Effect of Mobile Based Training on Nurses' Performance and Self-Efficacy of The Safe Practice for Intravenous Push Medications

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Abstract

Background: Effective and safe administration of medication is one of the most important nursing activities that requires a set of knowledge and specialized skills to reduce medication errors and improve patient safety. **This study aimed** to evaluate the effect of mobile-based training on nurses' performance and self-efficacy of the safe practice for intravenous push Medications. **Design:** A quasi-experimental research design was used to achieve the aim of the current study. **Setting**: The study was conducted at the General Medical and Surgical Department at Benha University Hospital, Qalyubia Governorate, Egypt. **Sample:** A convenient sample of nurses working in the Medical and Surgical Departments included ٨٠ from the Medical Department and ٥١ from the Surgical Department. **Tools:** The data was collected using three tools: **I**. The self-administered questionnaire included knowledge and self-efficacy. **II.** Nurses' competency skill observational checklist assessment. **Results:** A significant statistical improvement was observed in the nurses' knowledge mean % score, which increased by ٨٥.٣٦٪ of the total mean score in the second week post mobile-based training. Similarly, the nurses' practice improved to ٩٢.٨٧٪ of the total mean score in the second week of post-training compared with the pre-training intervention. Moreover, the nurses' self-efficacy showed a marked enhancement in the same period post-mobile-based training compared to the pre-training intervention, with a P-value < ٠.٠٠١**. **Conclusion:** Nurses' knowledge, practice, and self-efficacy had been significantly improved post mobile-based training, which reflects that Mobile videos can reinforce practical mobile training skills through repeated viewing on mobile and allow flexibility for learning nurses at their own pace. It supported the research hypotheses. **Recommendations:** Provide necessary support, including technical assistance and time management strategies, to facilitate the successful adoption of mobile-based training.

Keywords: Intravenous Push Medications, Mobile-Based Training, Nurses' Performance

Introduction

Intravenous (IV) push medication involves delivering a drug or fluid directly into the bloodstream through the venous system. This method allows the medication to enter the circulatory system instantly, reaching its target site without delay. IV push medications are commonly utilized in critical care settings, where any mistakes in the administration process can lead to significant adverse effects for patients **(Chang et al.,٢٠٢٢).**

Intravenous medications provide rapid and immediate therapeutic effects, making them crucial in emergency scenarios like cardiac arrest. They are useful to manage and quickly achieve the proper therapeutic levels and offer more reliable and complete absorption compared to other injection routes **(Kim & De Jesus, ٢٠٢١).** The administration of medication safely and effectively is a critical nursing responsibility that necessitates a specific body of knowledge and specialized skills aimed at minimizing medication errors and enhancing patient safety **(Alrabadi et al.,٢٠٢١).**

Many healthcare organizations have enhanced their technological infrastructures to better support healthcare providers. However, a significant number of nurses are utilizing their digital devices, like smartphones, while on the job **(Mbunge et al.,٢٠٢١).** Mobile-based training can enhance nurses' knowledge and skills, facilitating quick and convenient access to information, ensuring portability, and promoting easy accessibility and self-directed which has a positive impact on nurses' knowledge, skills, and attitudes toward learning **(Sansuwito et al.,٢٠٢٤).**

Self-efficacy in nursing is a crucial element of attitude that influences various factors such as patient outcomes, job satisfaction, stress levels, and overall performance. Nurses who possess a higher sense of self-efficacy typically demonstrate coping strategies that are more inclined to deliver care that is centered around patient care. **(Shorey& Lopez, ٢٠٢١).**

Significance of the study

The administration of intravenous (IV) push medications poses significant challenges for nurses, particularly in the absence of continuous education. Without up-to-date training, nurses may lack essential knowledge regarding accurate dosages, preparation techniques, and proper administration protocols, thereby increasing the risk of medication errors and compromising patient safety **(Pullam, ٢٠٢٤).** Additionally, insufficient education may impair nurses' ability to identify and respond effectively to adverse reactions or complications that can occur during or after medication administration **(Pullam, ٢٠٢٤).**

As healthcare continues to evolve with the introduction of new medications and technologies, nurses who do not engage in ongoing professional development may find it difficult to stay aligned with current best practices and clinical guidelines. This gap in knowledge not only affects the quality of care but can also lead to serious patient outcomes.These challenges highlight the importance of mobile-based training platforms, which offer accessible, flexible, and up-to-date educational resources to support nurses in maintaining competency and ensuring safe IV medication administration **(Abd Elghany et al.,٢٠٢٢).**

Aim of the study:

This study aimed to evaluate the effect of mobile-based training on nurses' performance and self-efficacy of the safe practice for intravenous push Medications.

Research hypotheses:

The following research hypotheses were formulated as follows:

H١: There is supposed the improvement significantly of nurses' knowledge level regarding safe practices for Intravenous Push Medications post mobile-based training implementation than before.

H٢: There is supposed the improvement significantly of nurses' practice level regarding Intravenous Push Medications post mobile-based training implementation than before.

H٣: The self-efficacy of nurses has improved significantly post mobile-based training implementation than before.

