

Original Article

Evaluation of the appropriateness of control measures related to nosocomial transmission of multidrug-resistant microorganisms within the SS Multipurpose Intensive Care Unit: observational study

Valutazione dell'appropriatezza delle misure di controllo relative alla trasmissione nosocomiale di microrganismi multiresistenti all'interno della SS Terapia Intensiva Polivalente: studio osservazionale

Paola Toselli,^{1,2} Roberta Di Matteo,³ Cesare Bolla,¹ Barbara Montanari,¹ Marco Ricci,¹ Elisabeth Marino,¹ Serena Penpa,³ Tatiana Bolgeo,³ Antonio Maconi³

¹SS Hospital Infection Prevention and Control and Antimicrobial Stewardship, Hospital Presidium Medical Directorate, Azienda Ospedaliero- Universitaria SS. Antonio e Biagio e Cesare Arrigo, Alessandria; ²SC Directorate of Health Professions, Azienda Ospedaliero-Universitaria SS. Antonio e Biagio e Cesare Arrigo, Alessandria; ³Research Training Innovation Infrastructure, Research and Innovation Department (DAIRI), Azienda Ospedaliero-Universitaria SS. Antonio e Biagio e Cesare Arrigo, Alessandria, Italy

Key words: multidrug-resistant microorganisms, Intensive Care Unit, control measures, nosocomial transmission.

ABSTRACT

Background: Healthcare-Associated Infections (HAIs), by definition, occur 48 hours or more after admission or within 30 days after discharge or surgical procedure; they represent a significant challenge for the healthcare system due to their prevalence in Italy and the involvement of multi-drug resistance. Intensive Care Units (ICU) exhibit the highest prevalence of such infections due to lapses in adherence to safety protocols. The primary cause of hospital-acquired infections is poor adherence to guidelines for the prevention and control of these infections. This study aims to evaluate infection control measures in a mixed ICU.

Materials and Methods: a cross-sectional observational single-center study was conducted in the Mixed ICU at the University Hospital of Alessandria. The study used an assessment tool based on the DVA 91 rev 03 issued on 07/22/22. This tool provides guidance on isolation type (airborne, contact, droplet), patient accommodation, care measures, cleaning and disinfection protocols, patient transportation, and visitor management.

Results: overall, 220 observations were included, primarily involving nurses (75.4%) and female personnel (65.9%), with a mean age of 35.8 years and a median length of service of 36 months in the Mixed ICU. Notably, all observations were made on patients in contact isolation. In 199 observations (92.6%), healthcare providers performed hand hygiene immediately after glove removal.

Conclusions: the findings highlight a strong adherence to infection control protocols at Alessandria Hospital-University. These efforts promote a safety culture among healthcare providers, ensuring the effective implementation of preventive measures.

Background: le infezioni associate all'assistenza sanitaria, per definizione, si verificano 48 ore o più dopo il ricovero, o entro 30 giorni dalla dimissione o da una procedura chirurgica; rappresentano una sfida significativa per il sistema sanitario a causa della loro prevalenza in Italia e del coinvolgimento della resistenza multi-farmaco. Le unità di terapia intensiva presentano la più alta prevalenza di tali infezioni a causa della scarsa aderenza ai protocolli di sicurezza. La causa principale delle infezioni acquisite in ospedale è la scarsa aderenza alle linee guida per la prevenzione e il controllo di queste infezioni. Questo studio si propone di valutare le misure di controllo delle infezioni in un'unità di terapia intensiva mista.

Materiali e Metodi: è stato condotto uno studio osservazionale trasversale in un unico centro presso l'Unità di Terapia Intensiva Mista dell'Azienda Ospedaliera Universitaria di Alessandria. Lo studio ha utilizzato uno strumento di valutazione basato sul DVA 91 rev 03 emesso il 22.07.2012. Questo strumento fornisce indicazioni sul tipo di isolamento (per via aerea, per contatto, per goccioline), sulla sistemazione dei pazienti, sulle misure di assistenza, sui protocolli di pulizia e disinfezione, sul trasporto dei pazienti e sulla gestione dei visitatori.

