

STUDY PROTOCOL

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Developing an Omaha System-based health application to improve knowledge, attitude, and behaviors regarding infectious disease prevention in the community: a study protocol for a randomized controlled trial

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Abstract

Background Infectious diseases remain significant public health concerns due to several factors such as climate and environmental changes and natural disasters. Mobile health applications (mHealth apps) can be an appropriate way for fostering community participation, disseminating knowledge, and promoting behavior change toward infectious disease prevention. This study aims to describe a protocol to evaluate the impact of the Omaha System-Based mHealth app (BUHOS) on improving knowledge, attitude, and behaviors (KAB) regarding infectious disease prevention in an earthquake-affected region of Türkiye. After earthquakes, increases can be observed in many infectious diseases such as water-borne, food-borne, vector-borne infections and respiratory infections.

Methods This study is a two-armed, parallel-group, single-blind, superiority randomized controlled trial. A total of 112 eligible participants will be recruited from two separate container cities in the earthquake-affected Hatay Province of Türkiye. These participants will be randomly allocated to either an intervention group or a control group. BUHOS will be designed based on the Omaha System, a widely recognized standardized taxonomy for the assessment, planning, and evaluation of healthcare services. BUHOS will include a two-week nursing intervention that will improve KAB employing Education (education videos), Surveillance (reminder messages), and assessing the outcomes. Outcome variables will be evaluated with the Problem Rating Scale for Outcomes, Community Communicable Diseases Knowledge Survey, Communicable Diseases Risk Awareness and Protection Scale and System Usability Scale. Outcome variables will be assessed on the 15th and 30th day after the intervention.

Discussion Mobile apps appear to be potential tools for improving KAB regarding infectious diseases. This study will evaluate the effectiveness of a mobile app (BUHOS) aiming to improve KAB regarding infectious disease prevention in an earthquake-affected region of Türkiye. The main strength of this study is the development of an Omaha System-based mHealth app to improve KAB of infectious diseases in the community. If the BUHOS is shown to be effective in

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enhancing KAB regarding infectious disease prevention among the population in an earthquake-affected region, it may offer potential benefits for other vulnerable communities in terms of infectious disease prevention.

Trial registration The protocol was registered at ClinicalTrials.gov (Identifier Number: NCT07048301, Registration Date: 02 July 2025).

Keywords Attitude, Behaviors, Infectious disease, Knowledge, Mobile application, Omaha system

Background

Infectious diseases continue to be major public health concerns with the emergence of new human pathogens and the re-emergence of many infections, despite the advances in prevention and control strategies [1, 2]. Urbanization, high population density, migratory flows, climate change, earthquakes and other disasters all contribute to an increase in the frequency and spread of infectious disease epidemics [3–5].

Globally, infectious diseases continue to account for a substantial proportion of morbidity and mortality, disproportionately affecting vulnerable populations [2, 5]. Furthermore, after earthquakes and other disaster and outbreaks, as shown during the COVID-19 pandemic, strain healthcare systems while also disrupting economies, education, and social life [2]. These challenges are further exacerbated by health system inequalities and limited access to reliable health information [6]. The importance of community participation, knowledge distribution, and behavior change has been emphasized in preventing infection spread, especially during periods of heightened vulnerability such as after earthquakes, epidemics, pandemics, or healthcare disruptions [7].

A devastating earthquake struck southeastern Türkiye on February 6, 2023, affecting 11 provinces. Among them, Hatay was one of the most severely impacted provinces, with a significant portion of its population losing their homes and being relocated to container settlements established by the government and humanitarian organizations [8, 9]. Despite nearly three years having passed since the earthquake, a portion of the population continues to live in these containers [9]. This Province is highly susceptible to various infectious diseases due to environmental and socioeconomic factors such as its geographic location, warm climate, dense population, and earthquakes [10, 11]. After earthquakes, increases can be observed in many infectious diseases such as water-borne, food-borne, vector-borne infections and respiratory infections [12, 13].

Many studies emphasize the relevance of knowledge, attitude, and behavior (KAB) in reducing the transmission of infectious diseases [14, 15]. Lee et al. (2021) demonstrated the link between knowledge and preventive actions such wearing face masks, practicing hand hygiene, and avoiding crowded settings [15]. Positive attitudes toward prevention strategies and risk perception

play a crucial role in influencing individuals' willingness to comply with public health recommendations [16]. Conversely, misinformation, low health literacy, and fatalistic attitudes are associated with lower adherence to protective behaviors [17]. Therefore, improving community KAB is critical for infectious disease prevention and control initiatives.