Operational definition:

Nurses' performance included the nurses' knowledge and practice of the skill of IV push medication.

Subjects and Method

Research design

A quasi-experimental design (pre- and post-test) will be utilized to achieve the aim of the study.

Study setting:
The study was carried out in the medical and surgical departments at Benha University Hospital, Qalyubia Governorate, Egypt.
Subject: The convenient sample of nurses working in the medical and surgical departments included ٨٠ nurses from the medical department and ٥١ nurses from the surgical department at Benha University Hospital. The sample size was calculated according to the following formula **(Shaheen & Siddik, ٢٠٢٣).**
n=N/(١+N(e)^٢)
N = total population ١٩٧
n= sample size ١٣١
The coefficient factor = ٠.٠٥
The nurses were enrolled in the study over six months from the beginning of March to the end of August, according to the following criteria:

Inclusion criteria:
-Nurses have smartphones.
-Nurses on work duty and willing to participate in this study.
-They have recent experience of no more than ٢ years and are assigned care for medication administration.

Tools of data collection:
To achieve the purpose of the study, three tools were used as follows:
I-Self-administered Questionnaire: This tool was adapted from **(Huang et al.,٢٠٢١), (Malbrain et al., ٢٠٢٠), (Fecteau, ٢٠٢١), (Gorski, ٢٠٢٤), (Gurung et al.,٢٠٢٢) & (Urakov et al.,٢٠٢٢)**–and aimed to assess nurses' knowledge and self-efficacy regarding safe practice for IV push medications.
It consisted of two parts:
Part I: Nurses' demographic characteristics:
It was concerned with assessing nurses' personal data and included five questions related to age, gender, marital status, educational level, and years of experience.
Part II: Nurses' knowledge, which included ٤٠ multiple-choice questions related to:

- Importance of Mobile-Based Training for continuing training nurses for intravenous push medications technique for safe practice (٣ questions)
- Indication and contraindication of IV push medication (٦ questions)
- Safe consideration during IV push medication administration (٤ questions)
- Nurses' role before, during, and after IV push medication administration (٨ questions)
- Dosage calculations of IV medications (٦ questions)
- Potential complications of IV push medications (٧ questions)
- Factors that increase the risk of IV push medication (٦ questions)

Scoring system:

The score was distributed as follows: one mark for each correct answer and zero for each incorrect answer. The total score was converted into percentages and categorized as follows:

- ≥ ٨٠ % grade as a good level of knowledge.

- < ٨٠-٦٥ % grade as a fair level of knowledge.

- ≤ ٦٥ % grade as a poor level of knowledge.

Part III: Nurses' Self-Efficacy Assessment (Appendix III): It was adopted **by Jerusalem & Schwarzer (١٩٩٢)** to assess the nurses' belief in their ability to respond to novel or difficult situations and deal with any associated obstacles or setbacks. The Generalized Self-Efficacy Scale (GSES) consists of ten items with a four-point Likert-type response scale.

Scoring system: For each item, there is a four-choice response as follows: Not at all true, which scored ١, Hardly true, which scored ٢, 'Moderately true, which scored ٣, and 'Exactly true, which scored ٤. The scores for each of the ten items were summed up to give a total score that ranges between ١٠ and ٤٠, with a higher score indicating more self-efficacy.
Tool II: Nurses' Competency Skills Observational Checklist: It was developed by the researcher **(Kim& De Jesus, ٢٠٢١)** and aimed to assess nurses' skills related to safe

practice for IV push medications. It included two parts:

Part I: It consisted of ٣٧ steps for administering IV medication directly with a syringe and was divided into the following sections:

* Preparation (٢٠ steps)
* Insertion (٨ steps)
* Post insertion (drug administration) (٨ steps)
* Documentation (١ step)

Part II: It consisted of ٣٨ steps for administering IV medication through an IV cannula and was divided into:

* Preparation contains (١٨ steps)
* Insertion (١٠ steps)
* Post insertion (drug administration) (٩ steps)
* Documentation (١ step)

Scoring system: The score was distributed as one mark for each step that was done and zero for steps that were incorrect or not done. The total score was converted into percentages and categorized as follows:

- ≥٨٥٪ were concerned with a competent level of practice.
-<٨٥٪ grade as an incompetent level of practice.

Nurses' guidelines (Appendix IV): It was developed by researchers based on related literature such as **(Van Zundert et al.,٢٠٢١), (Hantusch, ٢٠٢٠).** It was given to nurses after the pretest; the general objective of the nursing guidelines was to improve nurses' knowledge, practice, and self-efficacy regarding safe practice for IV push medications. The guideline was written in a simple Arabic language and supplemented by pictures and illustrations to help the nurse understand the content. It was divided into two parts:

Part I: The theoretical part: It included:

- Definition of vein.
- Anatomical and functional description of the vein.
- Definition of IV injection and its importance in providing treatment.
- Indications and contraindications for the use of IV medications.
- Possible adverse interactions and how to deal with them during IV infusion.
- The role of the nurse in providing care and ensuring patient safety during IV push medication administration.
- Importance of mobile-based training in improving nurses' efficiency in performing IV push medication.
- Positive effect of mobile-based training on improving nurses' knowledge and understanding of IV medications.

