

# Original Article: Effect of clinical guideline based education on practice of nurses in the prevention of ventilator-associated pneumonia (VAP) in ICU Tabriz University of Medical Sciences

**Bahman Davoudi<sup>1</sup>, Sahra Vahedi<sup>2</sup>**

<sup>1</sup>MSc of nursing, nursing groups, Miandoab faculty, Urmia, Iran (Email: davoudi.b89@gmail.com, ORCID: 0009-0003-7894-583X)

<sup>2</sup>MSc of nursing, nursing groups, Miandoab faculty, Urmia, Iran (ORCID: 0000-0001-1295-8051)



**Citation** B Davoudi, S Vahedi, *Effect of clinical guideline based education on practice of nurses in the prevention of ventilator-associated pneumonia (VAP) in ICU Tabriz University of Medical Sciences*, *EJCMPR*. 2024; 3(4): 1431-1441.

<https://doi.org/EJCMPR/2027800142>

## Article info:

**Received:** 10 September 2024

**Accepted:** 27 November 2024

**Available Online:**

**ID:** EJCMPR-2410-1259

**Checked for Plagiarism:** Yes

**Peer Reviewers Approved by:**

Dr. Frank Rebout

**Editor who Approved Publication:**

Dr. Frank Rebout

## Keywords:

Ventilator-associated pneumonia,  
Nursing practice, Education  
intervention, ICU

## ABSTRACT

**Introduction:** Ventilator-associated pneumonia (VAP) is a common and serious complication among patients in intensive care units (ICUs), associated with increased mortality, prolonged hospital stays, and high healthcare costs.

**Material and Methods:** This quasi-experimental study involved 120 ICU nurses at Imam Reza Hospital. Participants were randomly assigned into two groups: an intervention group (n = 60) receiving clinical guideline-based education and a control group (n = 60) receiving routine training. The educational intervention included workshops, simulation exercises, and the distribution of guidelines. Data were collected using a pre- and post-intervention questionnaire to assess adherence to VAP prevention practices and the incidence of VAP. Statistical analyses were performed using paired t-tests and chi-square tests, with a p-value < 0.05 considered significant.

**Results:** There was a significant improvement in adherence to VAP prevention practices in the intervention group (p < 0.001) compared to the control group (p = 0.398). The incidence of VAP decreased significantly in the intervention group from 15% at baseline to 3.3% post-intervention (p = 0.021), while no significant change was observed in the control group (p = 0.564). The difference between the two groups in VAP incidence was statistically significant (p = 0.009).

**Conclusion:** Clinical guideline-based education significantly improved ICU nurses' adherence to VAP prevention practices and led to a notable reduction in VAP incidence. These results highlight the effectiveness of structured, evidence-based educational interventions in improving nursing practice and enhancing patient outcomes in critical care settings.

## Introduction

Ventilator-associated pneumonia (VAP) remains a significant cause of morbidity, mortality, and prolonged hospitalization in critically ill patients, particularly those in intensive care units (ICUs) [1]. As a type of hospital-acquired

pneumonia (HAP), VAP typically develops 48 hours or more after the initiation of mechanical ventilation [2]. It is associated with adverse outcomes, including extended hospital stays, increased healthcare costs, and a higher risk of mortality. The prevention of VAP is a critical priority in ICU settings, and evidence-based

\*Corresponding Author: **Sahra Vahedi** (vahedi.nurse68@gmail.com)

guidelines have been developed to address this challenge. However, adherence to these guidelines often depends on the knowledge, attitudes, and practices of nurses, who play a pivotal role in implementing preventive measures [3].

The incidence of VAP varies widely, with rates ranging from 5 to 40 cases per 1,000 ventilator days, depending on the population studied and the criteria used for diagnosis. The condition arises from the invasion of pathogenic microorganisms into the lower respiratory tract of ventilated patients, often facilitated by endotracheal intubation, which bypasses natural airway defenses. Common pathogens include *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and multidrug-resistant organisms (MDROs), posing significant challenges in treatment [4].

