Research Paper

The Effects of Smartphone-based Learning on the Knowledge, Attitude, and Perception of Disaster Preparedness Among Nurses

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Citation Mirlohi, S., Keyvanloo Shahrestanaki, S., Haghani, Sh., & Najafi Ghezeljeh, T., 2025. The Effects of Smartphone-based Learning on the Knowledge, Attitude, and Perception of Disaster Preparedness Among Nurses. *Journal of Client-Centered Nursing Care*, 11(2), pp. 125-136. https://doi.org/10.32598/JCCNC.11.2.667.1

https://doi.org/10.32598/JCCNC.11.2.667.1

Article info:
Received: 06 Oct 2024
Accepted: 23 Feb 2025
Published: 01 May 2025

Keywords:
Disaster preparedness, Crisis, Perception, Smartphone-based learning, Nurse

ABSTRACT

Background: The increasing reliance on technology in various fields has prompted the exploration of smartphone-based learning as a viable educational tool, particularly in the health care sector. Given the significant challenges posed by the COVID-19 pandemic, enhancing nurses' readiness to respond effectively to disasters and health crises has become more critical. This study aims to evaluate the effects of smartphone-based learning on nurses' knowledge, attitude, and perception regarding disaster preparedness.

Methods: This quasi-experimental study was conducted in June–September 2020 using a pre-test- post-test control group design in urban hospitals of Falavarjan City-Iran. All 204 eligible nurses in the study settings were recruited and randomly allocated to either a control (n=102) or an intervention (n=102) group. An educational android app was designed and provided to the intervention group for one month. The subjects completed the disaster preparedness evaluation tool (DPET) and the disaster preparedness questionnaire (DPQ) before and one month after the onset of the intervention. The data analysis was conducted using descriptive statistics (absolute and relative frequencies, mean, and standard deviation) and inferential statistics (ANOVA, independent t-test, paired t-test, and chi-square test). The analysis utilized SPSS software, version 22, and a significance level of 0.05 was considered for all statistical tests.

Results: The groups showed no significant differences regarding the pre-test mean scores of disaster preparedness knowledge, attitude, and perception. No significant difference was also seen in the post-test mean score of disaster preparedness knowledge and attitude (P=0.20). However, the post-test mean score of disaster preparedness perception in the intervention group was greater than that in the control group (P<0.001).

Conclusion: Smartphone-based learning can promote nurses' disaster preparedness perception, particularly during the COVID-19 pandemic.

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Highlights

- The study evaluates smartphone-based learning's impact on nurses' disaster preparedness.
- This quasi-experimental study was conducted in urban hospitals in Iran.
- The analysis showed no significant differences in knowledge and attitude scores between the study groups.
- The intervention group exhibited an improved perception of disaster preparedness.
- Smartphone-based learning was beneficial for nurses during the COVID-19 pandemic.

Plain Language Summary

This study explored how smartphone apps can help nurses better prepare for disasters. We recruited 204 nurses in urban hospitals in Iran and divided them into two groups. One group used the app for a month, while the other did not. Before and after the study, we asked the nurses about their knowledge, attitude, and perception of disaster preparedness. We found no differences in knowledge and attitude between the two groups. However, after the study, the group using the app better perceived disaster preparedness. So, a smartphone app can help nurses feel more prepared for disasters, especially during the pandemic.

Introduction

Despite significant scientific advances in recent decades, disasters continue to result in substantial loss of life and assets (Mitchell et al., 2016). All communities worldwide are threatened by at least one type of disaster (Labrague et al., 2018). Iran, a country in Asia, has always been one of the most vulnerable nations to disasters (Ardalan et al., 2016; Kahen, 2025). Notably, natural disasters such as massive earthquakes have inflicted substantial human losses in Iran in the recent past (Tavakoli et al., 2017).

Disaster preparedness is deemed essential given the profound effects of disasters on human life (Yeo & Comfort, 2017). Disaster preparedness is linked to improved disaster response and assures efficient service delivery to those affected by disasters (Najafi Ghezeljeh et al., 2019; Najafi Ghezeljeh et al., 2022). Among health care providers, nurses are more important in preparing for these crises due to their involvement in the front line of disaster management (Heagele, 2017). Despite health care professionals' pivotal role in disaster response, studies indicate that many nurses do not feel adequately equipped to handle such circumstances (Heagele, 2017). In disaster management, nurses apply their professional knowledge and skills to devise approaches for minimizing disaster-related harm and eradicating threats to human lives (Yeo & Comfort, 2017). During disaster management, nurses use their professional knowledge and skills to develop methods for mitigating disaster-related damages and eliminating threats to human lives (Veenema, 2018). The novel coronavirus 2019 (COVID-19) pandemic has further underscored nurses' substantial contributions to managing disasters and crises (Al Thobaity & Alshammari, 2020; Songwathana & Timalsina, 2021). Moreover, nurses' professional competencies, particularly in emergency management and patient care, are essential for assisting disaster victims (Parrillo et al., 2016).

