

■ Original article

Resource allocation: the main problem in infection control in intensive care units of hospitals

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Abstract

Background and Purpose: Nosocomial infections, especially those occurring in intensive care units (ICUs), are one of the major health problems in every community. Nosocomial infections are associated with increased mortality rate and high treatment costs. Effective control of these infections essentially depends on the knowledge of healthcare providers regarding the detection and eradication of the associated causes. This study aimed to investigate the main challenges involved in the prevention and control of nosocomial infections in hospital ICUs.

Materials and Methods: This qualitative study was conducted on 21 healthcare providers selected via purposive sampling from various medical subgroups, including anesthesiologist, nursing managers, supervisors, faculty members, head nurses, and hospital managers. Data were collected via semi-structured interviews with the participants. Data analysis was performed using qualitative conventional content analysis.

Results: In total, four main themes were emerged from conventional content analysis, as follows: 1) complex nature of work in the ICU; 2) lack of knowledge of healthcare providers; 3) inadequate equipment and resources and 4) human resource shortage.

Conclusion: According to the results of this study, appropriate resource allocation, improvement of organizational health structures, and competency of healthcare personnel in hospital ICUs could be remarkably effective in the prevention, control and reduction of nosocomial infections.

Keywords: Intensive care units, Infection control, Nosocomial infections, Qualitative analysis

Introduction

Nosocomial infections, also known as hospital-acquired infections, refer to the infections that occur within 48-72 hours after hospitalization or 10-30 days after the discharge of the patient from hospital. These infections should not be in the latent stage or present upon the admission of the patient. In case foreign instruments are inserted or implanted into patient's body via surgery, it is predicted that nosocomial infections may occur within up to one

year after the surgical procedure (1-5).

According to the statistics proposed by the World Health Organization (WHO), regions in the Eastern Mediterranean and Southeast Asia account for the highest prevalence rate of nosocomial infections, while the lowest rates are reported in the countries of the Western Pacific Region and Europe (6). Furthermore, global studies conducted by WHO have indicated that 5-25% of the patients admitted

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to hospitals contract nosocomial infections. In intensive care units (ICUs) of developed and developing countries, this rate has been estimated at 25% and 50%, respectively (7).

Nosocomial infections are a major health concern due to the associated morbidity, mortality, and hospital costs. Each case of nosocomial infections has been shown to increase the length of hospital stay by 4.5 days, which imposes significant treatment costs on the healthcare organization. On the other hand, nosocomial infections may lead to psychological distress, incapacitation, and disability, which reduce the quality of life of patients. According to statistics, about two million people in the United States develop nosocomial infections each year, which has been associated with an average treatment cost of more than two billion dollars and is considered the 11th leading cause of mortality (8).

In the United States, the mortality rate associated with nosocomial infections has been reported to be 25,000-100,000 cases per year, and the treatment costs in this regard have been estimated at 7.5 million dollars. The prevalence rate of nosocomial infections is almost three times higher among the elderly, children, and patients admitted in the ICU compared to other hospital wards. In addition, bacteria have been observed to be the major cause of these infections in 90% of the cases (9).

Due to risk factors such as multiple trauma, low consciousness level, and lack of preventive mechanisms, patients admitted in the ICU are at a higher risk of developing nosocomial infections compared to other patients (10). Prevention of the complications caused by nosocomial infections is influenced by several factors, including invasive procedures, frequent changes in medical and surgical processes, changes in the composition of prescription drugs, antibiotic resistance, and microorganism resistance.

Prevention and control of nosocomial infections are a multi-professional and multi-dimensional process (11). Patients admitted in the ICU are highly vulnerable to interventional procedures (e.g., use of endotracheal tubes and mechanical ventilators, central venous and urinary catheterization) due to

the general weakness caused by the disease, poor defense mechanisms, and long-term hospitalization. Moreover, previous studies have denoted that the organisms causing nosocomial infections have become resistant to common antibiotic therapies (12).

