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The effect of an educational orientation tour on anxiety of nursing students before their first clinical training: a quasi-experimental study

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Abstract

Background The first clinical experience in a hospital setting can be highly stressful for nursing students, often leading to significant anxiety. Addressing this issue requires effective interventions to help students transition smoothly into their clinical practice. This study aimed to evaluate the impact of an educational tour on preclinical anxiety among first-year nursing students.

Methods This quasi-experimental study was conducted in 2024 in Tehran. A total of 72 s-semester nursing students were selected through convenience sampling and assigned to either the control group ($n=37$) or the intervention group ($n=35$). Before the start of clinical training, the intervention group participated in an educational tour of the hospital, conducted by the researcher, while the control group received no intervention. Data were collected using the Spielberger State-Trait Anxiety Inventory (STAI) one week before the clinical training and after its completion.

Results After completing the clinical training, the mean trait anxiety score was 34.28 ± 7.89 in the control group and 31.30 ± 6.70 in the intervention group. However, an independent t-test revealed that the difference in post-intervention trait anxiety scores between the two groups was not statistically significant ($p=0.089$). In contrast, the mean state anxiety score after the intervention was 36.14 ± 7.38 in the control group and 31.21 ± 6.86 in the intervention group, demonstrating a significant reduction in anxiety levels among students who participated in the educational tour ($p=0.005$).

Conclusion The findings suggest that an educational tour can effectively reduce preclinical anxiety among first-year nursing students, making it a valuable strategy for improving their transition into hospital-based clinical training.

Keywords Anxiety, Clinical training, Nursing students, Educational tour

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Introduction

Nursing is a practice-based profession that integrates theoretical knowledge with hands-on experience in real-life situations. The primary goal of nursing education is to help students develop psychomotor skills and prepare them for their future roles as professional nurses [1, 2]. The clinical learning environment plays a crucial role in this process, as it provides a setting where theoretical and practical components of the curriculum can be effectively integrated [3]. In fact, nursing students spend nearly three times more hours in clinical settings than in classroom-based instruction [4].

Clinical placements are the first settings where nursing students encounter their professional roles, making the quality of these experiences highly significant. The way students are introduced to clinical practice can influence their decision to continue studying nursing and even impact their future career choices. Given the importance of clinical training, nursing educators and policymakers must prioritize optimizing these environments when designing curricula [5].

The first clinical experience is a pivotal milestone for nursing students, as it marks their initial exposure to the healthcare system [6]. However, this transition can be challenging and often leads to anxiety. Compared to students in other fields, nursing students are at a higher risk of experiencing stress and anxiety during their training [7]. Research indicates that a significant percentage of nursing students experience mild to moderate anxiety levels throughout their clinical education. Factors such as unfamiliar environments, lack of skills, and changes in interpersonal relationships contribute to this anxiety [8, 9]. While moderate levels of anxiety can have a positive impact by fostering motivation and creativity [10], excessive anxiety can be detrimental. High levels of anxiety may impair concentration, increase the likelihood of errors, and ultimately hinder academic performance [11, 12].

Nursing students often employ a combination of problem-focused and emotion-focused coping strategies when dealing with stress [13]. Problem-focused strategies involve active problem-solving, effective time management, and seeking social support. These approaches directly address the root causes of stress and provide long-term relief [14]. On the other hand, emotion-focused coping mechanisms, such as positive reinterpretation, acceptance, and mindfulness, help regulate emotional responses to stress. While these strategies can ease stress in the short term, they do not tackle the underlying causes and therefore offer only temporary relief [15, 16].

Anxiety tends to peak during a student's first clinical placement, as they may question their own abilities and struggle with self-confidence in adapting to the clinical learning environment [17]. The stress of entering an unfamiliar setting can lead to feelings of insecurity and self-doubt. A lack of confidence in nursing skills can affect students' performance and, ultimately, the quality and safety of patient care. Therefore, clinical instructors must adopt innovative approaches to support students during this critical transition. Creative teaching strategies that facilitate a smoother adjustment to new roles and clinical environments are essential [18].