Nurses should have adequate preparedness to deliver services and solve problems in disaster situations (Al Thobaity & Alshammari, 2020; Songwathana & Timalsina, 2021). The World Health Organization (WHO) also recommends that all countries, regardless of disaster rate, prepare their health care providers for disaster management (Loke & Fung, 2014). Nonetheless, some studies reported that many nurses exhibit limited readiness for disaster management (Loke & Fung, 2014; Ahmed et al., 2023). For example, a study shows that the level of disaster preparedness among Indian nurses ranges from low to moderate (Martono et al., 2019). Another study reports that most Japanese nurses deployed to disaster regions are unsure of their actions, experience varying degrees of uncertainty, and believe they should wait for their managers' commands (Maeda et al., 2016). Similarly, a study in Iran reveals nurses possess inadequate knowledge, attitudes, and practices regarding disaster management (Azadi et al., 2018). Moreover, several studies in Iran highlight that

even though disaster preparedness guidelines are available in hospitals, nurses' levels of disaster preparedness range from low to moderate (Farajzadeh et al., 2017; Rahmati-Najarkolaei et al., 2017). Some studies indicate that nurses exhibit limited disaster preparedness despite their crucial role in serving disaster victims (Labrague et al., 2018; Husna et al., 2022).

Given nurses' constrained disaster preparedness and relatively limited knowledge of disaster management, educational interventions are imperative to enhance their understanding and skills in this area (NASH, 2017; Kalanlar, 2018). The fundamental mission of medical education lies in nurturing competent professionals equipped with the requisite knowledge, attitudes, and skills for upholding and advancing public health, especially in disasters (Ataei et al., 2020). Diverse methods exist for augmenting nurses' disaster preparedness. Some examples are simulation training, disaster scenario simulations, and ongoing training initiatives (Labrague et al., 2018). However, these approaches require direct interaction between educators and learners, creating the risk of infection transmission during the COVID-19 pandemic (Pokhrel & Chhetri, 2021). Moreover, traditional teaching methods cannot fulfill the different educational needs of learners. Therefore, electronic learning (e-learning) methods should be embraced and prioritized for academic purposes (Biswas et al., 2020; Morin, 2020) because e-learning methods can be associated with better learning outcomes in these circumstances (Rahal et al., 2018).

Smartphone-based learning stands as a noteworthy form of e-learning, driven by the rapid advancements in smartphone technology. It has spurred educators' heightened interest in employing smartphones to facilitate education and foster enhanced learning (Price et al., 2018; Short et al., 2014). Smartphones have become pivotal tools granting nurses seamless access to information, substantially improving their professional prowess and performance (Beauregard et al., 2017). Demonstrating this shift, a study reveals that nurses are enthusiastic about leveraging smartphones and social media as educational resources (Hay et al., 2017). Additionally, research showcases the considerable positive impact of smartphone-based learning on nursing students' prehospital trauma management skills (Taziki Balajelini & Najafi Ghezeljeh, 2018). Smartphone-based mobile learning positively influences nursing students by enhancing their knowledge, skills, confidence, and attitude toward education (Kim & Park, 2019; Cho & Lee, 2016). It is seen as an alternative or supplementary method for nursing education. Similarly, it has been indicated that disaster preparedness education through social media has the potential to augment emergency nurses' knowledge despite their demanding workloads and time constraints for learning (Najafi Ghezeljeh et al., 2019). Studying the impact of smartphone-based learning on nurses' disaster preparedness can unveil existing educational gaps (Heagele, 2017). This insight helps healthcare organizations in designing targeted interventions aimed at bolstering overall readiness and response, thereby enhancing patient outcomes during crises and disasters. This study is essential as it explores the impact of smartphone-based learning on enhancing nurses' knowledge, attitudes, and perceptions of disaster preparedness, ultimately aiming to improve their response capabilities in emergencies. Therefore, we undertook this study intending to evaluate the effects of smartphone-based mobile learning on disaster preparedness-related knowledge, attitude, and perception among nurses.

Materials and Methods

Design, setting, and sample

This quasi-experimental study used a pre-test-post-test design with a control group from June to September 2020.

The study settings were Imam Khomeini and Shafa hospitals in Falavarjan City, Iran. These two teaching hospitals are affiliated with the Isfahan University of Medical Sciences in Isfahan Province, Iran, with 280 nursing staff in different general and specialty wards. The census included all eligible nurses from these hospitals in the study. The inclusion criteria were consent to participate in the study, a bachelor's degree or higher in nursing, at least 6 months of clinical work experience as a nurse, and having a smartphone. In total, 204 nurses were eligible and recruited. The subjects were randomly allocated to either a control (n=102) or an intervention group (n=102) using block randomization with a block size of 4 and a randomization ratio 1:1.