Informatics solutions, such as mobile health (mHealth) applications (apps) have been used to manage various infectious diseases and their symptoms. Especially in the last five years, mHealth apps have been rapidly introduced to increase compliance with individual and public health measures in the community [18–20]. They have been utilized during epidemic and pandemic outbreaks due to their accessibility, ease of use, and broad user engagement [21]. Several studies have demonstrated that mobile health (mHealth) applications can effectively improve health outcomes across diverse populations. For example, a nurse-led Omaha System–based mobile health application (COVOS) significantly reduced physical, psychosocial, and cognitive symptoms and improved quality of life among COVID-19 patients followed at home in Türkiye [20]. Likewise, a mobile intervention combining a patient app, urine drug metabolite testing, and interactive communication with a treatment supporter enhanced treatment adherence and success rates among tuberculosis patients in Argentina [22]. Furthermore, evidence from pandemic contexts indicates that mHealth technologies have supported remote consultations, health education, data management, and disease monitoring in both developed and developing countries, contributing to more effective epidemic and pandemic responses [21]. These findings suggest that, despite variations in digital literacy and access to technology, appropriately adapted mHealth interventions can yield positive health outcomes across different socio-economic settings. The majority of mHealth apps have been developed for surveillance, diagnosis, and treatment purposes to capture accurate data and enable improved health care planning and decision-making [18, 20, 22]. Furthermore, mHealth apps offer a valuable option for patient self-management and health communication by reducing direct patient contact with healthcare providers. They can also serve as a health information source to support health care services during epidemic and pandemic outbreaks [21, 23]. Several studies have demonstrated that

mHealth app-based health education is an appropriate method for educating the public about COVID-19 [20, 24]. Furthermore, mHealth apps can be used to identify socio-demographic information, as well as knowledge and attitudes information for people's education by the analysis of collecting data [20, 25, 26]. This is an appropriate way for informing people about infectious diseases based on their sociodemographic, knowledge and attitudes information. Mobile-based education for infectious diseases control and prevention can be delivered in a variety of ways, including texts, pictures, voices, videos, and online voice and video communication [20, 21, 26].

There is a lack of structured, theory-based mobile health applications that utilize standardized terminology systems such as the Omaha System to systematically support the improvement of knowledge, attitudes, and behaviors in the context of infectious disease prevention. The Omaha System was originally designed in the 1970s to enhance practice, documentation, and information management. It is intended for use across the continuum of care for individuals, families, and communities. It is a comprehensive and standardized taxonomy that facilitates the assessment, planning, and evaluation of health care services across diverse populations [27]. Its simple codes and concepts also enable standards for the electronic exchange and management of health information [20, 27, 28]. The use of Omaha System terms seamlessly integrates consumer-generated health data within mHealth apps to reveal the consumer's health perspective [29, 30]. In Türkiye, the Omaha System has been integrated into undergraduate and graduate public health nursing education for more than two decades [31, 32]. However, despite its established role in education, its integration into mHealth apps for infectious disease prevention remains notably absent from the national health system.

Objective and hypotheses

This study describes a protocol for a pilot randomized controlled study proposing to evaluate the impact of the Omaha System-Based mHealth app on improving knowledge, attitude, and behaviors (KAB) regarding infectious disease prevention in the Turkish community living in the earthquake region.

On the 15th and 30th day after intervention compared to the control group;

H1: The Communicable/Infectious Condition

Knowledge score of the intervention group will be higher,

H2: Communicable diseases attitudes score of the intervention group will be higher,

H3: Communicable diseases prevention behaviours score of the intervention group will be higher,

H4: Communicable diseases knowledge, attitudes and prevention behaviours scores of the intervention group will be higher than before the intervention on the 15th and 30th day after intervention.

Methods

Study design

This study is designed as a randomized, parallel-group, single-blind, superiority trial aiming to evaluate the effectiveness of the Omaha System-Based mHealth app (BUHOS) in improving knowledge, attitudes, and behaviors regarding infectious disease prevention among individuals living in earthquake-affected areas of Türkiye. The study protocol was designed according to the SPIRIT 2025 statement and the CONSORT guidelines [33, 34]. The study was registered in the ClinicalTrials.gov database (NCT048301, July 02, 2025). If any changes occur during the trial, the changes will be recorded in ClinicalTrials.gov. The time schedule of enrolment, intervention and assessment is shown in Table 1.

Setting and recruitment

This study was conducted in Hatay province, one of the 11 provinces in Türkiye affected by the devastating earthquake on February 6, 2023. Following the earthquake, a significant portion of the population lost their homes and were relocated to temporary shelters, including tents and container cities. As of September 2025, 183 container settlements were reported to be in use within Hatay [9]. The data for this study will be collected from residents of the region who are still living in container settlements, approximately three years after the earthquake. A total of 112 people who meet the sample selection criteria will be randomly recruited from two separate container cities in Hatay Province, Türkiye. The sample size was determined using G*Power 3.1 software [35]. According to a prior study [36], a sample size of 56 participants per group was calculated for the Knowledge subdimension (effect size = 0.139, partial eta squared = 0.019), providing at least 90% power to detect a difference at a significance level of 0.05. In this study, an intention-to-treat (ITT) analysis will be conducted to preserve the effects of randomization and minimize bias due to attrition. Therefore, no additional adjustment to the sample size was made for potential participant dropout. Participants who meet the inclusion criteria will be informed about the study through a home (container) visit by the research team. During the home visit, the purpose and procedure of the study will be explained and written informed consent will be obtained. The home visit will last for 20–25 min.