Risultati: complessivamente, sono state incluse 220 osservazioni, che hanno coinvolto principalmente infermieri (75,4%), maggiormente femmine (65,9%) e con un'età media di 35,8 anni e un'anzianità di servizio mediana di 36 mesi nell'Unità di Terapia Intensiva Mista. In particolare, tutte le osservazioni sono state effettuate su pazienti in isolamento da contatto. In 199 osservazioni (92,6%), gli operatori sanitari hanno eseguito l'igiene delle mani subito dopo la rimozione dei guanti.

Conclusioni: i risultati evidenziano una forte adesione ai protocolli di controllo delle infezioni presso l'Azienda Ospedaliero-Universitaria di Alessandria. Questi sforzi promuovono una cultura della sicurezza tra gli operatori sanitari, garantendo l'efficace attuazione delle misure preventive.

Introduction

A nosocomial infection, also known as a Healthcare-Associated Infection (HAI), refers to an infection acquired by a patient during their stay in a healthcare setting that was not present at the time of admission. These infections typically manifest within 48 hours of hospital admission, within 3 days following discharge, or within 30 days after a surgical procedure.^{1,2}

Globally, HAIs exhibit a prevalence of 7% in developed countries and 10% in developing nations.³ The European Centre for Disease Prevention and Control has estimated an annual occurrence of 8.9 million different episodes of HAIs in acute care hospitals and long-term care facilities across Europe.⁴ In Italy, the annual incidence of HAIs among hospitalized patients is estimated to range between 450,000 and 700,000 cases, with 30% considered preventable.⁵ Notably, nosocomial infections contribute significantly to antimicrobial resistance, with Italy recording the highest number of additional hospitalization days due to infections caused by antibiotic-resistant organisms amounting to 2,300 extra days per 100,000 individuals, affecting patients over 50 years old and children under 9 years old.⁵ Furthermore, Italy experiences over 10,000 deaths annually from infections caused by antibiotic-resistant bacteria, constituting a substantial portion of the total 30,000 deaths reported across Europe each year.⁵ These trends align with the highest expenditure for the National Health Service, amounting to \$662,000 per 100,000 individuals per year.⁵

Intensive Care Units (ICUs) stand out as the hospital departments with the highest prevalence of HAIs.⁶ Globally, the prevalence of HAIs in ICUs is around 51.4%, while in Europe and the United States, it is estimated to range from 9% to 37%.^{7,8} The rise of HAIs in ICUs results from a multifaceted interplay of pathogenic elements (such as virulence and antibiotic resistance), host-related factors (including comorbidities and acute illnesses), treatment-related aspects (such as the use of invasive devices and antibiotics), and healthcare protocols (full staffing coverage and preventive measures).^{9,10} Predominant infections in ICUs are ventilator-associated respiratory infections, bloodstream infections linked to vascular catheters, urinary tract infections associated with bladder catheters, and surgical site infections.⁷ Previous research indicates a prevalence rate of 53% for respiratory infections and 27.6% for bloodstream infections within intensive care settings.^{6,7}

Prevention measures should be implemented during clinical procedures by all healthcare staff. Research has demonstrated that proper hand hygiene significantly reduces the transmission of bacteria, viruses, and other pathogens responsible for HAIs. Hand hygiene also serves as an effective means to prevent cross-contamination between patients and minimize the risk of nosocomial infections. It is recognized as the cornerstone of infection control and HAI prevention. By promptly removing transient pathogens from healthcare workers, hand hygiene practices mitigate the risk of transmission to patients, prevent colonization and infection in healthcare personnel, reducing environmental contamination.¹¹ In addition to standard precautions, including personal protective equipment, cleaning and disinfection protocols, safe injection practices, and proper disposal of sharps, transmission-based precautions should also be employed to prevent contact, droplet, and airborne transmission.¹² Contact precautions extend beyond standard measures and involve strategies such as limiting patient movement, employing disposable equipment, and ensuring

thorough cleaning and disinfection. Droplet precautions involve providing patients with masks and adhering to standard precautions while also limiting patient movement. Airborne precautions require isolating patients in specialized rooms equipped with all the aforementioned protections.¹²