Preparing nursing students for clinical practice is a complex challenge, particularly given the dual demands of theoretical and practical training [19, 20]. Nurse educators recognize the importance of presenting concepts in meaningful ways to bridge the gap between theory and practice. To achieve this, they incorporate experiential learning opportunities and student-centered activities designed to promote critical thinking, integration of knowledge, and self-reflection [21].

For example, at Mount Royal University (MRU), first-year nursing students participate in a structured pre-clinical shadowing experience before beginning their formal clinical training. This program allows students to observe and interact with registered nurses (RNs) in real healthcare settings. While students are not permitted to provide direct patient care, they are encouraged to engage with nurses, patients, and other healthcare team members. The goal of this initiative is to familiarize students with the roles and responsibilities of nurses, provide an overview of the clinical environment, and help them understand how theoretical concepts translate into practice [22].

Given the significant impact of anxiety on nursing students' learning and performance during their first clinical placement, it is essential to explore effective interventions for managing pre-clinical anxiety. A review of previous studies suggests that various methods have been implemented to alleviate student anxiety, including music therapy, progressive muscle relaxation, aromatherapy, reinforcement-based intervention programs, and biofeedback techniques [12, 23–25]. Additionally, simulation-based training has been widely used to enhance students' confidence in clinical practice [26, 27].

Orientation tours are a valuable educational tool designed to help nursing students transition smoothly into their academic and clinical roles. These tours provide students with essential insights into hospital operations, infrastructure, professional responsibilities, workplace hierarchies, and clinical departments through a combination of lectures and observational learning. Research by Altun Baksi (2017) found that preclinical orientation significantly reduced anxiety levels among first-year nursing students, highlighting the effectiveness of such interventions [28]. Orientation tours have also been studied in various contexts, demonstrating their role in alleviating

anxiety among patients undergoing coronary angiography, hospitalized children and their mothers, and even cardiac surgery candidates and their families following ICU visits [29–31].

Despite these promising findings, a review of the literature highlights a significant gap in research examining the impact of orientation tours on nursing students' anxiety, particularly among first-year students transitioning into the clinical setting. Notably, no studies in Iran have specifically investigated the effects of a pre-clinical orientation tour in alleviating anxiety before students' first clinical placement. Recognizing the need for structured interventions that help students acclimate to the hospital environment before engaging with patients, this study aims to assess the impact of a pre-clinical orientation tour on nursing students' anxiety levels prior to their first clinical training experience.

Research hypotheses

- **H1**: The educational orientation tour reduces trait anxiety levels among first-year nursing students.
- **H2**: The educational orientation tour reduces state anxiety levels among first-year nursing students.

Methods

Study design

This study was a quasi-experimental, two-group pretest-posttest intervention conducted between April and May 2024 at the Iran University of Medical Sciences, School of Nursing and Midwifery.

Sample

The study population consisted of second-semester nursing students who were entering their first clinical training in Fundamentals of Nursing. Participants were selected using convenience sampling, and those who met the inclusion criteria were randomly assigned to either the intervention or control group.

Based on the study by Inangil et al. and a power analysis with a 95% confidence level, 90% power, and a moderate effect size (0.5), the required sample size was determined to be 39 students per group [12]. The sample size calculation was performed using the following formula:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{\beta} \right) 2 \times \alpha^{2}}{d^{2}} \approx 39$$

Inclusion and exclusion criteria

The inclusion criteria for this study were second-semester nursing students entering their first clinical placement in Fundamentals of Nursing, who were willing to participate in the study and committed to full attendance in clinical training sessions. Additionally, participants had to have no prior clinical experience and no history of psychiatric disorders such as depression or panic disorder. On the other hand, students were excluded if they missed more than one clinical session, withdrew from the study at any stage, developed new medical conditions that could impact anxiety levels (such as acute stress or emotional trauma), or received concurrent psychological or pharmacological interventions for anxiety management.

Data collection

Data were collected using a demographic information questionnaire and the Spielberger State-Trait Anxiety Inventory (STAI). The distribution and completion of the questionnaires took place at the hospital where the training was conducted. Participants in the intervention group completed the questionnaires before the start of the orientation tour and again after completing the *Fundamentals of Nursing* clinical training, which was held immediately following the orientation tour. Similarly, participants in the control group completed the questionnaires before and after their *Fundamentals of Nursing* clinical training.