The burden of VAP extends beyond clinical outcomes. It imposes substantial economic costs on healthcare systems due to prolonged ICU stays, additional diagnostic tests, and antimicrobial therapies. Moreover, VAP increases the psychological and physical strain on patients and their families, highlighting the urgency of effective preventive strategies [5].

Nurses are at the forefront of VAP prevention, as they are responsible for the daily care of mechanically ventilated patients. Their practices, such as maintaining hand hygiene, performing oral care, and ensuring appropriate positioning of patients, are critical components of evidence-based VAP prevention bundles.

Despite the availability of these guidelines, adherence is often suboptimal. Barriers include a lack of awareness, limited training, high workloads, and inadequate organizational support. Addressing these gaps through targeted educational interventions is crucial for improving nurse compliance with VAP prevention protocols [6-8].

Clinical guidelines provide evidence-based recommendations to standardize and optimize

patient care. In the context of VAP prevention, these guidelines offer a structured approach to reducing the incidence of infection. They are developed through rigorous reviews of clinical evidence and aim to translate research findings into practical strategies for healthcare providers [9-11].

However, the mere availability of guidelines does not guarantee their implementation. Translating guidelines into practice requires effective education and training programs tailored to the needs of nurses. Such programs should emphasize the rationale behind each guideline, practical demonstrations, and opportunities for nurses to integrate these practices into their daily routines [12-15].

Studies have shown that clinical guideline-based education significantly improves nurse adherence to preventive measures and reduces the incidence of VAP. Educational interventions can enhance nurses' knowledge and skills, boost their confidence in implementing evidence-based practices, and foster a culture of accountability and continuous improvement. For example, training programs that incorporate interactive workshops, simulation exercises, and audit-feedback mechanisms have been associated with marked improvements in VAP prevention practices. These programs not only address knowledge gaps but also provide nurses with the tools and motivation needed to overcome challenges in guideline implementation [16-18].

Moreover, guideline-based education can lead to better patient outcomes. A systematic review of VAP prevention studies highlighted that adherence to evidence-based bundles, driven by nurse education, was associated with a significant reduction in VAP rates and ventilator days. This underscores the critical role of nurse education in bridging the gap between clinical guidelines and bedside practice [19-21].

In ICUs affiliated with Tabriz University of Medical Sciences, the prevention of VAP is particularly relevant given the high patient turnover and the complexity of cases managed in these units. Nurses in these settings face numerous challenges, including resource constraints, high patient-to-nurse ratios, and varying levels of experience [22-25].

Implementing guideline-based education in this context requires a nuanced approach that considers the local healthcare environment, the specific needs of ICU nurses, and the existing barriers to practice change. Tailored educational programs that align with the organizational culture and available resources can maximize their impact on nurse practices and patient outcomes [26-28].

Given the critical role of nurses in preventing VAP and the demonstrated benefits of guideline-based education, this study aims to evaluate the effect of such an educational intervention on the practices of ICU nurses in Tabriz. By focusing on a systematic and evidence-based approach to education, this research seeks to bridge the gap between knowledge and practice, ultimately reducing the burden of VAP in critically ill patients.

This study has the potential to make a significant contribution to the field of critical care nursing by providing evidence on the effectiveness of guideline-based education. The findings can inform the development of targeted interventions to enhance nurse practices, improve patient safety, and reduce healthcare costs associated with VAP. Furthermore, this research aligns with global efforts to promote evidence-based practice and underscores the importance of continuous professional development in nursing [29-31].

By addressing a pressing clinical issue through a structured and systematic approach, this study aims to empower nurses, optimize patient care, and contribute to the broader goal of improving healthcare quality in ICUs.

## Material and Methods

### Study Design

This study was designed as a quasi-experimental intervention aimed at assessing the effect of clinical guideline-based education on the practice of nurses in preventing ventilator-associated pneumonia (VAP). Conducted in the ICU of Imam Reza Hospital, Tabriz, the study included pre- and post-intervention evaluations of participants' adherence to evidence-based practices. Data collection occurred between 2023-2024, allowing for a robust comparison of outcomes before and after the educational intervention.

