

Promoting the Quality of Ventilator-Associated Pneumonia Control in Intensive Care Units: an Action Research

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Received: 2 September 2019

Accepted: 20 February 2020

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Background: Ventilator-associated pneumonia (VAP) is the most common infection in intensive care units (ICUs), with the highest mortality rate of all hospital-acquired infections. This study aimed to improve the quality of VAP control in the ICU of a university-affiliated teaching hospital in Kouhdasht, Iran.

Materials and Methods: This action research was conducted during 2016-2018. The survey data of 18 participants, who were included in the study using the non-probability sampling method, were evaluated. Qualitative data were analyzed using Graneheim and Lundman's qualitative content analysis, and descriptive indices and t-test were measured to analyze quantitative data. Finally, the qualitative and quantitative data were integrated.

This research was developed and implemented in four stages, including assessment and identification of priorities for improvement, design of action plans, implementation of action plans, and reassessment. Data were collected by analyzing 540 performance observations, 55 interviews, six focused group discussions, and two steering group discussions.

Results: The mean scores of VAP control before and after implementing the action plans were 259.33±21.64 and 395.16±13.90, respectively (P<0.001). The qualitative findings indicated that the low quality of the personnel's working life and poor organizational culture were the main barriers to the quality improvement of VAP control. Improvement was achieved after implementing the action plans for enhancing the nurses' quality of working life and realization of their professional identity.

Conclusion: The results of this study suggested that effective approaches, such as personnel empowerment, improvement of environmental conditions, and provision of facilities and equipment can improve the quality of VAP control in ICUs.

Key words: Action research; Intensive care unit; Pneumonia; Ventilator-associated; Quality of working life

INTRODUCTION

Ventilator-associated pneumonia (VAP), as a serious complication of mechanical ventilation, often occurs in intensive care units (ICUs) (1). VAP is defined as pneumonia that occurs 48-72 hours following intubation. It accounts for 85% of hospital-acquired pneumonia

infections and is responsible for 25% of nosocomial infections in ICUs (2). The rate of mortality associated with VAP is significantly higher in developing countries, and it is one of the main causes of mortality in patients hospitalized in ICUs (3-5). According to statistics from developing countries, the mortality rate is 25.6% in Costa

Rica (6) and 53% in Jordan (7). Generally, VAP can increase the healthcare costs, length of hospital stay, duration of mechanical ventilation, and drug resistance and result in the patient and his/her care giver's distrust of the treatment team (8, 9). The World Health Organization (WHO) considers VAP as a medical error and recommends preventive measures, such as adherence to clinical guidelines to reduce its prevalence (10). Also, Reason believes that these errors have multifactorial causes and result from the simultaneous failure of several protective layers. Therefore, these errors can be reduced by systematic protective measures, skilled personnel, or both (11). Nurses, as members of medical teams who spend significant amounts of time with the patients, play a critical role in reducing medical errors (12) and decreasing the incidence of VAP (13). If nursing interventions are developed based on scientific frameworks and systematic programs, the incidence of VAP will significantly decrease in patients at risk (14). Studies have documented that the nurses' performance and awareness of hospital infections, such as VAP, are not at optimal levels (15, 16); therefore, training the nursing staff can reduce the incidence of VAP (17,18).

Studies have shown that environmental factors, such as lack of an ergonomic design, lack of equipment standardization, lack of financial resources, violent environmental conditions, and human factors (e.g., mental capacity, heavy workload, insomnia, fatigue, and job dissatisfaction) affect the nurses' performance by complicating the process of delivering care services in ICUs, causing medical errors, and reducing patient safety (19-21). Since prevention of infections, such as VAP, depends on the proper functioning of medical staff and requires multi-professional collaboration, modification of factors that disturb the nurses' performance seems to be of great importance (14, 21). Therefore, the present study aimed to identify the problems and challenges of quality improvement in VAP management, to develop and implement problem-solving strategies, and to ultimately

evaluate the effects of these strategies on the performance of medical personnel in ICUs.

MATERIALS AND METHODS

This action research was conducted from December 2016 to March 2018 in the ICU of a university-affiliated teaching hospital in Kouhdasht, Iran. Eighteen individuals were invited to participate in the study, including the head nurse, 12 nurses, an infection control nurse, an educational supervisor, and three clinical supervisors. The participants were selected using the non-probability sampling method. The inclusion criteria were working in the ICU or being a nursing manager and willingness to participate in the study. The exclusion criteria were having more than two months of leave of absence and change of workplace.

