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# Identifying factors associated with adherence to aseptic techniques in orthopedic dressing by nurses

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## Abstract:

Adherence to aseptic techniques in orthopedic dressing is crucial for preventing infections and ensuring patient safety. Understanding the factors influencing nurses' compliance with these practices is essential for improving patient outcomes and infection control. This study aims to identify the factors associated with adherence to aseptic techniques in orthopedic dressing by nurses. This cross-sectional observational study was conducted in 2023 with 82 nurses from orthopedic wards in hospitals affiliated with Shahid Beheshti University of Medical Sciences, selected through a census sampling method. The research utilized a researcher-made checklist, comprising two sections: demographic information and factors related to aseptic technique adherence. Data analysis was performed using SPSS software, version 26. The study revealed that adherence to aseptic techniques during orthopedic dressing was moderate, with a mean score of  $24.98 \pm 2.64$ . Items related to the correct warming of saline, the proper opening of dressing packages, and appropriate use of cleaning solutions had the highest adherence scores while checking equipment expiration dates and explaining procedures to patients had the lowest scores. Among the domains, dressing application had the highest adherence score (1.45/2), while dressing preparation had the lowest (1.13/2). Statistical analysis showed no significant relationships between adherence and gender ( $P = 0.36$ ), marital status ( $P = 0.77$ ), education level ( $P = 0.50$ ), age ( $P = 0.33$ ), and work experience of the nurses ( $P = 0.45$ ). Given the importance of aseptic techniques in surgical dressing and the critical role of nurses, healthcare managers and ward supervisors should maintain current standards and implement effective interventions to enhance adherence.

## Keywords:

Aseptic, infection control, orthopedic nursing

## Introduction

Aseptic techniques are critical in healthcare settings to prevent infections and ensure patient safety, especially during invasive procedures and wound care.<sup>[1,2]</sup> In orthopedic nursing, where dressing changes are frequent and involve surgical sites or injuries, adherence to aseptic techniques is vital.<sup>[3]</sup> Nurses, as frontline healthcare providers, are tasked with maintaining these sterile environments to protect patients from potential infections.<sup>[4,5]</sup> In recent years, the incidence of wound infections has increased by 3% annually,<sup>[6,7]</sup> highlighting

the urgent need to address adherence to aseptic techniques in orthopedic settings. Orthopedic procedures often involve complex and delicate surgeries, making preventing infections a top priority.<sup>[8,9]</sup> The use of aseptic techniques during dressing changes includes measures such as hand hygiene, the use of sterile gloves and instruments, and maintaining a sterile field.<sup>[10]</sup> These practices are designed to eliminate the presence of harmful microorganisms that could lead to infections. These infections are particularly detrimental in orthopedic patients due to the potential for compromised bone and tissue integrity.<sup>[11]</sup> Therefore, strict adherence to

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aseptic techniques is essential for promoting healing and preventing complications.<sup>[12,13]</sup>

Several factors can influence adherence to aseptic techniques among nurses in orthopedic settings.<sup>[13]</sup> These factors can be categorized into individual, organizational, and external influences.<sup>[14]</sup> Individual factors include the nurse’s knowledge, experience, and attitude towards infection control.<sup>[14,15]</sup> Organizational factors encompass the availability of resources, workload, staffing levels, and institutional policies.<sup>[14,14]</sup> External factors might involve the availability of ongoing education and training programs, as well as the influence of mentors and role models within the healthcare environment.<sup>[15]</sup> In 2019, Tambe *et al.*<sup>[16]</sup> found that 85% of patients faced wound infections, and only 45% used sterile gloves, citing financial constraints and insufficient supplies as major barriers. Understanding these factors is crucial for developing effective strategies to enhance compliance with aseptic protocols. Research has shown that ongoing education and training are pivotal in ensuring healthcare professionals maintain high standards of aseptic technique.<sup>[17,18]</sup> However, the specific context of orthopedic nursing presents unique challenges that require tailored approaches [Figure 1].

While adherence to aseptic protocols has been extensively examined in broader healthcare contexts,<sup>[2,10]</sup> limited research specifically addresses the complex challenges faced by orthopedic nurses, whose patients are especially susceptible to adverse outcomes from infections. By exploring individual (knowledge, experience), organizational (resource availability, policy enforcement), and external (training access,

mentorship) factors, this study offers a comprehensive analysis tailored to the orthopedic setting. Such an approach highlights barriers and facilitators unique to orthopedic care, underscoring the need for targeted interventions. The primary goal of aseptic techniques is to minimize the risk of pathogenic organisms entering wounds or other sensitive areas while preventing the transmission of these pathogens from such areas to other patients and staff.<sup>[19,20]</sup> Therefore, adhering to these techniques is crucial for infection control, patient safety, and staff protection, as it reduces hospital-acquired infections, lowers treatment costs due to shorter patient stays, and decreases mortality rates.<sup>[21]</sup> Consequently, this study aims to identify the factors associated with adherence to aseptic techniques in orthopedic dressing by nurses.