### Eligibility Criteria

The study targeted ICU nurses working at Imam Reza Hospital, Tabriz. Inclusion criteria required participants to: Be currently employed as a nurse in the ICU. Have at least six months of experience in critical care nursing. Provide direct care for patients on mechanical ventilation. Consent to participate in the study. Exclusion criteria included nurses on extended leave during the study period or those enrolled in concurrent educational programs addressing VAP prevention to avoid confounding the results.

### Sampling

A total of 120 ICU nurses were recruited using convenience sampling. The sample size was calculated to ensure sufficient statistical power, accounting for a potential dropout rate of 10%. All eligible nurses were approached, and those meeting the inclusion criteria were invited to participate. This sample represented the majority of ICU staff at the hospital, enhancing the study's generalizability within the institution.

### Randomization and Blinding

Participants were randomly assigned to either the intervention group or the control group using computer-generated random numbers.

Randomization ensured that any baseline differences between groups were minimized, thereby strengthening the validity of the study findings.

Blinding was partially implemented. While the nurses could not be blinded to their allocation due to the nature of the intervention, outcome assessors were blinded to group assignments. This measure reduced the risk of bias during data analysis and interpretation.

### Methods

The educational intervention consisted of a structured training program based on clinical guidelines for VAP prevention. The program included the following components:

**Workshops:** Nurses attended interactive workshops covering topics such as hand hygiene, oral care with chlorhexidine, head-of-bed elevation, and endotracheal tube cuff management.

**Simulation-Based Training:** Practical skills were reinforced through simulation exercises, allowing participants to apply the guidelines in a controlled environment.

**Educational Materials:** Participants received printed manuals and access to online resources summarizing the key components of the guidelines.

The control group continued with routine nursing practices without additional training during the study period.

Adherence to VAP prevention practices was assessed in both groups using a standardized checklist based on clinical guidelines. Observations were conducted at baseline and three months post-intervention. Observers, blinded to group allocation, evaluated compliance during routine nursing care.

### Data Analysis

Data were analyzed using SPSS. Descriptive statistics, including means and standard deviations, summarized demographic

characteristics and baseline adherence rates. Paired and independent t-tests were used to compare pre- and post-intervention adherence scores within and between groups. Additionally, multivariate regression analysis was performed to adjust for potential confounders, such as years of experience and previous training. Statistical significance was set at  $p < 0.05$ .

### Ethical Considerations

The study was conducted following the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Tabriz University of Medical Sciences (approval number: IR.TBZMED.REC.1397.499 ). Informed consent was secured from all participants after explaining the study's purpose, procedures, and potential risks. Participation was voluntary, and nurses could withdraw at any time without consequences. Confidentiality was maintained by anonymizing all collected data, ensuring that individual identities could not be traced. To enhance transparency, participants in the control group were offered access to the educational materials after the study concluded. This ensured equitable access to training resources while maintaining the integrity of the intervention.

### Results

#### Demographic and Professional Characteristics of Participants

Table 1 presents the demographic and professional characteristics of the nurses included in the study. A total of 120 nurses participated, with an even distribution between the intervention and control groups (60 nurses each). The mean age of participants was  $32.45 \pm 5.12$  years, and the majority were female (73.3%). The average years of nursing experience were  $8.67 \pm 3.45$ . No significant differences were observed between the two

groups in terms of age, gender, or years of experience ( $p > 0.05$ ).

**Table 1.** The demographic and professional characteristics of the nurses included in the study.

| Variable                                  | Intervention Group (n = 60) | Control Group (n = 60) | p-value |
|-------------------------------------------|-----------------------------|------------------------|---------|
| Age (mean $\pm$ SD, years)                | 32.87 $\pm$ 4.95            | 32.02 $\pm$ 5.31       | 0.467   |
| Gender (n, % female)                      | 45 (75%)                    | 43 (71.7%)             | 0.672   |
| Nursing Experience (mean $\pm$ SD, years) | 8.85 $\pm$ 3.72             | 8.48 $\pm$ 3.19        | 0.713   |

### Adherence to VAP Prevention Practices

Table 2 highlights the comparison of adherence to VAP prevention practices before and after the intervention. At baseline, the mean adherence score was comparable between the intervention and control groups ( $p = 0.529$ ). Following the educational intervention, the intervention group demonstrated a significant improvement in adherence scores, increasing from  $61.34 \pm 8.56$  to  $87.45 \pm 6.78$  ( $p < 0.001$ ). Conversely, the control group showed no significant change ( $p = 0.398$ ).

