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IN SCIENZE INFERMIERISTICHE E SANITA' PUBBLICA**

XXXVII CICLO

Titolo della tesi

Healthcare-Associated Infections and the Leadership style of head nurses: from organizational well-being to nursing Sensitive Outcomes.

The variables of the organizational context, the mental processes, and team decision-making processes of the team involved in Infection Prevention Control.

Nome dottorando

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XXXVII CICLO - Anno Accademico 2023/2024

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Titolo tesi: *Le Infezioni Correlate alle pratiche Assistenziali e lo stile di leadership del coordinatore infermieristico: dal benessere organizzativo ai Nursing Sensitive Outcomes. Le variabili del contesto organizzativo, i processi mentali e decisionali del team implicati nell'Infection Prevention Control*

ABSTRACT (Italiano)

Background

Le Infezioni Correlate alle pratiche Assistenziali (ICA) rappresentano una sfida globale. Analizzare l'influenza esercitata dallo stile di *leadership* del coordinatore infermieristico e dal benessere organizzativo dei professionisti sanitari sui *Nursing Sensitive Outcomes*, come le *Catheter Associated Blood Stream Infections* (CABSIs), le *Catheter Associated Urinary Tract Infections* (CAUTIs) e le *Surgical Site Infections* (SSIs), è cruciale. Lo studio di questi aspetti clinici ed organizzativi consente ai *manager* e ai formatori di individuare le criticità nelle pratiche assistenziali e promuovere strategie mirate che includano i contributi di coloro direttamente coinvolti.

Obiettivi

Nel corso del triennio dottorale, è stato progettato e realizzato un progetto di ricerca con lo scopo di indagare come la *leadership* del coordinatore e le variabili del contesto organizzativo incidano sulla diffusione delle ICA. obiettivi della ricerca sono stati:

- Esplorare la relazione tra le ICA, il benessere organizzativo degli infermieri e lo stile di *leadership* del coordinatore infermieristico.
- Valutare l'associazione tra benessere organizzativo, stile di *leadership* e incidenza delle ICA.
- Testare un modello che analizzasse la relazione tra variabili del contesto organizzativo, come *Staffing*, *Stress* legato alle *demands*, *Workloads* e il verificarsi di specifiche ICA, quali le SSI.
- Esaminare come i processi mentali, i comportamenti e le azioni promossi dai coordinatori infermieristici e dei professionisti sanitari in Terapia Intensiva possano favorire l'adesione ai programmi di *Infection Prevention Control*, contribuendo a ridurre la diffusione delle infezioni da *MultiDrug Resistant Organism* (MDRO).

Metodo

Al fine di raggiungere lo scopo generale del percorso dottorale, sono stati i seguenti disegni di ricerca, quattro obiettivi precedentemente esposti. Per il primo obiettivo è stata svolta una revisione sistematica secondo il Manuale JBI. Per il secondo e terzo obiettivi è stato uno studio osservazionale monocentrico ed infine per l'ultimo obiettivo è stato uno studio qualitativo multicentrico secondo l'approccio della *Grounded Theory*. Per

ogni disegno di ricerca, sono stati adottati strumenti composti da scale validate, come ad esempio il *Quantitative Work Index* (QWI) e l'*Health Safety, Executive Indicator tool* (HSE-IT) per valutare il workload e lo stress percepito dall'operatore. È stato creato e fatto compilare per 30 giorni, previa formazione dei coordinatori infermieristici, un *Outcomes form* costruito ad hoc per rilevare i livelli di staffing e la prevalenza delle ICA, in accordo con la classificazione fornita dal Centro Europeo per la Prevenzione e il Controllo delle malattie (ECDC). Successivamente alla raccolta, questi dati sono stati analizzati utilizzando un modello di equazioni strutturali. Infine, per esplorare i processi mentali e decisionali del team sanitario è stata utilizzata dapprima la tecnica dell'osservazione libera non partecipante e poi le interviste semi strutturate singole e/o focus group all'intero team.

Risultati

Dalla letteratura emerge che uno stile di *leadership* del coordinatore infermieristico autentico è in grado di "ispirare una visione condivisa" e "sfidare il processo" e avere un impatto significativo sulla riduzione delle ICA ($\beta = 0,07$; $p = 0,024$), riducendo i tassi di infezioni *Catheter Associated Urinary Tract Infections* (CAUTIs) e *Catheter Associated Blood Stream Infections* (CABSIs) rispettivamente del 6% e del 17% (obiettivo 1). L'indagine condotta su un campione di 133 infermieri provenienti dai reparti di medicina, chirurgia e oncologia di un grande ospedale nel centro Italia ha esplorato la relazione tra il benessere organizzativo e l'incidenza delle ICA (obiettivo 2). Da questo campione, i dati raccolti mediante il QWI, dal HSE-IT e dall'*Outcome form* hanno mostrato che l'inadeguatezza del personale infermieristico ($\beta = -0,39$), lo squilibrio del carico di lavoro degli infermieri tra le esigenze dell'organizzazione, le esigenze dei pazienti e l'organizzazione del lavoro ($\beta = 0,24$) favoriscono le richieste legate allo stress degli infermieri ($\beta = 0,27$) con un aumento del numero di SSI (obiettivo 3). Attraverso un'analisi fenomenologica interpretativa dei dati raccolti sono emerse quattro tematiche che favoriscono la gestione delle ICA da MDRO: a) l'attenzione al problema infettivo, b) la supervisione del coordinatore infermieristico, c) la condivisione delle informazioni ed infine d) la distribuzione delle responsabilità (obiettivo 4).

Conclusioni

Il progetto dottorale ha permesso di comprendere come la *leadership* del coordinatore infermieristico rappresenti una leva strategica per il cambiamento e garantisca una gestione sostenibile del rischio infettivo nei diversi setting assistenziali. Tuttavia, il contrasto alle ICA necessita di azioni mirate e strategie integrate che coinvolgano l'organizzazione sanitaria, il *management* e la formazione, sia accademica che continua.

L'integrazione sinergica delle variabili organizzative e quelle cliniche può rappresentare un primo passo verso la ricostruzione di un sistema assistenziale orientato ad un servizio di qualità. In questa ridefinizione del sistema, il benessere organizzativo del personale e la qualità delle cure per il paziente assumono un ruolo centrale, contribuendo a un sistema sanitario più efficace e al tempo stesso più sostenibile.

Parole chiave: Benessere Organizzativo, Coordinatore Infermieristico, Infezioni Correlate alle pratiche Assistenziali, Leadership.

XXXVII CYCLE - Academic Year 2023/2024

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Title: *Healthcare-Associated Infections and the Leadership style of head nurses: from organizational well-being to nursing Sensitive Outcomes. The variables of the organizational context, the mental processes, and team decision-making processes of the team involved in Infection Prevention Control.*

ABSTRACT (English)

Background

Healthcare Associated Infections (HAIs) are a global challenge. Analyzing the influence of head nurse's leadership style and the organizational well-being of healthcare staff on Nursing Sensitive Outcomes—such as Catheter-Associated Bloodstream Infections (CABSI), Catheter-Associated Urinary Tract Infections (CAUTI), Surgical Site Infections (SSIs), and Multi-Drug Resistant Organism (MDRO) infections—is crucial. The study of these clinical and organizational aspects enables managers and educators to identify critical issues in care practices and promote targeted strategies that incorporate the contributions of those directly involved.

Objectives

During the doctoral program, a research study was designed and conducted to investigate how head nurses' leadership and organizational context variables impact the spread of HAIs. The main objectives of the research were:

- To explore the relationship between HAIs, nurses' organizational well-being, and the head nurse leadership style.
- To conduct a survey using validated scales on a sample of nurses and head nurses to assess the association between organizational well-being, leadership style, and incidence of HAIs.
- Test a model analyzing the relationship between organizational context variables—such as staffing, stress related to demands, and workloads—and the occurrence of specific HAIs, such as SSIs.
- To examine how mental processes, behaviors, and actions promoted by head nurse and health care workers in the Intensive Care Unit (ICU) can promote adherence to Infection Prevention Control programs, contributing to the reduction of MDRO infections.

Method

To achieve the overarching goal of the doctoral program, the research designs were structured to align with the four previously outlined objectives. A review based on the JBI Manual was conducted to address the first objective. The second and third objectives were examined through a single-center observational study, while

the final objective was explored using a qualitative multicenter study guided by the Grounded Theory approach. Each research design employed validated tools, such as the Quantitative Work Index (QWI) and the Health Safety Executive Indicator Tool (HSE-IT), to measure workload and the perceived stress of healthcare professionals. Additionally, a custom Outcomes Form was developed and implemented over 30 days, following specific training for nurse coordinators. This form was tailored to capture staffing levels and the prevalence of HAIs, adhering to the classification provided by the European Centre for Disease Prevention and Control (ECDC). Following collection, these data were analysed using a structural equation model. Finally, in order to explore the mental and decision-making processes of the healthcare team, the technique of free non-participant observation was used first and then semi-structured single and/or focus group interviews with the entire team.

Results

The literature shows that an authentic head nurse leadership style can “*inspire a shared vision*” and “*challenge the process*” and have a significant impact on the reduction of HAIs ($\beta = 0.07$; $p = 0.024$), reducing the rates of Catheter-Associated Urinary Tract Infections (CAUTIs) and Catheter Associated Blood Stream Infections (CABSIs) by 6% and 17% respectively (objective 1). The survey conducted on a sample of 133 nurses from the medical, surgical, and oncology wards of a large hospital in central Italy explored the relationship between organisational well-being and the incidence of HAIs (objective 2). From this sample, data collected through the QWI, the HSE-IT, and the outcome form showed that the inadequacy of the nursing staff ($\beta = -0.39$), the imbalance of the nurses' workload between the needs of the organisation, the needs of the patients and the work organisation ($\beta = 0.24$) contributed to the stress-related demands on nurses ($\beta = 0.27$) with an increase in the number of SSIs (objective 3). Through a phenomenological interpretative analysis of the data collected at the first research center, four themes emerged that favor the management of MDRO-associated HAIs: *a*) attention to the infectious problem, *b*) supervision by the head nurse, *c*) sharing of information, and *d*) distribution of responsibilities (objective 4).

Conclusions

The research conducted over the three years has highlighted how the leadership of the head nurse represents a crucial strategic lever for change and more sustainable management of infectious risks in different healthcare settings, including medical, surgical, oncology, and intensive care. However, addressing HAIs requires targeted actions and integrated strategies involving healthcare organizations, management, and both academic and ongoing professional education. The synergistic integration of organizational and clinical variables can serve as a foundational step toward reconstructing a care system oriented toward quality service. In this redefinition, the organizational well-being of staff and the quality of patient care take on a central role, contributing to a healthcare system that is both more effective and sustainable.

Keywords: *Head Nurses, Healthcare Associated Infection, Leadership, Organizational Well-being.*

1 Leadership Style of Head Nurse and Healthcare-Associated Infections.

1.1 Introduction

Healthcare organizations are complex entities to manage, as their primary goal is the health of individuals. To be truly effective, they must combine a well-structured organization with a rational use of resources, adequately addressing patients' needs. However, their management is made more challenging by factors such as large size, internal heterogeneity, strict regulatory constraints, and structural inertia that slow down change processes. (Almeida et al., 2024). For optimal functioning, a healthcare organization requires a clear structure and shared, respected rules, while also emphasizing the human aspect. It is essential to balance processes, hierarchies, and costs without losing sight of the importance of people. When this balance is lacking, organizational well-being suffers, leading to a general decline.

Organizational well-being is a multidimensional construct that goes far beyond the mere evaluation of workers' psychophysical health; it also includes job satisfaction and the quality of work performance itself (Almeida et al., 2024; Zaghini et al., 2020). In the healthcare sector, organizational well-being is influenced by numerous factors and determines productivity at professional, corporate, and social levels (Della Bella et al., 2022).

Healthcare professionals most exposed to organizational pressures are nurses. Nurses strive to competently meet the diverse needs of individuals with multiple comorbidities. Although nursing is often considered a "vocation," it is a demanding profession (WHO, 2022). In their work, nurses face physical, mental, emotional, and ethical challenges, which vary depending on their role and work environment. These challenges can range from the risk of infection to physical or verbal assaults, managing emotional conversations with patients and families, and addressing difficult social and ethical issues (Melnik et al., 2018). They are subjected to heavy workloads, organizational constraints, a high degree of responsibility, and a lack of economic and professional recognition (Della Bella et al., 2022; Zaghini et al., 2020; Fiorini et al., 2022; Almeida et al., 2024). Nurses, along with other

healthcare professionals, are the main frontline actors in responding to patients' needs while simultaneously meeting organizational demands (Congdon et al., 2020). The constant pressure to respond to both care and organizational needs exposes them to stress (Labrague et al., 2020), anxiety, burnout (Ferreira et al., 2022), and interprofessional conflicts (Zaghini et al., 2015), with negative repercussions on their quality of life in terms of health (Piredda et al., 2022), motivation, and job satisfaction (Zaghini et al., 2021; Asif et al., 2019), to the point of contemplating leaving their profession (Catania et al., 2024; Marques-Pinto et al., 2018).

The factors responsible for these conditions for nurses' well-being can be attributed to three levels of responsibility (NASEM, 2021). The first level is defined by healthcare sector laws, regulations, standards, and social values. The second level, defined as the “healthcare organization,” includes leadership, management, governance, policies, and organizational structures. The third level represents the actions and interactions among team members, organizational conditions, technologies, and clinical practice. These three levels include additional variables such as workload and administrative burdens, resources, teamwork, and professional relationships.

Furthermore, all these factors are mediated by individual factors, such as personality and resilience. Nurses are skilled at managing emotional pressure, providing attention to the most critical patients even during challenging times, and using empathy and effective communication to de-escalate tense situations. While these abilities were already well-known, they became more evident to the general public during the COVID-19 pandemic (NASEM, 2021).

Healthcare organizations that recognize and promote transparency, consistency, professional skill development, intra-organizational communication, conflict management, process

simplification, organizational justice, and openness to innovation foster a healthy, stimulating, and efficient work environment, with positive outcomes for staff health, the quality of patient care, and the organization itself (NASEM, 2021; Zaghini et al., 2020).

In agreement with Donabedian's conceptual model (1966), the organizational context — the set of all structural and systemic factors within a healthcare organization that influence the delivery and quality of care, such as physical, material, and human resources, as well as organizational culture— plays a fundamental role in deeply influencing nurses' behaviors and feelings by altering their perception — the process — and consequently their performance (Fiorini et al., 2022), ultimately impacting Sensitive Nursing Outcomes (NSOs, Doran 2013). For this reason, NSOs are considered outcome indicators that reflect the quality of nursing care provided (Griffiths et al., 2008).

An example of NSOs include Healthcare-Associated Infections (HAIs) in hospital settings, such as Catheter-Associated Urinary Tract Infections (CAUTI), Central Line-Associated Bloodstream Infections (CLABSI), and Surgical Site Infections (SSI). Activities aimed at preventing and interrupting the cross-transmission of microorganisms involve the use of standard precautions, such as proper hand hygiene and personal protective equipment (WHO, 2019), which every healthcare professional should know and apply. However, adherence to these best practices often falls short of expectations (Chang et al., 2022).

From these premises, the research question guiding the entire doctoral project was aimed at identifying the main “invisible” causes that contribute to the failure of Infection Prevention and

Control (IPC) programs and, at the same time, the increase in Healthcare-Associated Infection rates. The selection of variables for analysis was inspired by the studies of Zingg et al. (2015) on IPC programs and Mitchell et al. (2018) on HAI rates, which had already highlighted how the organizational context could affect the success of prevention activities. Building on their analyses, it was possible to identify some of the most significant variables and explore how the dynamic flow of clinical and care activities (Ivziku et al., 2022) interacts with specific critical factors. In particular, the investigation focused on the impact of elements such as inadequate staffing levels, limited resources, and workloads that are unbalanced between organizational demands and patient needs, factors that can contribute to the development of HAIs (Congdon et al., 2020).

To identify the underlying reasons, the variables of organizational well-being most likely to influence these conditions were analyzed. Once the key variables were identified, the barriers within the organizational context responsible for hindering infection control programs were explored, along with the facilitators that can promote cultural change and, consequently, positively influence healthcare professionals' behaviors (*Figure 1*).