## Materials and Methods

### Study design and setting

The present study was a cross-sectional observational design conducted in 2023 within orthopedic wards at hospitals affiliated with Shahid Beheshti University of Medical Sciences.

### Study participants and sampling

The sample included 82 nurses selected through a census sampling method. To facilitate the research, the nurses’ shift schedules at each hospital were obtained. Sampling was then carried out according to this schedule within the study period. The inclusion criteria were employment in an orthopedic ward and at least 6 months of active nursing experience in the orthopedic department, while the exclusion criterion was lack of cooperation during the study.

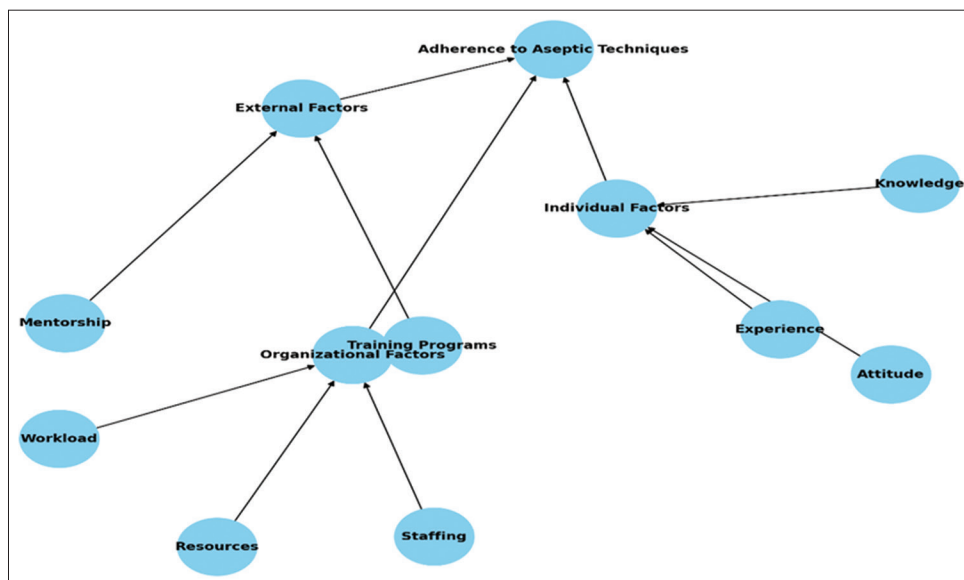


Figure 1: Conceptual framework for factors influencing aseptic technique adherence

### Data collection tools

The research tool used in this study was a checklist consisting of two sections. The first section collected demographic information, including variables such as age, gender, occupation, monthly income, marital status, and education level. The second section addressed factors related to adherence to aseptic techniques by nurses. To examine the factors associated with adherence to aseptic techniques, the checklist from the Nonino study was utilized.<sup>[22]</sup> This checklist included 19 questions (7 questions on dressing preparation, 9 questions on dressing application, and 3 questions on organizational behavior). The researcher marked one of the options—"completed," "not completed," or "needs improvement"—for each item in the checklist based on observations of the nurses' dressing procedures. The validity and reliability of the Nonino checklist were confirmed in this study. Both qualitative and quantitative methods were employed to assess Face validity. The qualitative method involved interviews with 15 respondents (nurses) and 10 specialists, where they were asked about the relevance, simplicity, clarity, and comprehensibility of the items, as well as the presence of terms reflecting the intended concepts. Their feedback was then incorporated into the evaluation process. In the quantitative method, the Item Impact Method was used to determine the item scores. A 5-point Likert scale was applied, ranging from "extremely important" to "not important at all" (1–5). Scores were assigned as follows: 5 for "extremely important," 4 for "somewhat important," 3 for "moderately important," 2 for "slightly important," and 1 for "not important at all." This scale was completed by 15 nurses and 10 specialists.<sup>[23]</sup>

To assess content validity quantitatively, both the Content Validity Ratio (CVR) using the Lawshe method and the Content Validity Index (CVI) were employed. The CVI for all items was above 0.79, confirming the content validity of the questions. The overall CVI for the questionnaire was 0.94. Reliability was evaluated using test–retest reliability and Cronbach's alpha, with input from supervising and consulting professors. For this purpose, 20 nurses completed the questionnaire. After 1–2 weeks, the same questionnaire was re-administered to the same group. The Intraclass Correlation Coefficient (ICC) for the entire questionnaire was 0.89, indicating high reliability.