Participant eligibility

The inclusion criteria were as follows: (a) being aged between 18 and 64 years, (b) living in one of the two

Table 1 The schedule of the study

	TRIAL PERIOD				
	Enrollment		Post-randomization		Close-out
TIMEPOINT ^b	$-t_i$ to 0	0	T_1 15 th day	T_2 30 th day	2026
ENROLLMENT:					
Eligibility screen	X				X
Informed consent	X				X
[List other procedures]	X				X
Randomization		X			X
INTERVENTION/ COMPARATOR:					
[BUHOS] ^c		X	X	X	X
[Comparator] ^d		X	X	X	X
ASSESSMENTS:					
[Communicable Diseases Knowledge Questionnaire]	X	X			X
[Omaha System- Problem Rating Scale for Outcomes]			X	X	X
[Communicable Diseases Risk Awareness and Protection Scale]			X	X	X
[System Usability Test]				X	X

container cities, (c) having a knowledge score of (1) no knowledge, (2) minimal knowledge and (3) basic knowledge on the Omaha System Problem Rating Scale for Outcome for Communicable/Infectious Problem Knowledge Parameter, (d) being literate (able to read and write in Turkish), and (e) owning a smartphone. Exclusion criteria were as follows: (a) having impaired vision or hearing, (b) having a mental illness, (c) being pregnant or postpartum, (d) refusing to participate.

Randomization and blinding

Individuals residing in container cities in Hatay Province will be invited to participate in the study. Participants for inclusion in the intervention and control groups will be recruited from distinct container cities. Initially, a list of container cities will be obtained from the local administration. Utilizing this list, randomization will be conducted through the random.org website to determine the container cities to be included in the intervention and control groups. Among the selected container cities,

one will constitute the intervention group and another the control group, ensuring no interaction based on their geographical characteristics. Individuals in the intervention and control groups will be informed about the study, and their consent will be obtained. Sociodemographic characteristics and infectious disease knowledge levels will be assessed using a Google form. Based on this evaluation, lists comprising participants with (1) no knowledge, (2) minimal knowledge and (3) basic knowledge scores according to the Omaha System Problem Rating for Outcome Scale Communicable/Infectious Knowledge Parameter will be generated. From these lists, participants in the intervention and control groups will be selected according to age, gender, and educational status strata. Participants will be stratified by age group (18–34, 35–49, and 50–64 years), gender (female, male), and educational status (primary/secondary school, high school, university or above). Randomization will be managed by an independent person external from the research team

using a computer-generated random number sequence. Eligible participants will be allocated to the intervention or control group using a stratified randomization scheme in a 1:1 ratio (Fig. 1). The allocation results will be communicated to the research team only after participant enrollment. The researchers and the outcome assessors delivering the BUHOS intervention will be aware of group assignments to ensure correct implementation, while participants and the data analyst will be blinded to allocation. Although both participants and the data analyst will be blinded, the study will be described as single-blind, consistent with behavioral intervention study conventions where the intervention provider cannot be blinded. Unblinding will occur only in the event of a technical issue that requires direct intervention by the research team.