Data analysis was performed in SPSS version 21, using descriptive statistics (mean and standard deviation) and t-test. Graneheim and Lundman's five-step method was used to analyze the qualitative data. This study was approved by the ethics committee of Lorestan University of Medical Sciences (No.: 124409-2015/1888/10). The hospital authorities also approved the research protocol. Informed consent forms were collected from all participants after explaining the research objectives and ensuring the confidentiality of personal information. Also, the validity of qualitative data was confirmed by Lincoln and Guba's method (22). There were four stages in this study, including the assessment and identification of priorities for improvement, design of action plans, implementation of action plans, and reassessment.

Stage one: Assessment and identification of priorities for improvement

This stage was carried out both quantitatively and qualitatively over four months. In the quantitative phase, 540 performance cases of 12 nurses working in the ICU were observed and recorded. The data collection instrument at this stage included a checklist, which was extracted from various scientific resources for observing the nurses' performance. The content validity of the questionnaire was confirmed by ten nursing faculty

members and one anesthesiologist with a content validity index (CVI) of 0.80 and a content validity ratio (CVR) of 0.62. The nurses' performance was assessed according to a checklist developed by the research assistant (a nursing expert trained for two months), using the participant observation method.

In the qualitative phase, the experiences of 18 staff regarding the challenges of quality improvement of VAP control were extracted from semi-structured interviews, focused group discussions, and notes on routine events and then explained. The data collection tool in this stage included an open-ended questionnaire, which extracted the participants' experiences. A total of 21 interviews were conducted for 30-45 minutes until reaching data saturation. After transcribing the interviews, the information was extracted as preliminary codes. Then, the codes were classified based on their similarities and continuous comparison for extracting the concepts and the contents. All codes were reviewed, analyzed, and grouped by the research team to extract categories and themes. The extracted content reflected the participants' opinions, and necessary changes were made according to their comments. At the end of the first phase, the problems were clarified and confirmed after mixing the quantitative and qualitative data.

Stage two: Design of action plans

The action plans were designed over two months, based on the content analysis in the previous stage. To propose solutions for promoting VAP control, focused group discussions with participation of the subjects were conducted in three sessions. Steering group meetings were also held, and decisions were made concerning issues, such as urgency, executive capacity, budget, preparation of research team, majority agreement, and compliance with standards and policies of the ministry and university. Moreover, there were meetings approved and financed by the hospital authorities.

Stage three: Implementation of action plans

Three cycles of change, designed in the previous stage, were operationalized during eight months, based on the

Gantt chart. These cycles were as follows: 1) Supplying human resources; 2) organizing training workshops; and 3) improving the equipment and upgrading the physical structure.

Stage four: Reassessment and reflections

After implementing the changes, as in the first stage, quantitative and qualitative data was collected for two months and compared with the data of the pre-change stage. At this stage, there were 540 cases of observation from 12 nurses, based on the checklist of nurses' performance to control VAP, and 29 interviews with 18 participants to survey the changes.

RESULTS

Assessment

In this study, there were 18 participants, including 12 nurses and six nursing managers. The mean age of the participants was 33.35 ± 8.0 years. Women accounted for 61.12% of the study population. Table 1 indicates the participants' demographic information. The analysis of quantitative data showed that the mean score of nurses' performance was 259.33 ± 21.64 before the action plans. In focused group discussions and in-depth interviews, the participants claimed that the low quality of working life and the challenges of organizational culture were the barriers to preventing VAP (Table 3).

Low quality of working life

Five subcategories were derived from this category:

a. Difficult nature of providing care

The participants stated that mandatory overtime, lack of manpower, high workload, out-of-service equipment, inappropriate physical conditions, and inadequate equipment made the provision of ICU services difficult. In this regard, nurse No. 1 stated:

"Because of the shortage of nurses, we have longer working hours, and no proper care can be delivered when we are exhausted."

b. Lack of training and skill development opportunities

Novice nurses received non-scientific and experimental training by more experienced nurses. Lack of in-service

training also led to insufficient clinical competence. In this regard, nurse No. 3 stated:

“What is important to me is filling the cuff of the endotracheal tube. I don't know how to measure the cuff pressure, and I have no information about the normal pressure level.”

c. Unfair nursing rights

Low wages and failure to pay the nurses' salaries on time, despite their high workload and work difficulty, reduce the quality of care.

d. Complex nature of nursing profession

In critical times, nurses focus on saving the patient's life and disregard proper care delivery, which increases the risk of VAP in patients. Nurse No. 4 stated:

“When a patient is critical and needs intubation, I just think of intubating the patient and do not care about sterilization tips and whether or not the principles are followed. At that moment, what matters to me is saving the patient's life.”