Nosocomial infections affect a significant number of patients and are one of the major causes of mortality in patients admitted in the ICU. Therefore, these infections are considered a major health concern in all the hospitals around the world. Despite efforts to prevent the occurrence of these infections, nosocomial infections remain a major risk factor in the ICUs, as well as a leading cause of patient mortality (13).

Review of the literature by the researchers indicated that to date, no similar qualitative research has been conducted to evaluate the problems associated with the prevention and control of nosocomial infections.

This study aimed to explore the experiences of medical staff regarding the occurrence of nosocomial infections in various hospital ICUs. It is hoped that the findings of this research help medical officials to reduce life-threatening outcomes through accurate healthcare planning for the prevention and control of nosocomial infections.

Materials and Methods

This qualitative study was performed using conventional content analysis during July-February 2014. Participants were selected via purposive sampling, and 23 interviews were conducted with 21 healthcare staff until data saturation. Duration of interviews was 35-145 minutes, with a mean duration of 50 minutes. Sample population of the study consisted of medical staff with previous experience of infection control in hospital ICUs who were willing to interview.

Data were collected using semi-structured interviews, which befitted the qualitative design of the study considering their flexibility and in-depth nature. During the interviews, the researchers aimed to use the direct statements of the participants regarding their experiences of infection control and avoid any analysis of the proposed viewpoints. All the interviews were written and recorded in Persian

and immediately transcribed afterwards.

Data analysis was performed using the content analysis approach and qualitative data analysis software (MAXQDA-4) based on the three main phases of preparation, organization, and report. In the preparation phase, the interviews were performed separately in the shortest possible time. In the preparation stage, all the interviews were performed separately. Afterwards, contents of the interviews were immediately transcribed and selected as units of analysis.

In this study, we applied an inductive process in the organization phase. After reviewing the units of analysis repeatedly, semantic units related to the research subject were identified, and primary open codes were emerged for the determined units. Semantically similar open codes were identified as the subthemes, and semantically similar subthemes were determined as the main themes of the study.

To ensure the validity of the study, the researchers applied long-term engagement, data triangulation, field noting, member checking, and constant comparison. Dependency refers to the stability and reliability of the collected data, and in this study, we used the external review method to determine the dependency of the data (14).

With respect to ethical considerations, informed consent was obtained from all the participants prior to the study. Moreover, they were assured of the confidentiality terms regarding the recording of the content of interviews and personal information. Considering the anonymity of the collected data, we eliminated any information that might have exposed the personal views of the participants. In addition, the participants were assured that the obtained audio recordings would be erased after the study and they were allowed to withdraw from the study at any time.

Results

In this study, the majority of the participants were male (57.1%; n=12) and within the age range of 36-45 years (42.8%). With regard to education status, nine participants (42.8%) had a bachelor's degree in nursing. The results of conventional

content analysis in terms of the main challenges against the prevention and control of nosocomial infections in the ICU revealed four main themes, as follows:

1. Complex nature of work in the ICU

Provision of health services in the ICU might become a significant challenge due to the unique conditions, structures, and processes in this hospital section.

In this regard, participant number 3 stated: "Most of the time, the work process in the ICU is unknown. Overall health of the patients may change suddenly requiring emergency treatment measures and procedures. Under such circumstances, saving the life of the patient is more important than infection control."

"There is no supervision on the traffic of ICU medical staff, and no specific programs have been developed to monitor the entry and exit of the personnel." (Participant 3)

2. Lack of knowledge and awareness of healthcare staff

Appropriate care services in the ICU require the adequate knowledge of healthcare staff, advanced equipment, and timely provision of the services. Lack of such competencies leads to irreparable complications in the patients hospitalized due to critical conditions and imposes heavy treatment costs on patient families and health organizations.