Data collection

The data collection instruments of this study encompassed a demographic questionnaire, the disaster preparedness evaluation tool (DPET), and the disaster preparedness questionnaire (DPQ) (Al Khalaileh et al., 2010). The demographic questionnaire comprised items related to age, educational level, clinical work experience, experience in an emergency department, experience in other hospital wards, history of care delivery to disaster victims, history of participation in disaster management educational courses, time passed from the last participation in such courses, and history of membership in the crisis management committees.

The DPET was used to assess nurses' perceptions regarding disaster preparedness (Al Khalaileh et al., 2010). This tool is composed of 46 items in three subscales, namely predisaster preparedness (25 items), response (15 items), and recovery (6 items). The items were scored on a 6-point Likert scale as follows: 1="strongly disagree," 2="disagree," 3="slightly agree," 4="neither agree nor disagree," 5="agree," and 6="strongly agree." Total scores range from 46 to 276, with higher scores indicating better disaster preparedness-related perception. The tool's developers reported its Cronbach α as 0.93 (Al Khalaileh et al., 2010). In this study, the content was first translated into Persian. Then, we asked another linguist to translate this content into English literally and word-for-word. Finally, the back translation was compared with the original text to ensure the correctness and completeness of the back translation. For this purpose, the content validity of the tool was evaluated and confirmed by 10 experts from the nursing faculty. Its Cronbach α was calculated as 0.961. The DPQ was used to assess disaster preparedness-related knowledge and attitude. The knowledge subscale encompasses 27 items addressing knowledge about disaster management and nursing responsibilities during disasters. The items are scored either 0 (wrong answer) or 1 (correct answer). The Kuder-Richardson coefficient of the knowledge subscale was reported as 0.659 (Al Khalaileh et al., 2010). The attitude subscale contains 20 items on disaster preparedness-related attitude. The items are scored on a 4-point Likert scale as follows: 4="very high," 3="high," 2="low," and 1="very low." The leading developer of the tool has reported the Cronbach α value of the attitude subscale as 0.849 (Al Khalaileh et al., 2010). The total possible scores of the knowledge and the attitude subscales are 0–27 and 20–80, respectively, with higher scores showing better knowledge and more positive attitude (Al Khalaileh et al., 2010).

In this study, the developer initially obtained permission for translation and validation. The translation followed the WHO's forward and backward method. Two bilingual experts in English and Persian, familiar with the subject and research, independently translated the English scale into Persian. To ensure the validity and reliability of the tool, a process involving face validity (expert review) and reliability assessment via the Cronbach α method was conducted. To do this, 5 experts in nursing and disaster management from Iran University of Medical Sciences, Tehran, Iran, reviewed and confirmed the face validity of this questionnaire. The knowledge subscale displayed a Kuder-Richardson coefficient of 0.70, and the attitude subscale exhibited a Cronbach α of 0.96.

Participants completed the study instruments before and one month after the onset of the study intervention. To mitigate the risk of COVID-19 transmission, the study instruments were uploaded to an online platform, and the participants were provided with a link via WhatsApp, prompting them to complete the instruments online.

Study intervention

The study intervention was a smartphone-based mobile learning program focused on disaster management. The software was developed by a programming expert using Android Studio (Java language) and Eclipse. It was designed to be used offline.

The program's content revolved around the four main components of disaster management: Mitigation, preparedness, response, and rehabilitation/reconstruction (in all disaster conditions). This content was crafted based on existing literature and used images, videos, and textual materials to convey educational information. This diverse range of content aimed to provide a well-rounded understanding of disaster management principles, fostering a more engaging and impactful learning experience for participants.

The content validity of the program was affirmed through expert review, and subsequently, a programming specialist utilized the program's content to develop an Android application. The application was designed with a user guide, password protection, and non-transferability between smartphones. The participants could access and engage with the application without any limitations. Three programming experts attested to its validity and usability. Moreover, feedback was sought from 10 external nurses, who were interviewed to assess the application's clarity and user-friendliness. Based on their input, necessary revisions were made to enhance the application's quality. The first author installed the application on the smartphones of the participants in the intervention group, provided them with education about its use, and noted that they could use the application for one month without any constraints. Moreover, the participants were integrated into a WhatsApp group and received weekly reminders to engage with the application. Also, nurses in the intervention group were encouraged to sustain this activity for over a month.

On the other hand, the control group was informed that utilizing the software during the intervention period was not feasible. However, after completing the questionnaires, they were assured access to the software after the intervention. The participants in the control group did not receive any intervention.

Data analysis

The data were analyzed using SPSS software, version 16 with a significance level of <0.05. The data distribution was assessed using the Kolmogorov-Smirnov test, revealing that the data in this study followed a normal distribution. Between-group comparisons were conducted using the chi-square and independent-sample t-test, while within-group comparisons employed paired-sample t-test. Cohen effect size was also computed to quantify the intervention's impact.In the context of an independent-sample t-test, the effect size was calculated by dividing the mean difference between groups by the total standard deviation of both groups. This value is interpreted as follows: 0.2 indicates a small effect, 0.5 indicates a moderate effect, and 0.8 signifies a large effect. To determine the effect size, an online statistical tool was utilized. For analysis, a per-protocol approach was adopted.