Part II: The practical part: It included practice regarding IV push medication administration. The researcher demonstrated nurses' practical skills in IV push medication administration, which included administering IV medication directly with the syringe and through an IV cannula.

Smartphone Training Videos (Appendix VI): Smartphone content APP included a cognitive part and psychomotor skill video concerning IV push medication procedure. It was developed through a review of related literature and was designed by the researcher.

Method

Ethical consideration:

The research approval was obtained from the ethical committee in the faculty of nursing before starting the study(REC/MSN-P١١٤). The researcher clarified the aim of the study to patients included in the study and ensured maintaining the anonymity and confidentiality of subjects. Nurses would be informed that they are allowed to choose whether to participate or not in the study, and they have the right to withdraw from the study at any time without any consequences. Then, written consent was obtained from each participant enrolled in the study. All information was gathered and used only for the benefit of the data and for the study.

Preparatory Phase:

This phase involved a review of national and international literature on various aspects of the study, including books, articles, internet sources, periodicals, and magazines, to develop the data collection tool and nursing guidelines. The duration of this phase was four months.

Pilot study:

A pilot study was conducted on ١٠٪ of the

total sample (١٣) nurses to test the applicability, clarity, and feasibility of the tool and identify obstacles that may be encountered during data collection, and estimate the time needed for filling in the forms.

The modifications needed were done to simplify some questions, reducing cognitive load and enhancing response accuracy. The nurses who were included in the pilot study were excluded from the study.

Validity and reliability:

Tool Validity (Appendix IV) :

The tools and guidelines were reviewed by a panel of five experts from the Medical-Surgical Nursing field at the Faculty of Nursing at Benha University. The jury involved five assistant professors to test the relevance, clarity of the content, comprehension, and understanding, and necessary modifications were done accordingly.

Tool's reliability (Appendix IV):

The reliability of the knowledge questionnaire was determined using Cronbach's alpha coefficient, which was ٠.٨٢٠. For the nurses' practice observational checklist tool, reliability was ٠.٩٥٧. The self-efficacy tool was ٠.٩٩٠.

Field work:

The data was collected from March to August during morning and afternoon shifts.

The researcher interviewed the participants of nurses, explained the aim of the study, and obtained their approval to participate in the study before data collection. The study was conducted in four phases as follows:

Phase I: Assessment phase: -

Once the researcher interviewed the studied nurses, they assessed their knowledge and Self-Efficacy using the self-administered questionnaire of tools I. The time required for completion of the questionnaire ranged from ٣٠-٤٠ minutes. The nurses' practical skills were observed by the researcher using an observational checklist (Tool II). It was done routinely at the time of administering IV push prescribed medications. The time required to complete the observation of practice ranged from ٣٠-٤٠ minutes. This assessment shed light and gave insight into the current knowledge, practice, and self-efficacy as a baseline data assessment.

٢. Planning phase

Based on the initial assessment, the researcher designed the program, and the training handout and smartphone training video were prepared and downloaded to each nurse on their mobile.

Proposed educational guidelines and general and specific objectives were determined based on predetermined subjects' needs, relevant recent literature, and opinions of nursing experts. These guidelines were revised and modified based on experts' comments and written in a very simple Arabic language, as well as supplemented by photos.

The smartphone content videos were designed by the researcher based on recent literature and revised by experts. Videos included cognitive and psychomotor skills concerning IV push medication administration.

The researcher designed and prepared the part of theoretical and practical video sessions and guidelines, then uploaded the video sessions to the Google Drive Application.

Phase III: Implementation phase

Once the questionnaires were downloaded and installed on the Google Drive Application and installed on the participants' smartphones, the researcher asked them to watch the demonstration of the procedures on their smartphones through the link that had been sent to them with the videos.

- The researcher gave the instructional colored guidelines booklet to nurses.
- The total number of nurses studied was ١٣١ nurses; they were divided into ١٣ groups. Each group contained ten nurses in every session. The researcher attended two days/week in the morning and afternoon shifts.
- The researcher met every group for five sessions: Three sessions for theory and two sessions for practice. Each session ranged between ٤٥ - ٦٠ minutes, including the period of discussion. The sessions were classified as follows:

Session one: The first session included orientation and explanation of the reasons and importance of designed videos and guidelines, and explained to improve the knowledge of about IV push medications such as the

definition of vein, anatomical and functional description of the vein, and the definition of IV injection and its importance in providing treatment.

Session two: It included an explanation about the indications and contraindications for the use of IV medications, possible adverse interactions, and how to deal with them during IV infusion, and the role of the nurse in providing care and ensuring patient safety during IV push medication administration.

Session three: It included an explanation of the importance of mobile-based training in improving nurses' efficiency in performing IV push medication and the positive effect of mobile-based training on improving nurses' knowledge and understanding of IV medications.

Session four: It was concerned with the practical part about the safe practice of IV push medication administration, which included administering IV medication directly with the syringe. The researcher carried out revision and reinforcement according to the nurses' needs.