Out of the five targeted hospitals, two were excluded from the study due to resident-based dressing procedures, and sampling was conducted in the remaining three hospitals. After obtaining sampling permission, the researcher introduced themselves to the department head and secured permission to observe the dressing process performed by the nurses and to complete the checklist during the dressing changes. Based on the

study schedule and the nurses' shift timings at the three hospitals, the checklists were completed. Nearly all nurses, after being informed of the research objectives and procedures, consented and cooperated. The researcher explained that the study was part of a thesis project and required marking items on the checklist during the dressing changes performed by the nurses. Since the nurses were not required to perform additional tasks, they readily agreed to allow the researcher to observe the dressing changes while maintaining distance.

Data analysis was performed using SPSS software, version 26. Descriptive statistics, including frequencies, means, and standard deviations, were calculated. To assess the relationship between scores and demographic variables, independent t-tests and Pearson correlation coefficients were used.

### Ethical consideration

The study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences (IR.SBMU.PHARMACY.REC.1402.110).

### Results

The results showed that the mean age of the study participants was  $30.76 \pm 6.47$  years. The majority of the participants (89%) were female, and 53.7% were married. Additionally, most participants (96.3%) held a bachelor's degree, and the mean and standard deviation of their work experience were  $8.19 \pm 6.71$  years.

Table 1 indicated that the highest mean adherence to aseptic techniques during dressing procedures was observed for the items: 4 "Does the nurse warm the saline solution?" (mean = 2), 9 "Does the nurse open the dressing package correctly?" (mean = 2), 12 "Does the nurse use the prescribed solution for cleaning the wound?" (mean = 2), and 18 "Does the nurse discard used equipment after each dressing?" (mean = 2). Conversely, the lowest mean scores were recorded for items 10 "Does the nurse check the expiration date of the equipment?" (mean =  $0.22 \pm 0.02$ ) and 2 "Does the nurse explain the procedure to the patient?" (mean =  $0.18 \pm 0.03$ ).

Table 2 shows that the mean adherence to aseptic techniques among all study participants was  $24.98 \pm 2.64$ , which falls within the moderate range of 13–26. Among the different domains, the domain related to dressing application had the highest score with 1.45 out of 2, while the domain related to dressing preparation had the lowest score with 1.13 out of 2.

The independent *t*-test revealed that adherence to aseptic techniques by nurses did not have a significant

**Table 1: Distribution of adherence to aseptic techniques during orthopedic dressing by nurses**

Item	Completed	Not completed	Needs improvement	Mean out of 2 (SD)	Score out of 100
	n (%)	n (%)	n (%)		
1 Does the nurse introduce herself to the patient?	77 (93.9)	0 (0)	5 (6.1)	1.93 (0.24)	96.5
2 Does the nurse explain the procedure to the patient?	0 (0)	79 (96.3)	3 (3.7)	0.03 (0.18)	1.5
3 Does the nurse prepare the dressing equipment separately for each patient?	63 (76.8)	1 (1.2)	18 (22)	1.75 (0.45)	87.5
4 Does the nurse warm the saline solution?	82 (100)	0 (0)	0 (0)	2	100
5 Does the nurse wash her hands before dressing?	3 (3.7)	78 (95.1)	1 (1.2)	0.08 (0.93)	4
6 Does the nurse position the patient appropriately for the dressing?	78 (95.1)	0 (0)	4 (4.9)	1.95 (0.21)	97.5
7 Does the nurse maintain the patient's privacy?	3 (3.7)	68 (82.9)	11 (13.4)	0.20 (0.49)	10
8 Does the nurse prepare a safe environment and ensure the patient's comfort?	64 (78)	1 (1.2)	17 (20.7)	1.90 (1.09)	95
9 Does the nurse open the dressing package correctly?	82 (100)	0 (0)	0 (0)	2.00 (0)	100
10 Does the nurse check the expiration date of the equipment?	1 (1.2)	81 (98.8)	0 (0)	0.02 (0.22)	1
11 During dressing changes, does the nurse keep used equipment away from the wound?	80 (97.6)	0 (0)	2 (2.4)	1.97 (0.15)	98.5
12 Does the nurse use the prescribed solution for cleaning the wound?	82 (100)	0 (0)	0 (0)	1.00 (0)	100
13 Does the nurse perform tasks in a logical and systematic order?	76 (92.7)	0 (0)	6 (7.3)	1.92 (0.26)	96
14 Does the nurse use the equipment correctly?	57 (69.5)	1 (1.2)	24 (29.3)	1.68 (0.49)	84
15 Does the nurse adhere to aseptic principles throughout the dressing process?	2 (2.4)	16 (19.5)	64 (78)	0.82 (0.43)	41
16 Does the nurse assess the patient's pain during the dressing procedure?	14 (17.1)	33 (40.2)	35 (42.7)	0.76 (0.72)	38
17 Does the nurse immediately place used equipment in its proper place after completing the task?	65 (79.3)	3 (3.7)	14 (17.1)	1.75 (0.51)	87.5
18 Does the nurse discard used equipment after each dressing?	82 (100)	0 (0)	0 (0)	2.00 (0)	100
19 Does the nurse wash her hands or use alcohol-based sanitizer after each dressing?	5 (6.1)	75 (91.5)	2 (2.4)	0.14 (0.49)	7