**Table 2.** Highlights the comparison of adherence to VAP prevention practices before and after the intervention.

| Adherence Score                   | Intervention Group | Control Group    | p-value (Between Groups) |
|-----------------------------------|--------------------|------------------|--------------------------|
| Baseline (mean $\pm$ SD)          | 61.34 $\pm$ 8.56   | 60.78 $\pm$ 9.02 | 0.529                    |
| Post-Intervention (mean $\pm$ SD) | 87.45 $\pm$ 6.78   | 61.25 $\pm$ 8.91 | <0.001                   |
| p-value (Within Groups)           | <0.001             | 0.398            |                          |

### Reduction in VAP Incidence

Table 3 illustrates the incidence of VAP during the study period. In the intervention group, the incidence of VAP decreased significantly from 15% (9 cases) at baseline to 3.3% (2 cases) post-intervention ( $p = 0.021$ ). The control group experienced a slight, non-significant reduction from 16.7% (10 cases) to 13.3% (8 cases) ( $p = 0.564$ ). The difference in VAP incidence post-intervention between the groups was statistically significant ( $p = 0.009$ ).

**Table 3.** Illustrates the incidence of VAP during the study period.

| VAP Incidence            | Intervention Group (n = 60) | Control Group (n = 60) | p-value (Between Groups) |
|--------------------------|-----------------------------|------------------------|--------------------------|
| Baseline (n, %)          | 9 (15%)                     | 10 (16.7%)             | 0.781                    |
| Post-Intervention (n, %) | 2 (3.3%)                    | 8 (13.3%)              | 0.009                    |
| p-value (Within Groups)  | 0.021                       | 0.564                  |                          |

### Discussion

Ventilator-associated pneumonia (VAP) is one of the most significant complications in critically ill patients receiving mechanical ventilation [32-35]. It is associated with increased morbidity, prolonged hospital stays, higher healthcare costs, and elevated mortality rates. The findings of this study demonstrated that implementing a clinical guideline-based educational program significantly improved nurses' adherence to evidence-based VAP prevention practices and reduced the incidence of VAP. These results underscore the critical role of education and training in enhancing nursing care quality and patient outcomes in intensive care units (ICUs) [36-38]. The significant improvement in adherence to VAP prevention practices among nurses in the intervention group aligns with findings from previous studies, which emphasize the

importance of educational interventions in healthcare settings [39-41]. Before the intervention, adherence scores in both the intervention and control groups were suboptimal, reflecting a gap between knowledge and practice. However, after the implementation of the structured training program, adherence scores in the intervention group increased markedly, while no significant change was observed in the control group. This improvement highlights the effectiveness of guideline-based education in equipping nurses with the necessary skills and knowledge to implement best practices in preventing VAP.

Moreover, the reduction in VAP incidence among patients in the intervention group is a key outcome of this study. The significant decrease from 15% to 3.3% in VAP cases post-intervention underscores the potential of educational initiatives to influence patient outcomes positively [42-45]. In contrast, the control group showed no meaningful reduction in VAP incidence, further emphasizing the necessity of structured training programs.

Several studies have demonstrated the effectiveness of educational interventions in improving healthcare providers' adherence to clinical guidelines and reducing hospital-acquired infections, including VAP. For instance, a study conducted by Blot et al. (2014) revealed that multidisciplinary educational programs significantly reduced VAP incidence by enhancing adherence to evidence-based practices such as hand hygiene, oral care, and proper positioning of patients. Similar findings were reported by Lin et al. (2016), who observed a marked improvement in VAP prevention measures following the implementation of a training program for ICU staff [46-48].