Session five*:* It was concerned with the practical part about the safe practice of IV push medication administration, which included administering IV medication through an IV cannula.

- Each session started with a summary of what had been covered in the previous session, then the objectives of the new topics, taking into consideration the use of simple language.
- Discussion, motivation, and reinforcement during the intervention sessions were used to enhance learning. At the end of each session, the nurses were asked questions to correct any misunderstandings.

At the end of the implementation, the researcher received notes from the nurses and thanked them for their cooperation. The researcher asked them about their opinion on mobile-based training and their benefits for the subject.

Phase IV: Evaluation phase

This phase aimed to evaluate the effect of mobile-based training on the nurses' performance and self-efficacy regarding the safe practice of IV Push Medications. Immediate evaluation was done to evaluate the gain of knowledge, and re-demonstration of practice by nurses was also evaluated using tool I (part ٢) and tool II. Then, ٢nd week later, for follow-up evaluation, post-mobile-based training implementation of the nurses' knowledge, practice. Self-efficacy was evaluated on the ٢ nd week using tools I (part ٢), II, and III.

Statistical analysis:

Data was analyzed using the statistical package for social science (SPSS), version ٢٥. Numerical data were expressed as mean, standard deviation (SD), and range. Qualitative data were expressed as frequency and percentage. The chi-square test was used to examine the difference between qualitative variables. Fisher's exact test was applied on smaller sample sizes, alternated to the chi-square test, when the frequency count is < ٥ for more than ٢٠٪ of cells. The paired t-tests are used to compare the mean scores between two different periods within the same group. Comparison of repeated measures at different time intervals, one-way ANOVA for repeated measures was done. For comparing the mean scores in the two groups were used to the independent t-tests. Correlation between different numerical variables was tested using the Pearson product-moment correlation coefficient and Spearman correlation for categorical variables. A p-value < ٠.٠٥ was considered significant, and <٠.٠٠١ was considered highly significant.

Results

Table ١ shows the distribution of nurses studied according to their demographic characteristics. It reveals that ٥٩.٥٪ of nurses are in the age group ٢٠- <٢٥ years old, with a mean age of ٢٤.٤٠ ± ٠.٤٩. ٦٠.٣٪ of the studied female nurses were married, out of a total female were ٨٠.٢٪. Regarding their educational level, ٧٤.٨٪ had a bachelor's degree in nursing. Nearly ٧٧٪ of them had <١ year of experience in the nursing field.

Figure (١) demonstrates that nurses' total knowledge level about safe practices for intravenous medications pre- and post-mobile-

based training, where ٧٩.٤٪ had a poor level of knowledge pre-mobile-based training, which improved to reach a good level of immediate post-training among ٧٨.٦٪ and slightly declined to ٧٦.٣٪ post ٢nd week of mobile-based training.

Table (٢) shows there were statistically significant differences regarding the overall practices of IV push safe medication (p- value <٠.٠٠١) directly with syringe pre mobile based training, compared to post immediate and ٢ weeks of mobile based training with mean score practice ٢٦.٢٤ ± ٢.٥٥, ٣٥.٨٦ ± ١.٩٧ and ٣٥.٢١ ± ٢.٨٥, respectively, or through IV canula pre mobile based training, compared to post immediate and ٢nd week of mobile based training with mean score practice ٢٧.٧٥ ± ١.٦١, ٣٥.٢٩ ± ٢.٣٦ and ٣٤.٤٤ ± ٢.٣٣, respectively. Also, there was an improvement in the total mean score practice ٥٤.٠٠ ±٣.٧٠ pre- mobile-based training, to ٧١.١٥ ± ٣.٨٧ and ٦٩.٦٥ ± ٤.٨٧ post immediate and ٢ weeks of mobile-based training, respectively.

Figure (٢) illustrates that nurses' total practice level about IV push medication administration pre-and post-mobile based training were ٨١.٧ % had an incompetent level of practice pre mobile based training to be improved to reach at competent level immediately post-training for all nurses (٨٧ %) and slightly declined to ٧٧.١ % post ٢nd weeks of mobile based training.

Figure (٣) illustrates that there were statistically significant differences regarding total mean score of self-efficacy pre and post mobile-based training, with a mean score of ٢٣.٣٨ ± ٣.٩٣ pre-mobile-based training and improved to ٣٣.٩٧ ± ٨.٤٢ post ٢ nd weeks of training.

Table ٣ shows that there was a positive and significant correlation between total knowledge, practice, and self-efficacy pre- and post-mobile-based training periods, p-value <٠.٠٠١**.

Table (١): Frequency distribution of the nurses ' demographic characteristics (n=١٣١).