Results

Participants characteristics

Five participants from the control group and 9 from the intervention group were excluded from the study due to incomplete responses to the study instruments or non-adherence to the study intervention. Finally, data from 97 participants in the control group and 93 participants in the intervention group were analyzed (Figure 1).

The Mean±SD age of the participants was 33.86±6.7 years in the intervention group and 32.55±6.65 years in the control group. The independent-sample t-test and the chi-square test results indicated no statistically significant differences between the study groups regarding demographic characteristics P>0.05 (Table 1).

Disaster preparedness-related perception and its subscales

There were no significant differences between the groups regarding the pre-test mean scores of disaster preparedness-related perceptions and its subscales (P>0.05). However, in the post-test, all these mean scores in the intervention group were significantly greater than the control group (P=0.003). Within-group comparisons also show that only the mean score of the response subscale of disaster preparedness-related perception significantly improved in the control group (P=0.017), while the mean scores of disaster preparedness-

Table 1. Between-group comparisons in terms of demographic characteristics

Groups Characteristics		No. (%)			P
		Total	Control	Intervention	
Age (y)	<30	62(32.6)	37(38.1)	25(26.9)	0.18*
	30–39	93(48.9)	42(43.3)	51(54.8)	
	≥40	35(18.4)	18(18.6)	17(18.3)	
	Total	190(100)	97(100)	93(100)	
	Mean±SD	33.19±6.69	32.6±55.65	33.6±86.7	
Educational level	Bachelor's	175(92.1)	90(92.8)	85(91.4)	0.723^
	Master's	15(7.9)	7(7.2)	8(8.6)	
Clinical work experience (y)	<5	56(29.5)	36(37.1)	20(21.5)	0.347*
	5–9	62(32.6)	24(24.7)	38(40.9)	
	10–14	40(21.1)	22(22.7)	18(19.4)	
	≥15	32(16.8)	15(15.5)	17(18.3)	
	Mean±SD	8.53±5.78	8.5±14.98	8.5±93.56	
Work experience in emergency department (y)	<1	95(50)	48(49.5)	47(50.5)	0.878*
	1–4	56(29.5)	28(28.9)	28(30.1)	
	5–9	31(16.3)	17(17.5)	14(15.1)	
	≥10	8(4.2)	4(4.1)	4(4.3)	
	Mean±SD	2.24±2.3	2.3±2.22	2.3±2.39	

Groups Characteristics		No. (%)			P
		Total	Control	Intervention	
Work experience in other hospital wards (y)	<1	24(12.6)	19(19.6)	5(5.4)	0.599*
	1–4	68(35.8)	33(34)	35(37.6)	
	5–9	54(28.4)	22(22.7)	32(34.4)	
	≥ 10	44(23.2)	23(23.7)	21(22.6)	
	Mean±SD	5.93±5.39	5.5±74.68	6.4±15.93	
History of care delivery to disaster victims	Yes	177(93.2)	92(94.8)	85(91.4)	0.347^
	No	13(6.8)	5(5.2)	8(8.6)	
History of participation in disaster management educational courses	Yes	130(68.4)	68(70.1)	62(66.7)	0.61^
	No	60(31.6)	29(29.9)	31(33.3)	
Membership in the crisis management committees of hospitals	Yes	163(85.8)	86(88.7)	77(82.8)	0.247^
	No	27(14.2)	11(11.3)	16(17.2)	
Time passed from the last participation in disaster-related courses (y)	No history	29(15.3)	16(16.5)	13(14)	0.355*
	1	77(40.5)	39(40.2)	38(40.9)	
	2	55(28.9)	28(28.9)	27(29)	
	3	17(8.9)	10(10.3)	7(7.5)	
	≥ 4	12(6.3)	4(4.1)	8(8.6)	
	Total	190(100)	97(100)	93(100)	
	Mean±SD	1.57±1.24	1.1±48.13	1.1±65.34	

*Independent-sample t-test, ^Chi-square test.

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related perception and all its subscales improve substantially in the intervention group (P=0.003). Furthermore, the differences between pre-test and post-test mean scores in the intervention group were notably larger than in the control group (P=0.001) (Table 2).

Disaster preparedness-related knowledge

The groups did not significantly differ regarding the mean scores of disaster preparedness-related knowledge or the mean score of disaster preparedness-related knowledge (P>0.05). However, within-group comparisons showed a significant increase in the mean score of disaster preparedness-related knowledge in the pre-test and post-test of both groups (P<0.001) (Table 2).

Disaster preparedness-related attitude

Within-group comparisons revealed that the mean score of disaster preparedness-related attitude significantly increased in both groups (P<0.001), and the between-group difference respecting the difference in the mean score of disaster preparedness-related attitude was not significant (P=0.233) (Table 2).