Moreover, the lack of personal protective equipment in ICUs exposes nurses to patient-transmitted infections; therefore, concerns about self-protection and lack of protective equipment prevent the delivery of systematic care.

e. Unprofessional activities

Some novice nurses deliver care services depending on their attitude and do not believe in care principles; in other words, they insist on the validity of their work. In this regard, nurse No. 3 stated:

“I only change my gloves, and in my opinion, it is the right thing to do; I don't believe in washing the hands.”

Challenges of organizational culture

Four subcategories were derived from this category:

a. Strict monitoring of nurses

According to the participants, the staff evaluation by managers was inappropriate, since poor documentation and high quantity of care services created concerns about nursing performance, and limited attention was paid to the way of providing care services.

b. Weakness of professional interactions

This subcategory was extracted from the two subcategories of professional mistrust and weakness of

interdisciplinary cooperation. In other words, distrust of nurses, accusing them of delivering inadequate care, and physicians' discouragement of concerned nurses might affect care delivery. According to nurses, the poor cooperation among nurses was due to their high workload. Nurse No. 6 stated:

“I can't ask my colleague to help me when he has not finished his own task yet; so I can't adhere to the principles of suctioning when I'm alone.”

c. Lack of motivation

There were many factors contributing to this subcategory, including the authorities' inattention to nurses, lack of financial bonuses for nurses as compared to other hospital staff, and the staff's poor welfare. These issues created a sense of frustration and demotivation, as nurses were reluctant to provide better care services.

d. Lack of encouragement

According to the participants, the hospital authorities paid no attention to their work progress and did not encourage them. The punishment system was the only system governing the hospital. These issues resulted in the nurses' failure to grow professionally and provide principled care services. After mixing the nurses' performance observations with their experiences of quality improvement challenges of VAP control, the problems were explained, confirmed, and prioritized. The most common problems included lack of specialized ICU nurses; lack of physiotherapists and nutritionists; nurses' poor performance in VAP control; lack of personal protective equipment; lack of gavage equipment; out-of-service beds; problems with suction and oxygen therapy devices; and non-standard physical space for the staff and patients.

Intervention

At this stage, with the active participation of the participants, an action plan was developed for each problem identified in the first stage. The overall action plan concerning human resources, equipment, and physical structure is briefly outlined in Table 4.

Reassessment

Analysis of quantitative data showed that the mean score of nurses' performance after the action plans was 395.16±13.90. The findings indicated a significant increase

of 52.37% according to t-test ($P < 0.001$), compared to the pre-action plan stage (Table 2). The greatest improvement in performance was related to weaning from mechanical ventilation (76.11%), while change of position showed the lowest percentage of improved performance (10.30%).

Reflections

The participants found the workshop content to be useful and practical, as the classes increased the nurses' self-confidence. Nurse No. 5 remarked:

"Because I was familiarized with the scientific and principled care methods, now I feel more confident and feel like a useful nurse."

Nurse No. 7 also said:

"Ever since a physiotherapist was employed in our ward, he has been providing nurses and patients with morning training, in addition to systematic physiotherapy; this has helped me to perform physiotherapy efficiently if needed."

The provision of safety equipment increased the quality and delivery of nursing care services. In this regard, nurse No. 8 said:

"We now have personal protective equipment. When I am about to perform suctioning, I am no longer afraid of pneumonia; this has made me better at suctioning."

The standardization of physical space and construction of new wards according to the standards can improve care delivery. Nurse No. 9 remarked:

"I am very pleased that we have good gender-specific resting rooms with our favorite colors, because I feel more relaxed and secure during rest and feel like my viewpoints are important to the managers."

The results of focused group discussions and in-depth interviews with the participants revealed that the quality of working life was promoted after action plans, which is compatible with the quantitative results; also, the nurses' professional identities were realized (Table 3).

Table1. Demographic characteristics among the participant

Post	Number	Age (years)	Work experience (years)	Marital status (%)		Gender (%)	
				Single	Married	Male	Female
Nurses	12	25/30	4/60	66/66	33/33	16/66	83/33
Nurses Manager	6	41/40	11/80	16/66	83/34	83/34	16/66
Total	18	33/35	8/20	50/00	50/00	38/88	61/12

Table 2. Comparison of mean scores of nurses' performance in the field of VAP prevention care

Items	Mean \pm SD Before	Mean \pm SD After	Increase in performance score(%)	P- Value
Oral Care	24/04 \pm 1/44	27/16 \pm 0/57	12/80	0/001
Prevention of aspiration	23/38 \pm 3/43	39 \pm 2/76	62/57	0/001
Suction	42/57 \pm 5/36	69/5 \pm 4/52	62/57	0/001
Hand washing	41 \pm 4/30	58/75 \pm 5/62	43/29	0/001
Care of ETT	6/33 \pm 0/65	15/5 \pm 1/38	14/47	0/001
Weaning	22/33 \pm 9/90	39/33 \pm 5/86	76/11	0/001
Prevention of respiratory connections	46/50 \pm 2/39	52/33 \pm 1/77	12/54	0/001
Chest physiotherapy	8/66 \pm 3/52	32/50 \pm 4/66	27/49	0/001
Change position	19/33 \pm 0/77	21/33 \pm 0/49	10/30	0/001
Assessment of the respiratory system	24/50 \pm 3/06	39/75 \pm 086	62/24	0/001
Total score	259/33 \pm 21/64	395/16 \pm 13/90	52/37	0/001