The primary cause of HAIs is the lack of adherence to hospital health and safety guidelines.¹³ Therefore, evaluating healthcare workers' adherence to these guidelines is essential to understand the reasons for non-compliance and to identify measures for improving infection control practices and preventing infections.¹⁴ This study aims to assess the adequacy of measures employed to control HAIs within the Mixed ICU of the SS. Antonio e Biagio e Cesare Arrigo University Hospital.

Materials and Methods

This study adopts a cross-sectional observational design and was conducted at the Mixed ICU at the University Hospital of Alessandria.

Participants

The study included all healthcare personnel who had access to the areas housing colonized/infected patients or isolation units within the Mixed ICU.

Data collection

An infection control conducted nurse visited the Mixed ICU three times weekly, during various morning and afternoon time slots (from 8 AM to 4 PM), from February 1, 2023, to 30 September 2023. The nurse systematically observed each healthcare worker upon entry into the colonized/infected patient areas and completed an assessment form for each healthcare provider.

Instruments

This study used a form to assess the correct application of insulation measures based on the DVA 91 rev 03 issued on 07/22/22, titled "Control Measures for Nosocomial Transmission of Infectious Diseases for Evaluating Infection Control Measures."

The assessment form includes observations on the type of isolation (airborne, contact, droplet), patient accommodation, care measures adopted, cleaning and disinfection protocols of the patient care unit, patient transportation, and visitor management. Each section includes specific items to be answered with "yes" or "no", with an option to provide additional notes for individual items. Furthermore, the professional position of the observed healthcare provider was noted on each assessment form.

Ethical considerations

The study was initiated following the receipt of approval from the Ethics Committee (determination No. 1958, dated 12/30/2022). The researcher informed participants about the study's objectives. Only after obtaining signed informed consent from participants was the assessment conducted.

Statistical analysis

Data were analyzed using descriptive statistics, which included measures such as mean, median, standard deviation,

range, minimum, and maximum values for continuous variables, as well as absolute and relative frequencies for categorical variables. Additionally, parametric and non-parametric statistical tests assessed potential associations between variables.

All statistical analyses were conducted using Statistical Package for Social Sciences (SPSS) (IBM Corp.; Armonk, USA) software version 25.

Results

In this study, 220 observations were conducted, with 166 (75.4%) involving nurses and 145 (65.9%) involving female personnel. The mean age was 35.8 years (SD=9.44), with a median length of service in the Mixed ICU of 36 months (ranging from 1 to 25 years). Half of the observations were conducted between 8 am and 12 am, while the remaining observations occurred between 12 am and 4 pm. Notably, all observations were associated with patients placed in contact isolation. Refer to Table 1 for a summary of the variables recorded during the observations.

In this study, the isolation type was consistently indicated, and inside, the rooms were always prepared according to protocol; documentation regarding the presence and type of isolation was consistently recorded in the patient's medical chart. Prior to entering the patient rooms, 145 (65.9%) observations were made; in only three instances did healthcare personnel fail to use appropriate Personal Protective Equipment (PPE) before entry. Among these, three were observed wearing gowns improperly, one with only gloves and one without a mask. In all 220 observations, healthcare providers safely removed and disposed of PPE within the patient rooms.

Hand hygiene post-glove removal was performed in 199 (92.6%) observations; among these, hand washing was observed in 85 (38.6%) instances, hand rubbing with antiseptic in 64 (29%), and both procedures in 37 (16.8%). In 13 observations (5.9%), hand hygiene was not performed with each glove change but only at the conclusion of activities. Additionally, in 16 observations

Table 1. Variables recorded in the observations.