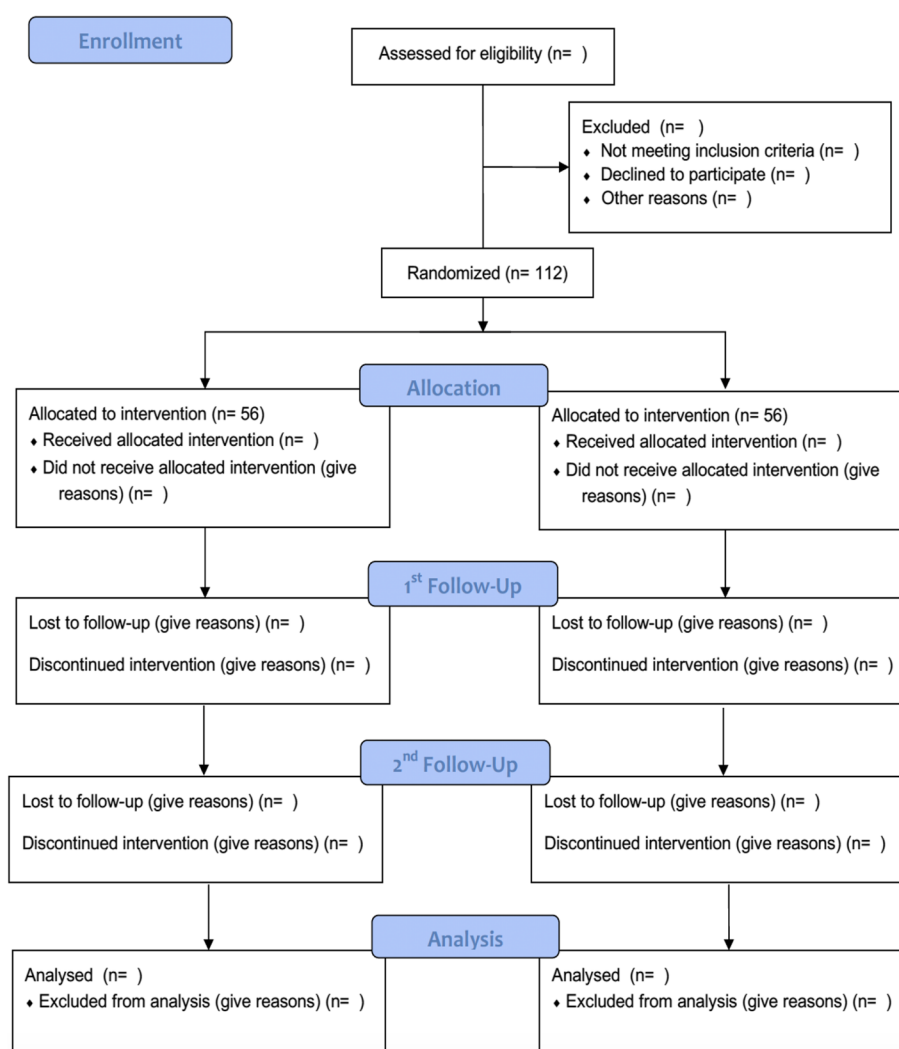


Fig. 1 CONSORT (Consolidated Standards of Reporting Trials) flowchart

Outcomes

The study outcomes in both groups will be measured at baseline, 15th day (1st follow-up), and 30th day (2nd follow-up) after the end of the intervention. The primary outcomes will be (i) communicable/infectious condition knowledge, (ii) communicable diseases attitudes, and (iii) communicable diseases prevention behaviors. Communicable Diseases Knowledge Questionnaire in the Community and The Problem Rating Scale for Outcomes will be used for evaluating the communicable/infectious condition knowledge. Knowledge measures include (1) no knowledge, (2) minimal knowledge, (3) basic knowledge, (4) adequate knowledge and (5) superior knowledge. The Communicable Diseases Risk Awareness and Protection Scale will be used to evaluate both the communicable diseases attitudes and communicable diseases prevention behaviors. The answer choices were designed to be in a five-point Likert type. Response choices for items measuring awareness/attitude are “Strongly Disagree” to “Strongly Agree;” for the items measuring behavior, the response choices range from “Never” to “Always.” The secondary outcome will be the usability score of the BUHOS application, which will be evaluated using the System Usability Scale (SUS).

Intervention

Development of BUHOS

The BUHOS health application will be developed by a multidisciplinary team consisting of the authors, nurses, an user experience (UX) designer and computer engineers. The BUHOS will be developed with a multi-layered architecture using cross-platform application development technology. The application will be able to run on mobile (iOS and Android) and web platforms. The application will host a web-based panel for management, data reporting, and analysis functions. The waterfall model shown in Fig. 2 will be used in project development process management.

The mHealth app (BUHOS) conceptual framework

The mHealth app (BUHOS) to be developed will be based on the Omaha System. The system comprises three components: (1) Problem Classification Scheme, (2) Intervention Scheme, and (3) Problem Rating Scale for Outcomes. The Problem Classification Scheme constitutes a comprehensive list that systematically diagnoses existing or potential problems in individual, family, and community. The Intervention Scheme represents a structured approach that encompasses categories of interventions to address the identified problems. The Problem Assessment Scale for Outcomes measures knowledge, behavior, and status concepts related to the problem [37].

In the study, the two-week nursing intervention will include (1) monitoring knowledge, attitude, and behaviors (KAB) regarding infectious disease prevention, (2) using the Omaha System Intervention Scheme of (a) Education, Guidance and Counselling and (b) Surveillance categories to improve the KAB, and (3) evaluating the outcomes with BUHOS app. In this study, nursing interventions will be prepared as (1) Education, Guidance and Counselling, (2) Surveillance according to the Intervention Scheme categories of the Omaha System and will be integrated into the BUHOS application. A total of nine videos with an average length of 1–3 min will be prepared to improve the KAB in the Intervention Scheme category of Education, Guidance and Counselling of the Omaha System. The Community Communicable Diseases Knowledge Survey will be applied within the scope of the Omaha System Intervention Scheme Surveillance category on the 10th day.

