	Self-control	Educating the generalities of leishmaniosis disease, its importance, and symptoms, to plan preventive behaviors from the seeker. Preparing a list of necessary measures to comply with preventive behaviors	Upload educational text and Practical training
10	Knowledge& Outcome expectations	Educating Types of leishmaniosis and its distribution in Iran and the world. Knowing the causative agent of leishmaniosis, its life cycle, and the mode of pathogenesis. Recognizing the reservoirs of leishmaniosis in different types of leishmaniosis, how to fight against the reservoirs of the disease Positive, and negative consequences of leishmaniosis prevention behaviors	Upload educational text Practical training, brainstorming
11	Environmental	Measuring environmental (garbage and sewage disposal) and their importance in the prevention and control of leishmaniosis Visiting the covered household and preparing a list of how to dispose of waste and sewage for the training program in cooperation with the Health House	Upload educational text Practice training and home visit
12	Behavior change& Environmental	Compilation of a summary of ways to prevent and control leishmaniosis disease by the health ambassador Presenting appropriate suggestions and solutions and cooperating with the Health Council and the Health House to implement these suggestions	Upload educational text and videos Meeting and telephone follow-up

Abdollahi *et al. BMC Infectious Diseases*   (2024) 24:786

Page 6 of 11

Ethical considerations

This study was approved by the Mashhad Ethics Committee Mashhad University of Medical Sciences, Iran (IR. SUMS.REC.1395.20) and registered in the Iran Clinical Trials Registry [IRCT2015072123279N2 (02/09/2020)]. All participants underwent the informed consent procedure, during which the research objectives were thoroughly elucidated. Their data confidentiality was assured, and participants retained the right to withdraw from the study. The study results were shared with participants upon request.

Results

In the present study, 35% of the participants were male, and 65% were female. The average age of health ambassadors in the intervention group was 32.31±6.61 years, while in the control group, it was 30.78±5.92 years. Most of the participants (202/220, 92%) were married. In addition, most of the participants did not have a university education (200/220, 91%) and most of them were housewives (117/220, 53%). More details of demographic information can be seen in Table 2.

The results of the Mann–Whitney test showed that before the intervention, there was no significant difference between the intervention and control groups in demographic variables, SCT structures, and leishmaniosis preventive behavior ($p < 0.001$).

The mean and standard deviation of the scores of the constructs of SCT and preventive behavior against leishmaniosis of participating health ambassadors are shown in Table 3.

Based on the results of the Mann–Whitney test, the changes in the scores of SCT structures after the intervention and three months after the intervention compared to before the intervention in the intervention group were significant ($p < 0.001$) (Table 3). The results of Friedman's test showed statistically significant changes in the scores of SCT constructs during the study. The

educational intervention increased the score of these constructs in the intervention group ($p < 0.001$) (Table 3).

The difference in leishmaniosis preventive behavior change score after the intervention and three months later was found to be significant ($p < 0.001$). To control for the significant difference in the scores of the constructs of knowledge, outcome expectation, understanding of the situation, environment, and emotional adaptation and behavior at the beginning of the study in the group of health ambassadors, covariance analysis was used. The results of the covariance analysis showed that despite this difference at the beginning, the intervention was effective in increasing the scores of all SCT constructs immediately after the intervention and three months after the intervention. The significance of the interaction effect of time and educational group in all structures in the results of ANCOVA repeated measures showed that the effect of educational intervention on these structures varies over time (before the intervention, immediately after the intervention, follow-up). Additionally, based on the results, changes in the leishmaniosis preventive behavior score were shown during the study (Fig. 2).

Discussion

This study aimed to investigate the effect of SCT-based educational intervention using WhatsApp on leishmaniosis prevention behaviors among health ambassadors and their family members. The knowledge of the health ambassadors in this study showed improvement, which is consistent with the findings of another study [29]. The educational intervention used in the study helped participants gain a clear understanding of ways to prevent leishmaniosis, which likely influenced them to set specific goals for applying the teachings in their daily lives. By gaining knowledge about health preventive measures, the participants were able to develop a better understanding of the behaviors they needed to adapt to reduce the risk of leishmaniosis transmission. Similar to the results of previous studies, our study showed that educational