**Table 2: Distribution of mean and standard deviation for adherence to aseptic techniques and its components**

Aseptic Techniques	Number of Questions	Minimum - Maximum	Mean±SD	Mean out of 2	Mean out of 100
Preparation of Dressing	7	11–5	1.00±7.97	1.13	56.5
Dressing Application	9	22–10	1.68±13.10	1.45	72.5
Organizational	3	6–2	0.74±3.90	1.30	65
Overall Adherence to Aseptic Techniques	19	38–18	2.64±24.98	1.31	65.5

relationship with their gender ( $P = 0.36$ ), marital status ( $P = 0.77$ ), or education level ( $P = 0.50$ ) [Table 3]. Additionally, Pearson correlation coefficients indicated that adherence to aseptic techniques was not significantly related to the age ( $P = 0.33$ ) and work experience of the nurses ( $P = 0.45$ ).

### Discussion

This study aimed to investigate the factors associated with adherence to aseptic techniques during orthopedic dressing by nurses. The results indicated that the mean adherence to aseptic techniques among nurses was at a moderate level. Among the domains, the domain related to dressing application had the highest score, while the domain related to dressing preparation had the lowest score. Consistent with these findings,

Zadi *et al.* (2020) reported that the performance of operating room technologists in adhering to surgical sterile techniques was at a moderate level.<sup>[21]</sup> According to the researcher, one of the significant reasons for the alignment of the current study with previous research is the critical importance of adhering to aseptic techniques. This is due to the potential risks to patient safety and the financial burden resulting from non-compliance, which necessitates at least a moderate level of adherence. A study by Tambe *et al.*<sup>[16]</sup> in 2019 found that 85% of nurses in Cameroon faced wound infections, and 80% reported that aseptic techniques were followed to a moderate extent. A study assessing nursing staff knowledge and barriers to aseptic technique found that about two-thirds of nurses had an average level of knowledge, while 33.7% had below-average knowledge.<sup>[24]</sup> In addition, a study at a tertiary care

**Table 3: Comparison of adherence to aseptic techniques among nurses based on demographic characteristics**

Variables	Categories	n	Mean±SD	Independent t-test
Sex	Female	73	2.71±25.08	t=0.92
	Male	9	1.92±24.22	P=0.36
Marital Status	Married	44	1.91±24.90	t=-0.28
	Single	38	3.31±25.07	P=0.77
Education Level	Bachelor	79	2.66±24.94	t=-0.67
	Master	3	2.00±26.00	P=0.50

hospital in Lahore found that while 94% of operating room nurses routinely practiced sterile techniques and 91% adhered to proper handwashing protocols, there were significant gaps in overall knowledge of aseptic techniques.<sup>[25]</sup> Contrary to the results of the present study, Ding *et al.*<sup>[9]</sup> (2017) showed that more than one-third of nurses did not properly use clean gloves. Additionally, the results of Chepkok 's study in 2016 indicated that 85% of nurses did not adhere to aseptic techniques in patient dressing procedures.<sup>[22]</sup> The most important reason for the discrepancy between the present study and Chepkok's study, which reported lower adherence to aseptic techniques, is the research environment. Kenya's healthcare system differs significantly from Iran's, with limited access to facilities, equipment, and experienced personnel. However, some studies have also reported inconsistent results but with a higher level of adherence to aseptic techniques and dressing management. A 2018 study conducted in Saudi Arabia by BaMohammed *et al.*<sup>[23]</sup> showed that most nurses managed wound dressings satisfactorily. Additionally, a study by Jarelnape<sup>[24]</sup> in 2023 found that the mean scores for the aseptic technique performance scale were above average. The 2012 study by Saberi *et al.* found that nurses' performance in hospital infection prevention and control averaged 8 out of 10.<sup>[26]</sup> According to the researcher, differences in the target group, research environment, timing of the research, and performance measurement tools can explain the variations and inconsistencies in the study results. The present study focused on nurses in orthopedic wards, where the execution of these dressings differs from other departments.