Discussion

The results of this study demonstrate that smartphone-based learning had significant positive effects on disaster preparedness-related perception and all its subscales among nurses. By utilizing smartphone-based learning, nurses benefit from flexible, on-demand training modules that enhance their awareness and confidence in disaster preparedness (Fecteau, 2021). This approach accommodates their diverse schedules and supports continuous learning and the immediate application of concepts in real-world scenarios. The significant improvements in disaster preparedness perceptions observed in this study suggest that such innovative educational interventions can lead to better emergency outcomes, enhancing overall patient care and safety (Amberson et al., 2020). As health care systems increasingly face the challenges posed by natural disasters and health crises, accessible, modern training methods like smartphone applications will be essential for developing a proficient and responsive nursing workforce. This study contributes valuable evidence on how smartphone-based learn-

Table 2. Within- and between-group comparisons of the mean scores of participants' disaster preparedness-related knowledge, attitudes, and perceptions

Variables (Range of Scores)		Time	Mean±SD		P*	Effect Size (95% CI**)
			Group			
			Control	Intervention		
Disaster preparedness-related perception	Predisaster preparedness (25–150)	Before	95.82±19.38	92.01±20.11	0.185	
		After	97.83±13.56	104.05±14.31	0.003	0.43 (0.14 to 0.72)
		P^	0.386	<0.001	—	
		Difference	2.01±22.74	11.71±20.46	0.002	—
	Response (15–90)	Before	58.43±12.02	56.72±13.36	0.354	
		After	62.7±12.17	66.81±9.37	0.01	0.37 (0.09 to 0.66)
		P^	0.017	<0.001	—	
		Difference	3.76±15.93	10.09±14.81	0.005	—
	Recovery (6–36)	Before	23.32±5.38	23.41±5.75	0.912	
		After	24.25±4.65	26.96±4.43	<0.001	0.59 (0.31 to 0.88)
		P^	0.173	<0.001	—	
		Difference	0.93±6.65	3.53±6.45	0.007	—
	Total (46–276)	Before	177.58±34.56	172.15±36.78	0.295	
		After	184.79±26.44	197.82±25.89	0.001	0.49 (0.21 to 0.78)
		P^	0.096	<0.001	—	
		Difference	6.7±41.27	25.34±37.81	0.001	—
Disaster preparedness-related knowledge (0–27)		Before	10.71±3.79	11.44±3.21	0.155	
		After	13.74±3.71	0.291		0.15 (–0.13 to 0.43)
		P^	<0.001	—		
		Difference	2.434.99	2.3±4.25	0.845	—
Disaster preparedness-related attitude (20-80)		Before	61.84±9.04	63.41±7.82	0.202	
		After	68.69±7.31	0.828		–0.015 (–0.3 to 0.25)
		P^	<0.001	—		
		Difference	7.09±10.76	5.27±10.1	0.233	—

*Independent-sample t-test, ^Paired-sample t-test, **Confidence interval.

ing can influence nurses' disaster preparedness perceptions, an area with limited prior empirical research.

In contrast, the findings show that disaster preparedness-related knowledge and attitudes improve significantly in the intervention and control groups, making it challenging to isolate the intervention's specific effects on these aspects. This finding indicates that the smartphone-based intervention may have had a limited impact on knowledge and attitudes related to disaster preparedness.

The intervention may have primarily enhanced perceptions by increasing participants' immediate sense of awareness and confidence in emergency preparedness.