In this regard, participant number 9 remarked: "To solve this problem, it is necessary to use qualified and trained personnel in the ICU and enhance their knowledge through continuous training courses. Moreover, visiting rounds are needed at the patient's bedside in order to introduce the patient and clarify the required procedures for the personnel of other shifts."

Moreover, participant number 14 stated: "Training of healthcare staff on proper hand hygiene, disinfection, and procedures such as suctioning is of paramount importance. However, healthcare personnel do not pay sufficient attention to these necessary measures since they are not familiar with the basic principles of infection

control.”

“Due to the higher prevalence of nosocomial infections in the ICU, it is absolutely necessary to provide training courses for ICU staff on the principles of infection control. Such periodic educational courses could lead to the convergence of medical team members. Another problem in the effective control of hospital-acquired infections is the individual performance of health staff. In the ICU, each member of the medical team, including physicians, nurses, and assistants, has a specific duty” (Participant 14).

3. Inadequate equipment and resources

Management of resources and equipment is essential to the provision of high-quality services in healthcare centers. Lack of resources and equipment could significantly impair the processes of care and treatment. Therefore, planning and management of equipment and resources should be set as a fundamental goal in every medical organization.

In this regard, participant number 4 commented: “Sometimes, we do not have any gloves in the ward and therefore, we have to use sterile gloves instead of disposable gloves. Nevertheless, we are always too tired and busy to worry about promoting the culture of using gloves in the ICU.”

In addition, participant number 15 remarked: “General service personnel are not commonly trained on the proper cleaning and transfer of patients. Therefore, they are not expected to have adequate information about different diseases and hospital-acquired infections.”

On the same note, participant number 2 stated: “The physical structure of the ward lacks enough space for medical team members. The space is limited and has non-standard and inadequate number of toilets. This is because of the substandard map of the place; the old ward was transformed into the new ICU by destroying one room and one floor.”

Moreover, participant number 10 said: “When there is lack of equipment such as shields, N-95 respirators, hand rub, gowns, Nelaton catheters, cleaning cloths, and gloves in the ICU

(hospital hoteling), it is not possible to control infections.”

4. Human resource shortage

Another obstacle against the proper control of nosocomial infections in ICUs is shortage of trained human resources in these hospital wards. Such shortage has been reported for various medical staff members, including physicians, nurses, and general service workers.

In this regard, participant number 7 stated: “There is shortage of recruitments for service providers. These health workers are supposed to deliver blood samples to the laboratory, transfer patients to the operation room or other wards, clean the wards, and move the waste materials to the incinerator. Despite the importance of all these tasks, many hospitals have shortage of maintenance and health staff, which is a major obstacle against the effective control of hospital-acquired infections.”

Additionally, participant number 19 commented: “Among the permanent and fundamental problems in the ICU is inadequate number of nursing staff. In some shifts, there is not enough nursing aid, especially during the night shifts. Unfortunately, the Nursing Office does not cooperate with us in this regard; so, we cannot find a solution for this problem. Despite the repeated complaints of the chief physician, the hospital managers neglect the problem of nursing staff shortage.”

Discussion

In the present study, results of qualitative conventional content analysis with regard to the experiences of healthcare staff in the prevention and control of nosocomial infections in hospital ICUs revealed four main themes. These themes included the “complex nature of work in the ICU”, “lack of knowledge and awareness of healthcare staff”, “inadequate equipment and resources”, and “human resource shortage”.

Human resource shortage was one of the main themes emerged in the current study, as well as a fundamental obstacle against the effective control of nosocomial infections in hospital ICUs

according to the viewpoints of our participants. In order to achieve the healthcare goals in every hospital, recruitment of health staff with scientific capabilities is of paramount importance. In the field of health care, human resource allocation plays a more pivotal role than other factors in the proper execution of care procedures. As such, lack of skilled, trained healthcare staff without the required expertise leads to the disruption of effective patient care and management. As confirmed by numerous medical experts, development and advancement of healthcare services and treatment procedures is considered imperative in medical organizations, which is directly correlated with the efficacy and adequacy of human resource management (15).

