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Factors Impacting Compliance with Infection Control Guidelines among healthcare providers in Neonatal Intensive Care Unit, referral hospital, Saudi Arabia

A. A. Alshehri, Phd[1*]

[1]College of Nursing, King Saud University, King Khalid Road, Riyadh 11421, Saudi Arabia

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***Corresponding author:** A. A. Alshehri, Phd
College of Nursing, King Saud University, King Khalid Road, Riyadh 11421, Saudi Arabia

Abstract

Healthcare-associated infections continue to be a major problem that endangers patient safety, especially for critically ill hospitalized patients. Reducing the risk of this infection can be achieved through improving compliance with infection control guidelines and identifying and controlling the associated factors. This study aim to investigate factors impacting compliance with infection control guidelines and increasing the risk of healthcare-associated infections in neonatal intensive care units. A qualitative approach, a one-to-one interview design, was used, between April 15 and May 15, 2021, to interview ten participants who worked in the neonatal intensive care unit at a Saudi Arabian referral hospital. Through data analysis, two major themes and four sub-themes were found, which include a factor related to the workforce (shortage of staff and lack of knowledge) and factors related to the workplace (shortage of supplies and lack of monitoring). In conclusion, healthcare-associated infections in neonatal intensive care units are a serious issue that could lead to an increase in mortality and morbidity rates among patients. Thus, healthcare settings' commitment to improve compliance with the infection control guidelines is essential to lowering the incidence of healthcare-associated infections. This can be achieved through proper staffing, sufficient supplies, and effective monitoring.

Keywords: Health-associated infection, compliance, infection control guidelines, neonatal intensive care unit, hospitals, Saudi Arabia.

INTRODUCTION

In healthcare settings (HCSs), healthcare-associated infections (HCAIs) are prevalent and can impact patients of all ages, including the elderly, immune-compromised individuals, and neonates (Kamunge, 2013). HCAIs are defined as infections that patients acquire during their hospitalization (Cardoso *et al.*, 2014). HCAIs most commonly occur in the urinary tract, respiratory tract, bloodstream, and surgical wounds (CDC, 2021; Lo *et al.*, 2014). It is also a significant burden that may threaten patient safety and treatment (WHO, 2012). It has been reported by the WHO (2012) that ten patients from developing countries and seven from developed countries may have HCAI per 100 patients. It is reported that in acute care units, the risk of HCAIs may increase to 30% compared to other hospital units.

The Agency for Healthcare Research and Quality reports that HCAIs are among the top 10 causes of death in the US and are the most common complication-related hospitalization (Haque *et al.*, 2018). When compared to non-infected patients, the average length of stay, mortality, morbidity, and cost for patients with HCAIs is higher (Gastmeier *et al.*, 2007).

New advancements in newborn intensive care units (NICUs) can improve health and raise the survival rate of infants (Fabbri *et al.*, 2013). However, several factors can increase the risk among infants by impacting compliance with infection control guidelines (ICGs) in NICUs. Compliance with ICGs is greatly impacted by the availability of supplies, HCP training, and effective surveillance methods, among other resources (Cohen *et al.*, 2003; Datta *et al.*, 2014). Maintaining compliance also requires a strong institutional culture and commitment that supports infection control training and guidelines, which can improve awareness among HCPs (Zingg *et al.*, 2015). However, issues related to staff turnover, workload, increased use of invasive devices, low birth weight, underdeveloped immune systems, increased use of antibiotics, the complexity of care,

understaffing, limited budget, and limited-service delivery organizations are all risks that can impact compliance and increase the risk of HCAIs among infants (Enweronu-Laryea *et al.,* 2015; Fabbri *et al.,* 2013).

Problem statement:

The selected hospital for this study has experienced recurrent and significant outbreaks over the past few years that have resulted in an increase in mortality and morbidity rates. Despite numerous improvement projects, this issue has persisted. Therefore, this study aims to investigate factors that influence compliance with ICGs and increasing the risk of HCAIs in NICUs in Saudi Arabia.

METHODOLOGY

Semi-structured interview methods were used among ten HCPs working in NICUs (with 56 cots) at a referral hospital (a maternity and children's hospital) located in the southern region of Saudi Arabia, with a bed capacity of 200). A one-to-one interview with the use of an open-ended question technique was used to understand in depth the factors influencing compliance with ICGs.

Sampling and recruitment:

Purposive sampling was used to recruit participants. An invitation letter was distributed among all HCPs working in the NICU. Participants who accepted to participate reported their names to the principal investigator (PI) through mobile WhatsApp.