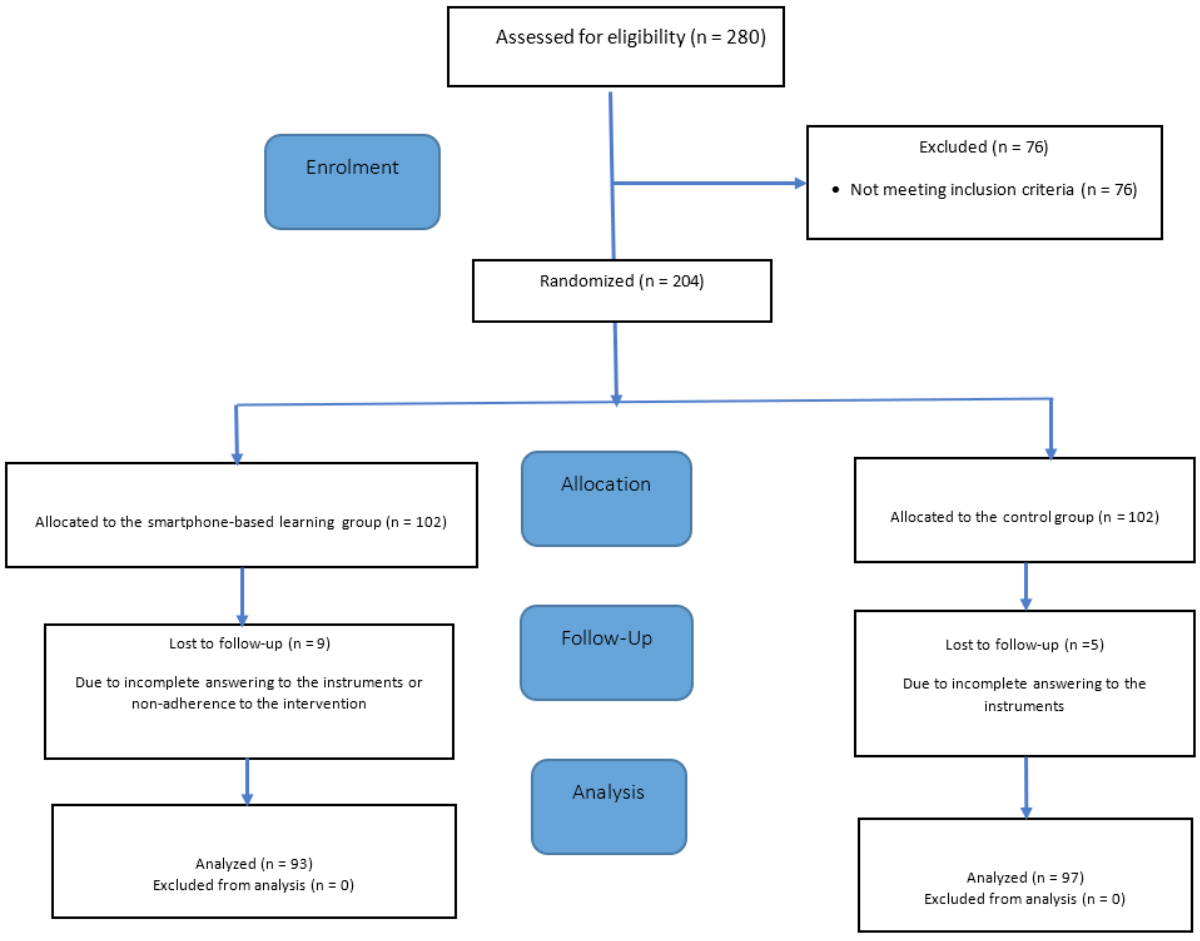

Figure 1. The flow diagram of the study

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Unlike knowledge and attitudes, which often require sustained learning and reinforcement, perceptions are more readily influenced by accessible educational formats like smartphone-based learning. While smartphone-based learning offers flexibility, it may lack the depth needed for lasting knowledge retention or the interpersonal engagement often essential for attitude shifts. As a result, the intervention may have been more effective in shaping disaster preparedness perceptions than in reinforcing knowledge or reshaping attitudes.

The intervention's impact on perception likely stems from its emphasis on practical, real-world scenarios, which can instill a sense of preparedness even if foundational knowledge and attitudes are less affected. Moreover, the high visibility of disaster preparedness topics during the COVID-19 pandemic may have contributed to existing knowledge and established attitudes among participants, making it more challenging for the intervention to effect additional change in these areas.

Consistent with our findings, a study in South Korea found that smartphone-based learning did not significantly impact nursing students' knowledge of infant airway management (Kim et al., 2017). Similarly, a study in Iran reports that education through social networks significantly improves disaster preparedness-related knowledge among emergency nurses but has no significant effect on their attitudes toward disaster preparedness (Najafi Ghezeljeh et al., 2019). The variation in outcomes may be influenced by the differing methodologies employed in each study. For example, the study by Najafi Ghezeljeh et al. (2019) utilizes a different intervention framework and engagement strategy, which may have led to a more interactive and immersive educational experience for participants. In contrast, the current study's design may have limited engagement and interactivity, affecting the overall effectiveness of the intervention. These methodological differences could explain the observed disparities in disaster preparedness knowledge among emergency nurses in the two studies.

The findings of this research suggest that smartphone-based learning can be more effective in enhancing disaster preparedness knowledge and attitudes alongside perceptions. Additionally, comparing the effectiveness of this intervention with other teaching methods would offer valuable insights into its relative impact.

Conclusion

This study suggests that smartphone-based learning enhances nurses' disaster preparedness-related perceptions but does not significantly impact their knowledge or attitudes. Further research is needed to identify effective teaching strategies to improve nurses' knowledge and attitudes. The findings can inform the development of smartphone-based continuing education programs for nurses, particularly in response to disasters. Additional studies are recommended to assess the impact of such interventions on nurses' disaster preparedness practices.

Study limitations

One strength of this study was minimizing information leakage between groups by assigning each intervention participant a personal password for the educational application. However, sampling both intervention and control groups from the same setting may have led to some information sharing, potentially contaminating the control group. Additionally, the app's exclusive compatibility with the Android operating system limited access for some nurses, highlighting the need for cross-platform applications in future studies. Another limitation was the inability to track software usage frequency, learning engagement, and the missing data from participants who did not fully adhere to the intervention. While the intervention impacted nurses' disaster-related attitudes, it may not justify its implementation in practice alone. Future studies should examine its effects on skills and practical application and compare this method with other educational approaches to accurately assess its impact.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of Iran University of Medical Sciences, Tehran, Iran, approved this study (Code: IR.IUMS.REC.1398.336). Necessary permissions for attending the setting were obtained from Isfahan University of Medical Sciences, Isfahan, Iran. All methods of this study were performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. Written informed consent was obtained from all individual participants included in the study.