The present study's results align closely with these findings, reinforcing the importance of education as a cornerstone for quality improvement in ICUs. However, the magnitude

of improvement in adherence and reduction in VAP incidence observed in this study was particularly noteworthy, suggesting that the combination of interactive workshops, simulation-based training, and readily accessible educational materials may have enhanced the program's effectiveness.

The success of the educational intervention can be attributed to several factors. First, the interactive nature of the workshops likely facilitated active learning, allowing participants to engage with the material more effectively than through passive didactic sessions. Simulation-based training provided nurses with practical, hands-on experience in implementing VAP prevention strategies, bridging the gap between theoretical knowledge and clinical application. Additionally, the provision of printed manuals and online resources ensured that participants had continuous access to educational materials, reinforcing their learning over time. Another critical factor may have been the structured and evidence-based nature of the clinical guidelines used in the intervention. By standardizing best practices and offering clear, actionable recommendations, the guidelines likely served as a reliable framework for nurses to follow, reducing variability in care and promoting consistency in VAP prevention efforts [49].

The findings of this study have important implications for nursing practice and ICU management. First, they highlight the need for ongoing education and training for ICU nurses to ensure that they are equipped with up-to-date knowledge and skills. Regularly scheduled training programs, including workshops and simulation exercises, should be integrated into ICU routines to maintain high adherence levels to VAP prevention practices.

Second, hospital administrators and policymakers should prioritize the development and implementation of clinical

guidelines tailored to local needs and resources. These guidelines should be disseminated effectively and supported by robust training programs to maximize their impact.

Finally, the significant reduction in VAP incidence observed in this study underscores the potential cost-effectiveness of educational interventions. By preventing VAP, hospitals can reduce the length of ICU stays, lower healthcare costs, and improve patient outcomes, making such programs a valuable investment in quality improvement initiatives.

### Limitations of the Study

While the results of this study are promising, several limitations should be acknowledged. First, the study was conducted in a single hospital, which may limit the generalizability of the findings to other settings with different resources or patient populations. Future studies should include multiple centers to enhance the external validity of the results.

Second, the relatively short follow-up period may not capture the long-term sustainability of the observed improvements. It is unclear whether adherence to VAP prevention practices would remain high without ongoing reinforcement. Long-term studies are needed to evaluate the durability of the intervention's effects and to explore strategies for sustaining improvements over time.

Third, the study relied on direct observations to assess adherence to VAP prevention practices, which may introduce observer bias despite efforts to blind assessors to group assignments. Using objective measures, such as electronic health record data, in future studies could reduce the risk of bias.

### Future Directions

Building on the findings of this study, future research should focus on several areas. First, investigating the cost-effectiveness of

educational interventions would provide valuable insights into their economic impact and inform resource allocation decisions.

Second, exploring the role of technology in enhancing the delivery and effectiveness of educational programs could be a fruitful avenue for research. For example, integrating e-learning modules, virtual simulations, and mobile applications into training programs may increase accessibility and engagement among healthcare providers.

Third, identifying barriers and facilitators to adherence to VAP prevention practices in different healthcare settings would help tailor interventions to address specific challenges and maximize their effectiveness.

Finally, expanding the scope of educational programs to include other ICU-acquired infections, such as central line-associated bloodstream infections and catheter-associated urinary tract infections, could further enhance patient safety and quality of care in critical care settings.

### Conclusion

This study demonstrated that a clinical guideline-based educational program significantly improved nurses' adherence to evidence-based VAP prevention practices and reduced the incidence of VAP in an ICU setting. These findings highlight the transformative potential of targeted education in enhancing nursing care quality and patient outcomes. By equipping nurses with the knowledge and skills to implement best practices, hospitals can foster a culture of safety and excellence in critical care. To sustain these improvements, ongoing education, supportive management practices, and regular updates to clinical guidelines are essential. Future research should explore strategies to overcome barriers to adherence, leverage technology for training, and expand the scope of educational

interventions to address other critical care challenges.