Table 2 Comparison of the demographic variables between the intervention and control groups

| Variable | Categories | Intervention group | | | | Control group | | | | *P*-value | |
		Health ambassadors		Family members		Health ambassadors		Family members		Health ambassadors	Family members
		N	%	N	%	N	%	N	%		
Marital status	Married	49	89	46	84	54	98	53	96	0.113	0.052
	Single	6	11	9	16	1	2	2	4		
Education	Elementary	23	42	19	35	20	36	30	55	0.687	0.072
	Diploma	28	51	33	60	27	49	20	36		
	University	4	7	3	5	8	15	5	9		
Income	< 70$	31	56	30	55	37	67	37	67	0.446	0.463
	70–115$	22	40	20	36	16	29	15	27		
	≥ 115$	2	4	5	9	2	4	3	6		

*Fisher's exact test

Table 3 Effect of educational intervention based on SCT on health ambassadors and their family members

Variable	Groups (55 Health ambassadors & 55 Family members)	Before the intervention Mean(SD)	Immediately after the intervention Mean (SD)	3 months after the intervention Mean (SD)	P value** (x^2)
Knowledge	Intervention	82.60(19.23)	98.83(3.30)	99.09 (2.40)	< 0.001 (70.76)
	Control	74.03(19.70)	77.66(16.61)	78.05(16.02)	< 0.001 (19.00)
	P value* (z)	0.006 (-2.76)	< 0.001 (-8.25)	< 0.001 (-8.39)	
Outcome expectations	Intervention	86.00(15.56)	97.09(4.05)	97.55(3.58)	< 0.001 (53.09)
	Control	79.18(13.29)	80.36(11.70)	80.64(11.27)	0.174 (3.49)
	P value* (z)	0.009 (-2.61)	< 0.001 (-8.00)	< 0.001 (-8.20)	
Outcome values	Intervention	91.67(10.76)	98.33(4.36)	98.64(3.50)	< 0.001 (31.65)
	Control	87.42(14.95)	87.58(13.88)	87.88(13.50)	0.657 (0.83)
	P value* (z)	0.152 (-1.43)	< 0.001 (-5.01)	< 0.001 (-5.19)	
Situational understanding	Intervention	74.55(17.22)	85.80(8.96)	87.27(8.75)	< 0.001 (24.62)
	Control	66.25(17.70)	67.05(17.57)	67.16(1752)	0.028 (7.12)
	P value* (z)	< 0.001 (-3.23)	< 0.001 (-8.61)	< 0.001 (-8.65)	
Environment	Intervention	64.70(16.97)	81.36(8.33)	82.88(8.70)	< 0.001 (49.94)
	Control	55.30(19.53)	56.06(19.47)	57.42(19.16)	0.017 (8.16)
	P value* (z)	0.009 (-2.21)	< 0.001 (-6.94)	< 0.001 (-6.96)	
Task self-efficacy	Intervention	84.09(14.46)	97.73(4.93)	97.73(4.93)	< 0.001 (51.94)
	Control	81.06(15.42)	80.91(15.60)	81.06(15.25)	0.867 (0.28)
	P value* (z)	0.293 (-1.05)	< 0.001 (-6.07)	< 0.001 (-6.07)	
Self-efficacy to overcome obstacles	Intervention	79.24(19.96)	98.48(4.84)	98.79(3.73)	< 0.001 (66.16)
	Control	75.30(15.55)	75.91(13.86)	76.52(13.90)	0.338 (2.16)
	P value* (z)	0.145 (-1.45)	< 0.001 (-8.47)	< 0.001 (-8.44)	
Self-control	Intervention	82.95(13.15)	96.25(4.90)	96.82(4.32)	< 0.001 (52.95)
	Control	78.18(16.13)	78.75(15.20)	79.09(15.03)	0.102 (4.57)
	P value* (z)	0.135 (-1.49)	< 0.001 (-6.24)	< 0.001 (-6.38)	
Emotional adaptation	Intervention	83.45(14.04)	97.27(3.83)	97.64(3.17)	< 0.001 (48.31)
	Control	77.91(13.60)	79.00(12.89)	79.27(12.74)	0.001 (13.73)
	P value* (z)	0.022 (-2.28)	< 0.001 (-7.33)	< 0.001 (-7.41)	

Table 3 (continued)