Funding

This study was financially supported by Iran University of Medical Sciences, Tehran, Iran (Code: 98-1-3-14603).

Authors' contributions

Conceptualization: Tahereh Najafi Ghezeljeh; Data collection: SeyedRohallah Mirlohi; Data analysis: Tahereh Najafi Ghezeljeh, and Shima Haghani; Writing: Tahereh Najafi Ghezeljeh, and Sahar Keyvanloo Shahrestanaki; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgments

The authors want to thank the Vice Chancellor for Research Affairs of Iran University of Medical Sciences, Tehran, Iran, for financial support and all the nurses who helped them in this research.

References

Abu Rahal, Z., et al., 2018. Use of information and communication technologies among individuals with and without serious mental illness. Psychiatry Research, 266, pp. 160–7. [DOI:10.1016/j.psychres.2018.05.026] [PMID]

Ahmed, A. E. M. E., et al., 2023. Effect of electronic based learning application on practical skills among community health nursing students. Journal of Nursing Science Benha University, 4(2), pp. 55-68. [DOI: 10.21608/jnsbu.2023.322581]

Al Khalaileh, M. A., et al., 2010. The Disaster Preparedness Evaluation Tool©: Psychometric testing of the Classical Arabic version. Journal of Advanced Nursing, 66(3), pp. 664–72. [DOI:10.1111/j.1365-2648.2009.05208.x] [PMID]

AL Thobaity, A. & Alshammari, F., 2020. Nurses on the frontline against the COVID-19 pandemic: An integrative review. Dubai Medical Journal, 3(3), pp. 87-92. [DOI:10.1159/000509361]

Amberson, T., Wells, C. & Gossman, S., 2020. Increasing disaster preparedness in emergency nurses: A quality improvement initiative. Journal of Emergency Nursing, 46(5), pp. 654–65. e21.[DOI:10.1016/j.jen.2020.05.001] [PMID]

Ataei, M., Hamedani, S. S. & Zameni, F., 2020. Effective methods in medical education: from giving lecture to simulation. Journal of Advanced Pharmacy Education and Research, 10(S1), pp. 36-42. [Link]

Azadi, A., Sahebi, A. & Tavan, H., 2018. The attitudes, knowledge and performance of Ilam nurses regarding disaster preparedness. Health in Emergencies and Disasters Quarterly, 3(2), pp. 105-12. [DOI:10.29252/nrip.hdq.3.2.105]

Beauregard, P., Arnaert, A. & Ponzoni, N., 2017. Nursing students' perceptions of using smartphones in the community practicum: A qualitative study. Nurse Education Today, 53, pp. 1–6. [DOI:10.1016/j.nedt.2017.03.002] [PMID]

Biswas, B., Roy, S. K. & Roy, F., 2020. Students perception of Mobile learning during Covid-19 in Bangladesh: University student perspective. AQUADEMIA, 4(2), pp. ep20023 [DOI:10.29333/aquademia/8443]

CHO, S. & Lee, E., 2016. Distraction by smartphone use during clinical practice and opinions about smartphone restriction policies: A cross-sectional descriptive study of nursing students. Nurse Education Today, 40, pp. 128-33. [DOI:10.1016/j.nedt.2016.02.021] [PMID]

Farajzadeh, M., et al., 2017. Preparedness of nurses for crises and disasters in imam Khomeini and social security hospitals of Saqqez. Health in Emergencies and Disasters Quarterly, 3(1), pp. 57-63. [DOI:10.29252/nrip.hdq.3.1.57]

Fecteau, K. J., 2021. Assessing readiness and effectiveness to learning with a smartphone application [PhD dissertation]. Arizona: The University of Arizona. [Link]

Hay, B., et al., 2017. "iM ready to learn": Undergraduate nursing students knowledge, preferences, and practice of mobile technology and social media. Computers, Informatics, Nursing: CIN, 35(1), pp. 8–17. [DOI:10.1097/CIN.0000000000000284] [PMID]

Heagele, T., 2017. Disaster□related community resilience: A concept analysis and a call to action for nurses. Public Health Nursing, 34(3), pp. 295–302. [DOI:10.1111/phn.12292] [PMID]

Husna, C., et al., 2022. Emergency preparedness information among nurses in response to disasters. Enfermería Clínica, 32(Supplement 2), pp. S44-9. [DOI:10.1016/j.enfcli.2022.03.016]

Kalanlar, B., 2018. Effects of disaster nursing education on nursing students' knowledge and preparedness for disasters. International Journal of Disaster Risk Reduction, 28, pp. 475-80. [DOI:10.1016/j.ijdrr.2017.12.008]