Personal data	(N.)	%
Age /year		
٢٠-< ٢٥	٧٨	٥٩.٥
٢٥-٣٠	٥٣	٤٠.٥
$\bar{\chi}$ ± SD	٢٤.٤٠ ± ٠.٤٩	
Gender		
Male	٢٦	١٩.٨
Female	١٠٥	٨٠.٢
Marital status		
Single	٥٢	٣٩.٧
Married	٧٩	٦٠.٣
Educational Level		
Secondary nursing diploma	٠	٠.٠
Secondary nursing institute	٣٣	٢٥.٢
Bachelor's degree in nursing	٩٨	٧٤.٨
Years of experience in the nursing field		
<١ year	١٠٢	٧٧.٩
١-٢ years	٢٩	٢٢.١

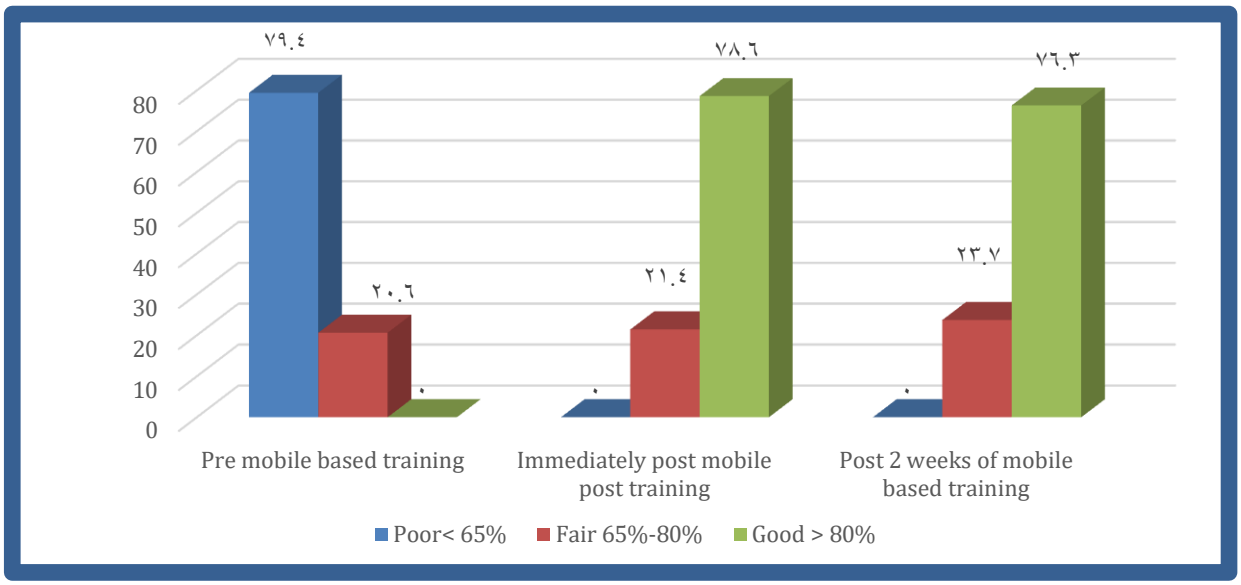

Figure (١): Frequency distribution of studied nurses regarding their total knowledge level about safe practices for intravenous medications pre and post mobile-based training (n=١٣١)

Table (٢): Mean score, standard deviation, and significant difference of the nurses' practice regarding IV push safe medication pre and post mobile-based training (n=١٣١).

Nurses' practice	Pre-mobile-based training (n=١٣١)	Post-training periods		F test p-value	Post Hoc Test (Bonferroni)		
		Immediately post mobile-based training (n=١٣١)	٢ nd week of mobile-based training (n=١٣١)		P value (١)	P value (٢)	P value (٣)
	$\bar{\chi}$ ± SD	$\bar{\chi}$ ± SD	$\bar{\chi}$ ± SD				
Administering IV medication directly with a syringe (Total Score ٣٧)							
Mean ± SD	٢٦.٢٤ ± ٢.٥٥	٣٥.٨٦ ± ١.٩٧	٣٥.٢١ ± ٢.٨٥	٠.٠٨٣ <٠.٠٠١**	<٠.٠٠١**	<٠.٠٠١**	<٠.٠٠١**
Administering IV medication through an IV canula (Total Score ٣٨)							
Mean ± SD	٢٧.٧٥ ± ١.٦١	٣٥.٢٩ ± ٢.٣٦	٣٤.٤٤ ± ٢.٣٣	٠.١١٨ <٠.٠٠١**	<٠.٠٠١**	<٠.٠٠١**	<٠.٠٠١**
Total practice (Total Score ٧٥)							
Mean ± SD	٥٤.٠٠ ±٣.٧٠	٧١.١٥ ± ٣.٨٧	٦٩.٦٥ ± ٤.٨٧	٠.٠٦٣ <٠.٠٠١**	<٠.٠٠١**	<٠.٠٠١**	<٠.٠٠١**

**Highly significant at p ‹٠.٠٠١. F: Anova with repeated measures, Sig. bet. Periods were done using Post Hoc Test (Bonferroni).
(١) Difference between knowledge pre- and immediately post-training
(٢) Difference between knowledge pre and post ٢ weeks of training