Selecting participants:

All HCPs (doctors, nurses, and respiratory therapists) working in the NICU, having experience for more than one year, and having direct contact with patients were invited to participate in this study. Other allied HCPs and trainees were excluded. Six physicians, seven nurses, and one respiratory therapist were accepted to be enrolled, and only ten of them (four physicians, five nurses, and one RT) were involved in the study because the researcher approached data saturation after seven interviews and confirmed after completing three interviews.

Data collection:

Interview guidelines were utilized to identify in-depth contextual data about this subject. Relevant literature was reviewed to create the question guides to answer the study's objectives, Table 1, followed by a pilot test among two HCPs who were not included in the study. Accordingly, a slight modification was applied to the questions to ensure clarity and comprehensiveness. Audio recording was used to record all the interviews as well as field notes taken during the interviews.

Table 1: Examples of interview questions

Type	Question
Starting questions	Please share anything important to HCAIs issue in your department? Why do you think HCAIs happened in your department? What are the sources of HCAIs, do you think? What was the effect of the HCAIs in your department?
Propping	What do you know about HCAIs and how do they transfer? And how do you control it? What do you know about infection control guidelines? Why is it significant? When and how do you apply it? What do you know about the significance of compliance with the infection control guidelines? When should you follow these guidelines? What factors can impact compliance with the infection control guidelines? What is the role of the IPC team in your department?
Ending question	Can you please share any other things that you think are important regarding this issue?

This study was conducted from April 15 to May 15, 2021. The interview for each participant lasted between 30 minutes to one hour. All the interviews were conducted in English language by the PI of this study.

Data processing and analysis

Transcribed verbatim were done throughout the software and reviewed again by the PI. The transcribe was sent back to the participants for further review to ensure it reflected the discussion done during the interviews. The PI used a phenomenological approach (Colaizzi's) to analyze the data. The seven-step process of Colaizzi's methods used to analyze data includes (1) familiarization (familiarize with data), (2) identifying significant statements, (3) formulating meaning (identifying meanings relevant to the phenomenon), (4) clustering themes, (5) developing an exhaustive description, (6) producing the fundamental structure, and (7) seeking verification of the fundamental structure (returning the fundamental structure statement to all participants) (Morrow *et al.,* 2015) . All these steps were applied critically.

The Social-Ecological Model (SEM) is used to guide the author throughout this study. This model has been generally recognized and embraced for use to improve health and well-being, and it is widely used to understand better individual health behaviors (Sunkwa-

Mills *et al.*, 2020). SEM can provide a comprehensive understanding of the factors that influence HCPs.

To ensure this study's trustworthiness, Lincoln and Guba (1985) framework was used. The four strategies of this framework were utilized to ensure the trustworthiness of qualitative data include credibility, dependability, confirmability, and transferability (Polit & Beck, 2018). To ensure credibility, the PI used three strategies: prolonged engagement (some interviews exceeded one hour), peer debriefing (a qualitative expert person reviewed the agreed coding), and member checking (all participants reviewed the transcription of their interviews). In reference to dependability and confirmability, the PI repeatedly identified codes, categorized them, and created themes; this allowed the researcher to ensure proper data management. To apply the transferability, the researcher used direct quotes from the participants to support the illustrated themes.

Ethical considerations:

Safe management of data was ensured during the study for both transcripts and field notes, which were kept in a secured file and protected with a password. Other ethical considerations involving obtaining informed consent, confidentiality, privacy, the right to withdraw from the study, and anonymity were all considered.

FINDINGS

The data analysis for this study demonstrated two main themes with four subthemes that affect compliance with ICGs. These themes include factors related to the workforce (shortage of staff and lack of knowledge) and factors related to the workplace (shortage of supplies and lack of monitoring).

Factors related to the workforce:

Shortage of HCPs:

Majority of participants reported that the ratio of nurses and RTs to a patient is not being met. Sometimes, a single nurse would care for four patients at once; some of these cases are rather serious. This issue can hinder nurses' and RTs' compliance with the ICGs and increase the risk of HCAIs.

> Most of the time, I will look for more patients……. Sometimes I have been assigned to four patients, some of whom are on a ventilator machine.

> The NICU has septic and aseptic patients with different organisms. Those septic patients should be cared for by a single nurse to avoid cross-infection between patients. Majority of participants reported that due to the nursing shortage in this department, the nurse will attend to aseptic patients in one room while simultaneously managing septic patients in another, which may increase the infection transmission risk among patients. A shortage forces nurses to look for septic and non-septic patients together at the same time.

Additionally, a staffing shortage caused HAIs to spread throughout two departments. The NICU and the pediatric intensive care unit (PICU) are housed in front of each other in this hospital. Some participants reported that in case of an RT shortage, the RT staff will provide respiratory care for patients in both departments at the same time, which may lead to cross-infection from one department to another.