Table 3. Participant's opinion about the challenges of improving the quality of VAP control and the changes made after the action plans

Before		After	
Category	Subcategory	Category	Subcategory
Low quality work-life	The difficult nature of providing care	Improve the quality life	Easy care
	Lack of training and skills development opportunities		
	Rights unfairly		
	The complex nature of the work		Improved occupational safety
	Unprofessional activity		
Challenges of organizational culture	Strict monitoring of nurses	realization of professional identity	Targeted care
	The Weakness of professional interactions		Professional competence
	Unmotivated		Protection
	Lack of encouragement		Improve professional interactions
			Professional discretion

Table 4. Action plans and reflect changes

Domains	Executive strategies	Reflection
Human resources	Passing certain authorities to critical care nurses and professional independence	From the workshop participants' point of view, the workshop content was useful and practical and raised their self-confidence. Physiotherapy was performed regularly and professionally. Nutrition needs of patients were assessed and planned by a nutritionist
	Holding training courses	
	Familiarizing nurses with standard instructions	
	Employing a nutrition and physiotherapist	
	Employing service personnel	
	Examining and assessing nurses' performance constantly	
Equipment	Supplying material and spiritual encouragement, providing welfare services, and meeting professional needs	Providing personal protective equipment resulted in nurses' enhanced confidence regarding their own safety and, consequently, providing better care. Placing hand rubs on each bed facilitated disinfecting hands for the nurses before and after the concerned procedures. Other tools also increased quality and facilitated nursing care.
	Purchasing gavage preparation equipment; personal protective equipment; new beds; cuff pressure gauge	
	Repair and equipping of suction machines and central oxygen	
	Fixing bed remote controls	
	Providing T-Piece disposable	
	Placing antiseptic fluid beside each bed	
Physical space	Constructing a new unit according to standards and the construction goals of the hospital	Standardizing physical space and constructing a new ward in accordance with standards improved the provided care. Considering the welfare facilities for the staff and asking for the personnel's ideas about the constructions, including room color and the construction of the isolation room improved the staff's mood as they felt being valued by the managers.
	Construction of men's and women's rest rooms for personnel	
	Building dirty and clean working rooms	
	Installing a ventilation system	
	Constructing patients' bathrooms	

Quality of life improvement

The results revealed that the nurses' quality of working life was improved after implementing the changes. The concepts were extracted in two categories of "simple care" and "improved occupational safety".

a. Simple care

Simple care was extracted from three subcategories: specialized tasks, adequate equipment, and appropriate physical conditions. Before recruiting a physiotherapist and a nutritionist, these tasks were undertaken by nurses;

therefore, the tasks, if performed, were unsystematic. On the other hand, purchasing and repairing the equipment needed by nurses could improve and accelerate the delivery of nursing care services. In this regard, nurse No. 10 said:

“Since new beds have been purchased, I can adjust the bed angle for gavage. In fact, creating appropriate physical conditions based on standards and using the nurses' opinions improved their well-being and morale.”

b. Improved occupational safety

By providing personal protective equipment for nurses, they could use them for suctioning and perform this procedure more favorably, as there were no more safety risks.

Realization of professional identity

This concept was derived from five categories, including targeted care, professional competence, protection, improved professional interactions, and professional authority.

a. Targeted care

Familiarity with the scientific and standard care methods increased the quality of care and even promoted the nurses' attitude toward providing better care services.

b. Professional competence

After implementing practical workshops and training programs, the nurses' clinical skills were improved, leading to their increased self-esteem and quality of care.

c. Protection

The action plans, along with the experiences of other nurses, changed the nurse's attitude toward maintaining patient safety. In this regard, nurse No. 5 stated:

“I checked the NGT placement before gavage, because one of my colleagues said one of the patients had aspiration following NGT relocation.”

d. Improvement of professional interactions

As the nurses' scientific and practical knowledge increased, the managers and physicians' trust in them increased, as well, leading to improved interactions and relationships.

e. Professional authority

An increase in the nurses' scientific and practical capabilities promoted their self-confidence. On the other

hand, given the physicians' trust in nurses, the nurses were given legal authority to act independently in providing some care services.