If participants had any questions regarding the questionnaire items, the researcher was available on-site to provide clarification. The study objectives were clearly explained to all participants, and before enrollment, they reviewed and signed an informed consent form. Participants were assured that their involvement in the study was entirely voluntary and that all collected data would remain confidential, used solely for the stated research purposes.

Measurement tool

The Spielberger State-Trait Anxiety Inventory (STAI) was used to assess anxiety levels. This self-report questionnaire, widely applied in clinical and research settings, was originally developed by Spielberger et al. in 1983. The tool's reliability and validity have been well established, with reported values ranging from 0.86 to 0.95 for reliability and 0.65–0.75 for validity [32]. In 1984, the questionnaire was translated into Persian by Mehram, and its psychometric properties were evaluated. The Cronbach's alpha coefficient for the Persian version was found to be 0.94, demonstrating high internal consistency [33]. The Persian version has been widely used across various population groups in Iran, with repeated assessments confirming its validity and reliability [34, 35]. The questionnaire consists of 40 items, divided into two subscales: state anxiety (situational anxiety), which measures anxiety at the moment of response (20 items), and trait anxiety (baseline anxiety), which assesses general, long-term anxiety tendencies (20 items). Responses are scored on a Likert scale ranging from 1 (very low) to 4 (very high).

The possible score range is 20–80 for each subscale, with a total anxiety score ranging from 40 to 160. In this study, the Cronbach's alpha coefficient was calculated as 0.94 for state anxiety and 0.96 for trait anxiety, confirming the high reliability of the instrument.

Intervention

Following informed consent, eligible students were randomly assigned to either the intervention or control group. Before the start of clinical training, the researcher, in coordination with the faculty's education department, conducted a three-day educational orientation tour for the intervention group at the designated teaching hospital.

A pre-clinical orientation tour was conducted in three separate sessions to familiarize first-semester nursing students with the hospital environment and the nursing profession before their clinical placement. This program was designed to help students not only understand hospital structure and professional expectations but also acquire essential foundational skills for their transition into clinical practice.

Session 1: theoretical introduction to the hospital environment and professional standards

The first session was held in a hospital-based classroom, where a clinical instructor and an educational supervisor delivered theoretical content. Conducted during both morning and afternoon shifts, this session included lectures on:

- Hospital environment and clinical placement requirements: An introduction to the hospital's organizational structure, the roles of healthcare professionals, and expectations from students in the clinical setting.

Professional regulations and standards: Evaluation criteria for student performance, professional dress codes, and essential equipment such as stethoscopes and ID badges.

- Challenges in nursing and patient rights: Common workplace challenges, occupational stressors, and ethical principles related to patient rights.

Communication and problem-solving skills: Training on effective communication with patients, the role of body language, communication barriers, and strategies for resolving communication challenges in clinical practice.

- Introduction to clinical documentation: A list of essential nursing abbreviations and diagnostic terms required for the Fundamentals of Nursing course.

This session was delivered using PowerPoint presentations and interactive teaching methods, including Q&A discussions, allowing students to clarify their doubts and receive direct feedback.

Sessions 2 and 3: hospital tour and clinical observations

On the second and third days, students participated in a guided hospital tour led by the clinical instructor and educational supervisor. Conducted from 7:30 AM to 12:00 PM, the tour included visits to general hospital wards, an introduction to interdisciplinary teamwork, and observations of clinical workflows in real-world settings.

During these sessions, students had the opportunity to apply theoretical concepts from the first session to the hospital environment. They observed the roles and responsibilities of healthcare professionals, familiarized themselves with hospital operations, and engaged in discussions to address any questions related to hospital structure and clinical procedures.

During this tour, students were introduced to various non-specialized clinical wards where they would undergo their Fundamentals of Nursing training, including the nursing management unit, nursing administration, and paraclinical departments such as the laboratory, radiology, and laundry unit. Furthermore, students were familiarized with nursing responsibilities, the roles of ward nurses, different nursing career levels within the hospital, and were given the opportunity to ask questions and receive answers. While this experience was entirely observation-based, students were encouraged to interact with nurses, patients, and other healthcare team members to gain a deeper understanding of the clinical environment and professional nursing roles. The control group received no intervention. To prevent cross-group interference, students from both groups completed their clinical training separately under the same instructor but at different times. Data collection was conducted before and after the clinical training by the researcher.