Preparation of contents

Nine videos will be prepared as BUHOS contents. The preparatory stages for the video content to be incorporated into the BUHOS mobile application are illustrated in Fig. 3. Appropriate content pertaining to community-prevalent infectious diseases will be developed in

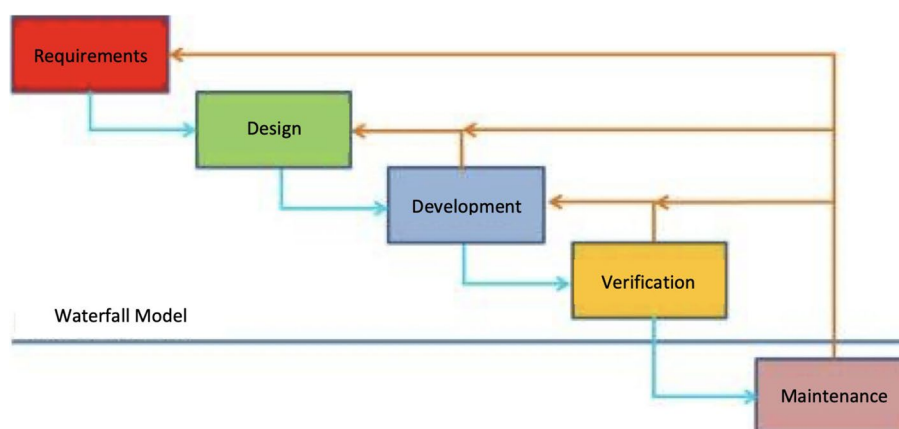


Fig. 2 Waterfall model

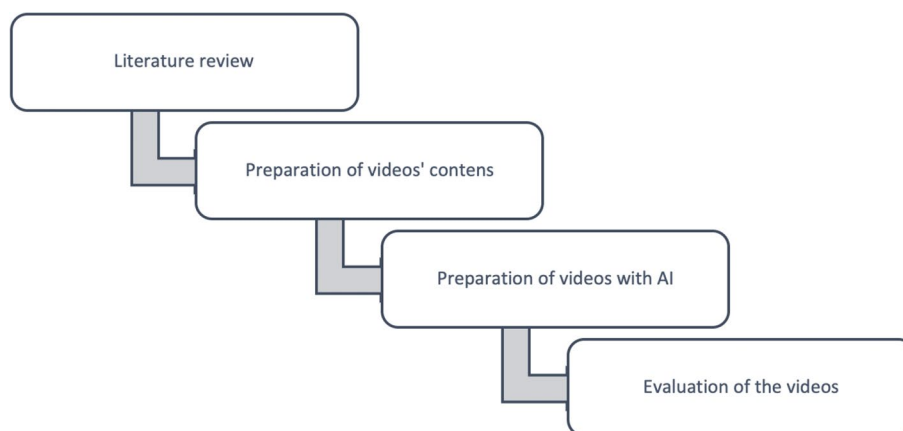


Fig. 3 Video preparation steps

accordance with the recommendations of authoritative institutions (Ministry of Health, Turkish Society of Clinical Microbiology and Infectious Diseases [KLIMIK], Turkish Infectious Diseases and Clinical Microbiology Specialty Association [EKMUD], World Health Organization, Centers for Disease Control and Prevention (CDC), and National Health Service (NHS)). The videos will be produced utilizing an artificial intelligence-supported program through a paid subscription and subsequently integrated into the mobile health application under development. In this context, a total of nine videos will be created, including one video each under the headings Infectious Diseases, General Hygiene, Personal Hygiene, Food Hygiene, Water Hygiene, Vaccines and Immunisation, and Symptoms of Infectious Diseases, and two videos under the heading Vector Control.

The videos will be submitted to expert opinion to be evaluated in terms of both design and content. Experts will consist of academics working in the field of public health nursing, mental health and diseases nursing, nursing principles, and nurses and doctors working in the community. Experts will be asked to present their opinions and suggestions regarding the videos. The videos will be edited in line with the suggestions of the experts.

Evaluation of the validity and reliability of BUHOS application The interaction, accessibility, user acceptance, and system usability of the BUHOS app will be tested. The BUHOS content will be sent to at least three application developers outside the study and tested for interface design, functionality, interactivity, and privacy issues. In addition, the BUHOS application will be shared with experts to evaluate its content, and the BUHOS application will be used and evaluated by individuals in container cities other than the container cities where the study will be conducted in the earthquake zone to ensure that the content of the BUHOS application is understandable to the target group. The application is aimed to be at

least 80% successful in the evaluations to be made with the System Usability Scale.