Variable	Mean (SD) or N (%) of the variable present in the observations
Healthcare worker qualification	
Nurse	166 (75.4)
Healthcare assistant	37 (16.8)
Doctor	17 (7.7)
Gender	
Female	145 (65.9)
Age	35.8 (9.44)
20-30	61 (27.7)
31-40	82 (37.2)
41-50	37 (16.8)
51-60	15 (6.8)
Months of service in Intensive Care	36 (1-300)
Type of isolation	
Contact	220 (100)

SD, standard deviation.

(7.4%), failure to perform hand hygiene after glove removal was noted. These observations were characterized by a median length of service in the Mixed ICU of 35 months (ranging from 12 to 276 months) and a mean age of 35.5 years (SD=10). Furthermore, among these observations, twelve involved nurses, two involved doctors, and two involved healthcare assistants.

Hospital linen changes were assessed in 67 observations; in six instances (8.9%), the linens were not hermetically sealed within the specified bag as required inside the patient rooms.

Discussion

This study aimed to evaluate the adherence to control measures concerning the nosocomial transmission of multidrug-resistant microorganisms within ICUs. Our findings demonstrate a good adherence among healthcare personnel to the prescribed control measures outlined in the institutional protocol.

While existing literature indicates a solid understanding of appropriate practices, although their consistent application is not always observed.¹⁵ Conversely, our study shows that healthcare providers consistently adhered to guidelines governing the management of isolated patients. This outcome could be attributed to the comprehensive educational strategy of the hospital university, which includes infection prevention and control training for new recruits and ongoing educational initiatives for staff. Furthermore, the landscape of infection prevention and surveillance has evolved during the COVID-19 pandemic, leading to increased knowledge, awareness, and compliance with guidelines aimed at reducing infection rates and enhancing patient safety.¹⁶

The correct use and disposal of PPE are crucial for safeguarding healthcare staff and patients from infectious diseases. In all observations, healthcare personnel demonstrated proficiency in wearing appropriate PPE and executing proper disposal procedures. Similar findings have been reported in prior studies,¹⁷ although others have identified instances where healthcare providers' knowledge and practices diverged from established guidelines.¹⁸ This variance may be attributable to disparities in study methodologies and participant demographics. Additionally, the decision to utilize PPE appears to be influenced by healthcare providers' risk perceptions, as evidenced by qualitative research findings.¹⁹

Approximately 13% of observations revealed lapses in hand hygiene practices or inconsistent hand hygiene following glove changes. This figure falls below the percentages reported in existing literature.^{16,20}

Several limitations in our study warrant consideration. Firstly, our observations exclusively focused on contact isolations, which may have overlooked potential variations in healthcare workers' behaviors when managing patients with different infectious diseases, including those transmitted through airborne or droplet exposure. Secondly, our study may be susceptible to the Hawthorne effect; nevertheless, it is important to note that although instances of non-compliance were rare, they may suggest healthcare workers' actions were unaffected by external observation. Lastly, our study was conducted exclusively at one hospital and its critical care facility, thereby potentially restricting the applicability of our findings to other healthcare settings and institutions.

Conclusions

The findings indicate strong adherence among healthcare providers to guidelines and protocols for nosocomial infection control aimed at maximizing safety for patients and healthcare staff. This result may be attributed to the Alessandria Hospital-University's emphasis on a workplace safety culture, particularly through the Hospital Infection Prevention and Control Unit and Antimicrobial Stewardship. These initiatives raise awareness among healthcare providers about the importance of personal protection and support them in effectively implementing preventive measures.

Correspondence: Roberta Di Matteo, Research Training Innovation Infrastructure, Research and Innovation Department (DAIRI), Azienda Ospedaliero-Universitaria SS. Antonio e Biagio e Cesare Arrigo, via Venezia 16, 15121 Alessandria, Italy.
 E-mail: rdimatteo@ospedale.al.it

Key words: multidrug-resistant microorganisms, Intensive Care Unit, control measures, nosocomial transmission.

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