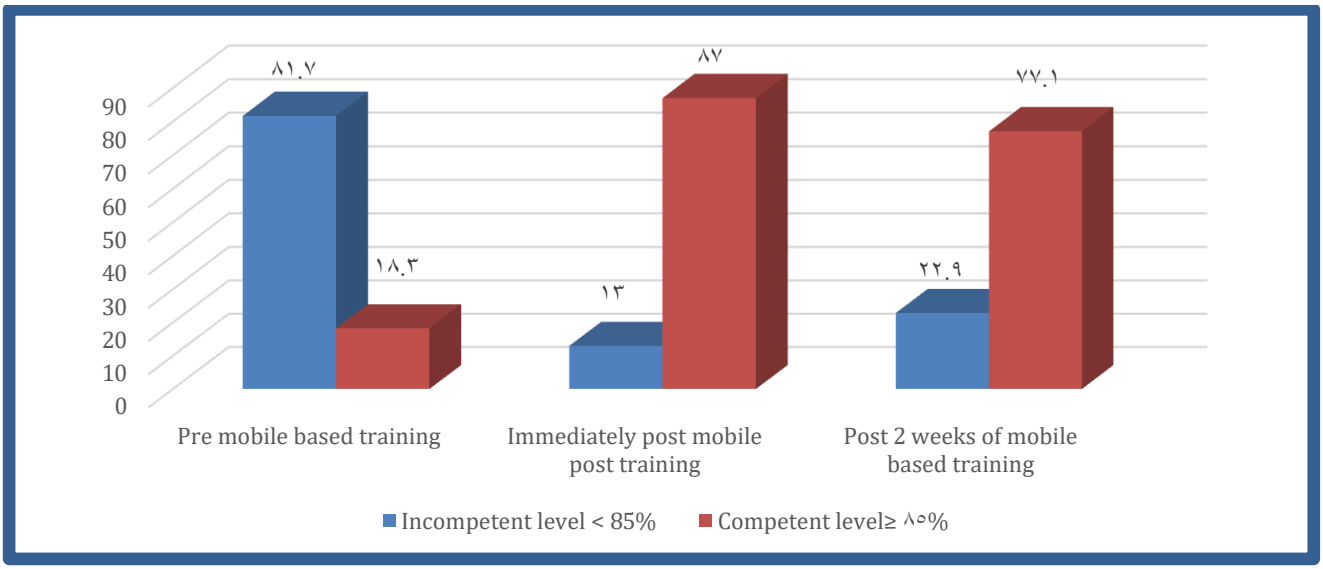

Figure (٢): Frequency distribution of studied nurses regarding their total practice level of IV push medication administration pre and post mobile-based training (n=١٣١)

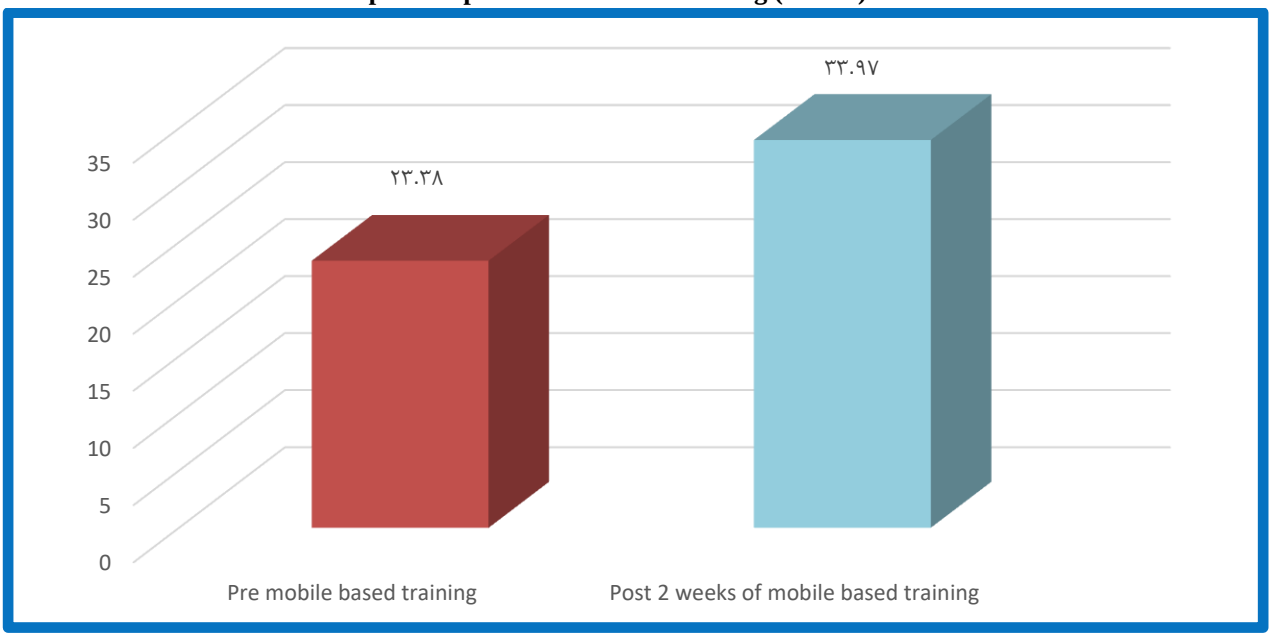

Figure (٣): Total mean score of nurses' self-efficacy regarding IV push safe medication practices