Variable	Groups (55 Health ambassadors & 55 Family members)	Before the intervention Mean(SD)	Immediately after the intervention Mean (SD)	3 months after the intervention Mean (SD)	P value** (x^2)
Preventive behavior of leishmaniosis	Intervention	88.41(11.49)	97.68(2.25)	97.91(2.08)	< 0.001 (52.5)
	Control	83.23(9.47)	83.27(9.68)	83.41(9.73)	0.494 (1.41)
	P value* (z)	< 0.001 (-3.23)	< 0.001 (-8.61)	< 0.001 (-8.65)	

SD: standard deviation. *Mann–Whitney** Friedman
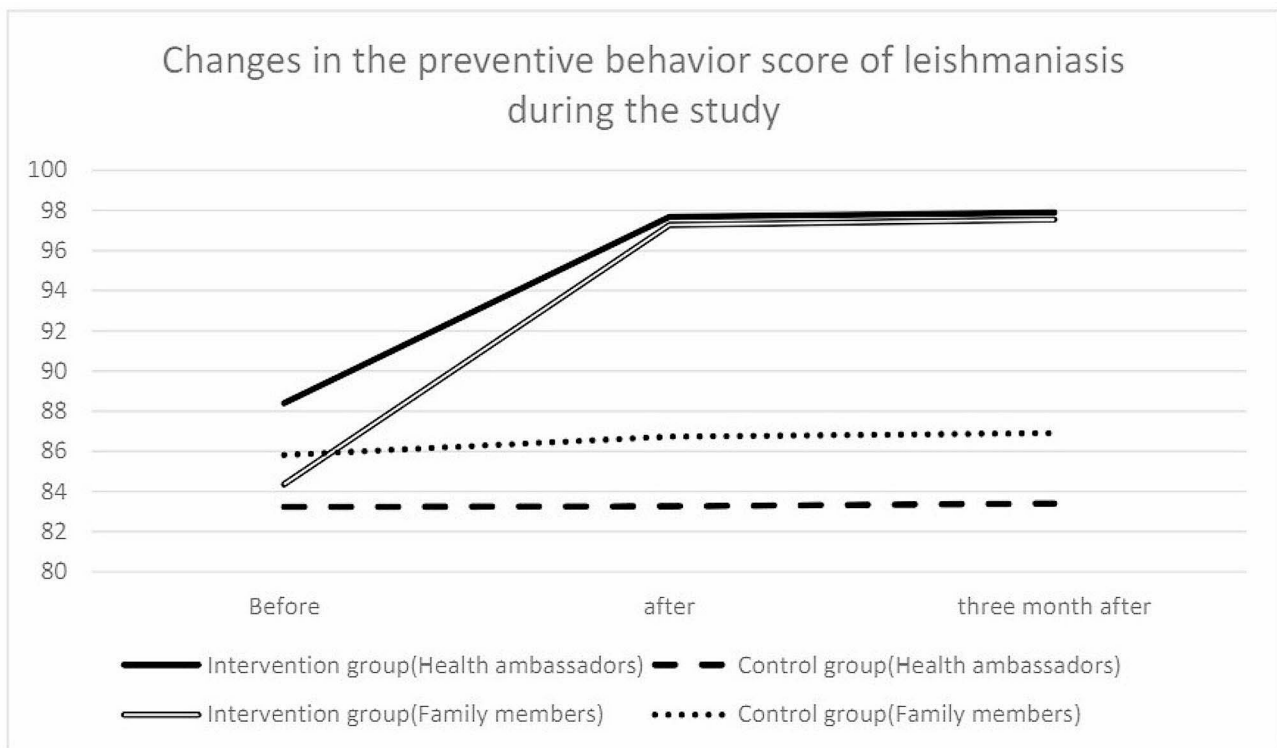
Fig. 2 Changes in the preventive behavior of leishmaniosis score during the study

intervention was effective in improving preventive behaviors and enhancing the participant's knowledge of the importance of such behaviors in leishmaniosis prevention. Having sufficient and correct information about diseases and ways to prevent them is the most basic step to changing behavior [30, 31].

In our study, the behavioral changes observed in the intervention group can be attributed to the SCT constructs used in the study. This study used virtual discussion groups to identify potential barriers to behavior change. In some studies, it has been shown that there are problems in rural areas, such as the long distance from cities and shopping centers, traditional customs for the prevention and treatment of diseases, which make it difficult to access and use appropriate equipment and facilities for disease control [31, 32].