Figure 1. Conceptual framework

1.2 Conceptual framework

From Healthcare Associated Infections to head nurse's leadership

According to the Point Prevalence Survey (PPS) conducted in 2022-2023 by the European Centre for Disease Prevention and Control (ECDC, 2024) across 28 European countries (293,581 patients from 1,250 hospitals), the average prevalence of hospitalized patients with at least one Healthcare-Associated Infection (HAI) was 6.3%. Out of a total of 22,806 reported HAIs, pneumonia accounted for 19.0%, surgical site infections 16.1%, urinary tract infections 19.2%, bloodstream infections 11.9%, and gastrointestinal tract infections 9.5%. The most frequent HAIs at the time of admission were surgical site infections (25.7%). However, HAIs can be caused by various microorganisms, including those often multi-resistant to antibiotic treatments (MDRO; ECDC, 2024). This situation not only worsens the patient's clinical condition—requiring extended hospital stays and additional diagnostic investigations—but also increases the burden of care on nursing staff (Cassini et al., 2016; Suetens et al., 2018; Giuliani et al., 2018) and raises costs related to antibiotic treatments (Poudel et al., 2023).

Among the factors responsible for the development and proliferation of HAIs, the patient's clinical condition, the type of care provided, and work organization play significant roles (Al-Tawfiq et al., 2014; Allegranzi et al., 2011). Within work organization variables, the leadership style of the head nurse plays a strategic role in a) developing and sustaining an environment conducive to clinical practice, b) "inspiring the team towards a shared vision" (Kouzes & Posner, 2017), and c) ensuring the smooth execution of activities through effective communication between management and frontline staff while maintaining and achieving the highest care standards (Ferreira et al., 2022).

The World Health Organization (WHO, 2009) also emphasizes the importance of an appropriate, consistent, and effective leadership style, advocating for a participatory and interprofessional approach where all team members share goals, responsibilities, and outcomes. The

role of the head nurse, in particular, is critical in creating efficient and productive work environments and in fostering behaviors and actions aimed at reducing adverse outcomes for patients (Cziraki et al., 2020; Labrague et al., 2021). However, the skills and actions of nurse leaders cannot be analyzed in isolation, as they are heavily influenced by the organizational context, institutional governance, and ethical decisions made by the organization (Cummings et al., 2021). The organizational context is a key aspect to consider when addressing complex issues such as HAIs. This is because a wide range of interdependent factors can affect the safety culture, organizational climate, leadership style of the head nurse, staff well-being, and ultimately, patient care outcomes (Cummings et al., 2021).

Although numerous studies have explored the relationship between head nurse leadership and organizational context variables, it is essential to delve deeper into how these factors impact the management of HAIs (Fischer et al., 2019). To date, research has mainly focused on understanding and analyzing the connections between leadership styles, nurse staffing levels, and healthcare associated infection rates (Mitchell et al., 2018; Storr et al., 2017; Warshawsky, 2020).

Understanding whether the evidence supports the relationship between the head nurse's leadership style and HAI management, including through an analysis of the work context, becomes crucial for healthcare organizations and educators. The former could be guided to redefine and reshape new care models, while the latter could design new educational and training programs for healthcare professionals.

In light of this, a literature review was conducted to describe the relationship between the head nurse's leadership style and the most frequent HAIs in hospital care settings.

From organizational context variables to Surgical Site Infections (SSIs)

Interest in Healthcare-Associated Infections (HAIs) has increased internationally due to the burden they impose and their potentially adverse outcomes for patients. The findings of the systematic review by Mitchell et al. (2018) suggest that staffing is associated with an increase in hospital infection rates. Specifically, higher staffing levels appear to be linked to a decreased risk of infections. Staffing was primarily measured in terms of staff levels (nurse-to-patient ratio or nursing hours per patient-day). In addition to the leadership of the head nurse, factors such as high bed occupancy, inadequate staffing levels, workload imbalances relative to available resources, and limited availability of appropriate supplies and materials for implementing infection prevention and control programs (Zingg et al., 2015; Mitchell et al., 2018) are critical. There is a growing and updated body of evidence demonstrating the relationship between human and material resources and hospital infections. The findings support the promotion of effective use of staffing resources and will inform healthcare managers and professional organizations about future staffing changes in hospitals, particularly about infection prevention. Nevertheless, the studies currently available provide aggregated HAI rates without differentiating by type, limiting the ability to explore the relationship between contextual variables and specific HAIs (Mitchell et al., 2018).

Nowadays, Surgical Site Infections (SSIs) are among the infections that garner the most scientific interest, as their prevalence is underestimated, with the majority developing after hospital discharge (Horgan et al., 2023). SSIs are a severe postoperative complication with negative consequences for patients and significant utilization of hospital resources (Horgan et al., 2023). The European Centre for Disease Prevention and Control (ECDC) defines SSIs as infections occurring within 30 days at the site of a surgical procedure or within 90 days if an implant was placed during surgery (ECDC, 2022). Due to the economic costs and impact on patient care, studies have extensively highlighted the importance of training and education for healthcare professionals working in surgical wards to prevent and control the spread of SSIs (Horgan et al., 2023).

However, little is known about the impact that contextual variables have on this type of infection (Tvedt et al., 2017). Managing SSIs requires particular attention and expertise to recognize and treat them promptly (Mengitsu et al., 2023). Moreover, efficient organizational contexts with specialized personnel are needed to plan targeted interventions both during hospitalization and follow-up (Peutere et al., 2023).

In light of the above, it has been hypothesized to test a multivariable model to tangibly demonstrate the extent to which certain variables of the organizational context, such as staffing, stress related to organizational demands, and workloads, may influence the development of Surgical Site Infections.

From Leadership Style to the thought process decision-making of healthcare professionals in MultiDrug-Resistant Organism Infections

Several studies have shown that authentic and transformational leadership styles have a positive impact on reducing HAIs (Healthcare-Associated Infections) (Asif et al., 2019; Boamah et al., 2018), particularly HAIs related to the use of medical devices, such as CAUTIs (Catheter-Associated Urinary Tract Infections) and CLABSIs (Central Line-Associated Bloodstream Infections) (Fischer et al., 2019; Adams et al., 2018). This is achieved through the head's ability to encourage nurses to seek evidence-based medicine solutions suitable for their specific work context, apply problem-solving and decision-making skills in complex situations (Asif et al., 2019; van

Buijtene et al., 2019), and promote collaboration and shared responsibilities with all team members (Cziraki et al., 2020). However, when this does not occur, it becomes necessary to identify the barriers within the system that prevent the team from developing a culture of safety and quality of care (Labrague et al., 2021).

Quantitative research has already examined how authentic and transformational leadership styles influence team organizational well-being (Asif et al., 2019; Boamah et al., 2018; Fiorini et al.,

2022) and the development of HAIs in different care settings (Labrague et al., 2021; Landerfelt et al., 2020; Boamah et al., 2018; Adams et al., 2018; Wong et al., 2013). Nevertheless, few studies have explored how the head nurse's specific actions at multiple clinical and organizational levels can influence the decision-making processes that guide team members' behaviors in preventing and controlling HAIs (Nibbelink et al., 2018; Boamah et al., 2018).

Healthcare professionals, throughout the entire patient care process, are responsible for numerous decision-making processes (Cummings et al., 2018; Cziraki et al., 2020; Labrague et al., 2021). These processes are guided by the integration of interconnected components, such as problem identification, information gathering, searching for the best evidence, clinical and contextual analysis, evaluating options, choosing the best option, implementing the decision, and monitoring outcomes (Bomhof-Roordink et al., 2019; Chisengantambu-Winters et al., 2019). Finally, as frequently happens in healthcare settings, healthcare professionals must make decisions and adopt behaviors under stressful conditions and clinical and organizational uncertainty (Chisengantambu-Winters et al., 2019). Therefore, using the Grounded Theory approach within qualitative research (Charmaz, 2006), the study aimed to explore how the leadership style of head nurse can influence the actions of healthcare professionals, particularly those linked to mental processes that hinder prevention and control measures for HAIs caused by MultiDrug-Resistant Organisms. The research sought to uncover the "invisible" motivations that drive professionals to repeat behaviors that deviate from best practices. Additionally, the study aimed to collaboratively identify with stakeholders effective and context-specific strategies to address these challenges and mitigate the adverse outcomes associated with such infections.

1.3 Structure of the doctoral project

The doctoral framework considered the various dimensions of the organizational context and decision-making processes that can influence the frequency of Healthcare-Associated Infections (HAIs) across different care settings within acute care hospitals (*Figure 2*).

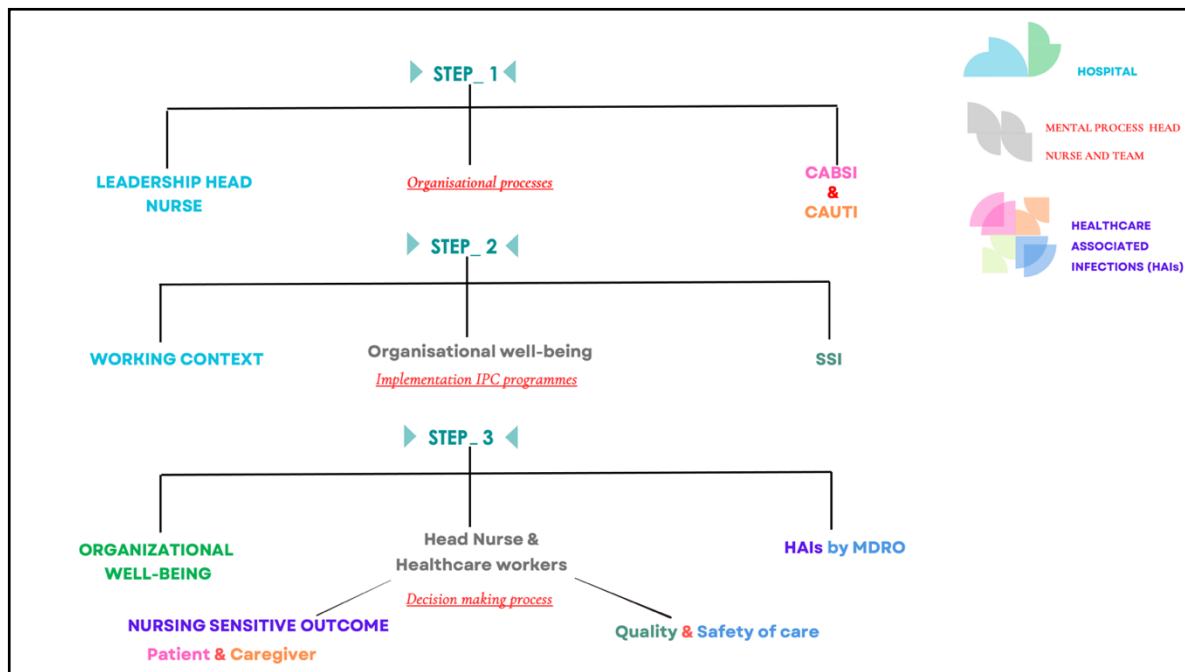


Figure 2: Structure of the doctoral project

Legend

IPC: Infection Prevention Control

CABSIs: Central Associated Bloodstream Infection

CAUTIs: Catheter-Associated Urinary Tract Infection

SSI: Surgical Site Infections

MDRO: MultiDrug Resistant Organism

Chapter Two is a literature review aimed at exploring the relationship between HAIs and the leadership style of the head nurse.

Chapter Three tested a multi-dimensional model to understand the relationships between certain organizational context variables—such as staffing, stress related to demands, and nurse

workloads—and the occurrence of surgical site infections. The empirical analysis was conducted on a sample of nurses and patients in medical and surgical wards of a large metropolitan hospital in northern Italy.

Chapter Four presents a research protocol with the primary objective of describing the thought processes that guide the behaviors of healthcare professionals (head nurses, nurses, healthcare assistants, and physicians) in two large hospitals in northern and central Italy during activities aimed at preventing and controlling HAIs caused by Multidrug-Resistant Organisms.

Chapter Five reports the results of the qualitative research and the practical implications this line of inquiry has for clinical and organizational practice, providing significant contributions to this project with real examples of strategies to enhance adherence to infection prevention and control (IPC) programs. Furthermore, recognizing the need to keep pace with organizational contexts and epidemiological and social changes, future research and development pathways within healthcare organizations and university training programs are outlined.

Chapter Six outlines the main implications of the relationship between the leadership style of the head nurse and HAIs. Additionally, potential future research directions will be identified to improve care outcomes and ensure the quality of care.

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2 Healthcare Associated Infections and Nursing Leadership.

A Systematic Review.

2.1 Introduction

In this second chapter, the results of the literature review will be presented, aimed at exploring the relationship between HAIs and the leadership style of the head nurse (*Figure 3*). Specifically, Table 1 will outline the aspects already known in the literature and what the study has revealed.

Table 1: *Summary of Known and New Scientific Evidence*

What is already known about this topic?	What does this research add?
<i>Nursing leadership influences nursing performance, the quality of care, and patient safety.</i>	<i>The rates of infections associated with the use of devices such as urinary catheters and central venous lines are influenced by the indirect effect of the head nurse's leadership style.</i>
<i>Authentic, relational, and transformational leadership styles have a positive impact on the quality of work life and the well-being of nurses.</i>	<i>Healthcare organizations should promote the participation of head nurses in training programs aimed at strengthening specific leadership skills, such as communication and problem-solving.</i>
<i>Nurses guided by head nurses with an authentic and transformational leadership style are more responsible and autonomous, showing greater decision-making autonomy in clinical practice, and as a result, improving their performance.</i>	

Figure 3. *Conceptual framework*

2.2 ABSTRACT

Background: Healthcare-associated infections are strictly related to healthcare practices. A head nurse stimulates and motivates nurses, boosts nurses' job performance and satisfaction, and can influence adverse event development.

Aim: To explore the relationship between healthcare-associated infections and head nurse leadership style.

Methods: A systematic review was conducted. The search was conducted from 1973 until March 2022 on PubMed, Cochrane Library, Scopus, CINAHL, Web of Science, Embase, and APA PsycInfo databases. The review followed the Joanna Briggs Institute Manual for Evidence Synthesis and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. A thematic synthesis and critical appraisal of the included studies have been conducted.

Results: Eight articles were included in this review. Head nurses' leadership, supported by the organization, can positively influence the job performance and job satisfaction of nurses by reducing infection rates associated with vascular access and urinary catheters.

Discussion: Authentic and transformational nurse leadership styles can foster targeted interventions and improvements tailored to preventing and controlling healthcare-associated infections. Even if there is limited evidence, the results support that the occurrence of infections can be reduced by leadership strategies implemented by head nurses.

Keywords: *Cross infection, head nurse, healthcare-associated infection, leadership, nurses, nursing, supervisory, nursing leadership style*

2.3 Background

Healthcare-Associated Infections (HAIs) remain problematic for patient safety and can cause prolonged hospital stays, long-term disabilities, increased costs for patients and their families, and excess deaths (Chen et al., 2017). The prevalence of patients with at least one HAI on a given day in a European Union/European Economic Area hospital has been estimated at 5.9% (Suetens et al., 2018). This data is also associated with 1) adverse events for the patient (Allegranzi et al., 2011) and 2) the organization and the whole community (Zimlichman et al., 2013). Concerning adverse events, the risk of HAI, morbidity, and mortality increases with the duration of the patient's stay in hospital. Mitchell et al. (2018) define HAIs as adverse events that have been defined as occurring 48 h or more after hospitalization. HAI can develop during hospital stays or when the patient returns home (WHO, 2020). The most frequent HAIs are those associated with the use of a device (e.g., vascular access device) and those that develop after surgery (Suetens et al., 2018). HAIs may cause a significant increase in healthcare costs (Scott et al., 2019).

In addition, an infected patient requires more care and assistance, with a significant workload for professionals (Giuliani et al., 2018). This involves an increase in resources and costs. A ward that has more infections will have more costs (e.g., pharmaceutical administration), and a need for more resources to the detriment of other departments where the infection is prevented and controlled.

To reduce the phenomenon of HAIs, international organizations have put forward numerous recommendations (WHO, 2020). Indeed, to reduce and/or prevent HAIs, healthcare organizations have been recommended to a) build multi-professional teams; b) collaborate with Infection Prevention Control (IPC) departments; c) operate in compliance with certain guidelines; d) create and implement HAI surveillance and monitoring systems; e) provide clean environments (Storr et al., 2017); and f) control healthcare professional workloads and staffing levels (Mitchell et al., 2018; Wong et al., 2013).

In addition to these recommendations, the literature has indicated the existence of other critical factors in the development and spread of HAIs in the hospital environment, which have been grouped into three macro-categories: environmental factors, care-associated factors, and patient-related factors (Al-Tawfiq et al., 2014). Among the care-associated factors, nursing care plays a key role. Such factors identified as crucial for the governance of HAIs include staffing levels, burnout, organizational support, training (Cummings et al., 2021; Mitchell et al., 2018), and head nurse leadership style (Hegarty et al., 2019; Van Buijtene et al., 2019).