DISCUSSION

This study aimed to improve the quality of VAP control in ICUs, according to the literature that considers the important role of personnel engagement in the design of solutions to workplace issues (23, 24). The quantitative and qualitative results of this study suggested that the low quality of working life and poor organizational culture were the main barriers to improving the quality of VAP control. In this study, some measures improved the quality of VAP control in ICUs, such as personnel empowerment, improvement of facilities and equipment, enhancement of nurses' professional discretion, promotion of interactions of managers and physicians with the nursing team, improvement of nurses' working life quality, and realization of their professional identity.

The present results revealed the undesirable performance of nurses in terms of VAP control. Nevertheless, the nurses' performance scores in VAP control significantly increased after participation in the VAP control workshops. One of the most important reasons for the nurses' undesirable performance in different treatment areas is their lack of knowledge, since having sufficient knowledge can play a critical role in the individual's performance (25). A study by Akin Korhan et al. reported the low knowledge level of ICU nurses regarding the prevention of VAP and recommended training for these nurses (26). Some other studies also suggest that training can play a positive role in preventing the incidence of VAP (14, 18, 27). According to a study by Jansson et al., there is a constant need for improving the staff training strategies based on clinical guidelines and implementing them effectively (28). In the present study, training was provided according to the guidelines and protocols. It is also suggested that nurses working in special sectors learn about VAP by using different educational approaches.

Consistent with a study by Mullen (29), we also found that the low quality of nurses' working life is one of the obstacles to improving the quality of VAP control. During in-depth interviews with the participants, it was observed that shortage of human resources, unprofessional tasks, high workload, non-standard working environments, and lack of welfare equipment in the workplace reduced the quality of nurses' working life. Overall, the low quality of working life is influenced by several factors, including working hours, unfavorable working conditions, low salary, inadequate opportunities for development, and lack of facilities and holidays (30). The high quality of working life is essential for retaining employees in organizations; it also reflects the relationships between the employees and their working environment (31). Inadequate salaries and bonuses, lack of equipment, low occupational safety, compulsory overtime work, and other factors result in the nurses' dissatisfaction with their working life; according to Morton, modification of these indices is a benchmark for work quality (32).

Lack of human resources, followed by increased workload, overtime work, fatigue, and specialized healthcare tasks (e.g., physiotherapy and monitoring of nutritional status by nurses), can affect the quality of nursing care. Some studies also suggest that adequate and efficient human resources have an impact on the quality of nursing care (33). In the present study, some nutritionists and physiotherapists were employed, and the number of servicemen was increased to provide specialized care and reduce the workload of nurses during shifts. However, due to the limited authority of the research team and hospital managers, increasing the number of nursing staff could not be realized.

In this regard, Matlakala and Botha claim that the insufficient number of nursing staff in ICUs is a global phenomenon, leading to poor patient care, increased errors, and reduced patient safety (34). Some other studies have found a correlation between the increased number of nurses in ICUs and the increased probability of survival in patients (35). In a study by Karagiannidis et al. in

Germany, the main factor affecting the closure of ICUs was the shortage of nursing staff (36); therefore, providing sufficient human resources based on standards is of great significance in providing high-quality care.

The present findings showed that the non-standard physical structure and inappropriate space for the patients and staff reduced the quality of nurses' working life, as well as the quality of nursing care in the prevention of VAP. One of the strategies used to improve the quality of working life was space standardization in this study. In 2005, the American Association of Critical Care Nurses (AACN) issued six standards to create and maintain a healthy workplace. They required managers to specifically observe the workplace and provide clear and measurable solutions to improve the working conditions (37, 38). In this regard, Wu et al. argued that nurses with a better working environment were one-third less likely to be exposed to occupational damages and risks (39). For implementing the action plans in the present study, some measures were adopted in line with the hospital goals to build a new standard ICU, as well as separate rooms for the personnel, to improve the quality of nurses' working life, as the participants mentioned that the quality of care services and their quality of life improved due to the availability of more facilities.

In the present study, some barriers to improving the quality of VAP control were the shortage of equipment and their defects. Some of these lacking equipment included air conditioning systems, gavage tools, antiseptic fluids beside the patient's bed, and insufficient personal protective equipment. Also, failure to use the working beds and lack of remote controllers to adjust the bed position can be among factors affecting the occurrence of pneumonia. In this regard, studies have shown that proper adjustment of the beds can be a barrier to the occurrence of VAP (40, 41).

According to various studies, the prevalence of occupational hazards and damages ranges from 42% to 80% among nurses (42-45), which indicates the significance of attention to occupational safety and the necessity of personal protective equipment for nurses to improve the

quality of their working life. In a study by Wu et al. in China, it was observed that poor working environments, overtime work, and working in low-quality hospitals further expose nurses to occupational damages (39). Therefore, in the implementation of action plans, the necessary equipment for nurses to prevent VAP was provided to improve the quality of care from the participants' viewpoints.