Self-efficacy is a key component of SCT, which refers to a person's belief in their own ability to change behavior. In the present study, the educational program implemented in the intervention group focused on several factors that facilitated behavior change through self-efficacy and motivation to change behavior. These factors include: increasing participants' understanding of the importance of the desired behavior and associated benefits, reducing and removing perceived barriers to adopting the desired behavior, breaking down the desired behavior into smaller, manageable steps, and increasing practical skills, which is consistent with findings from other studies [33, 34]. In the present study, the use of educational strategies based on SCT through group discussion on WhatsApp was able to help the participants in solving problems and promoting self-control and self-efficacy in

overcoming obstacles. In our educational intervention, this approach has also helped in promoting behavior change and improving leishmaniosis preventive behavior among health ambassadors and their family members. Improvements in emotional adjustment construct scores were observed during the WhatsApp follow-up. This shows that the intervention not only had a positive effect on the participants' emotional well-being and adaptation to preventive behavior against leishmaniosis, but also contributed to promote their preventive behavior against leishmaniosis. In another study, the results did not indicate the effectiveness of SCT-based intervention through smartphones in promoting physical activity of participants. Also, these researchers showed that virtual training with face-to-face meetings is more effective than virtual training alone [35].

The research revealed that utilizing WhatsApp for follow-up reminders reinforced the importance of adopting preventive behaviors and assisted participants in carrying out practical activities such as using mosquito nets and spraying plant areas. This suggests that the use of WhatsApp follow-up can be an effective tool in promoting behavior change and improving health outcomes. Similar to the findings of this study, other studies have shown that information transfer and behavior change through online messaging platforms such as WhatsApp and Facebook have been effective. These results indicate that the ease of receiving information through these online platforms is well available and can create appropriate behavior change [36]. On the other hand, in a systematic review study, it was shown that health interventions through mobile phones that have been used to manage diseases such as leishmaniosis and other neglected tropical diseases have not had obvious results and clear methodology [37].

In this research, to strengthen learning, educational materials were provided to the participants in the form of an educational package including pamphlets and tracts and a practical guide to the management of seekers on WhatsApp. In this way, the participants were able to obtain information about the disease vector, sanitary disposal of sewage, net installation, and the method of communication with people and institutions related to the management of leishmaniosis. Also, to encourage and strengthen learning and perform preventive behaviors, insect repellent spray was donated to families by the health ambassadors. These strategies helped the participants to be practically prepared for performing leishmaniosis preventive behaviors and led to the promotion of desirable preventive behaviors. Consistent with these results, other studies also show that behavior change interventions using mobile media messages can be a simple, low-cost and effective approach to behavior change [34, 38].

Strengths and limitations

The study is a cluster randomized controlled trial with a high response rate despite the COVID-19 pandemic. It utilized several important constructs of SCT as an educational intervention, delivered through face-to-face meetings and follow-ups on WhatsApp. This study is one of the few local studies that examine the effects of an intervention on leishmaniosis preventive behavior in health ambassadors. It is also the first to use educational intervention and a follow-up and reminder technique through WhatsApp to improve leishmaniosis preventive behavior. However, there are some limitations to consider. The use of self-report questionnaires may lead to under or over-reporting of outcomes, particularly regarding participants' self-efficacy. Future studies are encouraged to use objective measures. Additionally, the evaluation of health ambassadors' behavior in leishmaniosis prevention was conducted over three months, and longer follow-up periods may provide more accurate results. Therefore, it is recommended to continue the training program and its follow-up for a longer duration and evaluate the results over a longer period after the intervention. Finally, future studies should consider a larger sample size. This study was conducted in public health homes, which may have limited the participation of other cultures. It is important to note that the findings may differ among other populations.

Conclusion

The study demonstrates that a health education intervention based on Social Cognitive Theory and WhatsApp group follow-up is effective in increasing participation and improving leishmaniosis preventive behavior in health ambassadors and their families compared to traditional methods. It is recommended to use successful health ambassadors as trainers to support people and empower them in self-care activities, and to utilize video media and social networks in educational programs to enhance the effectiveness of education. The study suggests that this intervention should be evaluated in other populations and can also serve as fundamental data for other intervention studies.