The head nurse is a nurse with a clear understanding of nursing care, organization, and leadership. A nurse leader is a key member of the team, collaborating with nurses and the entire team and supporting them in clinical and management practice. (Cummings et al., 2021).

If we assume that the leadership style exercised on followers allows the reaching of set goals (Northouse, 2016), this must also apply to nursing care processes, in which the goal is the satisfaction of patient health needs. Indeed, functional nursing leadership must be present. Ferreira et al. (2022) note that a stimulating and motivating leadership style of nurses can improve patient outcomes. Cummings et al. (2018) consider that this type of leadership has positive effects on job satisfaction. Warshawsky (2020) suggests that stimulating and motivating leadership can help to achieve organizational objectives by improving the efficiency of the management.

Moreover, prior research has found that the leadership style of the head nurse has a fundamental influence on the nursing team, both positively in terms of engagement (Cziraki et al., 2020) and commitment (Cummings et al., 2018), and negatively in terms of burnout (Ferreira et al., 2022), nurses' performance (Landerfelt et al., 2020), and patient satisfaction (Zaghini et al., 2020).

The World Health Organization (World Health Organization, 2009) recognizes the importance of an adequate, appropriate, and efficacious leadership style by the head nurse, and therefore promotes a participative and interprofessional profile of leadership, in which all members of a team share objectives, responsibilities, and results. Accordingly, the head nurse is responsible for creating an

efficient and effective working environment (Cziraki et al., 2020), and for promoting behaviours and actions that favour the reduction of adverse patient outcomes (Labrague et al., 2021), including HAIs.

However, the variables of the head nurse leadership style are not isolated. They compete with other variables in the infections' development. HAIs are also influenced by the organizational settings, governance, and ethical choices of the hospital (Cummings et al., 2021). Then, the variables of the head nurse's leadership should be evaluated in the context (Hegarty et al., 2019). Different interdependent and organizational variables can influence the head nurse's leadership style, staff well-being, and, ultimately, patient outcomes. Therefore, the head nurse's leadership style should be compatible with the context and the team (Van Buijtene et al., 2019), since what may be good for one team of nurses, or a multidisciplinary team, may not have similar positive effects on individuals in another healthcare setting, even with the same characteristics (Lega et al., 2017).

Although the literature is rich in studies that have explored the relationship between head nurse leadership style and organizational context variables, it is important to further investigate how this may impact both HAI and management (Adams et al., 2018; Fisher et al., 2019; Wong et al., 2013). To date, studies have focused on understanding and analyzing the relationship between the management leadership style, nursing staffing, and HAI rates (Mitchell et al., 2018; Storr et al., 2017; Warshawsky, 2020; Wong et al., 2013). Understanding whether there is evidence to support the relationship between the head nurse's leadership style and HAI management, including through analyses of the work context, is important for all healthcare organizations, since it may influence access to related training and support programs for multidisciplinary teams.

Given the above, the main objective of this literature review was to explore the relationship between HAIs and the leadership style of head nurses. In particular, the following research questions were to be answered:

- 1) Which HAIs are influenced by head nurse leadership styles? 2) How are HAIs influenced by the head nurse's leadership style? 3) Is there a relationship between HAIs, head nurse leadership,

and nurses' organizational well-being? 4) Can the management of HAIs, in terms of prevention and monitoring, be influenced by head nurse leadership?

2.4 Methods

Design

The Joanna Briggs Institute (JBI) Manual for Evidence Synthesis (Aromataris et al., 2020) was referred to for the design of the systematic review, while the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA, *see supplementary materials 1*) (Moher et al., 2015) was used to orient the study reporting process. This systematic review protocol has been registered in the International Prospective Register of Systematic Reviews (PROSPERO No. CRD 42022316473).

Search methods

The review search was conducted in March 2022, using the following databases: PubMed, Cochrane Library, Scopus, CINAHL, Web of Science, Embase, and APA PsycInfo. Grey literature was searched via Google Scholar. Websites of international organizations were consulted: the World Health Organization (WHO) and the European Centre for Disease Prevention and Control (ECDC).

The search terms concerned leadership style (nurse, ethical, authentic, and transformational) and HAIs (healthcare-associated infection; nosocomial infection). Observational studies and systematic reviews have been taken into consideration. Moreover, any geographic, type of healthcare has been set. No publication time limits were set for the retrieval of articles (1973 until 03/2022). Included only articles in English and Italian language. Dissertations were excluded.

Following the JBI Manual, the Population, Intervention, and Outcome (PIO) methodology (Methley et al., 2014) was used to formulate inclusion and exclusion criteria (Table 1). Studies that

examined the effect of nursing leaders and type of leadership style on adverse events/HAIs were included. All types of studies and measurement tools were included. The keywords that have been used in the research are nursing leader, leadership style, nursing-sensitive outcome, healthcare-associated infection, nosocomial or hospital infection, urinary tract infection, catheter-related and associated infection, ventilator-associated pneumonia, and wound/ surgical site infection (*Table 2*).

Table 2: *Keywords, inclusion and exclusion criteria*

PIO	Query	Inclusion criteria	Exclusion criteria
Population	(Leadership nurs* OR "head nurse" OR "nursing leader*")	Nurse leadership	Other professionals
Intervention	(Leadership style "Ethical leader*" OR "Transformational Leader*" OR "Authentic leader*")	Leadership style of the nurse coordinator	Undefined leadership style
Outcome	("Nursing sensitive outcome*" OR "Nursing outcome*" OR "Patient outcome*" OR "healthcare associated infection" OR "HAI" OR "nosocomial infection*" OR "hospital infection*" OR "infection control" OR "urinary tract infection*" OR "catheter-related infection*" OR "catheter-associated infection*" OR "ventilator-associated pneumonia" OR "wound infection*" OR "surgical site infection*" OR "postoperative wound infection*" OR "Sepsi*" OR "bloodstream infection*" OR "septicemia" OR "infection rate")	NSO, HAIs related adverse events and the distinction between possible HAIs	Undefined adverse event and HAIs

Search outcome

The software Mendley 1.19.8 was used for the study selection process. After extrapolation of the records from the databases, three researchers (AS, FZ, and JF) analyzed the studies, first by title, then by abstract, and finally by full texts. Any disagreements between reviewers were resolved through consensus discussion.

Data extraction

To organize the information to be extracted, a table was created containing: the identification of the original article, the objective, the methodological characteristics of the study, the setting, the population, the tools, the outcome measured, and the main results. The data were extracted by one reviewer, and the accuracy was checked by the other two reviewers.

Data synthesis

The manuscript synthesis was elaborated via a narrative because the data were heterogeneous. The jointly developed themes were HAIs and leadership styles; the relationship between nursing leadership, nurse well-being, and HAIs; and HAI management and the role of nursing leadership. These three themes were developed to answer the research questions and achieve the main objective of the study.

Quality appraisal

The '*Critical appraisal checklist for analytical cross-sectional studies*' tool, developed by the Joanna Briggs Institute (JBI) (Aromataris et al., 2020) was used for quality appraisal by the three independent reviewers (EC, FZ, and JF). Studies that did not meet the 70% threshold for the relevant appraisal instrument were excluded. Any disagreements that arose between the reviewers were resolved through discussion.

2.5 Results

The literature review identified 2028 records. After removing duplicates, 975 articles were reviewed by reading the title and abstract, and 947 were excluded because they did not correspond to the identified PIO. The full texts of the remaining 28 articles were read and, of these, 8 articles were included in the final review and analysis. Therefore, 20 articles were not included because their research focus was not relevant to this review aim, or their outcomes did not consider the infection outcome. Figure 4 summarizes the review process.

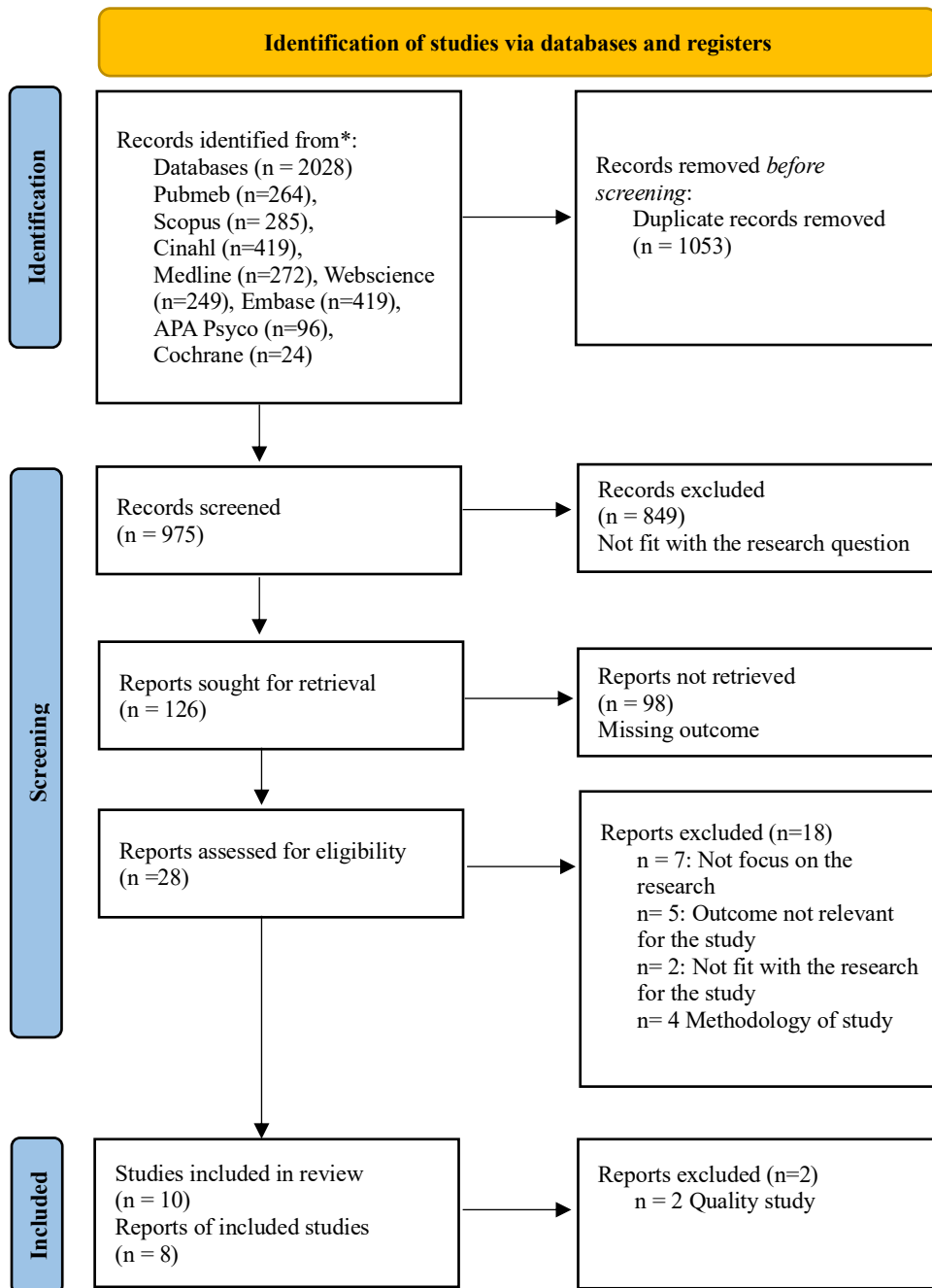


Figure 4. PRISMA 2020 flow diagram

Methodological quality

At first, 10 observational studies were included. However, two studies (Kliger et al., 2015; Landerfelt et al., 2020) were discarded because they were assessed to be of low quality due to the study designs used, undefined outcomes, and a lack of clarity in the conducted analyses.

The remaining eight studies (Adams et al., 2018; Asif et al., 2019; Boamah et al., 2018; Cziraki et al., 2020; Fisher et al., 2019; Labrague et al., 2021; Labrague, 2020; Wong et al., 2013) were assessed to be of high quality. Issues found in the quality assessment of the included studies related to the identification of possible confounding factors and strategies to deal with them. Indeed, most of the studies (n = 7) did not identify strategies to manage confounding factors, except for Asif et al. (2019), who, however, only performed confounding factor analysis for a possible response rate. Finally, it should be mentioned that Fisher et al. (2019) extracted the outcomes from a national register and an internal register of the organization in which the study was conducted without a specific description of how and when the data were collected (*Table 3*).

(Table 3. Quality Analysis of the Included Articles)

Study characteristics

Eight studies were included in this systematic review (*Table 4*), of which two were observational studies (Cziraki et al., 2020; Fisher et al., 2019), six had a cross-sectional design, and one was a multicenter study (Labrague, 2020). The studies were published within the last decade and were conducted in America (n = 5/8) and Asia (n = 3/8). The population comprised 5011 Registered Nurses (83%) and Head Nurse (17%) and most worked at acute hospitals (*Table 4*).

From the perspective of the instruments used in the studies included in the review, it was verified that all eight studies used self-report questionnaires administered to the selected sample. It was possible to group the scales contained in the questionnaires into the following categories: a) type of leadership (e.g. Authentic Leadership Questionnaire, Walumbwa et al., 2008); b) structural empowerment (e.g. Structural Empowerment Scale, Laschinger et al., 2006); c) staff well-being (e.g. Global Job Satisfaction, Hackman & Oldham, 1976); d) adverse events (e.g. Adverse Patient Events Scale, Laschinger & Leiter, 2006); e) quality of care (e.g. Quality of Care Measure, Aiken et al., 2017); and f) actions taken for patient safety (e.g. Patient Safety Actions, Van Bogaert et al., 2014).

From the analysis of the included articles, and according to the research questions, three thematic areas were identified for reporting the results: 1) HAIs and nursing leadership styles; 2) the relationship between nursing leadership, nurses' well-being, and HAIs; and 3) HAI management and the role of nursing leadership.

HAIs and nursing leadership styles

Regarding the main objective of the included studies, we were able to verify that seven of the eight selected studies investigated the correlation between HAIs and the head nurse leadership style (Asif et al., 2019; Boamah et al., 2018; Cziraki et al., 2020; Fisher et al., 2019; Labrague et al., 2021; Labrague, 2020; Wong et al., 2013). Contrary, the study by Adams et al. (2018) aimed to examine the relationship between nurse leader practice characteristics and patient outcomes. This study has

been included because it is considered a criterion of the leadership, that is, the coordinator indirectly exerts on the team.

In general, head nurse leaders are fundamental to healthcare organizations because they influence the organizational culture, including the safety of care and adherence to infection prevention control programs (Granqvist et al., 2024). In addition, all studies emphasised that a relational leadership style is associated with reduced HAI rates or incidences of adverse events for patients (Asif et al., 2019; Boamah et al., 2018; Cziraki et al., 2020; Fisher et al., 2019; Labrague et al., 2021; Wong et al., 2013). In particular, Cziraki et al. (2020), using the conceptual model developed by Conger and Kanungo (1988), demonstrated that having an accountable leader facilitated interprofessional collaboration ($\beta = 0.39$; $p < .001$) by increasing nurses' self-efficacy ($\beta = 0.31$; $p < .001$) and reducing adverse patient events ($\beta = -0.23$; $p < .001$). In their work, Labrague et al. (2021), also argued that the authentic leadership of the head nurse had a reductive impact on HAIs ($\beta = -.07$; $p = .024$). Fisher et al. (2019), in their study of Magnet hospitals, described the relationship between transformational leader behaviour and the occurrence of adverse events (catheter-associated urinary tract infections, or CAUTIs; and central line-associated bloodstream infections, or CLASBIs). It was found that when a leader was able to 'inspire a shared vision' and 'challenge the process' (Fisher et al., 2019), CAUTI and CLASBI rates were reduced by 6% and 17%, respectively. For Adams et al. (2018), some characteristics of the leader, such as authority ($r = -0.34$; $p < .011$), access to resources ($r = -0.35$; $p = .015$), and leadership expectations of staff ($r = -0.45$; $p = .007$), had a reducing effect on CAUTIs. Conversely, a toxic leadership style has been found to correlate with an increase in CAUTIs ($\beta = 6.29$; $p < .001$) and reduced quality of care ($\beta = -0.22$; $p < .001$) (Labrague, 2020).