Kahen, G., 2025. Disaster prevention and management: an academic challenge for disaster prone developing countries. WIT Transactions on Ecology and the Environment, 17. [Link]

Kim, J. H. & Park, H., 2019. Effects of smartphone-based mobile learning in nursing education: A systematic review and meta-analysis. Asian Nursing Research, 13(1), pp. 20–9. [DOI:10.1016/j.anr.2019.01.005] [PMID]

Kim, S. J., et al., 2017. A smartphone application to educate undergraduate nursing students about providing care for infant airway obstruction. Nurse Education Today, 48, p. 145-52. [DOI:10.1016/j.nedt.2016.10.006] [PMID]

Labrague, L. J., et al., 2018. Disaster preparedness among nurses: A systematic review of literature. International Nursing Review, 65(1), pp. 41–53. [DOI:10.1111/inr.12369] [PMID]

Loke, A. Y. & Fung, O. W., 2014. Nurses' competencies in disaster nursing: Implications for curriculum development and public health. International Journal of Environmental Research and Public Health, 11(3), pp. 3289–303. [DOI:10.3390/ijerph110303289] [PMID]

Maeda, T., et al., 2016. Disaster readiness among nurses in Japan: Current status following the Great East Japan earthquake. International Journal of Nursing, 3(1), pp. 15-28. [Link]

Martono, M., et al., 2019. Indonesian nurses' perception of disaster management preparedness. Chinese Journal of Traumatology, 22(1), pp. 41–6. [DOI:10.1016/j.cjtee.2018.09.002] [PMID]

Mitchell, M. L., et al., 2016. Enhancing disaster preparedness of specialty nurses on a national scale. Disaster Prevention and Management, 25(1), pp. 11-26. [DOI:10.1108/DPM-02-2015-0026]

Morin K. H., 2020. Nursing education after COVID-19: Same or different?. Journal of Clinical Nursing, 29(17-18), pp. 3117–9. [DOI:10.1111/jocn.15322] [PMID]

Najafi Ghezeljeh, T., et al., 2019. Effect of education using the virtual social network on the knowledge and attitude of emergency nurses of disaster preparedness: A quasi-experiment study. Nurse Education Today, 73, pp. 88–93. [DOI:10.1016/j.nedt.2018.12.001] [PMID]

Najafi Ghezeljeh, T., et al., 2022. Home care nurses' perception of the challenges they faced during the COVID-19 pandemic: A qualitative study. BMC Nursing, 21(1), pp. 314. [DOI:10.1186/s12912-022-01082-y] [PMID]

Nash, T. J., 2017. A guide to emergency preparedness and disaster nursing education resources. Health Emergency and Disaster Nursing, 4(1), pp. 12-25. [Link]

Pokhrel, S. & Chhetri, R., 2021. A literature review on impact of COVID-19 pandemic on teaching and learning. Higher Education for the Future, 8(1), pp. 133-41. [DOI:10.1177/2347631120983481]

Pourteimour, S., et al., 2019. The effect of smartphone-based application learning on the nursing students' performance in preventing medication errors in the pediatric units. Pediatric Quality & Safety, 4(6), pp. e226. [DOI:10.1097/pq9.0000000000000226] [PMID]

Price, A. M., et al., 2018. First year nursing students use of social media within education: Results of a survey. Nurse Education Today, 61, pp. 70–6. [DOI:10.1016/j.nedt.2017.10.013] [PMID]

Rahmati-Najarkolaei, F., et al., 2017. Assessment of a military hospital's disaster preparedness using a health incident command system. Trauma Monthly, 22(2), pp. e31448. [Link]

Short, S. S., et al., 2014. Smartphones, trainees, and mobile education: implications for graduate medical education. Journal of Graduate Medical Education, 6(2), pp. 199-202. [DOI:10.4300/JGME-D-13-00238.1] [PMID]

Songwathana, P. & Timalsina, R., 2021. Disaster preparedness among nurses of developing countries: An integrative review. International Emergency Nursing, 55, pp. 100955. [DOI:10.1016/j.ienj.2020.100955] [PMID]

Tavakoli, N., et al., 2017. Designing a model of patient tracking system for natural disaster in Iran. Journal of Education and Health Promotion, 6, pp. 77. [DOI:10.4103/jehp.jehp_135_16] [PMID]

Taziki Balajelini, F. & Najafi Ghezeljeh, T., 2018. Prehospital trauma management: Evaluation of a new designed smartphone application. Journal of Client-Centered Nursing Care, 4(4), pp. 193-202. [DOI:10.32598/jccnc.4.4.193]

Veenema, T. G., 2018. Disaster nursing and emergency preparedness. New York: Springer Publishing Company. [Link]

Yeo, J. & COMFORT, L. K., 2017. An expected event, but unprecedented damage: Structure and gaps of large-scale response coordination of the 2011 Thailand floods. Disaster Prevention and Management: An International Journal, 26, pp. 458-70. [DOI:10.1108/DPM-02-2017-0048]

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