Another strategy to promote the quality of life of the nursing staff is to enhance organizational justice, which is associated with satisfaction among nurses (32). Studies have reported that nurses' job satisfaction is correlated with the patients' satisfaction and patient safety (46-48). According to a study by Alex, job satisfaction is an important factor affecting the function and quality of services provided by the hospital staff, including nurses (49). In this study, the researchers tried to address this aspect of nurses' working life by providing welfare services, meeting their professional needs, and encouraging them both materially and spiritually.

In this study, poor organizational culture was one of the other challenges of VAP control, as the culture governing each organization has a direct impact on the staff performance. In this action research, poor organizational culture led to a reduction in the quality of care provided by nurses. According to the social contract theory by van der Wal et al., a contractual relationship is established between the staff and the organization. Therefore, if nurses observe injustice in evaluating their performance, they will experience some anxiety and tension; consequently, they try to reduce their participation in the organization to reduce such tensions. Conversely, if nurses feel that the evaluations are fair, they will be encouraged to increase their participation in the organization by showing participatory behaviors beyond their organizational role (23).

In the present study, strict monitoring, inappropriate evaluation processes, disciplinary procedures, and discouraging measures resulted in the lack of proper

professional interactions between nurses and authorities. Also, since nurses mistrusted the authorities, they had low work motivation, and therefore, the quality of care services reduced. Following the implementation of action plans, the participants highlighted the importance of cooperation between the healthcare teams and nurses in providing optimal services for VAP control. This collaboration could lead to professional independence, which increased the nurses' confidence, professional relationships, work incentives, and care quality for a better VAP control. In this regard, an action research by van der Wal showed that besides the improvement of work environment, increased teamwork and respectful relations had positive effects on the workplace (23).

One of the strengths of this study was identifying and resolving the care problems of ICU nurses, because they are present in the workplace and are considered as the best target group for identifying problems, providing solutions, and improving the quality of care services. However, this study had some limitations due to limited financial resources for meeting the research objectives. These limitations were eliminated to some extent by continuous follow-up and promotion of managers' contribution.

CONCLUSION

The results of this study showed that the low quality of working life and poor organizational culture were the main barriers to improving the quality of VAP control. Effective approaches, such as personnel empowerment, improvement of environmental conditions, and provision of facilities and equipment, improved the quality of VAP control in the ICUs.

Conflict of Interest

The authors declare no conflicts of interest.

Acknowledgments

The authors of this article appreciate welders who participated in this study.