In Iran, substantial budgets are allocated to the management of human resources in hospitals, with the average cost estimated at 55-60% of the total operational costs in every healthcare organization (16, 17). According to a research conducted in our country, shortage of nursing staff and inadequate distribution of human resources were reported to be the most important healthcare issues in different hospitals (18, 19). Therefore, standardization of the distribution and allocation of healthcare staff in clinical settings is essential to the enhancement of the quality of care services provided for patients, efficient utilization of available resources, and increasing productivity in hospitals (19).

Lack of knowledge and awareness of healthcare staff was another main theme emerged in the current research. Several quantitative studies conducted in Iran and other countries have suggested that the knowledge of medical staff about nosocomial infections is at a low or medium level (20-24). Adequate knowledge regarding proper health care enables medical personnel to effectively prevent and identify infectious diseases and perform the required treatments (25, 26).

Conclusion

According to the results of qualitative conventional content analysis, provision of adequate human resources, improvement of healthcare structures and increasing the competency of health staff in hospital

ICUs play a pivotal role in the prevention, control, and reduction of nosocomial infections.

Conflicts of interest

None declared.

Authors' contributions

E Mohammadnejad collected the data, A Abbaszadeh, E Mohamadnejad, H Souri, S Afhami data analysis and interpretation, and A Abbaszadeh, E Mohamadnejad, H Souri, S Afhami the first draft of the manuscript. A Abbaszadeh, E Mohamadnejad critically revised the manuscript and A Abbaszadeh, H Souri, S Afhami supervised the project

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Reference

1. Couto RC, Pedrosa TM, Tofani Cde P, Pedroso ER. Risk factors for nosocomial infection in a neonatal intensive care unit. *Infect Control Hosp Epidemiol* 2006; 27(6):571-5.
2. Dasgupta S, Das S, Chawan NS, Hazra A. Nosocomial infections in the intensive care unit: incidence, risk factors, outcome and associated pathogens in a public tertiary teaching hospital of Eastern India. *Indian J Crit Care Med* 2015; 19(1):14-20.
3. Zorgani A, Abofayed A, Glia A, Albarbar A, Hanish S. Prevalence of device-associated nosocomial infections caused by gram-negative bacteria in a trauma intensive care unit in Libya. *Oman Med J* 2015; 30(4):270-5.
4. Azimi L, Motevallian A, Ebrahimzadeh Namvar A, Asghari B, Lari AR. Nosocomial infections in burned patients in Motahari hospital, Tehran, Iran. *Dermatol Res Pract* 2011; 2011:436952.
5. Zurek J, Fedora M. Classification of infections in intensive care units: a comparison of current definition of hospital-acquired infections and carrier state criterion. *Iran J Med*