Strategies for monitoring and improving intervention protocol adherence All participants will be afforded the opportunity to contact the researchers if necessary. The contact section in the BUHOS will be implemented to facilitate communication of any issues experienced by the participants in the intervention group to the researchers. To ensure accuracy and eliminate errors, a researcher will examine and verify the data being entered on a regular basis. To improve adherence to the intervention, participants will get reminders and motivating messages via the app. For this, on the designated dates for research data collection, a notification will be transmitted via BUHOS app, prompting participants to complete the required information. Furthermore, reminder messages will be dispatched to participants in the intervention group who have not completed the research data on the scheduled dates or have not viewed the assigned videos. Participants who fail to complete the research data at the predetermined times will be contacted via phone.

Adverse event detection and reporting The BUHOS mobile application includes a “Report a Problem” button, allowing participants to instantly report any issues, such as technical malfunctions or usability problems. All reports are automatically transmitted to the admin panel, where a designated member of the research team monitors submissions daily and documents them using a standardised reporting form. Each report will be reviewed to determine its severity and whether it is related to the intervention. Appropriate action will then be taken, such as providing technical assistance or withdrawing the participant from the study if necessary. Serious or unexpected adverse events will be promptly reported to the institutional ethics committee and managed in accordance with established ethical and regulatory procedures. Furthermore, any nec-

essary corrections to the BUHOS application will be made immediately in collaboration with the development team.

Pilot phase A pilot phase will be performed before the intervention trial is implemented for testing the use of BUHOS, evaluating the compliance with research guidelines, and the quality of the measurements collected and the methods used. Participants in the pilot phase will not be retained for the intervention trial.

Intervention group

The BUHOS application will be introduced to the people included in the intervention group during the home (container) visit and will be downloaded from the virtual market (Google Play or App Store) to the participants' phones. Participants will be given a username and password during the home visit to use the application. The participant will be asked to log in to the BUHOS application with the given username and password. The screen features in the application will be explained to the participant and an information brochure about the use of the application will be given. The participant's questions about the application will be answered. The participant will then be asked to fill in the data collection forms on the 'Profile' screen in the application.

People in the intervention group will be asked to watch nine videos in the BUHOS during the initial week of the intervention to improve KAB. On the 8th day, researchers will evaluate video viewing status via the web admin panel and dispatch reminder messages; on the 10th day, the Communicable Diseases Knowledge Questionnaire will be applied within the scope of the Omaha System Intervention Scheme Surveillance category to evaluate the need for reinforcement of the app contents and on the 11th day, videos requiring repetition will be sent to the participants if needed. Intervention outcomes will be evaluated on the 15th and 30th day after intervention.

Control group

Data collection forms will be filled in during the home visit with the people included in the control group. The obtained values will be shared with the researcher during the follow-up by telephone. Participants in the control group will not receive any additional interventions, with no modifications to their daily routines. Outcome variables will be assessed from the participants in the control group at baseline, on the 15th (1st follow-up) and 30th (2nd follow-up) day after the end of the intervention. The second follow-up will be conducted 30 days after the end of the intervention period. To ensure that access to the training does not influence the study outcomes, the educational videos will be shared with the control group via whatsapp only after data collection has been

completed for all participants in the control group at the 2nd follow-up.

Instruments

Data will be collected with the Sociodemographic Information Form, Communicable Diseases Knowledge Questionnaire in the Community, The Problem Rating Scale for Outcomes, The Communicable Diseases Risk Awareness and Protection Scale, The System Usability Scale.

The sociodemographic information form is a form that includes the individual's age, gender, educational level, marital status, employment status, economic status, presence of chronic diseases, regularly used medications, current and past history of infectious diseases.

Communicable Diseases Knowledge Questionnaire in the Community is an instrument to evaluate participants' knowledge about communicable diseases in the community [38]. The validity and reliability of the questionnaire were developed and tested by the authors in a community-based sample of 533 individuals residing in container settlements in earthquake-affected areas of Hatay, Türkiye, excluding the two container cities where the present randomized controlled trial will be conducted.

It consists of 17 items comprising 4 subfactors with eigenvalues greater than 1, accounting for 45.66% of total variance with a Kaiser–Meyer–Olkin value of 0.784 and Bartlett's test of sphericity $\chi^2=1292.770$, $p<0.001$. The content validity index of the instrument ranged from 0.77 to 1.00, with a scale-level of 0.98. Confirmatory factor analysis showed good model fit ($\chi^2/df=1.95$, RMSEA=0.04, AGFI=0.94, GFI=0.95, SRMR=0.046, CFI=0.91). The Kuder–Richardson Formula 20 yielded a reliability coefficient of 0.735. The instrument contains items with response options "true," "false," and, "I don't know." Correct responses were scored as 1 and incorrect or "I don't know" responses as 0, with a total score range of 0–17. Higher scores indicate greater knowledge of communicable diseases in the community.