The relationship between nursing leadership, nurses' well-being, and HAIs

Concerning the relationship between HAIs and head nurse leadership, several studies analyzed which variables influence patient outcomes. Specifically, four of the eight studies investigated the

mediation effect of some independent variables in the relationship between the head nurse leadership style, nursing outcomes, and the quality of care delivered (Asif et al., 2019; Boamah et al., 2018; Labrague et al., 2021; Wong et al., 2013). The independent variables that were found to negatively mediate the relationship between the leadership style adopted by the head nurse and HAIs were patient safety actions by nurses (Labrague et al., 2021), structural empowerment (Asif et al., 2019; Boamah et al., 2018), job satisfaction (Asif et al., 2019), trust in the leader, and areas of work life (Wong et al., 2013).

Concerning patient safety actions, Labrague et al. (2021) tested the impact of guidelines on nursing outcomes. The guidelines allowed the management of various nursing activities, such as correct hand hygiene, and early reporting of adverse events. The introduction of these actions increased the effect of authentic leadership on the quality of care ($\beta = 0.04$; $p = .002$) by reducing the number of adverse events ($\beta = -0.06$; $p = .057$).

Then, another relevant relationship is between the head nurse's transformational leadership, HAIs, and the well-being of the workers as noted by Boamah et al. (2018). The authors include an explicative variable of the relationship between the head nurses' transformational leadership and HAIs, such as nurses' job satisfaction and structural empowerment. The results of the study showed that a head nurse who exercises transformational leadership increases nurse satisfaction ($\beta = 0.61$; $p < .001$) and reduces the occurrence of HAIs ($\beta = -0.14$; $p < .01$). When the head nurse shares access to organizational and financial information with the nurses, it encourages their participation in clinical care decision-making, and provides them with the opportunity to exercise their clinical leadership at the patient's bedside. This was seen to cause an increase in their motivation ($\beta = .86$; $p < .001$) and a reduction in HAIs ($\beta = -0.63$; $p < .05$).

Also, Asif et al. (2019) confirmed the impact of transformational nursing leadership on workers. When a leader promotes a healthy working environment, motivating nurses and inspiring them, has a positive effect on structural empowerment ($\beta = 0.77$; $p < .001$), on nurses' job satisfaction

($\beta = 0.37$; $p < .01$), on their self-efficacy ($\beta = 0.41$; $p < .01$), on the number of adverse events for patients ($\beta = -0.29$; $p < .01$), and on the quality of care ($\beta = 0.31$; $p < .01$). Finally, Wong et al. (2013) investigated another effect of the head nurse's transformational leadership on the nursing team, such as the trust of the team in the leader. In particular, they also studied whether this relationship could influence HAIs. The study results showed that a nursing team led by an authentic leader had more trust in its leader ($\beta = .69$; $p < .001$) and that this nurse/head nurse relationship can reduce HAIs ($\beta = -0.12$; $p < .01$).

HAI management and the role of nursing leadership

The results of the studies show that it is possible to govern the phenomenon of HAIs in clinical practice through nursing leaders who promote multi-professional collaboration and interprofessional communication (Cziraki et al., 2020). Furthermore, through the promotion and stimulation of the job satisfaction of nurses (Asif et al., 2019; Boamah et al., 2018), the nurse leader is capable of positively influencing their performance (Asif et al., 2019), thereby increasing the quality of care and patient safety. Moreover, to reduce negative patient outcomes such as HAIs, organizational governance should work on alignment between individual professional and organizational expectations (Wong et al., 2013), the dissemination of IPC guidelines (Labrague et al., 2021), and the continuous monitoring of nursing outcomes, adverse events, and patient and family claims (Labrague, 2020; Labrague et al., 2021).

The studies also suggested that, in addition to nursing leadership, a good corporate error culture program, with a proactive and non-punitive approach, should also be provided, since the involvement, empowerment, and autonomy of nurses in reporting adverse events (Cziraki et al., 2020; Labrague et al., 2021) and the possibility of being allowed to participate in identifying possible corrective actions improves nurses' performance, with clear reductions in CAUTI and CLASBI rates (Cziraki et al., 2020). Finally, the studies stated that the relational leadership style of the head

nurse, as well as the communication skills of problem-solving, decision-making, and persuasion (Adams et al., 2018), were essential for multi-professional teams to counteract HAIs (Asif et al., 2019; Boamah et al., 2018; Cziraki et al., 2020; Fisher et al., 2019; Labrague et al., 2021).

(Table 4. Summary of Researched Studies)

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2.6 Discussion

This systematic review summarizes evidence from the literature on the relationship between HAIs and head nurse leadership style. Overall, the findings have been consistent with previous systematic reviews that supported the argument that the influence of the head nurse's leadership style can lead to negative patient outcomes (Cummings et al., 2018; Ferreira et al., 2022; Van Buijtene et al., 2019; Wong et al., 2013). Studies have established that authentic and transformational leadership styles have a positive impact on countering HAIs. It is reasonable to expect these results because nurses guided by leaders with such approaches are encouraged to work according to evidence, to seek solutions or alternatives suitable for their work context, to share and collaborate in the team clearly and transparently, to promote change in nursing practice, and finally to exercise their clinical leadership at the patient's bedside.

Despite this premise, only two (Adams et al., 2018; Fisher et al., 2019) of the eight studies (*Table 4*) found a close correlation between the head nurse leadership style and specific types of HAIs. It was observed that the rates of CAUTIs and CLASBIs were negatively influenced by the indirect action of the nursing leaders' behaviours and attitudes toward the nurses (Adams et al., 2018; Fisher et al., 2019). In the rest of the studies, a questionnaire was used to assess adverse events (Laschinger & Leiter, 2006). Nurses were asked to complete a questionnaire in which they reported, according to a Likert scale, the frequency of adverse events, including HAIs, that had occurred concerning their patients in the last year. Therefore, data measurements and aggregations did not take into account the different types of HAIs that could occur and other contextual and organizational variables that may influence the outcome of nursing performance (Mitchell et al., 2018; Van Buijtene and Foster, 2019; Zingg et al., 2015). To increase the quality of the evidence produced, a more timely and accurate survey of HAIs would be desirable, and not only the data reported by nurses.

WHO (2020) recommend that a well-organized team is relevant in reducing the risk of HAIs. Following their guidelines, when measuring HAI rates, the multidisciplinary team must be clear about

the standard definition of each HAI, collaborate with the microbiology laboratory, use appropriate diagnostic criteria, and finally collect HAI data in well-structured and constantly updated datasets, to be able to aggregate the information correctly and provide an appropriate interpretation of the data. By such statements, healthcare organizations should implement monitoring and surveillance systems for HAIs (WHO, 2020), to define the correlation between HAIs and head nurse leadership, and implement, together with IPC specialists, the most appropriate corrective interventions for the specific healthcare setting. Future researchers when approaching these issues should take such methodological aspects into account, and distinguish between risk and diagnosis for each HAI according to standard criteria.

The review made tangible the influence of nursing leadership on the quality of working life and working well-being of nurses, and consequently on HAIs. At times, this leader's influence in managing HAIs was enhanced by the use of corporate operational tools and systems (Asif et al., 2019; Boamah et al., 2018; Labrague et al., 2021), allowing nurses to be more accountable and autonomous and to actively participate in the patient care process, reducing the frequency of HAIs themselves (Wong et al., 2013). The findings therefore suggest the need to develop organizational strategies to create positive working environments and provide for (a) periodic monitoring of feedback on the head nurse's performance by nurses, to enhance their skills; (b) the reading of patient and family claims to implement improvement interventions; and (c) the scheduling of role training/support interventions involving the nurse leader, to encourage participative, collaborative, and context-specific leadership styles.

Limitation

This review has some limitations. The eight studies measured the effect of their observations through different scores and evaluations that could not be summarized and only two of these studies measured device-related infections. Most of the identified studies focused on the

United States and other high-income countries. The lack of research in different socioeconomic and cultural settings makes the results difficult to generalize. The health systems and context of the included countries, as well as technological innovations, may differ from other countries. Self-reports were used in the assessment of the head nurse's leadership style, adverse events, and quality of care. In several studies, individual, organizational, and infrastructural factors that may influence the quality of care and adverse events were not taken into account. The aggregate results of HAIs may be associated with several types of HAI evaluated without a clear definition by the authors. Further research using a more rigorous research design (e.g., experimental) would be needed to test the effectiveness of a head nurse leadership development program in improving HAI outcomes.

However, this review does provide a valuable summary of how HAIs can be influenced by authentic and transformational leaders, and how the leadership styles of such leaders can promote a culture of safety in their operational units.

2.7 Conclusion

This study shows that the relationship between HAI and leaders is weak. The head nurse's leadership style is one of many variables that can affect healthcare-associated infection. Even if there is limited evidence, the results support the argument that the occurrence of HAIs can be reduced by leadership strategies implemented by head nurses about their followers. The positive influence on nurses can be mediated by certain operational tools, including the leader's behaviours and opportunities given to nurses to participate in decision-making and organizational processes. Nurses who are more motivated, autonomous, accountable, open to change, and to nursing approaches that emphasize an evidence-based infectious risk culture will improve their nursing performance.

However, policies to combat HAIs within healthcare organizations require not only competent and qualified leaders, but also precise actions and direction from the organization itself and the management.

This review is an opportunity to understand the relationship between the occurrence of HAIs and the nursing leader within operational units. Future research should define and measure HAIs according to international guidelines (WHO, 2020), with a clear and precise methodology, and consider possible confounding factors in the data collection and analysis, to appropriately generalize obtained results.

Supplementary materials 1. PRISMA 2020 Checklist

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3 The Nursing Organizational Context and the Surgical Site Infections. A Structural Equational Model.

3.1 Introduction

In this third chapter, the results of the multidimensional model used to understand the relationships between certain variables in the organizational context—such as staffing, stress related to demands, and nurses' workload—and the occurrence of Surgical Site Infections will be presented (Figure 5). Specifically, Table 5 will outline aspects already known in the literature and what the study has revealed.

Table 5: *Summary of Known and New Scientific Evidence*

What is already known about this topic?	What does this research add?
<i>Surgical site infections (SSIs), like all healthcare associated infections, are influenced by multiple variables such as clinical conditions, nurse well-being, and the organizational context.</i>	<i>Increasing the number of nurses within the nursing team reduces the likelihood of developing a surgical site infection (SSI).</i>
<i>Prevention of SSIs is a complex and multidimensional process, where education and training of nurses play a crucial role in managing these infections.</i>	<i>In a positive organizational environment, nurses are more motivated, satisfied, and focused on ensuring better adherence to infection prevention and control practices.</i>
	<i>Nurse managers should reflect on the organization of nursing work in different care settings and find a balance between patient needs, professional expectations, and organizational requirements.</i>

Figure 5. *Conceptual framework*

3.2 ABSTRACT

Aim: To assess the relationships existing among variables of the organizational context -staffing, stress-related demands, workloads - and the occurrence of Surgical Site Infections (SSIs).

Design: An observational study was conducted

Methods: A convenience sample of nurses working directly with patients were enrolled. Staffing levels, workload, and stress were measured using valid and reliable instruments. In according to the European Centre for Disease Prevention and Control classification, the prevalence of SSIs was measured for 30 days. Structural equation modeling was performed.

Results: This study enrolled 133 nurses. The high prevalence of SSI was associated with the inadequacy of nurses during daily shifts, increased workloads and evolving patient needs, as well as increased nurses' stress resulting from work demands.

Discussion: Even if the SSIs required multidisciplinary collaboration, this study showed that the nursing organizational context, in terms of staffing level and workloads, influenced directly nurses' stress and indirectly SSI prevalence.

Conclusion: Nursing managers and head nurses should improve the nurses' working conditions and promote specific interventions for their organisational well-being to influence SSI prevalence.

Keywords: *Occupational Stress; Nurses; Nursing Staff; Surgical Wound Infection; Workload.*

3.3 Background

Healthcare-associated infections (HAIs) have been identified by the World Health Organisation (WHO) and the European Centre for Disease Prevention and Control (ECDC) as a global health challenge (Zingg et al., 2019). Surgical site infections (SSIs), the most frequent HAIs, occur at or near the incision site within 30 days or 90 days post-implant surgery (ECDC, 2017; Allegranzi et al., 2016).

SSIs have substantial implications for patients and healthcare systems (ECDC, 2023). When they are identified, further diagnostic tests and antibiotic treatment are required, often necessitating hospital readmissions and intensive care (ECDC, 2017). SSIs also affect patients' lives, causing prolonged isolation from family members and work colleagues (Costabella et al., 2023).

The WHO (2016) guidelines for SSI prevention lack the organizational strategies needed to manage SSI risk factors (Zingg et al., 2015). SSI prevention is a complex and multidimensional process, requiring adequate staff training and expertise to understand the risks associated with the type of surgery and the patient's clinical condition, and to implement effective SSI prevention and control (WHO, 2016). The implementation of evidence-based care practices, such as preoperative patient body wash (Jurt et al., 2021), perioperative glycaemic control, antimicrobial prophylaxis, and institutional and formal nurses' training decreased SSI incidence by up to 60% (Horgan et al., 2023). It is not yet clear what influence staffing characteristics, work organization, and the well-being of nurses can have on the SSI development (Tvedt et al., 2017). This study aimed to use a multi-dimensional model (*Figure 6*) to assess the relationships that exist among some organizational context variables such as staffing, stress-related demands, workloads, and SSIs.

Theoretical Framework

Research shows that HAIs are associated with clinical and working context variables. Clinical variables include the patient's condition, the type of surgery, and the antibiotic treatment administered (Allegranzi et al., 2016; ECDC, 2023). Working context variables include the level of nursing staffing,

which evidence suggests should be 1:6 (nurse: patient; Aiken et al., 2024) the nursing leadership style (Cummings et al., 2020), technological innovation (Mitchell, et al., 2018), and the organizational context (van Buijtene et al., 2019; Zingg et al., 2015). Nurses' education and skills are other determinants in HAI development; a low rate of HAIs is observed when patients are cared for by a clinical nurse specialist, or a highly trained and experienced nurse (e.g. wound care nurse, or nurse practitioner; Mitchell et al., 2018). In this regard, Zingg showed that high bed occupancy, inadequate staffing levels, unbalanced workload regarding resource availability, and poor availability of equipment and materials affected the Infection Prevention Control Program (IPC) implementation (Zingg et al., 2015).

3.4 Methods

Aims and Hypotheses

Despite this evidence, the literature often provided aggregated HAI data, without differentiating by typology and investigating the impact of contextual variables on HAIs (Mitchell et al., 2018). For example, while literature focuses on the surgical nurse's knowledge and training to reduce SSI occurrence (Horgan et al., 2023), the relationship between nurses' shift staffing and SSI occurrence is unclear. *Given the above, it could be hypothesized that (H1) there is a relationship between staffing levels (patient-nurse) and SSIs.*

In recent years, nurses have managed an increasing number of additional organizational demands. These demands included professional responsibilities for dealing with COVID-19, following institutional duties on documentation and adhering to institutional policies and protocols, which, combined, severely influenced nurses' lives (Zaghini et al., 2020). Initially, nurses could cope with the challenging working conditions, completing the required tasks and investing heavily in their psychophysical resources (Zaghini et al., 2020). However, over time, these coping strategies did not

compensate for the organizational demands, thus, nurses' stress increased and job satisfaction and quality of care decreased (Zaghini et al., 2020; Wenderott et al., 2023). Therefore, it would be interesting to understand how nurses' psychophysical conditions, due to the organizational demands and working conditions, might affect SSI development. *It could be hypothesized that (H2) there is a relationship between working demands, nurses' psychophysical condition, and SSIs.*

The surplus workload for nurses could depend on various factors, such as the patient's clinical condition, caring time, new technologies, the nurse-patient ratio, turnover (Ivziku et al., 2022), and the preventive measures against HAIs (Giuliani et al., 2018). Recognizing and containing SSIs requires skilled and competent nurses (ECDC, 2017), access to necessary equipment and tools, and enough staff to effectively care for patients (Peutere et al., 2023). Organizations that fail to understand their working contexts and implement strategies to deal with the dynamic flow between the organizational demands and nurse shifts in each care setting, could lead us *to hypothesize that (H3) there is a relationship between nurse workload and SSIs (Figure 6).*

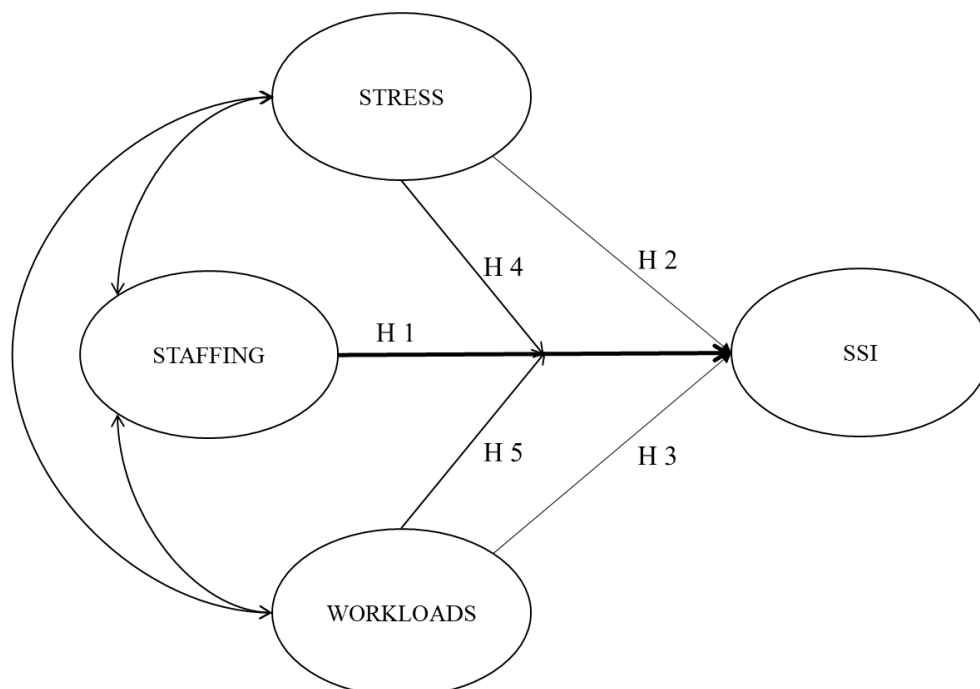


Figure 6. Model of research hypothesis

Note: SSI = Surgical Site Infection.