Based on the results of the study, among the three factors related to adherence to aseptic techniques in orthopedic dressing by nurses, factors related to dressing application had the highest score, while factors related to dressing preparation had the lowest. In Nasiri Formi's 2021 study, it was found that the factors associated with adherence to aseptic principles in the operating room were related to operating room techniques and maintaining patient health.<sup>[25]</sup> Additionally, the study by Parnikh *et al.* in 2022 showed that providing necessary hospital supplies, using appropriate guidelines and educational programs,

supervision, and setting appropriate policies can help improve aseptic performance.<sup>[24]</sup> A 2019 study by Tambe *et al.*<sup>[16]</sup> in Cameroon found that 25% of nurses attributed infections to poor aseptic techniques, 20% to negligence, and 5% to patients' financial constraints. Determining the factors related to the adherence to aseptic techniques in orthopedic dressing by nurses has been approached from different perspectives and with various objectives.<sup>[26]</sup> Some factors may include demographic characteristics and the nature of the illness. Some factors may include organizational, environmental, equipment, and human resource factors. However, the present study specifically examined factors related to the dressing itself, including dressing application, organizational factors, and dressing preparation. While overall adherence to aseptic techniques in orthopedic dressing is crucial, analyzing specific domains and breaking down this broad objective into smaller goals can create better conditions for effective interventions.

The results showed that there was no significant relationship between any of the demographic characteristics of nurses and their adherence to aseptic techniques in orthopedic dressing. A study conducted in Iran in 2022 by Parnikh *et al.* found that age and work experience had a weak negative correlation with the subscale "creating a sterile environment," and there was a significant relationship between nurses' aseptic performance scores and their level of education.<sup>[24]</sup> Additionally, a study conducted by Azarbarzin in several selected hospitals in Isfahan found that work experience was related to adherence to dressing standards, while it did not have a statistically significant correlation with adherence to intramuscular injection standards.<sup>[26]</sup> Furthermore, Maghaminejad *et al.* (2021) showed that among the contextual variables, marital status and employment status were significantly related to the overall application of ethical principles during patient dressing. Specifically, the average score of married nurses and those covered by the human resources plan was higher than that of other nurses.<sup>[27]</sup> Since the demographic characteristics of participants vary across different research environments, it is not possible to definitively consider a single demographic variable as a predictor for a particular variable or phenomenon. However, utilizing the results of studies and, if confirmed, incorporating these factors into planning can be beneficial.

### Limitations and recommendations

The present study, despite its valuable insights into the adherence to aseptic techniques among nurses, has several limitations. First, the cross-sectional design restricts the ability to infer causality, as it only captures data at a single point in time. Additionally, the sample was drawn from hospitals affiliated with Shahid Beheshti University of Medical Sciences, limiting the

generalizability of the findings to other healthcare settings or regions. Future research should adopt a longitudinal design to better understand the causal relationships between factors influencing aseptic technique adherence among nurses. Expanding the sample to include nurses from different regions and healthcare settings would enhance the generalizability of the findings. Additionally, further studies should consider using a mixed-methods approach, combining quantitative data with qualitative interviews to explore the underlying reasons behind non-adherence to aseptic techniques.

## Conclusion

This study found that adherence to aseptic techniques during orthopedic dressing by nurses was at a moderate level, with the highest scores in dressing application and the lowest in dressing preparation. The lack of a significant correlation between demographic characteristics and adherence suggests that while these factors vary across settings, they do not predict adherence levels definitively. Focusing on specific aspects of the dressing process can enhance the effectiveness of interventions. From a health policy perspective, this study underscores the importance of implementing targeted interventions that address the identified gaps in aseptic technique adherence. Health policy benchmarks should aim to enhance training and continuous education for nurses, focusing on critical moments during the dressing process. Furthermore, policies should advocate for adequate resources, support systems, and a structured approach to infection control that ensures adherence to aseptic practices is maintained consistently. Improving aseptic technique adherence not only protects patient safety but also aligns with broader health policy goals of reducing hospital-acquired infections and enhancing healthcare quality.

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## Conflicts of interest

There are no conflicts of interest.

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