The Problem Rating Scale for Outcomes will be used to measure the knowledge of communicable diseases. It is a main component of the Omaha System and has been validated for use in the Turkish population ($\kappa=0.72$ –0.83) [39]. This Likert-type scale (1–5) evaluates Knowledge, Behavior, and Status of problems [37]. In this study, the Knowledge parameter will be used to assess knowledge towards the Communicable/Infectious condition problem of the Omaha System. Knowledge measures include (1) no knowledge, (2) minimal knowledge, (3) basic knowledge, (4) adequate knowledge and (5) superior knowledge. In this study, the determined participants' level of knowledge about infectious diseases by Communicable Diseases Knowledge Questionnaire in the Community will be matched with the Omaha System Problem

Rating Scale for Outcomes, a systematic classification tool.

The Communicable Diseases Risk Awareness and Protection Scale (CDRAPs) developed by Ener, Seyfeli, and Çetinkaya (2022) aims to assess the general risk awareness, protection behavior, and attitude levels of individuals aged 18 years and older [40]. The scale, for which validity and reliability studies were conducted, comprises six subdimensions and 36 items. The subdimensions were designated as Common Life Risk Awareness, Personal Protection Awareness, Protection Behaviors, Hand Washing Behaviors, Social Protection Awareness, and Personal Contact Awareness. The scores obtained from the scale ranged from 36 to 180. An increase in the total score obtained from the scale may be interpreted as an elevation in the general risk awareness and protection levels of individuals regarding infectious diseases. The total Cronbach's α value of the scale was 0.91, with the subdimensions ranging between 0.60–0.78 [40]. In this study both communicable diseases attitudes and prevention behaviors will be evaluated with CDRAPs.

The System Usability Scale (SUS) was developed by Brooke in 1996 and is utilized to assess the usability of systems or products, such as websites and mobile applications [41]. The scale comprises 10 statements and a 5-point Likert scale (1 [strongly disagree] to 5 [strongly agree]). The System Usability Scale was translated for the Turkish population by Kadirhan et al. (2015) and validated with a Cronbach's α value of 0.78 [42].

Data analysis

The SPSS (version 20.0) (IBM Corp., Armonk, New York, USA) statistical package program will be used for data analysis and G Power program (version 3.1) will be used for power analysis. The intention-to-treat (ITT) principle will be applied with baseline data for all participants and multiple imputation for missing data. The significance level will be accepted as $p < 0.05$. Data will be given as frequencies for categorical variables, means and standard deviations for continuous variables. The Shapiro–Wilk test will be used to analyze conformity with the normal distribution. Fisher's exact test, Yates correction and Pearson chi-squared test will be used to compare categorical data according to groups, and multiple comparisons will be made using the Bonferroni corrected Z-test. The Independent Samples t-test is used to compare data that fit the normal distribution according to groups, and the Mann–Whitney U test is used to compare data that do not fit the normal distribution.

Ethical consideration

The study will be conducted in accordance with the Declaration of Helsinki, and ethical approval has been obtained. Permission was obtained from the Hatay City

Governorate to conduct the study in container cities. All participants will be informed about the purpose and process of the study before enrolling in study groups. A written informed consent will be collected from the participants. For the assessment, data collection and app use, all participants will be identified by a coded identification number to maintain their confidentiality. Moreover, participants will be provided with an individual password to use mobile app. They will receive instructions to change the provided password to one that they only know. All data collected will be anonymized and kept confidential. Only principal investigators will have access to the study information and data. All study data will be stored in encrypted digital format for a period of five years and will be permanently deleted by a qualified data security expert once the retention period concludes.

Throughout the intervention, participants will be encouraged to report any discomfort, concerns, or technical issues related to the BUHOS application or its content. Participants will also be informed about their right to withdraw from the study at any time without any consequences. A designated member of the research team will be available via phone or messaging to address any technical or usability issues encountered during the use of the application. Any serious or unexpected events will be reported to the institutional ethics committee in accordance with reporting guidelines.

Discussion

This study protocol presents the design and methodology of a randomized controlled trial aimed at evaluating the effectiveness of a mobile health application (BUHOS) in improving knowledge, attitudes, and behaviors (KAB) related to infectious disease prevention among residents of container cities in the earthquake-affected region of Türkiye. This study will be the first theory-based mobile health intervention that employs a standardized terminology system—the Omaha System—to systematically support the improvement of KAB in the context of infectious disease prevention in the community. Grounded in a theoretical and standardized nursing taxonomy, the Omaha System distinguishes this study from many existing mHealth interventions that lack a conceptual framework [27]. The study is expected to contribute by demonstrating the feasibility of Omaha System-based mobile applications in public health interventions and by providing preliminary evidence on the effectiveness of structured mobile health education in disaster-affected populations. The findings may inform future large-scale studies, and the methodology could serve as a model for mHealth interventions addressing other community health priorities.