Data analysis

Data were analyzed using SPSS version 22.0. Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize the data. To assess the homogeneity of variables between the two groups, Chi-square tests and independent t-tests were conducted. Additionally, paired t-tests and independent t-tests were used to evaluate anxiety level changes before and after the intervention. A p-value of less than 0.05 was considered statistically significant.

Table 1 Participants' demographic data

Group Characteristics		Control	Intervention	Total	*P* value
Age (years) [a]* (Mean ± SD)		20.54 ± 1.26	20.85 ± 1.33	20.69 ± 1.29 [19–23]	0/304
Gender [b]** N (%)	Male	(% 16.67) 12	(% 20.83) 15	(%37.5) 27	0/361
	Female	(% 34.72) 25	(% 27.78) 20	(%62.5) 45	
Marital status**	Married	(% 6.94) 5	(% 5.56) 4	(%12.5) 9	0/789
	Single	(% 44.44) 32	(% 43.06) 31	(% 87.5) 63	
Current job**	Yes	(% 6.94) 5	(% 5.56) 4	(%12.5) 9	0/789
	No	(% 44.44) 32	(% 43.06) 31	(%87.5) 63	
Family member ** working in healthcare sector	Yes	(% 9.72) 7	(% 12.5) 9	(%22.22) 16	0/488
	No	(% 41.67) 30	(% 36.11) 26	(% 77.78) 56	
Loving ** the nursing profession	Yes	(% 23.61) 17	(% 20.83) 15	(%44.44) 32	0/792
	No	(% 27.78) 20	(% 27.78) 20	(%55.56) 40	
Physical exercise**	No	(% 11.11) 8	(% 6.94) 5	(%18.06) 13	0/573
	1 per week	(% 19.44) 14	(% 20.83) 15	(% 40.22) 29	
	2 per week	(% 15.28) 11	(% 13.89) 10	(% 29.11) 21	
	> 2 per week	(% 5.56) 4	(% 5.56) 5	(% 12.50) 9	

SD: standard deviation. a: Values are presented as mean ± standard deviation. b: Values are presented as frequency and percentage

*Independent t-test

**Chi-square test

Table 2 Comparison of the trait anxiety inventory scores before and after intervention by groups ($n = 72$)

Group Time	Control Mean ± SD	Intervention Mean ± SD	*P* value
Before	39.37 ± 10.68	38.73 ± 11.57	0.807*
After	34.27 ± 7.88	31.30 ± 6.69	0.089
P value	$p < 0.001$**	$p < 0.001$	

SD: standard deviation

* Independent t-test

** Paired t-test

Results

The findings revealed that among the 72 participants, 45 were female (62.5%) and 27 were male (37.5%). Additionally, 9 participants (12.5%) were married, while 63 participants (87.5%) were single. Nine participants (12.5%) were employed, and 16 participants (22.22%) had a family member working in a healthcare facility. Only 32 participants (44.44%) expressed an interest in the nursing profession. Regarding physical activity, 5 participants (5.56%) exercised more than twice per week.

Table 3 Comparison of the state anxiety inventory scores before and after intervention by groups ($n = 72$)

Group Time	Control Mean ± SD	Intervention Mean ± SD	*P* value
Before	38.77 ± 8.06	38.66 ± 10.01	0.96*
After	36.14 ± 7.37	31.20 ± 6.85	0.005
P value	0.001**	$p < 0.001$	

SD: standard deviation

* Independent t-test

** Paired t-test

The mean age of participants was 20.7 ± 1.3 years. Statistical analyses using Chi-square and independent t-tests indicated no significant differences in demographic characteristics between the control and intervention groups ($P > 0.05$) (Table 1).

According to the study findings, an independent t-test comparing trait anxiety (baseline anxiety) between the control and intervention groups before and after the intervention showed no statistically significant difference ($P > 0.05$). As a result, H1 was rejected (Table 2).

However, when comparing state anxiety (situational anxiety) between the two groups using an independent t-test, no significant difference was observed before the intervention ($P > 0.05$). After the intervention, a statistically significant reduction in anxiety was observed in the intervention group ($P < 0.05$). Therefore, H2 was confirmed (Table 3).