REFERENCES

- McCue MK, Palmer GA. Use of Chlorhexidine to Prevent Ventilator-Associated Pneumonia in a Long-term Care Setting: A Retrospective Medical Record Review. *J Nurs Care Qual* 2019;34(3):263-268.
- Aloush SM, Abdelkader FA, Al-Sayaghi K, Tawalbeh LI, Suliman M, Al Bashtawy M, et al. Compliance of Nurses and Hospitals With Ventilator-Associated Pneumonia Prevention Guidelines: A Middle Eastern Survey. *J Nurs Care Qual* 2018;33(3):E8-E14.
- Bagheri-Nesami M, Amiri M. Nurses' knowledge of evidence-based guidelines for preventing ventilator-associated pneumonia in intensive care units. *Journal of Nursing and Midwifery Sciences* 2014;1(1):44-8.
- El-Rabbany M, Zaghlol N, Bhandari M, Azarpazhooh A. Prophylactic oral health procedures to prevent hospital-acquired and ventilator-associated pneumonia: a systematic review. *Int J Nurs Stud* 2015;52(1):452-64.
- Jain M, Miller L, Belt D, King D, Berwick DM. Decline in ICU adverse events, nosocomial infections and cost through a quality improvement initiative focusing on teamwork and culture change. *Qual Saf Health Care* 2006;15(4):235-9.
- Ugalde OC, Hidalgo RF, Rosenthal VD, Hernandez IC, Gutierrez GM, Fuentes CC, et al. Device-associated infection rates, bacterial resistance, length of stay, and mortality in intensive care units of Costa Rica: Findings of the International Nosocomial Infection Control Consortium (INICC). *Can J Infect Control* 2016;31(1):28-34.
- Samrah S, Bashtawi Y, Hayajneh W, Almomani B, Momany S, Khader Y. Impact of colistin-initiation delay on mortality of ventilator-associated pneumonia caused by *A. baumannii*. *J Infect Dev Ctries* 2016;10(10):1129-1134.
- Younan D, Griffin R, Zaky A, Pittet JF, Camins B. Burn patients with infection-related ventilator associated complications have worse outcomes compared to those without ventilator associated events. *Am J Surg* 2018;215(4):678-681.
- Braun SE. The Effects of Staff Education on Ventilator-Associated Pneumonia in the Intensive Care Unit: A Literature Review. 2019.
- Montalvo I. The national database of nursing quality indicators™ (NDNQI®). *OJIN: The Online Journal of Issues in Nursing* 2007;12(3):112-214.
- Reason J. The human contribution: unsafe acts, accidents and heroic recoveries: CRC Press; 2017.
- Clark MJ. Community health nursing. Prentice Hall; 2015.
- Costa DK, Yang J, Manojlovich M. How The Nurse Work Environment And ICU Physician Staffing Influence Risk Of Ventilator-Associated Pneumonia. In: *Critical Care: Can Icu Design Improve Icu Care?* American Thoracic Society. 2016: A4697-A4697.
- Costa DK, Yang JJ, Manojlovich M. The critical care nurse work environment, physician staffing, and risk for ventilator-associated pneumonia. *Am J Infect Control* 2016;44(10):1181-1183.
- Aeen FB, Zolfaghari M, Noghabi AA, Mehran A. Nurses' Performance in Prevention of Ventilator associated Pneumonia. *Hayat* 2013;19(3).
- Allah-Bakhshian A, Moghaddasian S, Zamanzadeh V, Parvan K, Allah-Bakhshian M. Knowledge, attitude, and practice of ICU nurses about nosocomial infections control in teaching hospitals of Tabriz. *Iran journal of nursing* 2010;23(64):17-28.
- Álvarez Lerma F, Sánchez García M, Lorente L, Gordo F, Añón JM, Álvarez J, Palomar M, et al. Guidelines for the prevention of ventilator-associated pneumonia and their implementation. The Spanish "Zero-VAP" bundle. *Med Intensiva* 2014;38(4):226-36.
- Sahni N, Biswal M, Gandhi K, Kaur K, Saini V, Yaddanapudi LN. Effect of Intensive Education and Training of Nurses on Ventilator-associated Pneumonia and Central Line-associated Bloodstream Infection Incidence in Intensive Care Unit at a Tertiary Care Center in North India. *Indian J Crit Care Med* 2017;21(11):779-782.
- Chippes E, Wills CE, Tanda R, Patterson ES, Elfrink V, Brodnik M, et al. Registered nurses' judgments of the classification and risk level of patient care errors. *J Nurs Care Qual* 2011;26(4):302-10.
- Duffield C, Diers D, O'Brien-Pallas L, Aisbett C, Roche M, King M, et al. Nursing staffing, nursing workload, the work