> In some time, only one RT staff member will handle the patients for two departments.

Despite the shortage of nurses in the NICU, some nurses will not attend their work (absent) without advance notice to the head nurse.

> This absenteeism issue can increase the workload on the other nurses who joined the work looking after those patients who were supposed to be seen by this absent nurse.

> My colleagues in some situations, are not coming to work; their cases will be distributed among those nurses who join the work.

Low number of senior staff:

A low number of senior staff is a critical factor that is stated by most HCPs. HCPs reported that the NICU has many newly graduated nurses and RTs with low experience.

> In some situations, those HCPs may handle critical patients alone, which may increase the risk of HCAIs.

> We have many new staff with little experience. They sometimes look after critical baby patients. You can see them sometimes not wearing gloves, not washing their hands, and not following infection control practices.

Factors related to knowledge

Some HCPs reported that knowledge of some HCPs regarding the ICGs is not adequate. They demonstrated some knowledge factors related to HH five moments, the use of invasive procedure bundles, standard precautions, and HCAIs. During the interview, it was clear that some interviewees could not state the meaning, types, and prevention strategies of the HCAIs.

> If you ask some staff, I can guarantee that they can't illustrate all the five moments of HH.
>
> Sorry, I don't know what the definition and meaning of HCAIs are.

Factors related to the workplace

Supplies:

There is consistency among all HCPs regarding the shortage of supplies. Among all participants, a shortage of supplies has been reported as a significant issue that affects their compliance with the ICGs and increases the risk of HCAIs. A shortage of supplies, such as PPE, disposable syringes, testing machines and equipment, and soap and tissues, can hinder HCPs' compliance with ICGs. Some of the HCPs reported that, in some situations, there is a limited size of gloves that does not fit all staff's hands.

> My hands are big, and I cannot wear small-size gloves.
> Sometimes only small and medium sizes are available.

> Our supply, really, we are suffering for supply... especially
> gloves….. limited size available.

> Syringes are sometimes not available in all sizes, like 10
> -cc syringes.

In some scenarios, a shortage of supplies forced nurses to reuse disposable syringes for the same patients, reported by some participants.

> Many times, I used the same syringe for the same patients
> for the whole shift, and sometimes I endorsed the used
> syringe to the next shift.

A shortage in testing machines such as thermometers and glucometers has forced nurses to use one machine for both septic and aseptic patients. In addition, not all babies have a special stethoscope; thus, one stethoscope is used by doctors for all patients admitted to one room.

> Like a thermometer, glucometer, …. We have only two in this big room.
> I want to auscultate one baby. She brought me a stethoscope from another incubator that belong to other patient.

There is a shortage of essential supplies for proper hand hygiene (HH). Some HCPs reported that antibacterial soap and tissues are not frequently available.

> Sometimes I need to wash my hands with antiseptic soap,
> but unfortunately, it is not there….. Even sometimes,
> tissues to dry my hands are not there.

Monitoring:

Most of the HCPs acknowledged a lack of monitoring systems for infection control practice in the NICU. They recommended frequent monitoring among all HCPs. They stated that all workers in the NICU should expect that someone is observing them all the time.

> I recommend having a surveillance system to monitor the
> practice of HH and other standard precautions.

DISCUSSION

This study aimed to investigate factors that influence compliance with ICGs and increase the risk of HCAI outbreaks in NICUs. The result of this study demonstrated several factors that can influence compliance and increase the risk of HCAI outbreaks in NICUs. These factors are related to the workplace (shortage of supplies and lack of monitoring) and factors related to workforce (shortage of staff, lack of knowledge). These factors can influence compliance with ICGs and increase the risk of HCAIs, which lead to an increase in mortality and morbidity among hospitalized babies.

HCSs have a significant role in controlling HCAIs among hospitalized babies in NICUs. The HCSs should consider several strategies to improve compliance with ICGs, including activating a multidisciplinary infection control committee, ensuring active monitoring of practice for the ICGs, ensuring availability of ICGs among staff, ensuring active training programs, periodically monitoring HCAI incidence, and ensuring authority of the infection control team and leaders (Ducel *et al.*, 2002).