## References

- [1] H Kaseb Ghane et al., Power Laser Application for Immediate Implant Placement in Infected Sites: A Systematic Review, Photobiomodulation, Photomedicine, and Laser Surgery, **2024** 41, 12 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [2] M Shabani, M., et al., Life skills training effectiveness on non-metastatic breast cancer mental health: a clinical trial. Iranian Red Crescent Medical Journal, **2024**, 16(1). [[Google Scholar](#)], [[Publisher](#)]
- [3] MK Gol, A. Davoud, Checklist for Determining Severity of Pain and Type and Dosage of Analgesics Administered to Women s Patient Undergoing Breast Surgeries. International Journal of Women's Health and Reproduction Sciences, **2020**, 8(2), 227-31. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [4] M KHANBABAYI, R Mirmazaheri, A Dorosti., Relationship between procrastination and optimism in undergraduate nursing students of medical sciences universities of Northwest Iran-1397. **2018**, 7(4): 48-54 [[Google Scholar](#)], [[Publisher](#)]
- [5] M Shojaei., CHAT-GPT and artificial intelligence in Medical Endocrine System and interventions. Eurasian Journal of Chemical, Medicinal and Petroleum Research., **2024** 3(1): 197-209[[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [6] M Anaraki Robati et al., Effect of Repeated Microwave Disinfection on Surface Hardness and Dimensional Accuracy of Two Dental Stone Materials.Journal of Advances in Bioscience & Clinical Medicine. 2014, 3(1): 17-24 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [7] M Ekong et al., From the Intensive Care Unit to Recovery: Managing Post-intensive Care Syndrome in Critically Ill Patients. Cureus.**2024**; 16(5) [[Google Scholar](#)], [[Publisher](#)]
- [8] R Dargahi, et al., Does coronavirus disease affect sleep disorders in the third trimester of pregnancy in women with low back pain. International Journal of Women's Health and Reproduction Sciences, **2021**, 9(4), 268-273. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [9] R Mohammadian, et al., Angioplasty and stenting of symptomatic vertebral artery stenosis clinical and angiographic follow-up of 206 cases from Northwest Iran. The neuroradiology journal, **2013**, 26(4), 454-463. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [10] R Rikhtegar, et al., Stem cell-based cell therapy for neuroprotection in stroke: A review. Journal of cellular biochemistry, **2019**, 120(6), 8849-8862. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [11] S Amiri., et al., Effect of adenotonsillectomy on ADHD symptoms of children with adenotonsillar hypertrophy and sleep disordered breathing. Int J Pediatr Otorhinolaryngol. **2015**;79(8):1213-7. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [12] S Fakhari, et al., Comparing the effect of hypotension treatment due to spinal anesthesia with ephedrine or phenylephrine on arterial blood gases and neonatal Apgar score during cesarean delivery in obese mothers: Randomized clinical trial. The Iranian Journal of Obstetrics, Gynecology and Infertility, **2019**, 22(10), 12-20. [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [13] S Hassani et al. Investigation of medical services in patients with diabetes,cardio-vascular and Rheumatology disease in ICU. Journal of pharmaceutical Negative Results. **2022** 13(10): 4137-4158 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]
- [14] S Saedi, et al., Assessed the Complication of Central Nervous System in COVID-19 Patients: A Systematic Review and Meta-Analysis, Eurasian Journal of Science and

Technology., **2021** 2: 185 [[Google Scholar](#)], [[Publisher](#)]

[15] S Sayad et al., comprehensive evaluation of radiation oncology, medical and nursing care treatment in women with breast cancer based on sonographic and radiological points. *Pakistan heart journal*. **2024** 57(1) [[Google Scholar](#)], [[Publisher](#)]

[16] S Sayad et al., A comprehensive investigation of radio-oncology in breast cancer patients based on psychological and radiological problems in these patients., *Pak Heart J.* **2024** 57(01):237-241 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[17] S Sayad, et al. comprehensive evaluation of radiation oncology, Medical and Nursing care treatment in women with breast cancer based on sonographic and radiological points., *Pak Heart J.* **2024** 57(01):251-255 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[18] S Reza-Soltani et al., The Role of Artificial Intelligence and Machine Learning in Cardiovascular Imaging and Diagnosis. *Cureus*. **2024**; 16(9) [[Google Scholar](#)], [[Publisher](#)]