- environment and patient outcomes. *Appl Nurs Res* 2011;24(4):244-55.
21. Montgomery VL. Effect of fatigue, workload, and environment on patient safety in the pediatric intensive care unit. *Pediatr Crit Care Med* 2007;8(2 Suppl):S11-6.
 22. Guba EG, Lincoln YS. Competing paradigms in qualitative research. *Handbook of qualitative research*. 1994; 2(163-194): 105.
 23. van der Wal R, Globerman J, Numata Y, Schulzer M, FitzGerald M, Yassi A. Improving the practice environment: a pilot project in a critical care unit. *Health Manage Forum*. 2008;21(2):29-35.
 24. Brady-Schwartz DC. Further evidence on the Magnet Recognition program: implications for nursing leaders. *J Nurs Adm* 2005;35(9):397-403.
 25. Baethge A, Müller A, Rigotti T. Nursing performance under high workload: a diary study on the moderating role of selection, optimization and compensation strategies. *J Adv Nurs* 2016;72(3):545-57.
 26. Akin Korhan E, Hakverdioğlu Yönt G, Parlar Kılıç S, Uzelli D. Knowledge levels of intensive care nurses on prevention of ventilator-associated pneumonia. *Nurs Crit Care* 2014;19(1):26-33.
 27. Jam Gatell MR, Santé Roig M, Hernández Vian Ó, Carrillo Santín E, Turégano Duaso C, Fernández Moreno I, et al. Assessment of a training programme for the prevention of ventilator-associated pneumonia. *Nurs Crit Care* 2012;17(6):285-92.
 28. Jansson M, Ala-Kokko T, Ylipalosaari P, Syrjälä H, Kyngäs H. Critical care nurses' knowledge of, adherence to and barriers towards evidence-based guidelines for the prevention of ventilator-associated pneumonia—a survey study. *Intensive Crit Care Nurs* 2013;29(4):216-27.
 29. Mullen K. Barriers to work-life balance for hospital nurses. *Workplace Health Saf* 2015;63(3):96-9.
 30. Arefi M, Khorsandi A, Ghahramani M. The identify the relationship between organizational justice and quality of work life and the mediating role of organizational culture from the point of view of employees at shahid beheshti university. *Journal of Career & Organizational Counseling* 2015; 7 (23); 41 To 67.
 31. Mohammadi M, Mozaffari N, Dadkhah B, Etebari Asl F, Etebari Asl Z. Study of work-related quality of life of nurses in Ardabil Province Hospitals. *J Health Care* 2017;19(3):108-6.
 32. Gharacheh S, Ahmadi E. Prediction the quality of work life based on organizational justice dimension in nurses of Shiraz hospitals. *The Journal of Urmia Nursing Midwifery Faculty* 2018;16(3):164-70.
 33. Nobahar M. Care quality in critical cardiac units from nurses perspective: a content analysis. *Journal of Qualitative Research in Health Sciences* 2020;3(2):149-61.
 34. Matlakala MC, Botha AD. Intensive care unit nurse managers' views regarding nurse staffing in their units in South Africa. *Intensive Crit Care Nurs* 2016;32:49-57.
 35. West E, Barron DN, Harrison D, Rafferty AM, Rowan K, Sanderson C. Nurse staffing, medical staffing and mortality in Intensive Care: An observational study. *Int J Nurs Stud* 2014;51(5):781-94.
 36. Karagiannidis C, Kluge S, Riessen R, Krakau M, Bein T, Janssens U. Impact of nursing staff shortage on intensive care medicine capacity in Germany. *Medizinische Klinik, Intensivmedizin und Notfallmedizin* 2018;114(4):327-33.
 37. American Association of Critical-Care Nurses. AACN standards for establishing and sustaining healthy work environments: a journey to excellence. *Am J Crit Care* 2005;14(3):187-97.
 38. Sacco TL, Czurzynski SM, Harvey ME, Ingersoll GL. Compassion Satisfaction and Compassion Fatigue Among Critical Care Nurses. *Crit Care Nurse* 2015;35(4):32-43.
 39. Wu Y, Zheng J, Liu K, Baggs JG, Liu J, Liu X, You L. The associations of occupational hazards and injuries with work environments and overtime for nurses in China. *Res Nurs Health* 2018.
 40. Najafi Ghezeljeh T, Kalhor L, Moradi Moghadam O, Niyakan Lahiji M, Haghani H. The comparison of the effect of the head of bed elevation to 30 and 45 degrees on the incidence of ventilator associated pneumonia and the risk for pressure ulcers: A controlled randomized clinical trial. *Iranian Red Crescent Medical Journal* 2017;19(7).
 41. Wang L, Li X, Yang Z, Tang X, Yuan Q, Deng L, et al. Semi-recumbent position versus supine position for the prevention

- of ventilator-associated pneumonia in adults requiring mechanical ventilation. *Cochrane Database Syst Rev* 2016;2016(1):CD009946.
42. Cho E, Lee H, Choi M, Park SH, Yoo IY, Aiken LH. Factors associated with needlestick and sharp injuries among hospital nurses: a cross-sectional questionnaire survey. *Int J Nurs Stud* 2013;50(8):1025-32.
43. de Castro AB, Cabrera SL, Gee GC, Fujishiro K, Tagalog EA. Occupational health and safety issues among nurses in the Philippines. *AAOHN J* 2009;57(4):149-57.
44. Nantsupawat A, Nantsupawat R, Kulnaviktikul W, McHugh MD. Relationship between nurse staffing levels and nurse outcomes in community hospitals, Thailand. *Nurs Health Sci* 2015;17(1):112-118.
45. Smith DR, Mihashi M, Adachi Y, Shouyama Y, Mouri F, Ishibashi N, et al. Organizational climate and its relationship with needlestick and sharps injuries among Japanese nurses. *Am J Infect Control* 2009;37(7):545-50.
46. Gallagher R, Gormley DK. Perceptions of stress, burnout, and support systems in pediatric bone marrow transplantation nursing. *Clin J Oncol Nurs* 2009;13(6):681-5.
47. MacKusick CI, Minick P. Why are nurses leaving? Findings from an initial qualitative study on nursing attrition. *Medsurg Nurs* 2010;19(6):335-40.
48. Mason VM, Leslie G, Clark K, Lyons P, Walke E, Butler C, et al. Compassion fatigue, moral distress, and work engagement in surgical intensive care unit trauma nurses: a pilot study. *Dimens Crit Care Nurs* 2014;33(4):215-25.
49. Alex MR. Occupational hazards for pregnant nurses. *Am J Nurs* 2011;111(1):28-37; quiz 38-9.