Table (٣): Correlation matrix between total knowledge and practice with self-efficacy among the studied nurses' pre- and post-mobile-based training periods (n=١٣١).

r-p variables	Study periods	Total knowledge		Total Practice		Total self-efficacy	
		r-test	P-value	r-test	P-value	r-test	P-value
Total knowledge	Pre-training	-	-	٠.٦٠٧	<٠.٠٠١**	٠.٤٩٦	<٠.٠٠١**
Total Practice		٠.٦٠٧	<٠.٠٠١**	-	-	٠.٧٤٣	<٠.٠٠١**
Total self-efficacy		٠.٤٩٦	<٠.٠٠١**	٠.٧٤٣	<٠.٠٠١**	-	-
Total knowledge	Immediate post-training	-	-	٠.٦٦٩	<٠.٠٠١**	-	-
Total Practice		٠.٦٦٩	<٠.٠٠١**	-	-	-	-
Total knowledge	٢ weeks post-training	-	-	٠.٣٤٤	<٠.٠٠١**	٠.٨٨٠	<٠.٠٠١**
Total Practice		٠.٣٤٤	<٠.٠٠١**	-	-	٠.٣٧٣	<٠.٠٠١**
Total self-efficacy		٠.٨٨٠	<٠.٠٠١**	٠.٣٧٣	<٠.٠٠١**	-	-

**: Highly statistically significant at p ≤ ٠.٠٠١

Discussion

Mobile-based training has emerged as a transformative tool in nursing education, significantly enhancing nurses' performance and self-efficacy in the safe practice of IV push medications. Moreover, mobile-based training supports continuous professional development by enabling nurses to learn at their own pace and revisit training materials as needed. This flexibility is particularly beneficial for busy healthcare professionals who may struggle to find time for traditional in-person training sessions **(BilgiÃ et al.,٢٠٢١).**

The interactive nature of mobile video training fosters greater engagement and retention of information, leading to improved clinical competence and patient safety. Also, the use of mobile videos for training has been associated with increased self-efficacy among nurses, as they feel more prepared and confident in their ability to perform IV push medication procedures correctly and safely **(Altmiller & Pepe, ٢٠٢٢).**

Regarding Demographic characteristics of the studied nurses, the current study revealed that more than half of the studied nurses were within the age group of twenty to less than twenty-five years old. From the researcher's point of view, this result may be due to that nurses who have recent experience of no more than ٢ years according to the inclusion criteria were recently graduated.

These findings are in the same line with a study by ***Ton et al., (٢٠٢٤)*** about " Effects of Standardized Patient Simulation and Mobile Applications on Nursing Students' Clinical Competence, Self-Efficacy, and Cultural Competence," which showed that most participants were between the ages of ٢٠-٢٥ years old.

The present study findings are incongruent with ***Qalawa et al. (٢٠٢٠),*** who studied " Effectiveness of Applying Simulation-Based Learning on Nurses' Performance and Self-efficacy Regarding Advanced Basic Life Support" and reported that the majority of the studied nurses were within age groups from thirty to less than forty years.

The findings of the current study also disagree with ***Nezamdoust et al., (٢٠٢٢),*** who carried out a study titled " Determinant Factors in Adopting Mobile Health Application in Healthcare by Nurses", it showed that the average age of participants was ٣٢ years old.

As regards gender, the current study results showed that the majority of the studied nurses were females. From the researcher's point of view, the increased number of females in the study is due to Egyptian culture females commonly work in the nursing field more than males. These findings are in line with a study by ***Qalawa et al., (٢٠٢٠),*** who reported that the majority of the studied nurses were females.

Also, these findings are in agreement with a study conducted by ***Farsangi et al., (٢٠٢٣)*** titled" Designing, Implementing, and

Evaluating A Mobile App-based Cultural Care Training Program to Improve The Cultural Capacity and Humility of Nursing Students," and stated that a higher percentage of study participants were females. Additionally, these findings are in the same line with a study conducted by ***Nezamdoust et al. (٢٠٢٢),*** who mentioned that most of the study participants were females.

Concerning marital status, the result of the current study revealed that less than two-thirds of the studied nurses were married. These findings are supported by a study by ***Gomaa Amr et al., (٢٠٢٣)*** about the " Effect of Smartphone on Nursing Staff Performance in Intensive Care Units," and reported that more than half of the nurses studied were married.

Also, these findings are in the same line with a study conducted by ***Bahrambeygi et al., (٢٠١٩)*** titled " Evaluation of the Effects of E-learning on Nurses' Behavior and Knowledge Regarding Venous Thromboembolism," and mentioned that most studied nurses were married.

These findings disagree with a study conducted by ***Hojati et al., (٢٠٢٣)*** entitled " The Impact of Training Chemotherapy Safety Standards with A Smartphone Application on the Knowledge, Attitude, and Performance of Nurses", and showed that more than half of the studied nurses were single.