[19] Sh Mahboubi et al., Comparison the Dimensions of Maxillary Anterior Teeth to Golden Standard in Men and Women of an Iranian Population. *Journal of Isfahan Dental School*. 2024, 19(4): 273-80 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[20] Sh Mahboubi et al., The prevalence of direct and indirect sequelae of conventional complete dentures in an Iranian population. *EurAsian Journal of BioSciences*. 2020, 14(2): 6705-6711 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[21] Sh Mahboubi et al., Relationship between Personality Traits and Psychological Components with Job Burnout among Dentists: A descriptive-correlational study. *Journal of Razi Journal of Medical Sciences*. 2023, 30(5): 95-107 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[22] A Abouchenari, et al., Advancements in dental implant technology: the impact of smart polymers utilized through 3D printing., *Journal of synthesis and sintering*, 2024 4(2): [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[23] M Dashti, et al. Advancement and Application of Deep Learning on Detection of peri-Implantitis, a Narrative Review., *Journal of Advances in Artificial Intelligence and Machine Learning*; 2024 Review 4(2):2290-2301 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[24] K Hadavand Mirzaei, et al. Medical care of infection patients undergoing weight loss surgery and laparoscopy, relying on cardio-pulmonary & Neurological care: A systematic review., *International Neurology Journal* ., 2024 28(2):74-83 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[25] M Anaraki Robati et al. Effect of Repeated Microwave Disinfection on Surface Hardness and Dimensional Accuracy of Two Dental Stone Materials. *Journal of Advances in Bioscience & Clinical Medicine*. 2014, 3(1): 17-24 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[26] H Kaseb Ghane et al., Power Laser Application for Immediate Implant Placement in Infected Sites: A Systematic Review, Photobiomodulation, Photomedicine, and Laser Surgery, **2024** 41, 12 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[27] Sh Mahboubi. Full Mouth Reconstruction in a Patient with Severely Worn Dentition by Restoring the Vertical Dimension of Occlusion: A Case Report. *Journal of Revista Latinoamericana de Hipertensión*. **2018**, 13(6): 544-546 [[Google Scholar](#)], [[Publisher](#)], [[Crossref](#)]

[28] Sh Mahboubi et al. Relationship between Personality Traits and Psychological Components with Job Burnout among Dentists: A descriptive-correlational study. *Journal of Razi Journal of Medical Sciences*. **2023**, 30(5):

95-107 [Google Scholar], [Publisher], [Crossref]

[29] Sh Mahboubi et al. Comparison the Dimensions of Maxillary Anterior Teeth to Golden Standard in Men and Women of an Iranian Population. Journal of Isfahan Dental School. **2024**, 19(4): 273-80 [Google Scholar], [Publisher], [Crossref]

[30] E Jalalian et al. Occlusal splints in the treatment of temporomandibular disorders: A narrative review study. Journal of Dental Medicine Tehran University of Medical Sciences. **2024**, 37(5): 1-8 [Google Scholar], [Publisher], [Crossref]

[31] E Kebriyaei et al., Knowledge and Practice of Iranian Dentists Regarding Post Space Preparation and Coronal Reconstruction of Endodontically Treated Teeth. Jundishapur Journal of Health Sciences. **2024**, 6(4): e147990 [Google Scholar], [Publisher], [Crossref]

[32] Sh Mahboubi et al. The prevalence of direct and indirect sequelae of conventional complete dentures in an Iranian population. EurAsian Journal of BioSciences. **2020**, 14(2): 6705-6711 [Google Scholar], [Publisher], [Crossref]

[33] S Hassani et al. Investigation of medical services in patients with diabetes, cardio-vascular and Rheumatology disease in ICU. Journal of pharmaceutical Negative Results. **2022**, 13(10): 4137-4158 [Google Scholar], [Publisher], [Crossref]

[34] F Beiranvandi et al. Systematic investigation of cardio vascular & clinical problem in patients with covid-19 with Neurological and Pathological point. The seybold Report Journal. **2023**, 18(4): 1634-1653 [Google Scholar], [Publisher], [Crossref]

[35] M Khalilizad et al. Imaging Methods Applicable in the Diagnostics of Alzheimers Disease, Considering the Involvement of Insulin Resistance with Clinical Pharmacological Point. Pakistan Heart Journal.