Study Design

A single-centre observational study was conducted from September to November 2022. The checklist 'Strengthening the Reporting of Observational Studies in Epidemiology' (STROBE) was used to conduct and report this study (Vandenbroucke ET AL., 2007).

Study Setting

The study was conducted in a 1200-bed Italian hospital, where nurses followed a shift schedule divided into time slots: morning (7:00 am - 2:00 pm), afternoon (2:00 pm - 9:00 pm), and night (9:00 pm - 7:00 am). The hospital SSI protocol included prevention, identification, management, staff training and education, patient education, use of technology, and audit conduction. The protocol was based on the ECDC recommendations (2023) and was clinically implemented in January 2022 by the infection control nurses and head nurses. Ward nurses were responsible for SSI prevention, management, treatment, and follow-up.

Sampling

A sample of nurses working in different wards (oncology, surgery, and medicine) was enrolled. Nurses who voluntarily consented to participate had to have worked in direct contact with patients for at least six months. Novice nurses in the organization (working experience of less than 6 months), leaders, and nurses' managers were excluded from the study.

Ethical Considerations

The study followed the Declaration of Helsinki principles (World Medical Associated, 2024) and was approved by an Ethics Committee (Prot. No. S00008/2022). To ensure anonymity, all participants were assigned an alphanumeric code and data was analysed in aggregate form. Online

data storage was created and protected by a double identification system (personal ID and secure code), which was accessible only to the researchers.

Data Collection

A web survey, via the participant's hospital email, was used to collect responses. About 164 e-mails were sent with weekly reminders. The first page described the study aim and asked for their informed consent. The questionnaire was fully anonymous and completed once by each participant. Additionally, staff levels and SSI prevalence were collected over one month.

Instruments

Data were collected using two tools. The first, the Nurse Questionnaire, was a 2-part web survey. The first section collected the participant's sociodemographic and work-related data, and the second used two validated scales.

The Quantitative Work Index (QWI) assessed perceived workloads through four items, with a Cronbach's alpha (α) of 0.82 in the previous study (Spector et al., 1998; Barbaranelli et al., 2013) and 0.89 in this study.

The Health Safety Executive Indicator tool (HSE-IT) evaluated perceived work-related stress through nineteen items, with α of 0.85 in the previous study (Marcatto et al., 2011) and 0.86 in this study.

The second tool (Outcomes Form) was a specially developed form to collect SSI information and nursing staffing levels. It was filled in daily by each ward head nurse for 30 consecutive days detailing the number of nurse staff on the three scheduled shifts and the SSI prevalence (Fiorini et al., 2022). SSIs were diagnosed based on specific symptoms described by ECDC (2017) Before data collection, head nurses were trained to correctly complete the form.

Statistical analysis

The sociodemographic, working characteristics and instrument measurements were analysed using descriptive (mean and standard deviation SD) and inferential statistics (Pearson's correlation and linear regression). The instruments' internal consistency was estimated through Cronbach's α (Nunnally, 1994). To test the percentage of variance shown by the independent variables (staffing, workloads, and stress) versus the dependent variable (Surgical Site Infections), a linear regression test with the step-back method was used. To test the hypotheses under study, a Structural Equation Model (SEM) with reliability correction for the one-dimensional variables was constructed using the Maximum Likelihood (ML) method and was conducted at ward level, pairing nurses' responses to SSI prevalence. The fit indices considered acceptable were chi-square (not significant), RMSEA (< 0.06), CFI (> 0.90), TLI (> 0.90), and SRMR (< 0.08) (Muthén et al., 2012). SPSS Ver 22® and MPlus® Ver 7.1 were used for analysing data, setting the significance level at $p < 0.05$.

3.5 Results

Sample and organizational characteristics

The sample, with a response rate of 81%, consisted of 133 nurses, mainly women ($N = 105$; 78.9%) with a mean age of 37 ($SD = 9.6$). Most of the nurses ($N = 101$; 75.9%) had a bachelor's degree in nursing and were married ($N = 59$; 44.4%). Sixty-three per cent of nurses worked in the medical area ($N=84$), 21% in the surgical area ($N=28$), and 16% worked in the oncology ward ($N=21$). Nurses worked a mean of 8.4 hours daily ($SD = 5.5$) and worked as nurses for a mean for 11.68 years ($SD = 8.8$). Nurses perceived a workload level mean of 3.29 ($SD = 1.11$) and stress level of 2.78 ($SD = 0.78$).

Staffing levels (nurse/patient ratio) measured were found to be daily at a mean of one nurse for over seven patients ($SD = 0.3$). The staffing level for shift scheduling is described in Table 6.

During the 30 days of data collection, a prevalence of 654 SSIs was measured. Specifically, 102 occurred in the neurology ward (15.60%), 43 in rehabilitation (6.57%), 153 in oncology (23.39%), 162 in surgery and hepatology (24.77%), 22 in nephrology (3.36%), 122 in the trauma centre (18.65%), and 50 (7.65%) in cardiology.

Table 6. *Socio-demographic and occupational characteristics of the sample (N = 133)*

	N	%	M	SD
Age			37	9,6
Gender				
Male	28	21,1%		
Female	105	78,9%		
Non binary	-	-		
Marital Status				
Single	68	51,1%		
Married	59	44,4%		
Separated/Divorced	6	4,5%		
Professional Title				
University diploma	32	24,1%		
Bachelor's degree	101	75,9%		
Clinical Setting				
Medicine	84	63%		
Surgery	28	21%		
Oncology	21	16%		
Working Years			11,6	8,8
Daily working hours			8,4	5,5
Weekly extra working hours			13,6	34,7
Number of working absences for sickness in the last 6 months			3,9	7,2
Ratio Staffing (nurses: patients)			1:7,1	0,3
Ratio Staffing Morning			1:5,3	0,3
Ratio Staffing Afternoon			1:7,7	0,3
Ratio Staffing Night			1:9,1	0,3

Note: M = mean; SD = standard deviation.

Correlations

A negative correlation was found between SSIs and staff levels ($r = -0.51$; $p < 0.001$). Stress ($r = 0.26$; $p = 0.003$) and workloads ($r = 0.23$; $p = 0.007$) were positively correlated with SSI (Table 7).

Table 7. Descriptive analysis, reliability, and correlations among the studied variables.

Variable	M	SD	α	SSI	Staffing	Stress
SSI	11,88	12,03	-			
Staffing	0,14	0,03	-	-		
				0.51**		
Stress	2,78	0,78	0,86	0.26*	-0.05	
Workloads	3,29	1,11	0,89	0.23*	-0.10	0.71*
						*

Note: M = mean; SD = standard deviation; α = Cronbach's α coefficient; SSI = Surgical Site Infection; * = significance level $p < 0.05$; ** = significance level $p < 0.001$.

Linear Regression

The regression model analysis was statistically significant ($R^2 = 0.182$; $p < 0.001$) and it showed that nurses' staffing ($\beta = -0.338$; $p < 0.001$), perceived workload, and stress ($\beta = 0.251$; $p = 0.002$) influenced SSI prevalence.

Structural Equation model (SEM)

The SEM demonstrated a satisfactory model fit, as shown in Figure 7 (CFI=0.947; RMSEA=0.076; $\chi^2=926.485$, $df=78$, $p < 0.001$). Regarding the first research hypothesis, the nursing staff levels had a negative and direct association with SSIs ($\beta = -0.39$; $p < 0.001$). Moreover, nurses' stress deriving from the organizational demands was positively associated with SSIs ($\beta = 0.27$;

SSI increase can be determined by low staffing levels, high-stress levels deriving from organizational demands, and high workloads. A negative relationship between the nurse/patient ratio and HAI increase has been already studied (Mitchell et al., 2018). However, our study, focusing on SSIs, corroborated that the synergy between workloads, work demands, and nurses' shift patterns contributed to SSI occurrence. In our study, only in the morning shifts (7 a.m. - 2 p.m.) were the nursing staff well-balanced in the nurse/patient ratio and adhered to the international ratio of 1:6 (Mitchell et al., 2018). Previous research demonstrated that a balanced nursing staff ensured more time for caring activities and specialist consultations, to review the patient's clinical condition (Congdom, 2020). In contrast, the staffing levels registered during the afternoon (2.00 p.m. - 9.00 p.m.) and night (9.00 p.m. - 7.00 a.m.) shifts were inadequate to the desired standard (Congdom, 2020). This work organization could depend on the common belief that the caring activities were mostly performed in the morning rather than in other shifts (Congdom, 2020). During the afternoon and night, workloads were still significant and further aggravated by the activities unfinished in the morning, increasing workloads and stress due to these demands (Books, et al., 2020). Guaranteeing the right staffing level should be a priority for the nursing manager to improve nurse job satisfaction (Wenderott et al., 2023) and quality of care (Dall'Ora et al., 2016).

The SEM results showed a positive association between workloads, stress deriving from organizational demands, and SSI occurrence. As already found in previous studies (Chang et al., 2022; Zaghini et al., 2020) this study confirmed that high workloads and work-related stress interfered with caring activities. With the increased workloads, nurses might dedicate less time to proper hand hygiene (Chang et al., 2022), surgical medication and drainage management (WHO, 2016; ECDC, 201). This increased the risk of SSI (Books et al., 2020), due to missed nursing care and possible mistakes performed by nurses in clinical practice (Farnese et al., 2019).

Nurses working in organizational settings where workloads are balanced and there is an adequate nurse/patient ratio, focus on caring activities and adhere to institutional procedures,

achieving goals more easily and better clinical outcomes (Farnese et al., 2019). A nurse experiencing organizational well-being is also more motivated, satisfied, and adherent to IPC practices (van Buijtene et al., 2019; Zaghini et al., 2020; Zingg et al., 2015), which are vital for effective SSI management (ECDC, 2017). This emphasised the nursing managers' and head nurses' role in making the nurses feel part of the organization, improving their working context, levels of engagement, commitment (Zaghini et al., 2020) and motivation in assessing SSI risk factors, such as blood glucose levels, body temperature and caring for surgical site wounds (WHO, 2016).

Implications of the Study

This study provided two suggestions for clinical and managerial practice. Although strategies to prevent SSIs were always evolving and implied the collaboration of the entire healthcare team (Horgan et al., 2023), the results showed that SSIs are inevitable (ECDC, 2017). Therefore, a first reflection is that nursing managers need to take responsibility and awareness that the process of managing SSIs and the nurses' organizational context were essential to identify gaps in the complex patient care process (Farnese et al., 2019; Zaghini et al., 2020)

Specifically, the obtained results could make us reflect on the motivations that determined the team climate (Cummings et al., 2020) and the meaning systems (e.g. values, and behaviours) of each team's professional (Farnese et al., 2019). This approach was typical of Magnet hospitals (Fisher et al., 2019) where attention to people's safety and quality of services were always their gold standard (Graystone, 2017) Therefore, it would be necessary for the organisation to take an interest in the well-being of its professionals and the quality of the care provided, implementing flexible healthcare models that consider the patient's clinical condition, work organisation, and the skills and abilities of each professional (Tvedt et al., 2017). Another driver to promote organisational change is the specific nurses' training. Indeed, literature has already shown that this reduced SSI rates (Horgan et al., 2023) Training could increase the nurses' awareness of their orientation to malpractice and their key role in

influencing the patient's clinical course of care. Aware nurses can influence and shape the organisational culture of the ward if supported by their head nurse and the entire organisation.

Limitations

The study results must be considered in light of some limits. A small number of nurses, enrolled in a single hospital through a convenience sampling, may not allow results generalisability. Besides, this study has not considered nurses' skill mix, which might influence the obtained results, and workload and stress levels were not measured for each performed shift, but only as general data. Furthermore, the self-reporting instrument could have influenced the collection of participants' variables and SSI reporting.

3.7 Conclusion

The nursing organisational context characteristics, of staffing, stress, and workloads, negatively influenced the occurrence of SSIs. Considering the predictive value of organizational context variables on caring outcomes, nursing managers should improve the nurses' working conditions, trying to find a compromise between the context, resources and working demands. When the appropriate number of nurses assigned to care and staffing levels are ensured, work-related stress and SSIs will be lower.

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4 Head Nurse Leadership: Facilitators and Barriers to Adherence to Infection Prevention Control Programs. A Qualitative Study Protocol.

4.1 Introduction

In this fourth chapter, the research protocol will be presented, with the primary objective of describing the thought processes that guide the behaviors of healthcare professionals (head nurses, nurses, healthcare assistants, and physicians) in two major hospitals in northern and central Italy during activities for the management of Healthcare-Associated Infections caused by MultiDrug Resistant Organisms (*Figure 8*). Specifically, Table 8 will outline the aspects already known in the literature and what the study is expected to reveal.

Table 8: *Summary of Known and New Scientific Evidence*

What is already known about this topic?	What does this research add?
<i>Barriers and facilitators in the management of healthcare associated infections (HAIs) are primarily related to the organizational environment, the characteristics of the healthcare professional's interventions, and the type of processes involved.</i>	<i>The research will analyze the barriers and facilitators that hinder adherence to Infection Prevention Control programs, develop strategies to minimize the impact of non-supportive behaviors, and focus on variables that promote adherence to best practices.</i>
<i>Continuous education is essential for every team member to develop clinical, organizational, relational, and communication skills that are effective in addressing emerging challenges, such as those related to infections caused by multidrug-resistant pathogens.</i>	<i>Additionally, the study's results may provide educators with further insights for developing and/or implementing training programs to support decision-making based on the most up-to-date evidence. At the same time, the findings could guide healthcare managers in identifying potential care models that could help achieve the desired outcomes.</i>

Figure 8. *Conceptual Framework*

4.2 ABSTRACT

Background. The effective management of Healthcare-Associated Infections (HAIs) relies on the implementation of good practice across the entire multidisciplinary team. The organizational context and the role of head nurses influence the team's performance and behavior. Understanding how decision-making processes influence healthcare professionals' behavior in the management of HAIs could help identify alternative interventions for reducing the risk of infection in healthcare organizations. This study aims to explore how the behaviors promoted and actions implemented by the head nurse can influence healthcare professionals' adherence to Infection Prevention and Control (IPC) programs. **Methods:** A multi-center qualitative study will be conducted using a Grounded Theory approach. Observations will be conducted, followed by individual interviews and/or focus groups. A constructive and representative sample of healthcare professionals who care directly for patients will be enrolled in the study. The COnsolidated criteria for REporting Qualitative research (COREQ) checklist will be followed to ensure the quality of this study protocol. A multistep inductive process will be used to analyze the data. **Conclusions:** The study results will provide an understanding of how nurses perceive the influence of leadership and how they modify their behaviors and activities toward patients according to IPC programs. The study will identify barriers and facilitators to IPC compliance and suggest strategies to minimize negative patient outcomes, such as the development of an HAI.