Additionally, a paired t-test showed a statistically significant reduction ($P < 0.05$) in both state and trait anxiety levels within each group before and after the intervention (Tables 2 and 3) (See Fig. 1).

Discussion

This study was designed to address the existing gap in research on intervention programs aimed at reducing stress and anxiety among nursing students during clinical training. The findings of this research indicated that prior to entering the clinical setting, there was no statistically significant difference in state and trait anxiety scores between the control and intervention groups, with both groups scoring within the moderate range. This suggests an initial homogeneity in the students' self-esteem levels. In line with the present study, research by Kabuk et al. (2020), which examined the effect of music and progressive muscle relaxation on the stress levels of first-year nursing students in a clinical trial, found that students' state and trait anxiety levels prior to entering the clinical environment were also within the moderate range [12]. However, in the study conducted by Touqan et al. (2022), nursing students exhibited mild levels of anxiety [36]. Similarly, the research by Barrientos (2019) assessing the

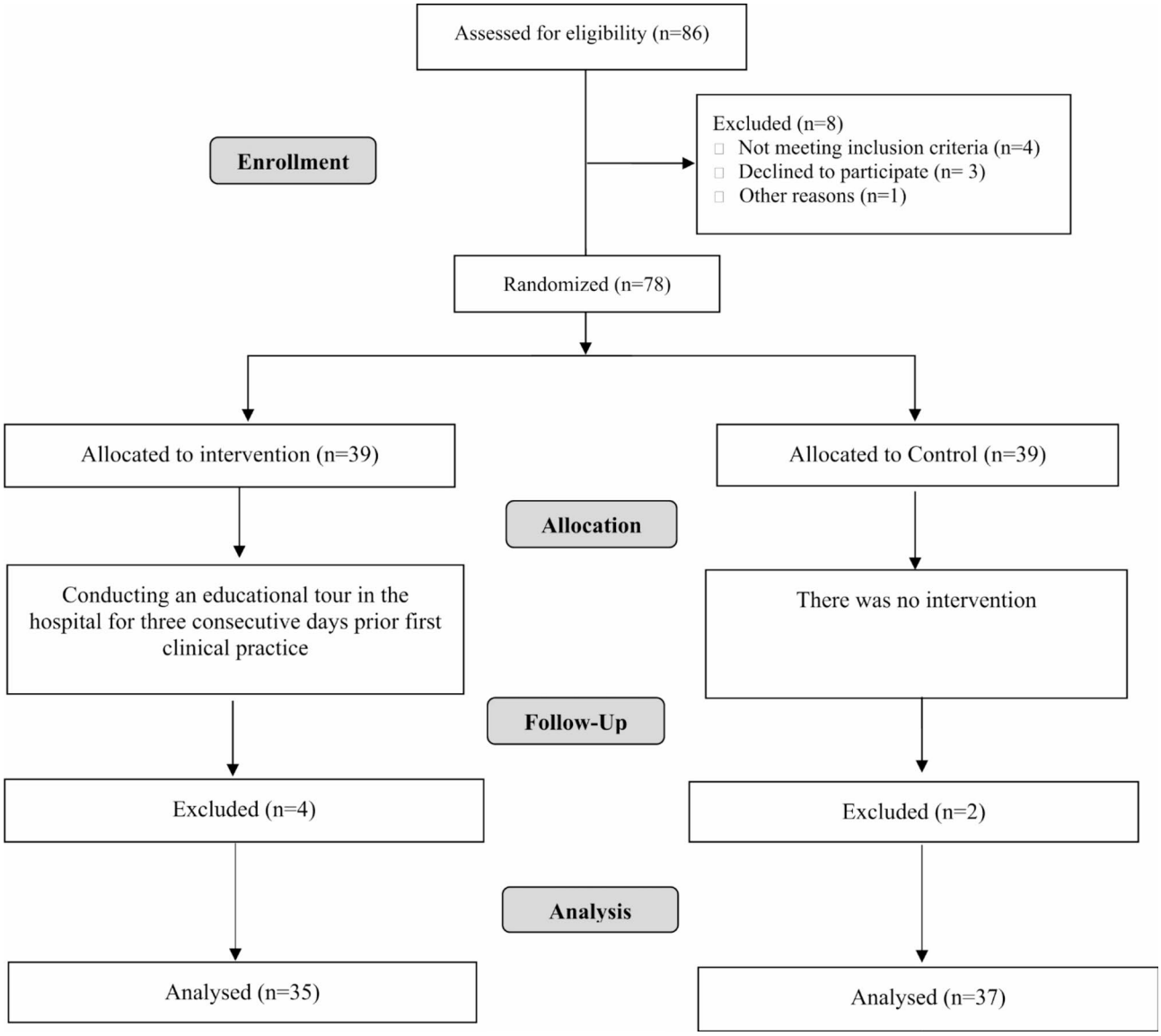

Fig. 1 CONSORT flowchart

anxiety levels of nursing students during their first anatomy internship reported mild anxiety levels [37].

First-year nursing students often experience anxiety before entering the clinical environment, primarily due to a lack of full awareness of the knowledge and skills required for patient care. While a moderate level of anxiety can serve as a motivational factor that enhances focus and precision, excessive anxiety may hinder learning and performance [38]. Anxiety among nursing students is well-documented and can have detrimental effects on their well-being, clinical skills, and academic success. Therefore, providing effective tools and strategies to manage and reduce this stress and anxiety is essential [39].

Following the implementation of the educational tour, although there was a reduction in state and trait anxiety scores in the intervention group compared to the control group, a statistically significant difference was observed only in state anxiety. Various interventions have been employed to regulate students' stress and anxiety levels. In this regard, the study by Baksi (2017) showed that pre-clinical orientation training before first-year students enter the clinical environment reduced the anxiety levels of the intervention group. However, this reduction was not statistically significant between the control and intervention groups. Nevertheless, the significant decrease in scores in the intervention group was considered important, as it suggests that even minimal training had an impact. It should be noted that this situation may be related to the fact that behavioral changes occur gradually and may take anywhere from six months to five years to manifest [28].