Shortage of HCPs

Shortage of HCPs is a significant factor that influences compliance with the ICGs. Research shows that the shortage of HCPs is a significant factor associated with the increase of HCAIs in the NICU (Ferrer *et al.*, 2014). Understaffing in NICUs leads to increased HCP mobility between patients and results in minimizing compliance with the ICGs (Ferrer *et al.*, 2014). When there's understaffing, the workload can be increased among the available staff, resulting in potentially fatigue and stress (Buxton *et al.*, 2019). This issue might compromise the ability of HCPs to comply with ICGs due to the rush on work or high demands. Therefore, HCSs should ensure adequate coverage of NICU staff by improving recruitment strategies such as part-time jobs, overtime, or recruiting new staff.

Lack of knowledge:

HCPs' adequate knowledge of ICGs is a significant aspect of preventing and controlling the spread of HCAIs in NICUs. Understanding the significance of ICGs, such as hand hygiene, using PPE, and complying with isolation protocols, is crucial in reducing the risk of HCAIs (Alhumaid *et al.*, 2021). It is

important for HCPs to stay updated on the guidelines and evidence-based practices to ensure effective implementation of ICGs (Al-Maweri *et al.,* 2015). Therefore, HCSs have an essential role in enforcing new strategies for training, education, and utilizing guidelines to improve compliance of HCPs with the ICGs. Research shows that traditional education and training will not sustain improvement (Wilson *et al.,* 2011). Using a multimodal approach such as visual reminders and poster signs are all significant strategies that improve compliance and ensure continuous compliance with infection control measures (Seibert *et al.,* 2014).

Senior staff

HCPs play a significant role in improving compliance with ICGs. Senior staff with good experience are often set up as mentors for other junior staff, and they can enhance and promote compliance with the ICGs. They are considered a cornerstone of sustaining practice with ICGs by employing their experience and advocating compliance (McInnes *et al.,* 2014). They have a crucial role, incorporating not just educating their junior staff, but also actively guiding, monitoring, and supervising the implementation of the ICGs (McInnes *et al.,* 2014). They also participate in creating policies, setting a positive culture with the ICGs, setting a pace of work, and serving as role models for others (Shah *et al.,* 2015).

Insufficient supplies:

A shortage in supplies can create a critical challenge for HCSs in maintaining compliance with ICGs. Insufficient supplies, such as gloves and PPE, are a significant factor that can increase the risk of HCAIs among patients in NICUs (Chaib, 2020). It is a worldwide issue due to misuse, panic buying, and increased demand (Chaib, 2020). Thus, HCSs should develop better strategies to ensure adequate supplies are available. To ensure adequate supplies, HCSs should calculate, identify, and manage the required level of stocks they require (Borg, 2010). For example, HCS may calculate the physical characteristics of the HCPs who provide the care and the number of care procedures. In addition, in the NICU, the HCSs should ensure the availability of adequate equipment and devices (e.g., stethoscopes for each patient) that meet the number of patients in the NICUs. These devices are considered a mode of transmission for pathogens that facilitate the transmission of infection between HCPs, from patient to HCP, or from HCP to patient (Collins, 2008). Therefore, optimizing proper resources and utilizing effective strategies to improve supplies is an essential role of HCSs.

Monitoring practice with ICGs:

Monitoring compliance with ICGs within HCSs plays a vital role in reducing the risk of HCAIs. Rigorous surveillance serves as the cornerstone for reducing the risk of HCAIs within HCSs (RT, 2007). With a consistent monitoring system, HCSs can identify potential risks, identify areas for improvement, take corrective action, and minimize the risk of infection (McKibben *et al.,* 2005). Invasive procedures (e.g., central lines, urinary catheters, and endotracheal tubes) in the NICU should be monitored periodically and should be removed immediately when patients improve (RT, 2007). This continuous monitoring can reduce the risk of HCAIs, ultimately protecting both HCPs and patients.

Limitations:

This study acknowledges a number of limitations. This study was done in one referral hospital, which may not be applicable for private and other small and rural hospitals, which may affect the generalizability of the study. The sampling technique (purposive sampling) used may also limit the generalizability of the findings of this study.

Recommendation for future studies:

A longitudinal research design can be used in future studies to investigate the long-term effects that influence compliance with ICGs. Investigating the psychological effect is crucial, particularly concerning observations made by the PI regarding some HCPs expressing emotions such as crying or planning to leave the work after experiencing the loss of babies, accompanied by feelings of guilt. Research into individual factors and HCS culture factors emerges as a critical area for future research.

IN CONCLUSION

This study investigated the issues related to factors influencing compliance with ICGs in the NICU. Two main themes and four subthemes were identified. The HCSs have an essential role in managing the risk of HCAIs among their hospitalized babies. HCPs also require effective training and educational programs that can enhance their knowledge, attitude, skills, and competency related to ICGs. Infection control members should take further actions to ensure that ICGs are effectively applied. They are also required to critically monitor compliance with the ICGs by HCPs.

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