Keywords: *Cross Infection; Leadership; Drug Resistance Multiple; Nurses; Qualitative Research.*

4.3 Background

In recent years, increased attention has been focused on infections acquired by patients in healthcare facilities within 48 h of hospitalization (König et al., 2021), particularly those caused by multidrug-resistant microorganisms (MDROs), such as carbapenemase-resistant *Escherichia coli*, third-generation cephalosporin and carbapenemase-resistant *Klebsiella pneumoniae*, vancomycin-resistant *Enterococcus faecium*, carbapenemase-resistant *Acinetobacter*, and *Pseudomonas aeruginosa*. Each year, over 670,000 infections are caused by MDROs, resulting in 33,000 deaths due to the lack of effective treatment (WHO, 2020). The spread of these infections is influenced by various factors, and infection development may be related to intrinsic patient conditions (Allegranzi et al., 2011), and healthcare professionals' adherence to Infection Prevention and Control (IPC) and antimicrobial stewardship programs (ECDC, 2023; WHO, 2016). In addition to these factors, it is possible to include others related to the organization of the hospital (Warshawsky et al., 2020; Zingg et al., 2015) the type of leadership used by managers and head nurses (Cummings et al., 2021), the quality and quantity of resources available (Mitchell et al., 2018), and, most importantly, the culture of patient safety present in the hospital (van Buijtene et al., 2019). The head nurse, also known as nurse managers or charge nurses, are registered nurses responsible for the management and supervision of the nursing staff within a healthcare facility, department, or unit. They also guide, support, and motivate the entire clinical care team to work towards the achievement of objectives, ensuring high care quality (Ferreira et al., 2022). Given this, the head nurse is also responsible for the prevention and control of Healthcare-Associated Infections, given his/her role, responsibilities, and skills required by the hospital. This can be achieved by promoting adherence to good healthcare practices among the team of healthcare professionals they manage, with the support of infection risk specialists (Saint et al., 2010). The head nurse also serves as the link between the instructions of the organization's management and the evidence-based practice activities of the healthcare professionals (Cummings et al., 2018).

Within healthcare organizations, the head nurse manages and leads a team of individuals with diverse backgrounds and competencies. As a middle manager, their role is to improve the well-being of nurses, achieve high levels of performance, and ultimately improve the quality of care for patients (Cummings et al., 2018; Cziraki et al., 2020; Labrague et al., 2021).

According to the World Health Organization (WHO, 2020), promoting, supporting, and incentivizing educational pathways that prepare healthcare professionals to become hospital head nurses is critical. These pathways prepare healthcare professionals to provide effective leadership within their care settings and teams. Success can be achieved through the implementation of specialized skills and competencies such as systematic thinking, communication, negotiation, strategy, and analysis, as well as the development of a culture of learning (Scammell et al., 2020).

These skills and competencies being used in clinical practice guarantee the following: (a) The acquisition of an effective and transparent method of communication capable of conveying concepts derived from evidence-based nursing practices (Hegarty et al., 2019). (b) The overcoming of stress factors presents within the team (Gobbi et al., 2014), mainly due to staff disagreements (Fiorini et al., 2022), which inevitably lead to burnout, job dissatisfaction (Zaghini et al., 2020), and the intention to leave (Saint et al., 2010). (c) The identification and implementation of multimodal strategies to address emerging challenges such as HAIs caused by multidrug-resistant pathogens (MDROs), which are a serious concern worldwide (WHO, 2022; Storr et al., 2017; Suetens et al., 2018).

Theoretical Framework

Studies have shown that authentic and transformational leadership styles are positively related to HAIs (Asif et al., 2019; Boamah et al., 2018), including device-associated infections like Catheter-Associated Urinary Tract Infections (CAUTIs) and Central Line-Associated Bloodstream Infections (CLABSIs) (Adams et al., 2018; Fischer et al., 2019). These findings may have been achieved because the head nurses encouraged their nurses to follow the Infection Prevention and Control (IPC) programs

available within their hospital (Storr et al., 2017) to seek evidence-based solutions suitable for their work context; to use problem-solving and decision-making skills in complex situations (van Buijtene et al., 2019; Asif et al., 2019) to share and collaborate clearly and transparently with the multidisciplinary team, breaking all institutional hierarchies (Cziraki et al., 2020); and, finally, to exercise their clinical leadership, actively participating in the decision-making processes on the patient care pathway (Boamah et al., 2018). This method of team coordination and management promotes a culture of safety and quality of care (Labrague et al., 2021) by removing barriers, leveraging facilitators, and making tangible changes in clinical care delivery (Dekker et al., 2022; Wong et al., 2013).

The management of HAIs can be hindered or facilitated by several factors within the healthcare organization, including the work environment of the hospital or ward, the characteristics of the healthcare worker's intervention, and, ultimately, the nature of the process (Dekker et al., 2022). Although the factors that influence implementation efforts are evident, the impact of the head nurse's leadership on outcomes for patients with HAIs is often unclear.

Prior quantitative research has already identified leadership as a key organizational factor related to the safety and quality of care delivered (van Buijtene et al., 2019; Labrague et al., 2021; Wong et al., 2013). The importance of head nurse's role in preventing and controlling HAIs was evaluated through studies comparing transformational and authentic leadership styles (Asif et al., 2019; Boamah et al., 2018), organizational team well-being (Fiorini et al., 2022), and HAIs in care settings (Labrague et al., 2021; Boamah et al., 2018; Adams et al., 2018; Landerfelt et al., 2020). To date, no studies have examined how interventions from the head nurses could affect the clinical and organizational behaviors of the clinical care teams being managed. Examining the impact of the head nurse's role in the prevention and control of HAIs through a qualitative approach can offer valuable insights into the effects of organizational and managerial decision-making on both the team and individuals. This approach could shed light on the potential intervention alternatives for healthcare facilities in the management of infection risks (*Figure 9*).

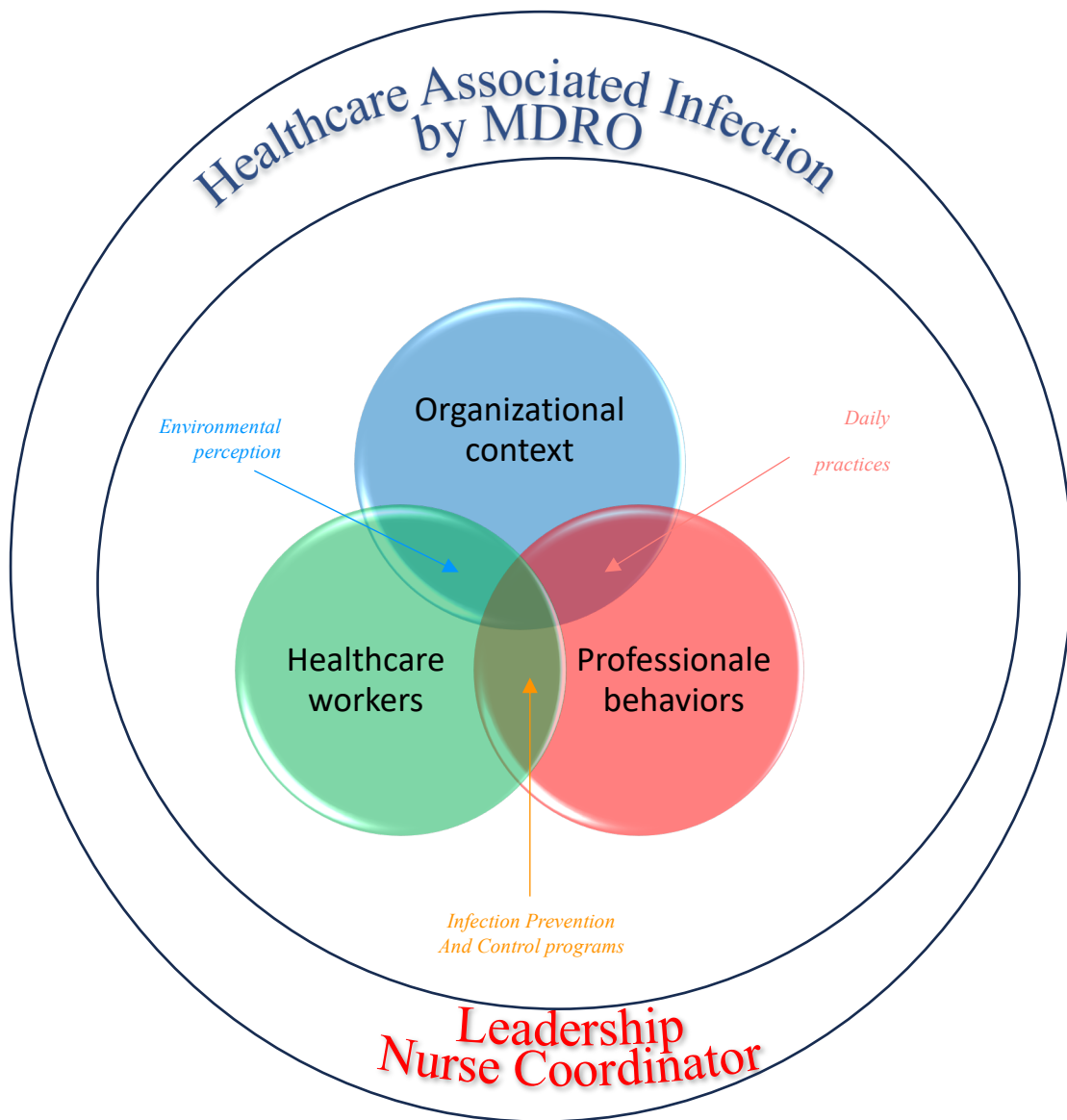


Figure 9. *Theoretical Framework*

4.4 Materials and Methods

Objective

The purpose of this study is to examine how the behaviors and actions of the head nurse can promote compliance with Infection Prevention and Control (IPC) programs across the clinical care team.

To achieve this objective, we will:

- describe the thought processes that motivate healthcare workers in the care provided for reducing HAIs;
- identify the barriers and facilitators to the implementation of IPC programs in clinical practice.

Design

The study will be a grounded theory (Charmaz, 2006; Strauss & Corbin, 1998) multicenter qualitative study. Non-participant observation will be followed by single interviews and/or focus groups. This approach enables the events to be observed as they occur, whereas the individual interviews provide a greater understanding of the thoughts behind each practitioner's performance. The COnsolidated criteria for REporting Qualitative research (COREQ) checklist will be used for the reporting of this research (Tong et al., 2007, see *Supplementary materials 2*).

Recruitment

The study will be conducted in at least two hospitals with equivalent IPC programs, according to WHO recommendations (Health et al., 2016) Healthcare facility managers from multiple hospitals will be invited to participate in the study and, if enrolled, the respective epidemiological offices will be requested to complete the WHO Infection Prevention and Control Assessment Framework (IPCAF; WHO, 2018). During data analysis, we will compare participating healthcare facilities which have similar IPCAF scores.

Participants

The study will use a convenience sampling method, in which wards and related healthcare workers, who voluntarily choose to participate, will be included. The study will include head nurses, nurses, nursing assistants, and clinicians who have worked in the selected ward for at least six months. The purpose is to understand the work organizational dynamics and leadership style of the head nurse and how it affects the thought processes of the clinical-care team because the theoretical framework sustains that the head nurse inspires and motivates healthcare professionals to collaborate and work together to ensure optimal patient care (Cummings et al., 2018).

For the purposive sampling, a variety of settings will be ensured, including medical, surgical, and intensive care units. We will include healthcare professionals who are involved in direct patient care activities, both on and off shift, regardless of their employment contract (full-time/part-time, temporary/permanent). Healthcare professionals who do not give their consent to the study, those who work in the infectious diseases ward as they have IPC procedures dedicated to the isolation of specific pathogens, and managers will be excluded.

Since a qualitative method will be used, once the data has been saturated, participant enrollment will end (Polit & Beck, 2010). A minimum of four professionals from each healthcare setting will be enrolled in order to collect and examine different clinical and work perspectives. These professionals will include head nurses, direct patient care nurses, nursing assistants, and clinicians.

Data Collection

After the individual wards have been identified and enrolled, an e-mail invitation to participate in the study will be sent to the head nurses, nurses, nursing assistants and clinicians. A multidisciplinary group of participants will be selected. Participants will be informed about the aims of the project and asked to consent to being observed during their daily activities. They will then be interviewed regarding the activities observed. The number of care activities and processes performed during the day will determine

the number of observations required. A minimum of ten observations for each hospital are expected to be conducted.

Instruments

To mitigate the Hawthorne effect and potential inter-observer biases (WHO, 2022), observations will be conducted by at least two experienced professionals who have previously participated in audits and infection risk management (e.g., hand hygiene audits). One observer will belong to the ward, and the other will be from the healthcare organization where the study is conducted. The observed activities will last approximately three hours and will be recorded in a logbook to reduce researcher subjectivity. Observations will focus on the behaviors and actions related to the following care activities or processes, according to international guidelines and scientific evidence (WHO, 2016; WHO, 2018; Sandelowski et al., 2002).

- The appropriate use of standard precautions in the management of HAIs caused by devices such as Central Line Associated Bloodstream Infection-CLABSI and Catheter-Associated Urinary Tract Infection - CAUTI

- The appropriate use of standard and additional precautions in the management of device HAIs caused by MDROs

- The use or non-use of cohorting staff in the case of patients with an HAI due to MDRO
- The management of in-hospital transport of a patient with an HAI caused by an MDRO.
- The adherence of out-of-ward consultants to the proper use of standard and additional precautions in the case of a patient with an HAI due to MDROs

- The management of environmental sanitation and the relations between healthcare personnel and out-of-hospital cleaners.

Following the observations, an expert will conduct individual interviews and/or focus groups to understand why the staff member behaved or acted as described. The interviews and focus groups will be recorded with a digital audio recorder, with prior explanation and informed consent from the person concerned. The researcher will also collect field notes. Each question is designed to allow the participant to describe how they perceive the topic of the study. The interview will be guided by open-ended questions with the dual purpose of creating a welcoming, non-judgmental environment (Mortari, 2010) and understanding the thought processes that accompany the actions of the healthcare professionals (*Table 9*).

Table 9. Guidelines for Conducting Interviews

Table 9. Guidelines for Conducting Interviews

Finally, participants will be asked to provide their biographical information, including gender, age, qualifications, education, and work experience, and whether they have participated in training programs at their hospital on Infection Prevention and Control, management of HAI or infections caused by MDRO, or antibiotic stewardship.

Data Analysis

The data will be analyzed using a qualitative descriptive approach (Mohajan et al., 2022). The interdisciplinary analysis will be conducted by an occupational psychologist, a qualitative research expert, and a university professor specializing in Grounded Theory. The observations will provide a general understanding of the environment, the participants, and the behaviors of professionals related to the management of HAIs. Instead, the interviews will be read multiple times and coded as appropriate. The interviews will be coded in the following three phases:

First phase: Open/initial coding, where transcripts will be read and parts of the text containing units of meaning related to the description of healthcare professionals' thought processes that influence their behavior and actions will be selected. The importance of these units of meaning will depend on the research question(s). Additionally, the researcher's field notes and observations will be included.

Second Phase: Final Coding—After open-coding all interviews, the texts and notes will be reread and the macro-categories will be identified, which provide a summary of the activities—both evident and unseen—that emerge from analyzing the interviews.

Third phase: Theoretical Coding—Among the macro-categories, the central categories will be identified, which must be significant and recurring, and possible connections between them will be suggested. Based on the results, a detailed description will be provided by presenting discussions that are appropriate for the research focus.

Methodical Rigor

The research team is composed of expert professors in the sector of nursing sciences who are experienced in clinical, organizational, qualitative, and occupational psychology research. This composition enables an understanding of the operational reality of nursing contexts, facilitating the observations and recruitment of participants for individual interviews and/or focus groups. During the construction, translation, and interpretation phases, the researchers, as instruments of inquiry, will strive to avoid potential biases or overestimations that could lead to theoretical “distortions” (Mortari, 2010). To manage and control subjectivity, reflexivity (Charmaz, 2006) and active confrontation within the team will be used to limit faulty or preconceived interpretations (WHO, 2013). Researchers will explicitly clarify their back- grounds and experiences to participants to help them understand the context and dynamics present in the selected wards (Olmos-Vega et al., 2022). This awareness is fundamental to successful grounded research. Finally, direct observation by experienced healthcare professionals from the same ward can avoid behavioral assessment limitations.