Consistent with our findings, the study by Kabuk et al. (2020) demonstrated that after progressive muscle relaxation intervention, there was no significant difference in trait anxiety scores between the control and intervention groups; however, a significant difference was found in state anxiety scores [12]. Additionally, the study by Korkut (2021) demonstrated that the use of progressive muscle relaxation exercises significantly reduced the anxiety levels and heart rate of nursing students in their clinical skills center. Furthermore, this intervention led to an improvement in their blood pressure measurement test scores. Before entering the clinical environment, students learn nursing skills in the clinical skills center, and therefore, effective interventions should be implemented to facilitate their learning and reduce anxiety [40].

In a mixed-methods study, Beanlands et al. (2019) reported that the use of dialectical behavior therapy techniques led to a significant reduction in stress levels and an improvement in emotional well-being among nursing students in both clinical and academic settings [41]. Another intervention study by Ruiz et al. (2023) demonstrated that mindfulness interventions significantly reduced stress, anxiety, and physiological variables among nursing students during simulated clinical training [42]. According to Stevens et al. (2020), nursing educators should recognize that students, especially during their initial clinical internships, experience heightened stress and anxiety. Therefore, it is crucial for nursing educators to assist students in identifying and managing their stress and anxiety levels. Employing confident, skilled, and experienced mentors as role models can foster personal and professional growth, serving as an initial step toward reducing stress and anxiety [43].

Al-Shahrani (2018) identified key factors and strategies that contribute to making the first clinical experience of first-year nursing students more positive and constructive. These strategies included discussion sessions with clinical instructors, conversations with peers and family about their initial clinical experiences, adequate preparation before entering the clinical environment, seeking guidance from supportive nursing staff, and fostering effective communication between nursing faculties and clinical institutions to ensure proper coordination and clear expectations [44]. In the present study, during the educational tour, students became familiar with the roles and responsibilities of nurses, various nursing positions in hospital settings, and hierarchical job structures.