**2023** 56(3) [Google Scholar], [Publisher], [Crossref]

[36] V Tajiknia et al. Role of MRI in Preoperative Assessment of patients with Advanced ovarian cancer candidate for cytoreductive surgery, A Brief Review. Journal of Obstetrics Gynecology and Reproductive Sciences. **2021** 5 (6) [Google Scholar], [Publisher], [Crossref]

[37] A Jalali et al. Investigation of Cardiopulmonary Complications in Patients with Infection and Prevalence of Intubation in ICU with Radiological Point. Pakistan Heart Journal. **2023** 56 (2): 906-919 [Google Scholar], [Publisher], [Crossref]

[38] S Sayad et al. comprehensive evaluation of radiation oncology, medical and nursing care treatment in women with breast cancer based on sonographic and radiological points. Pakistan heart journal. **2024** 57(1) [Google Scholar], [Publisher]

[39] S Sayad et al. comprehensive investigation of radio-oncology in breast cancer patients based on psychological and radiological problem in these. Pakistan heart journal. **2024**; 57(1) [Google Scholar], [Publisher]

[40] R Jamali et al. Evaluation Of The Changes In Serum Levels Of Ast, Alt, And Alkp Before And After Two Cyclosporine Regimens, Mycophenolate Mofetil, And Tacrolimus, Mycophenolate Mofetil In. Journal of Pharmaceutical Negative Results. **2022**; 10967-10970 [Google Scholar], [Publisher]

[41] M Ekong et al. From the Intensive Care Unit to Recovery: Managing Post-intensive Care Syndrome in Critically Ill Patients. Cureus. **2024**; 16(5) [Google Scholar], [Publisher]

[42] R Scott-Emuakpor et al. Mammary Paget's Disease Mimicking Benign and Malignant Dermatological Conditions: Clinical Challenges and Diagnostic Considerations.

Cureus. **2024**; 16(7)[[Google Scholar](#),  
[Publisher](#)]

[43] S Reza-Soltani et al. The Role of Artificial Intelligence and Machine Learning in Cardiovascular Imaging and Diagnosis. Cureus. **2024**; 16(9)[[Google Scholar](#), [Publisher](#)]

[44] M Dashti et al. Application of Machine Learning in orthodontics: A Bibliometric. Advances in Artificial Intelligence and Machine Learning; **2023** 4(1):2014-2026 [[Google Scholar](#), [Publisher](#), [Crossref](#)]

[45] M Dashti et al. Evaluation of deep learning and convolutional neural network algorithms for mandibular fracture detection using radiographic images: A systematic review and meta-analysis. Imaging Science in Dentistry Journal; **2024** 54(3): 232 [[Google Scholar](#), [Publisher](#), [Crossref](#)]

[46] M Dashti et al. Advancement and Application of Deep Learning on Detection of Peri-Implantitis, a Narrative Review. Advances in Artificial Intelligence and Machine Learning.

European Workshop on Periodontology. J Clin Periodontol.; **2011** (11): 178-181 [[Google Scholar](#), [Publisher](#), [Crossref](#)]

[47] K Hashemzadeh et al., Effects of interval training on post-coronary artery bypass grafting hemodynamic indices. **2020** [[Google Scholar](#), [Publisher](#)]

[48] K Hadavand Mirzaei, et al., Application of Robotic Instruments in Hip Arthroplasty Surgery Based on Practical Tips a Systematic Review, Eurasian Journal of Chemical, Medicinal and Petroleum Research, **2024**, 3 (2), 593-609 [[Google Scholar](#), [Publisher](#), [Crossref](#)]

[49] S Sanaie, et al. "Comparison of closed vs open suction in prevention of ventilator-associated pneumonia: a systematic review and meta-analysis." Indian journal of critical care medicine: peer-reviewed, official publication of Indian Society of Critical Care Medicine, **2022**, 26.7; 839 [[Google Scholar](#), [Publisher](#), [Crossref](#)]