Abbreviations
SCT   Social cognitive theory
WHO   World Health Organization
RCT   randomized controlled trial
CONSORT   Consolidated Standards for Reporting Trials

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s12879-024-09590-9.

Supplementary Material 1

Supplementary Material 2

Abdollahi *et al. BMC Infectious Diseases*   (2024) 24:786

Page 10 of 11

Data availability
The data supporting the findings of this study are available from the Deputy of Research of Mashhad University of Medical Sciences. However, there are restrictions on the availability of this data, as it was used under license for the current study and are not publicly available. However, the data can be obtained from the responsible author upon reasonable request and with the permission of Mashhad University of Medical Sciences. To request the data, you can contact the author via email at Mahdizadehtm@mums.ac.ir.

Declarations

Ethics approval and consent to participate
This study was approved by the Mashhad Ethics Committee Mashhad University of Medical Sciences, Iran (IR.SUMS.REC.1395.20) and registered in the Iran Clinical Trials Registry [IRCT2015072123279N2]. All procedures performed in this study were by the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable. Written informed consent was obtained from all subjects and/or their legal guardians.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

References
1. Georgiadou SP, Makaritsis KP, Dalekos GN. Leishmaniasis revisited: current aspects on epidemiology, diagnosis and treatment. J Translational Intern Med. 2015;3(2):43–50. https://doi.org/10.1515/jtim-2015-0002.
2. Steverding D. The history of leishmaniasis. Parasites Vectors. 2017;10(1):1–0.
3. Mokni M. Annales De Dermatologie et de venereologie. In: Cutaneous leishmaniasis editor; 2019.
4. World Health Organization Leishmaniasis. Overview. WHO. https://who.int/health-topics/leishmaniasis#tab=tab_1. Accessed on 12/03/2023.
5. Hamzavi Y, Nazari N, Khademi N, Hassani K, Bozorgomid A. Cutaneous leishmaniasis in Qasr-e Shirin, a border area in the west of Iran. Veterinary World. 2018;11(12):1692. https://doi.org/10.14202/vetworld.2018.1692-1697.
6. Moein D, Masoud D, Saeed M, Abbas D. Epidemiological aspects of cutaneous leishmaniasis during 2009–2016 in Kashan city, central Iran. Korean J Parasitol. 2018;56(1):21. https://doi.org/10.3347/kjp.2018.56.1.21.
7. Piroozi B, Moradi G, Alinia C, Mohamadi P, Gouya MM, Nabavi M, Gharachorloo F, ERFAN MB, Shirzadi MR. Incidence, burden, and trend of cutaneous leishmaniasis over four decades in Iran. Iran J Public Health. 2019;48(Supple 1):28–35.
8. Saghafipour A, Nejati J, Mozaffari E, Rezaei F, Gharlipour Z, Mirheydari M. The effectiveness of education based on the BASNEF model on promoting preventive behavior of cutaneous leishmaniasis in students. Int J Pediatr. 2017;5(6):5125–36. https://doi.org/10.22038/ijp.2017.22373.1875.
9. Limongi JE, Costa LC, Perissato IL, Giorgiani M, Rocha MB, Faria LF, Valente HC, Oliveira SV. Knowledge, attitudes, and practices concerning visceral leishmaniasis among residents of a sporadic transmission area in southeast Brazil. Trans R Soc Trop Med Hyg. 2021;115(6):644–52. https://doi.org/10.1093/trstmh/traa102.
10. Margonari C, Menezes JA, Mayr de Lima Carvalho G, Miranda JB, Furtado de Sousa F, Rêgo FD, Campos AM, Monteiro CC, Madureira AP, Andrade Filho JD. Level of knowledge and risk factors for visceral leishmaniasis in a mining area of Minas Gerais State, Brazil. Interdisciplinary Perspectives on Infectious Diseases. 2020;2020. https://doi.org/10.1155/2020/6301310.
11. Tamiru HF, Mashalla YJ, Mohammed R, Tshweneagae GT. Cutaneous leishmaniasis a neglected tropical disease: community knowledge, attitude and practices in an endemic area, Northwest Ethiopia. BMC Infect Dis. 2019;19:1–0. https://doi.org/10.1186/s12879-019-4506-1.