One of the strengths of this study lies in its utilization of a structured, theory-based mHealth application that

leverages the Omaha System—a standardized terminology system—to systematically improve KAB regarding infectious disease prevention. While many mHealth applications have been developed primarily for surveillance, diagnosis, and treatment, few have focused on KAB development using standardized terminology systems such as the Omaha System [20]. The Omaha System's comprehensive and standardized taxonomy for health interventions at both individual and community levels enhances the potential effectiveness of this application [27, 43, 44]. Moreover, the Omaha System has an established presence in nursing education in Türkiye [39, 45] and its adaptation into a mHealth app highlights the innovative aspect of this study. But it may require further validation to assess its long-term sustainability and integration into national health infrastructures.

Another strength of this study is that the BUHOS application includes structured educational content based on the Omaha System Intervention Scheme categories of Education, Guidance and Counseling, and Surveillance. In disaster-affected regions, where access to reliable health information is often disrupted and traditional healthcare services are limited, delivering accurate and evidence-based education via mobile platforms is particularly critical [46, 47]. BUHOS provides concise, visually engaging videos that convey essential information on disease transmission routes, preventive strategies such as hand hygiene, mask usage, and social distancing, as well as the importance of early symptom recognition and timely medical consultation. This structured and culturally appropriate content can enhance risk perception and encourage adoption of preventive behaviors [15, 16, 48]. However, differences in users' digital literacy, smartphone access, and internet connectivity may affect engagement and learning outcomes. Continuous monitoring and adaptive feedback mechanisms are therefore essential to ensure equitable reach and sustained participation across varying user profiles.

Despite these strengths, several limitations should be considered. First, the generalizability of the findings may be constrained by the relatively small sample size and the study's implementation in a single earthquake-affected region of Türkiye, which may not capture the diversity of disaster-affected populations. Future research should test the intervention across different demographic and cultural contexts to strengthen external validity. Second, variations in digital literacy and internet accessibility among participants may influence their interaction with the BUHOS application, potentially introducing selection bias. Third, the reliance on self-reported measures for assessing knowledge and behavior may lead to response or social desirability bias. Incorporating objective behavioral indicators or app usage analytics in future studies could enhance the robustness of the findings. Lastly,

while the Omaha System offers a rigorous theoretical foundation, its novelty in mHealth interventions necessitates ongoing evaluation to determine its adaptability and effectiveness across broader healthcare settings.

Conclusion

This study introduces an innovative, standardized terminology-driven approach to promoting infectious disease prevention in disaster-affected communities through the Omaha System-based BUHOS application. To the best of our knowledge, this intervention is among the first app-based initiatives to aim to improve knowledge, attitudes, and behaviours (KAB) regarding infectious disease prevention in the Turkish community living in the earthquake-affected region. There is insufficient evidence on the effectiveness of applications that aim to improve KAB related to infectious diseases using a standardized terminology system, the Omaha System in Türkiye. If the BUHOS is shown to be effective in enhancing KAB regarding infectious disease prevention among the Turkish population in an earthquake-affected region, it may offer potential benefits for other vulnerable communities in terms of infectious disease prevention.

Abbreviations

BUHOS	Omaha System-Based mHealth app
WHO	World Health Organization
KAB	Knowledge, attitudes, behavior
UX	User Experience
MVC	Model-View-Controller
MVVM	Model-View-View-Model
KLİMİK	Turkish Society of Clinical Microbiology and Infectious Diseases
EKMUD	Turkish Infectious Diseases and Clinical Microbiology Specialty Association
CDC	Centers for Disease Control and Prevention
NHS	National Health Service
CDRAPs	Communicable Diseases Risk Awareness and Protection Scale
SUS	System Usability Scale
ITT	Intention-to-treat

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Dissemination

Upon completion of the study, the results will be disseminated through presentations at scientific conferences and publications in peer-reviewed journals.

Authors' contributions

Conceptualization: SS, NI, MAY, GT, Methodology: SS, NI, MAY, GT, SDB, Writing—Original Draft: SS, MAY, GT, Writing—Review & Editing: SS, NI, MAY, GT, SDB; All authors have read and agreed to the published version of the manuscript."

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

The study will be performed following the Declaration of Helsinki. Ethical approval was obtained from the Istanbul Atlas University Ethics Committee (Date: 2024/07 Number: 29). Permission was obtained from the Hatay City Governorate to conduct the study in container cities. All participants will be informed about the purpose and process of the study before enrolling in study groups. A written informed consent will be collected from the study participants.

No monetary compensation will be provided to participants. However, as a token of appreciation, participants will receive a clothing item sponsored by a clothing brand after completing the study. This small non-monetary gift is intended solely to acknowledge their contribution and will not affect their decision to participate in the study.

For the assessment, data collection and app use, all participants will be identified by a coded identification number to maintain their confidentiality. Moreover, participants will be provided with an individual password to use mobile app. They will receive instructions to change the provided password to one that they only know. All data collected will be anonymized and kept confidential. Only principal investigators will have access to the study information and data.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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