Reliability

Following the COREQ criteria (Tong et al., 2007), the researchers will adhere to the basic steps of qualitative research and its theoretical interpretation. A detailed methodological description of the activities observed will be provided to facilitate comparison with the context, promote the replicability of the design, and enhance the reliability of the results. Finally, the study will be conducted by qualitative experts with extensive experience in the field to strengthen the theories developed.

Ethical Considerations and Dissemination

The principal investigator guarantees that the study will be conducted according to the protocol, Good Clinical Practice, the current version of the Declaration of Helsinki, and applicable regulations

(Kouzes et al., 2017) and has been approved by the Ethics Committee of the Tor Vergata Hospital University–Rome with the following protocol number (Prot. N° RS 104.23).

The objectives of the study and the confidentiality of the data will be explained to all participants during a preliminary meeting. Participation in the protocol study is voluntary, and any healthcare professionals may refuse to participate at any time. Before partaking in any procedure related to this study, all participants must sign the informed consent.

4.5 Discussion

This study examines how head nurses' behaviors and actions can promote clinical care team adherence to Infection Prevention and Control (IPC) programs. The decision to use a Grounded Theory approach is based on its intrinsic characteristics, such as its focus on the processes of meaning in research practice, language analysis, and the underlying processes that characterize social interaction (Kouzes et al., 2017). Since care processes are characterized by a common constant, which is the interaction between different healthcare professionals within the work context, this research aims to define an interpretive theory (Mortari, 2010) that will provide a better understanding of the factors responsible for the proper governance of HAIs.

Through the results of this study, we expect to outline the role of the head nurse within their team (Kouzes et al., 2017) and their capability to motivate them to ensure a performance that guarantees quality of care (Labrague et al, 2021). Additionally, it will analyze the challenges and requirements of the head nurse and their team in adopting IPC programs and managing HAIs from multiresistant pathogens (Cziraki et al., 2020). Targeted strategies can be developed from these considerations to enhance professional, technical, and non-technical competencies and skills for managing infectious risks in clinical practice.

The theoretical framework will be developed based on observations of care processes, patient interactions, clinical care procedures, and environmental sanitation activities. This question will be

discussed, and understanding will be gained on how the figure of the head nurse could become a way to intervene in the ward and across the entire multidisciplinary team. The theoretical framework is essential for the prioritization of appropriate and innovative interventions that are responsive to the needs of head nurses and healthcare professionals. Describing the thought processes that motivate healthcare professionals in providing care to reduce HAIs will benefit healthcare managers by reducing the costs associated with negative patient outcomes.

Furthermore, these findings have great potential because they explore the perceptions of all healthcare professionals involved in the care process, care coordinators, nurses, nursing assistants, and clinicians. This approach considers potential barriers to using HAI programs and facilitators that could reduce the incidence of HAIs. These findings will be essential in informing policy decisions and improving day-to-day practice through the identification of potential internal changes. An understanding of the needs of head nurses and the clinical care team can provide insight into the actual unmet needs and the support necessary to implement new organizational and training strategies appropriate to the work context. Finally, identifying potential facilitators or barriers can ensure that all stakeholders can act intentionally and concretely. This will facilitate the development of synergistic collaborations with a focus on the significance of the infectious outcome in the care pathway of a hospitalized patient.

Limitations

This study has some limitations due to the methods of data collection, observation activities, and interviews. The interpretation of operational reality will be compared to that of other researchers. To minimize subjectivity, a diary will be used. Additionally, interviewees' perceptions and feelings may deviate from reality due to biases, such as a lack of trust in ensuring anonymity. To ensure confidentiality and anonymity, we will rely on the researchers' experience in handling participants' information, values, and beliefs.

4.6 Conclusions

The head nurse, with the support of the organization, is responsible for promoting a culture of safe care within the team. Field observations and interviews with key decision-makers in the team are needed to understand the impact of the head nurse's leadership in the management of HAIs. Furthermore, analyzing the perceptions of head nurses, nurses, nurse assistants, and clinicians regarding the barriers and facilitators to adhering to HAI programs could be informative. Developing strategies to minimize the impact of barriers and focusing on factors that promote adherence to evidence-based best practices may help improve compliance with IPC programs and ensure quality care for patients with multi-drug-resistant HAIs.

Supplementary materials 2. COnsolidated criteria for REporting Qualitative research (COREQ) protocol.

Supplementary materials 2. COnsolidated criteria for REporting Qualitative research (COREQ) protocol.

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5 Healthcare Associated Infections Management inside Intensive Care Units: “What do Nurses Think about their Head Nurses?” A Qualitative Pilot Study.

5.1 Introduction

In this fifth chapter, the results of the qualitative research and the practical implications for implementing strategies to improve adherence to Infection Prevention and Control (IPC) programs will be presented (*Figure 10*). Specifically, Table 10 will outline the aspects already known in the literature and what the study has revealed.

Table 10: *Summary of Known and New Scientific Evidence*

What is already known about this topic?	What does this research add?
<i>The leadership of the head nurse influences, inspires, and motivates nurses by leading by example and upholding moral values.</i>	<i>The role of the head nurse in managing MDRO-related HAIs serves as a key driver of change in high-risk infection settings.</i>
<i>The presence of an authentic and transformational leader within a multidisciplinary team can encourage the clear and transparent sharing of information, and improve patient satisfaction, work engagement, commitment, performance, and the quality of care.</i>	<i>The head nurse who attends to the issue, supervises, shares information, and distributes responsibilities can promote nurses' adherence to the prevention and management of MDRO-related HAIs.</i>
	<i>Managers must provide head nurses and nurses with adequate training and a certain degree of care flexibility, enabling teams to perform effectively and be suitably prepared to adapt their practices to new national and international political and epidemiological strategies.</i>

Figure 10. *Conceptual Framework*

5.2 ABSTRACT

Introduction. Preventing and controlling Healthcare Associated Infections (HAIs) caused by Multi Drug Resistant Organisms (MDROs) is one of the primary goals in high-risk settings like Intensive Care Units (ICUs). The leadership style of the head nurse can result in a reduction of infection rates, such as bloodstream and urinary tract infections; however, it is unclear how leadership can encourage nurses to adhere to Infection Prevention Control (IPC) programs. This study aims to explore the role of the head nurse in encouraging the clinical care team to adhere to IPC practices for preventing and controlling MDRO infections in the ICU.

Methods. In 2024, a single-centre interpretative phenomenological study was conducted following the Consolidated Criteria for Reporting Qualitative (COREQ). Nurses and head nurses from three ICUs were recruited. Data were collected through semi-structured interviews and analysed thematically.

Results. Eleven nurses and two head nurses were recruited. The results identified four themes that facilitate the management of HAIs by MDROs: a) awareness of the infection problem, b) head nurse supervision, c) information sharing, and d) distribution of responsibilities. The involvement of leadership and learning through feedback from head nurses are perceived not as barriers but as added value that promotes the dissemination of best practices.

Conclusions. Recognising the role of the head nurse in the management of HAIs by MDRO would represent an important driver for change in high-risk infection settings. It would enable healthcare organisations to intervene not only with nurses directly involved in patient care but also with middle managers who implement the hospital's directives and produce nursing sensitive outcomes.

Keywords: *Head Nurse, Healthcare Associated Infections, Intensive Care Units, Leadership, MultiDrug-Resistant Organisms.*

5.3 Background

Preventing Healthcare Associated Infections (HAIs) caused by MultiDrug Resistant Organisms (MDROs), such as *Escherichia coli* resistant to carbapenems, *Klebsiella pneumoniae* resistant to third-generation cephalosporins and carbapenems, *Enterococcus faecium* resistant to vancomycin, *Acinetobacter* and *Pseudomonas aeruginosa* resistant to carbapenems, is one of the priorities for patient safety and healthcare systems (WHO, 2024).

MDROs responsible for HAIs have a negative impact on the morbidity and mortality rates of hospitalised patients (Cassini et al., 2015) because they cause Catheter Associated Urinary Tract Infections (CAUTI), Central Line Associated Bloodstream Infections (CLABSI), and Ventilator Associated Pneumonias (VAP). In some care settings, such as ICU, these phenomena are amplified due to the clinical conditions of the patient and the type of treatments they require (ECDC, 2023), as well as the risk of transmission by healthcare professionals (de Kraker et al., 2022). A recent European prevalence study on infection risk (Tabah et al., 2023), found that 78% of patients admitted to intensive care contracted a CLABSI or VAP with multidrug resistance, of which about one-third died due to the infection, and only 10% were discharged alive 28 days after admission.

Although evidence-based best practices to prevent MDRO transmission are well known, their implementation is not always feasible due to numerous contextual variables (ECDC, 2023; Allegranzi et al., 2016). These variables include those related to hospital organisation (Cummings et al., 2018) and care models, the knowledge and risk perception of healthcare and medical staff (Alhumaid et al., 2021), and lastly, the clinical conditions of the patient (Haque et al., 2020). Therefore, the management of critically ill patients in the ICU requires considerable effort and, above all, a team that is aware, oriented and strongly motivated to pursue the well-being of patients and their caregivers and, consequently, the quality of care (Alloubani et al., 2019).

In an organizational context, the leadership of the head nurse plays a crucial role, as their ability to influence, inspire, and motivate nurses, primarily through example and ethical guidance in nursing work and adherence to best practices, has a significant impact (Ferreira et al., 2022). Numerous studies demonstrate that having an authentic and transformational leader within a multidisciplinary team (Avolio et al., 2009; Boamah et al., 2018) can promote clear and transparent communication (Cziraki et al., 2020), improve patient satisfaction (Zaghini et al., 2020) increase job engagement (Cziraki et al., 2020), strengthen commitment (Cummings et al., 2018), improve performance (Landerfelt et al., 2020), quality of care (Asif et al., 2019), and reduce both adverse patient safety events (Wong et al., 2013), rates of staff turnover (Cziraki et al., 2020) and job stress (Cummings et al., 2018).

Head nurses who can master leadership skills and manage their nursing teams can promote the overall development of professionals and contribute to the adoption of best practices for preventing nosocomial infections, reducing CAUTI and CLABSI rates (Cappelli et al., 2024), improving nursing sensitive outcomes (Fiorini et al., 2022), and consequently, reducing patient mortality (Hegarty et al., 2019; van Buijtene et al., 2019). Although the relationship between the head nurse's leadership style and infection rates in ICU is well known, it is still unclear how it promotes the nursing teams' adherence to Infection Prevention Control (IPC) programs in managing MDROs (Cappelli et al., 2024). To fill this gap, a qualitative study was conducted to explore how the head nurse's role can encourage adherence to IPC best practices in preventing and controlling MDRO infections in ICU. Understanding, with an interpretative approach, how a head nurse's actions can modulate the work activities of a group of nurses within the ICU would provide healthcare and head nurses with an additional way of intervening and managing HAIs by MDROs and combatting one of the major challenges in this care setting.

5.4 Methods

Study Design

An interpretative phenomenological qualitative study (IPA; Smith, 2009)) was conducted within three ICUs of an Italian University Hospital (cardiac surgery, post-surgical, and emergency units), where an IPC program is active. This design was utilised for its ability to understand the participants' lived experience (Giorgi, 2009) in its complexity, providing a detailed and relevant account of the choices and behaviours adopted during nursing practice. To improve the quality of the research process, the principles of the Consolidated Criteria for Reporting Qualitative Research (COREQ; Tong et al., 2007) were followed (*see Supplementary materials 3*).

Sample

The sample was a convenience sample. To ensure participant heterogeneity the following inclusion criteria were applied: nurses with more than five years of work experience in the emergency care area and at least six months in the ICU and head nurses with at least three years of experience in intensive care. Participation in the study was voluntary. Before enrolment, each participant was informed about the purpose of the study, their privacy was guaranteed, and informed consent was obtained. Participants were enrolled until data saturation (Vaismoradi et al., 2013).

Data Collection

A semi-structured interview was created and validated by a professional specialising in advanced nurse training on infection risk and another professional focused on nursing leadership in healthcare. The questions were structured according to the themes present in the international guidelines (ECDC, 2023) and the study protocol (Cappelli et al., 2024). Additionally, each participant was asked about their gender, age, type of education, years of professional experience, and the ward they worked in (*see Supplement Materials 4a, 4b*). The interviews were conducted individually,

audio- recorded, and conducted within a safe space free of potential influences on the participants (e.g., away from the ward, low noise levels).

The interviews were conducted by two researchers experienced in qualitative research and occupational psychology (EC, LL), who did not work for the hospital where the data was collected. Furthermore, a logbook was used to collect non-verbal expressions, which were integrated into the verbal data during the decoding and analysis phases. The average duration of an interview was approximately 30 minutes.

Data Analysis

Each interview was transcribed and enriched with non-verbal subtleties recorded in the logbook to characterise the management practices conveyed by the head nurse in handling MDRO infections and implemented by nurses in their care practices. The transcription, coding, and analysis were conducted following the approach of Smith (2009) and Giorgi (2009). The process of data interpretation began with the first interview and extended through the analysis of all transcriptions. The interviews were numbered and categorised by the following professional categories (Nurse N° 1, N1; Head Nurse N° 1, HN1).

The transcriptions were read several times to obtain an overview of the information (Vaismoradi et al., 2013). In the first phase of analysis, initial codes were generated by coding the main characteristics of the studied phenomenon and reporting them in the margin of each text (Graneheim et al., 2017). Subsequently, the identified codes were grouped into potential themes, defined with clear and simple statements. Finally, the themes were connected to generate a map.

Socio-demographic characteristics were analysed using descriptive analysis, with absolute and percentage frequencies.

Methodical Rigor

To ensure rigor and reliability, the researchers who developed and asked the interview questions were experts in qualitative research, nursing work organisation, infection risk and occupational psychology (EC, LL, JF).

The researchers independently conducted the entire data collection process, and the codes only emerged after the results were shared. Confirmability and consistency of the analysis were ensured through preliminary meetings to discuss the findings. Codes and themes were discussed with the entire research group until approval was reached by all members (Graneheim et al., 2017). Reliability was ensured by providing a detailed description of the data and including contextually relevant quotes from participants within tables to vividly illustrate each individual's perspective.

Ethical Considerations

The research was conducted following the principles of the Declaration of Helsinki (2024). The Ethics Committee of the University Hospital where the data collection took place approved the study under protocol number (Prot. N° RS 104.23). Participants were first informed about the study's purpose and subsequently signed an informed consent form. Anonymity was guaranteed, and the transcripts included in the text were not traceable to any individual or their specific context. Participants were free to decline to answer any questions that might cause discomfort and could withdraw from the study at any time.

5.5 Results

Sample Characteristics

In compliance with the inclusion criteria, data saturation occurred with 11 nurses and 2 head nurses. The 13 participants interviewed were aged between 35 and 52 years, 9 were women, and

54% held a Master of Science Degree in Nursing (*Table 11*). The participants had been working as nurses for at least 10 years and in intensive care for 4 years.

Data analysis revealed that the main themes promoting the management of HAIs caused by MDROs are associated with four main leadership practices: a) awareness of the infection problem, b) head nurse supervision, c) information sharing, d) distribution of responsibilities.

The results and qualitative interview data are presented and grouped based on the themes identified during the analysis process (*Figure 11*).

Table 11. *Sociodemographic data of nurses and head nurse*

n	Gender	Age	Educational Experience	Total Working Years	Working Years in The Same Wards	Department/Ward
HN₁	F	43	MSN	20	12	Emergency Intensive Care
HN₂	F	50	MSN	28	18	Cardiac Surgery, Post-Surgical Intensive Care
N₁	F	52	BSN	29	20	Cardiac Surgery, Post-Surgical Intensive Care
N₂	F	41	MSN	18	12	Cardiac Surgery, Post-Surgical Intensive Care
N₃	F	36	MSN	12	4	Cardiac Surgery, Post-Surgical Intensive Care
N₄	F	47	BSN	23	22	Emergency Intensive Care
N₅	F	44	MSN	20	13	Emergency Intensive Care
N₆	F	41	BSN	17	6	Emergency Intensive Care
N₇	F	44	BSN	18	18	Emergency Intensive Care
N₈	M	35	MSN	11	4	Cardiac Surgery, Post-Surgical Intensive Care
N₉	M	42	BSN	16	16	Emergency Intensive Care
N₁₀	M	37	BSN	12	6	Emergency Intensive Care
N₁₁	M	35	MSN	10	4	Cardiac Surgery, Post-Surgical Intensive Care

Legend

LN: Lead Nurse

N: Nurse

F: Female

M: Male

MSN: Master of Science in Nursing

BSN: Bachelor's degree in Nursing

Figure.11 *Overview of the emerged themes on the management of Healthcare Associated Infections caused by MultiDrug-Resistant Organisms*

Awareness of the infection problem

The head nurse and nurses interviewed provided their perspectives on managing HAIs caused by MDROs, offering various reflections on this practice.