- Sci 2012; 37(2):100-4.
6. Duce G, Fabry J, Nicolle L. Prevention of hospital acquired infections: a practical guide. 2nd ed. Cambodia: Department of Communicable Disease, Surveillance and Response; 2002.
 7. Mohammadnejad E, Abbaszadeh A, Soori H, Afhami S. Control and prevention of nosocomial infection: A must for medical centers. *Cardiovascular Nursing J.* 2015; 4(1) :58-65 (Persian).
 8. Ghorbani BA, Asadpoor S. Nosocomial infections in intensive care unit of Ahvaz Arya hospital (2008-2009). *Modern Care J* 2011; 8(2):86-93 (Persian).
 9. Yazdani Cherati J, Shojai J, Chaharkameh A, Khosravi F, Rezai F, Dalili A. Prevalence of nosocomial infection in selected cities in Mazandaran province based on national nosocomial infections surveillance system. *J Mazand Univ Med Sci* 2015; 24(122):64-71 (Persian).
 10. Ajalloeyan M, Kazemi H, Samar G, Fazzade A. Rate and effective factor of infection in ICU of Khatamolanbia hospital. *J Goum* 2007; 2(22):34-8 (Persian).
 11. Masoomiasl H, Zahraiee SM, Majidpoor A, Nateghian AR, Afhami SH, Rahbar AR, et al. National guideline of nosocomial infections surveillance. 2nd ed. Tehran: Center for Communicable Disease Control, Ministry of Health; 2007 (Persian).
 12. Zandyeh M, Falhgari G, Salavsti M, Borzoo S. Study of applying proposed infection control standards in ICU. *J Shahr-e-kord Univ Med Sci* 2005; 6(4):79-86 (Persian).
 13. Vosylius S, Sipylaite J, Ivaskевичius J. Intensive care unit acquired infection: a prevalence and impact on morbidity and mortality. *Acta Anaesthesiol Scand* 2003; 47(9):1132-7.
 14. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today* 2004; 24(2):105-12.
 15. Mahmoudi H, Ebrahimian A, Solymani M, Ebadi A, Hafezi S, Feizi F, et al . The study of job motivation factors in critical care nurses. *J Behav Sci* 2008; 1(2):171-8.
 16. Abolhalaj M, Jafari-Sirizi M, Inalou S. A situational analysis of human resources in Iranian hospitals affiliated with ministry of health in 2008. *J Shahrekord Univ Med Sci* 2010; 12(1):60-8 (Persian).
 17. NooriHekmat S, Dehnavieh R, Mohammadi N, Poorhosseini S, Rezai F, Mehralhasani S et al. Determining the optimum number of nursing staff is needed in Kerman Shafa hospital emergency department. *Toloo-e-behdasht* 2014; 13(2):140-55 (Persian).
 18. Sadeghifar J, Pourreza A, Ahmadi B, Zeraati H, Arab M. Assessment of necessary staff for hospitals of Ilam university of medical sciences in accordance with personnel criteria and standards of Iranian health ministry. *J Ilam Univ Med Sci* 2011; 19(1):24-32 (Persian).
 19. Litvak E, Bisognano M. More patients, less payment: increasing hospital efficiency in the aftermath of health reform. *Health Aff* 2011; 30(1):76-80.
 20. Wolf R, Lewis D, Cochran R, Chesley R. Nursing staff perceptions of methicillin-resistant *Staphylococcus aureus* and infection control in a long-term care facility. *Am J Med Dir Assoc* 2008; 9(5):342-6.
 21. Chan R, Molassiotis A, Chan E, Chan V, Ho B, Lai CY, et al. Nurses' knowledge of and compliance with universal precautions in an acute care hospital. *Int J Nurs Stud* 2002; 39(2):157-63.
 22. Kalantarzadeh M, Mohammadnejad E, Ehsani SR, Tamizi Z. Knowledge and practice of nurses about the control and prevention of nosocomial infections in emergency departments. *Arch Clin Infect Dis* 2014; 9(4):e18278.
 23. Merle V, Van Rossem V, Tavolacci MP, Czernichow P. Knowledge and opinions of surgical patients regarding nosocomial infections. *J Hosp Infect* 2005; 60(2):169-71.
 24. Kennedy AM, Elward AM, Fraser VJ. Survey of knowledge, beliefs, and practices of neonatal intensive care unit healthcare workers regarding nosocomial infections, central venous catheter care, and hand hygiene. *Infect Control Hosp Epidemiol* 2004; 25(9):747-52.
 25. Yousefi H, Nahidian M, Sabouhi F. Reviewing the effects of an educational program about sepsis care on knowledge, attitude, and practice of nurses in intensive care units. *Iran J Nurs Midwifery Res* 2012; 17(2 Suppl 1):S91-5.
 26. Khatiban M, Gomarverdi S, Soltaniyan AR. The effect of education on impediments perception of adherence from infection control standards in intensive care nurses: a randomized clinical trial. *Sci J Hamadan Nurs Midwifery Facul* 2014; 22(2):74-82 (Persian).