Smith (2016) noted that individuals who utilize task-oriented coping strategies seek practical solutions for stressful situations, such as observing the interactions of nursing staff and engaging in conversations with patients to become acquainted with them before providing care [45]. Implementing educational tours can serve as a similar strategy by allowing students to familiarize themselves with the clinical setting and their duties prior to exposure to high-stress environments. This approach enhances students' preparedness and confidence, encouraging them to practice and anticipate potential clinical situations. Consequently, educational tours can function as preparatory interventions that mitigate initial internship-related stress and contribute to a more positive clinical experience for students.

Aslan et al. (2021) conducted a study on the impact of peer-assisted learning on the clinical stress levels and psychomotor skills of first-year nursing students entering the clinical environment for the first time. The results showed that the difference in post-test scores regarding clinical stress levels and psychomotor skills between the two groups was statistically significant. This study indicated that first-year nursing students who received peer support had lower clinical stress levels and made better progress in developing psychomotor nursing skills [46]. A clinical trial by Sediq et al. (2024) further demonstrated that peer mentoring programs significantly enhanced students' clinical academic performance, boosted their confidence, and reduced their stress and anxiety levels [47].

First-year nursing students primarily engage in observational clinical experiences and do not provide direct patient care. Uslu et al. (2020) studied the impact of simulation-based learning on the stress and anxiety levels of nursing students on their first clinical day. The results revealed that the use of simulation before entering the clinical environment significantly reduced the stress and anxiety levels of nursing students. Students who participated in training sessions before their first clinical day reported feeling more prepared and showed higher confidence when facing real clinical situations [48].

This study is the first of its kind to specifically examine the impact of educational tours on anxiety levels among first-year nursing students. Similar findings in previous research suggest that coping strategies and psychological interventions can effectively reduce students' stress and anxiety. However, further research is needed to evaluate the long-term effects of such interventions and to identify additional factors influencing nursing students' anxiety in clinical settings. Future studies could also explore how these methods can be integrated with other educational strategies and psychological interventions to determine the most effective approaches for minimizing student stress and anxiety at different stages of their training. Moreover, assessing the impact of these interventions across diverse cultural and geographical contexts could enhance the generalizability and practical applicability of the findings.

Limitations of this study include the sample size, which may not fully represent the broader population of first-year nursing students, potentially affecting the

generalizability of the results. Additionally, the study did not account for confounding variables such as social support levels and students' psychological and personality traits. Given that this study was conducted in Iran, the findings may not be entirely applicable to other cultural and educational systems. Furthermore, the use of self-reported measures to assess anxiety may have limitations, as responses could be influenced by personal perceptions. To enhance the validity and generalizability of future research, larger sample sizes, longitudinal study designs, and complementary assessment tools should be employed for a more comprehensive evaluation of anxiety levels.

Based on the results obtained, it is recommended that future studies not only examine personality factors such as coping strategies, adaptability, and resilience, but also explore other influencing factors, including academic motivation, social support, and variables such as interest in the nursing profession and the impact of physical activity. This approach could lead to a more comprehensive and deeper understanding of the anxiety associated with entering the clinical environment and guide the results of studies towards improving educational and supportive interventions.

Conclusion

This study demonstrated that educational tours can have a positive impact on reducing state anxiety associated with clinical situations among first-year nursing students. Although no significant difference was observed in trait anxiety between the intervention and control groups, the findings suggest that educational tours serve as an effective intervention method, helping students prepare for clinical experiences and alleviating their initial stress. This study underscores the importance of incorporating educational strategies, such as clinical tours, to reduce nursing students' anxiety and recommends integrating this approach as a complementary tool in nursing education programs.

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Author contributions
E.A and Pe.SH designed the study. Pa.SH collected the data. E.A and Pe.SH analyzed the data. E.A, Pe.SH, and Pa. SH prepared the manuscript. All authors approved the final version for submission.

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Data availability
The quantitative datasets used and analyzed in this study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
To ensure the rights of all participants, this study strictly adhered to the Declaration of Helsinki in its design and execution. Ethical approval was obtained from the Ethics Committee of Hamadan University of Medical Sciences, Iran (Ethics Code: IR.UMSHA.REC.1403.424). All students were informed about the study's objectives and the voluntary nature of their participation. Written consent was obtained from all participants, and they were assured of the confidentiality of their data and their right to withdraw from the study at any time. All methods were conducted in accordance with relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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