Some interviewees reported that the problem of infections within their ward is “*meticulously*” (N1) attended to, because critically ill patients are “*highly susceptible to infectious complications*” (N3), which can sometimes lead to the patient’s “*death*” (N3).

After the COVID-19 pandemic, there has been a “*change in direction*” (HN1) in the hospital, firstly on the part of healthcare managers and subsequently also by the “*entire care team*” (HN1). Even infectious disease specialists “*were no longer regarded as troublesome consultants*” (HN1). This meticulous attention is perceived by many interviewees as a “*continuous incentive to analyse and correct the behaviour of all professionals involved in the patient care process*” (N6).

Head Nurse Supervision

The control and management exercised by the head nurse within their ward and over the nursing staff and cleaning staff can enable them to motivate adherence to best clinical practices. Supervision can be carried out through directive or motherly feedback, with the ultimate goal of “*helping to understand the rationale behind everything that is said and then done*” (N4). In both cases, the head nurse demonstrates a significant sensitivity to infection problems, and actively promotes and supports various infection control training initiatives that the hospital, and in particular the Hospital Infection Committee, makes available to everyone. In this regard, nurses reported that their head nurse is “*present, attentive to infections, and supportive*” (N5). This leads to a certain sensitivity to the results and quality of care, and, at the same time, provides an opportunity to re-educate nurses on best practices. Indeed, the interviews revealed

that head nurses encourage their nurses to

“*..participate in hospital courses on hand hygiene and similar training*” (N5).

Feedback from the head nurse helped nurses identify priorities and implement necessary process changes to address infection problems. For instance, during a night shift, upon the arrival of a patient with a “*New Delhi*” infection, nurses self-managed, redistributed their workloads and implemented staff cohorts, where “*only one nurse was dedicated to the care of the infected patient*” (HN2).

Information Sharing

To support decision-making in patient care practices and to optimise available resources, nurses have identified information sharing as crucial. The primary methods used by the head nurse to communicate information — clinical and administrative — include emails, daily briefings, informal and formal meetings such as audits, and signage.

The most common communication mode is via email, through which “*new hospital procedures, new ministerial circulars, and new protocols*” (N8) are usually disseminated. Infection data and objectives are discussed during internal audits. However, “*true information sharing occurs during coffee breaks*” (N3) and morning briefings. During coffee breaks, “*the coordinator calmly explains and clarifies what needs to be done*” (N3). Instead, a briefing is a formal meeting for sharing and making clinical care decisions, where doctors and nurses discuss each patient to establish medium- and long-term care plans. Nurses emphasised the importance of attending these meetings as they facilitate “*the updating of the clinical conditions of all patients in the ward*” (N4).

Additionally, ward signage is used, such as coloured tags placed at the head of patients’ beds indicating the type of isolation required for pathogen colonisation/infection, or posters on proper hand hygiene (WHO, 2009) and the donning/doffing of personal protective equipment (CDC, 2020). While participants recognise their usefulness, they feel that the signage is not “*very visible to the staff, external consultants, and even the patients’ relatives themselves*” (N3). Many suggested that an optimal strategy should be identified so that the signage can catch the attention of those approaching the inpatient unit of the isolated patient.

Distribution of Responsibilities

For infection management of MDROs to become a priority throughout the hospital, each member of the care process must recognise their responsibilities and errors in their choices and actions. Nurses stated that the head nurse is responsible for creating an efficient and effective work environment, which includes delegating certain tasks and actively involving doctors and external consultants in infection prevention processes. In practice, within the team, the head nurse is one who “*guides the behaviour of less compliant individuals*” (N3) by proposing “*targeted updates*” (N3) and “*empowering some nurses*” (N6) on specific IPC activities, such as environmental sanitation.

It is necessary for professionals who do not regularly work in intensive settings but visit for consultations to recognise infection sources and approach safely by “*wearing gowns and washing hands before and after approaching the patient*” (HN2). Interviewees emphasised the need for an open organisational climate within the team, where problems are discussed transparently, avoiding institutional hierarchies. Indeed, all involved, including residents, need to “*be aware of the presence of infections and how to behave*” (N3) and everyone must “*give due value even to aspects that are not always relevant to their professional profile*” (N6). Even leaders are responsible for infection management, and, according to the experts, their “*presence, control, and decisions*” (HN2) could be crucial in collaboratively solving some of the problems in the operational context.

5.6 Discussion

This study aimed to explore how the role of the head nurse can support nurses in preventing and controlling MDRO infections in intensive care settings. The results indicate that a head nurse who attends to the problem, supervises, shares information, and distributes responsibilities can significantly enhance nurses’ adherence to MDRO infection prevention and management in an ICU.

Although the power of the clinical care team is crucial in preventing infections, it is undeniable that the governance of healthcare leaders and the ethical choices of the hospital can influence the hospital culture (Cummings et al., 2021). Indeed, as described by both nurses and head nurses, having an authentic and transformational head nurse alone is not sufficient; it is also necessary to actively involve managers in these processes. This ensures that actions and directives align with common and shared goals. Managers must provide head nurses and nurses with adequate training and a certain level of operational flexibility so that teams are performing well and adequately prepared to change new national and internal political and epidemiological choices and strategies (Gon et al., 2020).

Participative, collaborative, and context-specific head nurse leadership can positively impact the well-being of nursing staff and, consequently, affect MDRO infections (Cappelli et al., 2024). However, this influence alone is not always sufficient to support all infection prevention practices. Nurses need to perceive their leaders as committed, determined, and engaged to effectively channel their efforts (Cummings et al., 2018; Ferreira et al., 2022). The way the head nurse provides feedback to frontline staff is not binding for the implementation of good practice. Providing feedback to frontline staff does not necessarily ensure the implementation of good practices. Having leaders with a direct or motherly communication approach is not perceived as a hindering factor, but as an added value that favours the dissemination of best practices. Furthermore, recognising the importance of an effective leadership style enables all team members to share goals, responsibilities, and outcomes (Cziraki et al., 2020)..

Periodic updates via email or routine scheduled meetings can assist head nurse even when they are not physically present in the hospital. Previous research has shown that formal and informal communication, as well as interactions with the head nurse and other team members, can provide significant opportunities for nurses and clinicians to address knowledge gaps and improve care practices (van Buijtene et al., 2019).. Additionally, the use of operational tools and systems, such as head nurse feedback, audits, hospital procedures, and continuous training, allows all professionals to

be more accountable and autonomous, and to participate more actively in patient care, reducing MDRO infections (Cappelli et al., 2024; Asif et al., 2019; Boamah et al., 2018).

Another aspect that emerged from the results was the distribution of responsibilities and their strategic role in infection management. Sometimes, interviewees identified difficulties in adherence to best IPC practices by doctors, particularly residents, who often do not receive adequate training during their educational programs (Tsioutis et al., 2020). In conclusion, it is crucial that each professional independently and responsibly recognises the infection problem, communicates doubts and concerns with the rest of the team, shares best strategies, and implements them to control and manage infections effectively (ECDC, 2023).

Limitations of the Study

The results of this study should be considered in light of certain limitations. The study sample, limited to nurses and head nurses from a single hospital, may not accurately reflect the diversity and complexity of the phenomenon studied. To gain a more comprehensive understanding, it is important to explore the perspectives of other healthcare professionals, such as doctors, residents, cleaning staff, and support personnel. Therefore, further research is needed that includes participants from different operational settings as well as other professionals, such as medical doctors, infection risk specialists, physiotherapists, and technicians. This will help achieve a more complete understanding of the issues discussed and examine how various leadership practices could be more effective in preventing HAI by MDROs.

5.7 Conclusions

Having a head nurse who can effectively supervise, engage, share information, and provide feedback to frontline staff facilitates the prevention and management of HAIs by MDROs.

The role that the head nurse plays in multidisciplinary teams is crucial for maintaining adherence to best clinical practices, positively reinforcing key concepts that ensure good work performance and quality nursing care for users. For nurses, being guided by a leader with these characteristics means being encouraged to participate in advanced training, to refine their skills and competencies, and to contribute directly to the improvement of nursing sensitive outcomes.

Implications for Clinical Practice

Healthcare organisations have an urgent need to address problems related to MDRO infections. Implementing strategies that enhance the leadership of the head nurse can be successful in promoting efficient and, at the same time, sustainable solutions. Sharing data and information, proactively involving all stakeholders in the care process, breaking down institutional hierarchies, adopting shared responsibilities, and fostering a healthcare culture focused on safety can help reduce this healthcare burden.

Supplementary materials 3. *Checklist Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist*

Supplementary materials 3. *Checklist Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist*

Supplementary materials 3. *Checklist Consolidated criteria for reporting qualitative studies (COREQ): 32-item checklist*

Supplementary materials 4a. Guide to interviewing with a head nurse

<i>Demographic Data</i>	Age, Gender
<i>Educational Background</i>	Diploma, Bachelor's Degree, Master's Degree, Other
<i>Work Experience</i>	Years of Experience
<i>Type of Facility</i>	Hospital, University, Community
<i>Ward of Assignment as Head Nurse</i>	Medical, Surgical, Critical Care
<i>Leadership Head Nurse & Healthcare Associated Infections (HAIs) da MultiDrug Resistance Organisms (MDROs)</i>	<ol style="list-style-type: none"> 1. How does your ward address the problem of HAIs by MDROs? 2. What are the strengths and weaknesses of your work team regarding infection risk management? 3. Can you tell me about a case of infection/colonisation and its causes? 4. What should be done to strengthen the capacity to limit infection risk in your ward? 5. In your opinion, how is the role of the head nurse crucial in managing infection risk prevention and control processes? 6. Have you encountered difficulties in making your team understand the importance of proper infection risk management? 7. In your view what should the nursing coordinator do to increase adherence to infectious risk procedures/good practice within your team?

Supplementary materials 4b. Guide to conducting an interview with a nurse

<i>Demographic Data</i>	Age, Gender
<i>Educational Background</i>	Diploma, Bachelor's Degree, Master's Degree, Other
<i>Work Experience</i>	Years of Experience
<i>Type of Facility</i>	Hospital, University, Community
<i>Ward of Assignment as Head Nurse</i>	Medical, Surgical, Critical Care
<i>Leadership Head Nurse & Healthcare Associated Infections (HAIs) da MultiDrug Resistance Organisms (MDROs)</i>	<ol style="list-style-type: none"> 1. How does your ward address the problem of HAIs by MDROs? 2. In your opinion, how does the quality of relationships influence the effectiveness of infection risk prevention? 3. What are the strengths and weaknesses of your team in the management of infectious risk? 4. Can you tell me about a case of infection/colonisation and its causes? 5. In your opinion, in what ways/terms is your role crucial in the prevention and control of infections related to care practices? 6. In your opinion, in what way is the role of the head nurse in the management of infection risk prevention and control processes?

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6 Conclusion and Future Perspectives.

6.1 For more sustainable management of Healthcare-Associated Infections

In conclusion, this doctoral course confirms that leadership of the head nurse, combined with the efficient organization of care settings, plays a crucial role in the prevention and management of Healthcare-Associated Infections (HAIs). Prioritizing education and continuous professional development in these areas is not just a strategic decision but a fundamental necessity for delivering safer and more effective patient care. In the future, it will be essential to continue investigating and implementing new organisational and training approach capable of adequately addressing the challenges posed by healthcare-associated infections in an ever-evolving epidemiological landscape.

The management of Healthcare-Associated Infections (HAIs) represents one of the key challenges for healthcare systems globally (Alhumaid et al., 2021). These infections, though often preventable, negatively affect patient clinical outcomes (Aiken et al., 2014; Doran, 2013), increase management costs, and add to the workload of healthcare professionals (Manoukian et al., 2018; Giuliani et al., 2018). In this context, the role of the head nurse is crucial, as their leadership can guide the team towards safer and more effective care practices, fostering an organizational environment conducive to adherence of HAI prevention and management protocols (Cummings et al., 2021; Fiorini et al., 2022).

Authentic and transformational leadership by the head nurse can improve care quality by encouraging the team through active listening, personal example, and motivation (Labrague et al., 2021; Boamah et al., 2019). This leadership style promotes proactive behaviors, a culture of safety, and a sense of shared responsibility (Alloubani et al., 2019). Additionally, the head nurse is instrumental in supervising care activities, ensuring adherence to procedures, and providing constructive feedback for continuous team improvement (Cummings et al., 2021).

Clear and transparent communication is another essential aspect: the head nurse must serve as a point of reference for sharing information, identifying problems, and finding shared solutions

(Ferreira et al., 2022). The prevention of HAIs also depends on effective organizational management, including shift planning, equitable distribution of resources, and workload balancing (Mitchell et al., 2018). These factors are critical to avoiding stress and burnout among healthcare professionals, which could compromise adherence to the best scientific evidence (Zaghini et al., 2020).

In addition to monitoring HAIs and analysing relevant data, the head nurse must ensure the timely and appropriate implementation of corrective measures (Van Buijtene et al., 2019). Similarly, infection risk specialists must ensure the development of clear, updated protocols and procedures aimed at standardizing behaviors (Labrague et al., 2021; Hegarty et al., 2019). These tools must be easily accessible and integrated into the daily activities of healthcare staff. In parallel, healthcare organizations and managers must support head nurse and staff with adequate resources, including materials, equipment, technological tools, and infrastructure, to enhance the monitoring and management of HAIs (Warshawsky et al., 2020; Dekker et al., 2022). Lastly, educators and trainers need to adopt participatory training methods and utilize clinical cases to transfer advanced knowledge and updated practices. This approach will enable each professional, based on their role and area of expertise, to effectively address infection-related challenges in different care settings, promoting safer and more informed management.

6.2 Implications for healthcare professionals and the Healthcare Organization

Implications for Clinical Practice

The leadership of the head nurse plays a crucial role in managing Healthcare-Associated Infections (HAIs), such as Catheter-Associated Bloodstream Infections (CABSI), Catheter-

Associated Urinary Tract Infections (CAUTIs), Surgical Site Infections (SSIs), and infections caused by MultiDrug-Resistant Organisms (MDROs). Mastery and application of key skills like delegation, communication, motivation, and error management are essential for improving care quality and reducing the incidence of infections.

Furthermore, the academic training of the head nurse is insufficient to cover all the responsibilities of the role. Ongoing professional development is crucial, with training programs emphasizing advanced leadership and infection control strategies. Effective initiatives may include interprofessional workshops, audits, critical evaluations of clinical practices, and tailored feedback. Engaging nurses, physicians, and other healthcare professionals enhances collaboration, fortifies team dynamics, and promotes safer practices.

A frequently overlooked aspect is the direct involvement of patients in the prevention and management of HAIs. Since healthcare-associated infections are predictable, patients need to be aware of potential critical situations and be prepared to manage them appropriately. This inclusive approach could represent an important step toward improving the effectiveness of infection prevention and management.

Finally, practical training tools, such as simulations and case-based learning are invaluable in preparing healthcare teams to manage real-world challenges. These methods encourage the adoption of best practices, cultivate a culture of safety, and ensure high standards of patient care.

Implications for the Healthcare Organization

From an organizational standpoint, incorporating innovative roles is critical to enhancing the management of Healthcare-Associated Infections (HAIs). For instance, assigning "Champions" with specialized skills or integrating infection control link nurses into the team can significantly bolster infection prevention efforts. Furthermore, healthcare teams should focus on implementing targeted care strategies, such as bundle protocols for medical device management, to minimize infection risks.

Another key aspect is the use of advanced surveillance systems. The introduction of standardized dashboards and monitoring systems, aligned with the guidelines of the European Centre for Disease Prevention and Control (ECDC), would enable structured data collection and analysis related to HAIs. These tools would help monitor the effectiveness of the link nurse system in infection prevention, improving decision-making processes and optimizing care practices.

To evaluate the effectiveness of the implemented strategies, longitudinal studies and clinical trials are needed to assess the impact of the new professional roles. By comparing results before and after the introduction of these professionals, it would be possible to measure the effectiveness of the adopted strategies and identify areas for improvement.

Furthermore, it is essential to continuously monitor HAI rates through the use of data collection and analysis tools. This would allow for an accurate assessment of the impact of organizational changes and ensure that the new staffing structure is effective in infection prevention, while maintaining high care standards.

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