12. Nazari M, Taravatmanesh G, Kaveh MH, Soltani A, Ghaem H. The effect of educational intervention on preventive behaviors towards cutaneous leishmaniasis at Kharameh city in 2014. Shiraz E-Medical J. 2016;17(10). https://doi.org/10.17795/semj39957.
13. Gutierrez JD, Martínez-Vega R, Ramoni-Perazzi J, Diaz-Quijano FA, Gutiérrez R, Ruiz FJ, Botello HA, Gil M, González J, Palencia M. Environmental and socioeconomic determinants associated with the occurrence of cutaneous leishmaniasis in the northeast of Colombia. Trans R Soc Trop Med Hyg. 2017;111(12):564–71. https://doi.org/10.1093/trstmh/try011.
14. Glanz K, Rimer BK, Viswanath K. Health Behavior and Health Education: theory, Research, and practice. London: Wiley; 2008.
15. Saffari M, Shojaeizadeh D, Ghofranipour F, Heydarnia A, Pakpour A. Health Education and Promotion-theories, models and methods. Sobhan Pub; Tehran; 2009. pp. 12–21.
16. KriShnaMohan S, Stalin P, Singh Z, Sridhar M. Efficacy of health education using Facebook to promote healthy lifestyle among medical students in Puducherry, India: a non-randomized controlled trial. J Clin Diagn Research: JCDR. 2017;11(7):LC07. https://doi.org/10.7860/JCDR/2017/27385.10259.
17. Rounsefell K, Gibson S, McLean S, Blair M, Molenaar A, Brennan L, Truby H, McCaffrey TA. Social media, body image, and food choices in healthy young adults: a mixed methods systematic review. Nutr Dietetics. 2020;77(1):1940. https://doi.org/10.1111/1747-0080.12581.
18. Zhang N, Campo S, Yang J, Janz KF, Snetselaar LG, Eckler P. Effects of social support about physical activity on social networking sites: applying the theory of planned behavior. Health Commun. 2015;30(12):1277–85. https://doi.org/10.1080/10410236.2014.940669.
19. 15 Globally Most Downloaded Apps of All Time. https://softwaretestinghelp.com/most-downloaded-apps. Accessed on 12/03/2023.
20. Mohammad Z, Ahmad N, Baharom A. The effects of theory-based educational intervention and WhatsApp follow-up on Papanicolaou smear uptake among postnatal women in Malaysia: Randomized controlled trial. JMIR mHealth uHealth. 2022;10(6):e32089. https://doi.org/10.2196/32089.
21. Muntaner-Mas A, Vidal-Conti J, Borras PA, Ortega FB, Palou P. Effects of a whatsapp-delivered physical activity intervention to enhance health-related physical fitness components and cardiovascular disease risk factors in older adults. J Sports Med Phys Fit. 2017;57(1–2):90–102. https://doi.org/10.23736/S0022-4707.16.05918-1.
22. Sarkhani N, Negarandeh R, Pashaeypoor S. The effects of face-to-face education for student health ambassadors on the health-promoting lifestyle of adolescent female students: a randomized controlled trial. J Public Health. 2021;1–7. https://doi.org/10.1007/s10389-020-01439-0.
23. Sarkhani N, Pashaeypoor S, Negaranddeh R. Student health ambassadors: a new program to promote health among the adolescent. Int J Community Based Nurs Midwifery. 2021;9(1):88. https://doi.org/10.30476/ijcbnm.2020.46761.
24. Agarwal S, Sripad P, Johnson C, Kirk K, Bellows B, Ana J, Blaser V, Kumar MB, Buchholz K, Casseus A, Chen N. A conceptual framework for measuring community health workforce performance within primary health care systems. Hum Resour Health. 2019;17(1):1–20. https://doi.org/10.1186/s12960-019-0422-0.

25. Schulz KF, Altman DG, Moher D, for the CONSORT Group. CONSORT 2010 Statement: updated guidelines for reporting parallel group randomized trials.

26. Monfared EV, Sadeghi R, Sedaghat MM, Saghafipour A, Tol A, Yaseri M. Effect of educational intervention based on Social Cognitive Theory on promoting preventive behaviors of cutaneous leishmaniasis. Koomesh. 2018; 20(4).