Also, these results disagree with a study by ***Wong et al., (٢٠٢٣)*** entitled " The Development and Implementation of A Blended Video Watching and Peer Learning Model for Master's Nursing Students," who found that most of the study sample was single.

As regards the educational level, the current study showed that more than two-thirds of the studied nurses had a bachelor's degree in nursing. From the researcher's point of view, this result may be due to there having been a significant shift in the nursing profession towards requiring higher levels of education over the past few decades, and many leadership and administrative positions in nursing require a bachelor's degree in nursing.

These findings agree with a study by ***Nezamdoust et al., (٢٠٢٢),*** who mentioned that most of the studied nurses had a bachelor's degree in nursing.

Also, these results agree with a study done by ***Khorammakan et al., (٢٠٢٤)*** entitled " Continuous Training Based on The Needs of Operating Room Nurses Using Web Application," and found that most of the study sample had a bachelor's degree in nursing.

Also, these results agree with a study by ***Abbasi et al., (٢٠٢٣)*** entitled " Need Assessment and Development of A Mobile-Based Medication Dosage Calculation Application for ICU Nurses," and reported that the majority of the study sample had a bachelor's degree.

Concerning Years of experience in the nursing field, the result of the current study revealed that more than three-quarters of the studied nurses had less than one year of experience in the nursing field. From the researcher's point of view, it may be due to new appointments with nurses and willing to participate in the study, especially if they are seeking to improve their practice early in their careers.

These findings are supported by a study of ***Gomaa Amr et al., (٢٠٢٣),*** who reported that the majority of the studied groups had experience of less than one year.

These results disagree with a study by ***Mohamed et al., (٢٠٢٤)*** entitled " Exploring The Potential Impact of Applying for Web-Based Training Program on Nurses' Knowledge, Skills, and Attitudes Regarding Evidence-Based Practice," and showed that most of the study sample had more than ٥ years.

This study revealed that there was an improvement in the mean score of total knowledge immediately and ٢ weeks after mobile-based training. It might have contributed to using different educational strategies as smartphone videos and booklets. These findings are in the same line with a study by ***Khari et al., (٢٠٢٢)*** titled " The Effect of E-Learning Program for Care on The Knowledge of Nurses," which revealed that the total mean score of nurses' knowledge immediately and one month after training significantly increased compared to baseline time.

This study revealed that there was an improvement in the mean score of total practice immediately post mobile-based training, as Videos can be watched multiple times, allowing nurses to review and reinforce their learning as needed. These results are supported by ***Mohamed et al., (٢٠٢٤),*** who revealed that there was a highly significant difference between the total mean scores of the skills pre- and post-interventions.

Also, it was agreed with a study done by ***Bokari et al., (٢٠٢١)*** titled" The Effectiveness of Smartphone Video to Improve Skill Performance and Confidence of Student Nurses in Performing Hygiene Care which revealed that the post-test total skill performance score improved compared with the pre-test.

The current study revealed that there was an improvement in the mean score of total nurses' self-efficacy post the ٢nd week of training. It might have contributed to mobile video-based training that can provide a comprehensive and flexible approach to learning that supports the development of confidence and competence in nursing practice. These results are in the same line with ***Zarshenas et al., (٢٠٢٢),*** who studied " The Effect of Micro-Learning on Learning and Self-Efficacy of Nursing Students " and revealed that the difference between the mean score of self-efficacy in the intervention group before and after the training was statistically significant.

Regarding the Correlation matrix between total knowledge and practice with self-efficacy among the studied nurses pre- and post-mobile-based training periods. The study revealed that there was a positive and significant correlation between total knowledge, total practice, and total self-efficacy at pre- & post-mobile-based training periods.

From the researcher's point of view, these results may be due to the knowledge acquired by nurses, helping them perform practical skills after understanding the scientific knowledge background, which leads to higher self-efficacy. This enhanced self-efficacy, in turn, motivates them and integrates their knowledge into practice effectively, creating a reinforcing cycle. The mobile-based training likely provided accessible and relevant content, allowing nurses to enhance their knowledge and practice skills, which directly boosted their confidence and self-efficacy, reinforcing the positive correlation across both periods.

These findings agree with ***Qalawa et al., (٢٠٢٠),*** who showed that there was a highly positive correlation between nurses' total self-efficacy, total knowledge, and practice. Also, these findings are consistent with ***Abd Elghany et al., (٢٠٢٢),*** who reported that there was a positive correlation between the studied nurses' total knowledge, total practice, and total attitude scores at pre-/post-video intervention.

Conclusion

Nurses' knowledge, practice, and self-efficacy had been significantly improved post-mobile-based training, which reflects that Mobile Videos can reinforce practical skills through repeated viewing and the flexibility of mobile training allows nurses to learn at their own pace leading to more effective retention and application of knowledge enhancing their overall self-efficacy which supported the research hypotheses. Also, there was a positive and significant correlation between total knowledge, practice, and self-efficacy at pre- & post-mobile-based training periods.

Recommendations

- Develop comprehensive mobile-based training modules that cover various aspects of intravenous push medication administration.

- Continuously update mobile-based training content to align with the latest guidelines and best practices based on evidence.

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