27. Yamato TP, Maher CG, Saragiotto BT, Catley MJ, Moseley AM. Rasch analysis suggested that items from the template for intervention description and replication (TIDieR) checklist can be summed to create a score. J Clin Epidemiol. 2018;101:28–34. https://doi.org/10.1016/j.jclinepi.2018.05.014.

28. Pakpour A, Alijanzadeh M, Pouresmaeil M, Taherkhani F, Mohammadgholiha R, Jozi N. Predictive factors associated with breastfeeding initiation and duration behaviors of 6-months postpartum mothers referred to health centers in the city of Qazvin based on theory of planned behavior. Iran J Health Educ Health Promotion. 2016;4(1):20–30. https://doi.org/10.18869/acadpub.ihepsaj.4.1.20.

29. Alizadeh G, Shahnazi H, Hassanzadeh A. Application of BASNEF model in students training regarding cutaneous leishmaniasis prevention behaviors: a school-based quasi- experimental study. BMC Infect Dis. 2021;21:1–9. https://doi.org/10.1186/s12879-021-06874-2.

30. Nejadsadeghi E, Zubaidi M. Cutaneous leishmaniasis preventive behaviors and the related factors among parents: application of BASNEF model. Int J Pediatr. 2022;10(7):16417–27. https://doi.org/10.22038/ijp.2022.65966.4971.

31. Jajarmi H, Tavakoli sani SB, Pourtaheri A, Gholian-Aval M, Esmaily H, Hosseini SH, et al. A community based intervention to modify preventive behaviors of cutaneous leishmaniasis in children: a randomized controlled trial based on PRECEDE PROCEED model. BMC Public Health. 2024;24(1):1304. https://doi.org/10.1186/s12889-024-18810-5.

32. Abdulmoein SA-H, Abdulaziz MH, Al-Hejri YM, Al-Mutairi KDA, Alanoud MA, Abdullah JA, et al. Knowledge, attitude and practice regarding the cutaneous leishmaniasis among infected patients and their families in Al-Madinah Al-Munawarah. GSC Adv Res Reviews. 2021;6(1):076–89. https://doi.org/10.30574/gscarr.2021.6.1.0011.

33. Alidosti M, Shahnazi H, Heidari Z, Zamani-Alavijeh F. Design and evaluation of two educational media in the form of animation and games to promote the cutaneous leishmaniasis prevention behaviors in adolescent female. BMC Public Health. 2022;22(1):1–0. https://doi.org/10.1186/s12889-022-14772-8.

34. Bagheri A, Jorvand R, Shakerian Rostami SK. The Effect of BASNEF Model-Based Education on Preventive Behavior of Leishmaniosis in High School Students. Iran J Health Educ Health Promotion. 2022;10(3):263–74. https://doi.org/10.52547/ijhehp.10.3.263.

35. Romeo AV, Edney SM, Plotnikoff RC, Olds T, Vandelanotte C, Ryan J, Curtis R, Maher CA. Examining social-cognitive theory constructs as mediators of behaviour change in the active team smartphone physical activity program: a mediation analysis. BMC Public Health. 2021;21:1–1. https://doi.org/10.1186/s12889-020-10100-0.

36. Cheung YTD, Chan CHH, Ho KS, Fok WYP, Conway M, Wong CKH, et al. Effectiveness of WhatsApp online group discussion for smoking relapse prevention: protocol for a pragmatic randomized controlled trial. Addiction. 2020;115(9):1777–85. https://doi.org/10.1111/add.15027.

37. Carrion C, Robles N, Sola-Morales O, Aymerich M, Postigo JAR. Mobile health strategies to tackle skin neglected tropical diseases with recommendations from innovative experiences: systematic review. JMIR mHealth uHealth. 2020;8(12):e22478. https://doi.org/10.2196/22478.

38. Zeinali M, Mohebali M, Mahmoudi M, Hassanpour GR, Shirzadi MR. Study on knowledge, attitude, and practice of health workers of East Azerbaijan, Ilam, and Khorasan Razavi provinces about leishmaniasis during 2015–2016: a comparative study before and after intervention. Archives Clin Infect Dis. 2019;14(1). https://doi.org/10.5812/archcid.64282.

Publisher's Note