

Infection prevention and safety performance – relevance and implications for patient safety

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List of Abbreviations

HAI	Healthcare associated infections
HCP	Healthcare professionals
IPC	Infection prevention and control
OSH	Occupational safety and health
PPE	Personal protective equipment
SGB	Social Code
SJT	Situational judgement test
SOP	Standard operating procedure
SPOHC	Safety performance of healthcare professionals
WHO	World Health Organization

Definition of Terms

Hand hygiene: “A general term referring to any action of hand cleansing” (World Health Organization, 2009, S. 2).

Healthcare associated infections (also referred to as “nosocomial” or “hospital infection”): “An infection occurring in a patient during the process of care in a hospital or other health care facility, which was not present or incubating at the time of admission. Health care-associated infections can also appear after discharge. They represent the most frequent adverse event associated with patient care”. (World Health Organization, 2016a). “These infections are often preventable” (Association for Professionals in Infection Control and Epidemiology, 2022, S. 1).

Hygienic handrub: “An alcohol-containing preparation (liquid, gel or foam) designed for application to the hands to inactivate microorganisms and/or temporarily suppress their growth. Such preparations may contain one or more types of alcohol, other active ingredients with excipients, and humectants” (World Health Organization, 2009, S. 2).

Hygienic handwash: “Treatment of hands with an antiseptic handwash and water to reduce the transient flora without necessarily affecting the resident skin flora. It is broad spectrum, but is usually less efficacious and acts more slowly than the hygienic handrub” (World Health Organization, 2009, S. 2).

Infection prevention and control (IPC): “is a practical, evidence-based approach preventing patients and health workers from being harmed by avoidable infections. Effective IPC requires constant action at all levels of the health system, including policymakers, facility managers, health workers and those who access health services. IPC is unique in the field of patient safety and quality of care, as it is universally relevant to every health worker and patient, at every health care interaction. Defective IPC causes harm and can kill. Without effective IPC it is impossible to achieve quality health care delivery. Infection prevention and control affects all aspects of health care, including hand hygiene, surgical site infections, injection safety, antimicrobial resistance and how hospitals operate during and outside of emergencies. Programmes to support IPC are particularly important in low- and middle-income countries, where health care delivery and

medical hygiene standards may be negatively affected by secondary infections” (World Health Organization, 2023b).

Medical gloves: “Disposable gloves used during medical and care procedures” (World Health Organization, 2009, S. 3).

Patient safety: “A framework of organized activities that creates cultures, processes, procedures, behaviours, technologies, and environments in health care that consistently and sustainably lower risks, reduce the occurrence of avoidable harm, make error less likely and reduce the impact of harm when it does occur” (World Health Organization, 2021, S. V).

Transmission: “Refers to the way germs are moved to the susceptible person. Germs don’t move themselves. Germs depend on people, the environment, and / or medical equipment to move in healthcare settings. There are a few general ways that germs travel in healthcare settings – through contact (i.e., touching), sprays and splashes, inhalation, and sharps injuries” (Centers for Disease Control and Prevention, 2016, S. 1).

1 Abstract

The World Health Organization states safe healthcare as a fundamental human right, collaboratively achieved with the patients to ensure patient safety. Organizational and patient safety are rooted in the human factors approach. One critical factor contributing to healthcare-associated infections, frailty, and even death of nursing home residents is the knowing-doing gap in evidence-based measures for infection prevention.

However, in complex healthcare systems, various human factors may contribute to the gap between knowledge and implementation in patient safety. To improve patient safety and control healthcare associated infections, it is crucial for healthcare workers to adopt a systemic approach that takes into account the multitude of factors that affect hand hygiene compliance. The Integrative Model of Workplace Safety developed by Christian et al. (2009) and the Systems Engineering Initiative for Patient Safety developed by Carayon et al. (2006–2020) provide valuable frameworks in this regard. These models guide the understanding and management of the complex interplay of human factors in healthcare. By understanding and using the Integrative Model of Workplace Safety and the System Engineering Initiative for Patient Safety approach, healthcare facilities can develop comprehensive strategies to improve patient safety and prevent healthcare-associated infections.

The overarching aim of this dissertation is to improve patient safety in healthcare organizations by gaining a more profound understanding of the human factors that affect infection prevention and safety performance. The study will specifically investigate individual and organizational factors that influence the hand hygiene behavior of individuals in nursing homes. Additionally, the study will explore the role of safety performance in healthcare organizations' ability to promote patient safety.

- 1) The primary objective is to explore the influences of individual and organizational factors of hand hygiene in nursing home staff, with a particular focus on the function of role modeling by nursing managers.
- 2) The secondary objective is to investigate hand hygiene behaviors of general practitioners in nursing homes, their attitudes toward infection prevention

measures, and the enablement of nursing home residents to perform hand hygiene measures.

- 3) The tertiary objective is to provide a general perspective on safety performance and gain an understanding of how this construct influences the work of healthcare professionals to ensure patient safety.

By pursuing these objectives, the research tries to identify opportunities for improving infection prevention and safety performance in healthcare, leading to improved patient safety.

This cumulative dissertation includes articles published in international peer-reviewed journals indexed in the Web of Science. It includes two publications based on data collected during the PränosInAA study, which was conducted between 2011 and 2015 by the Institute for Hygiene and Public Health at the University Hospital Bonn in cooperation with the Institute for Patient Safety (IfPS). Additionally, it includes one publication based on data from the SPOHC study, which was conducted between 2018 and 2020 at the Institute for Patient Safety (IfPS) of the University Hospital Bonn.

The first publication is a mixed-methods study surveying 165 nurses and interviewing 27 nursing managers from six nursing homes in Germany.

The second publication is a qualitative study, in the context of which 24 semi-structured interviews were conducted with 12 general practitioners and 12 nursing home residents in Germany, using thematic content analysis of the data.

The third publication uses a qualitative approach and content analysis of data to examine the interviews of 23 healthcare professionals on the perspectives of safety performance in acute medical care.

To improve patient safety effectively and sustainably, it is crucial to consider not only individual staff, but the entire work system. The findings of this thesis suggest that healthcare staff may face challenges in ensuring patient and workplace safety. Knowing, understanding, and implementing human factors approaches could contribute significantly to improvement in this regard. In addition, the knowledge and decision to actively engage patients and their families is essential for patient safety. While the methods and theory-

driven approach used in the exploratory studies enhance the validity of the findings, it is important to acknowledge the limitations in generalizability. Furthermore, considering that all studies were conducted before the COVID-19 pandemic, further research is needed to validate the findings in current contexts. Finally, multifaceted interventions in health service research with the human factors approach and the focus on the spatio-temporal patient journey perspective are essential for enhancing patient safety.

2 Introduction and Aims

In its Global Action Plan for Patient Safety 2021-2031, the World Health Organization (WHO) has declared “patient safety a global health goal” (World Health Organization, 2021). WHO Member States are encouraged to recognize patient safety as a health priority in their health sector strategies and programs and to work together to eliminate preventable harm in health care. (World Health Organization, 2021). WHO defines safe healthcare as a fundamental human right, which is always co-produced with the patients and their relatives, and in achieving patient safety, it is “required that patients be informed, involved and treated as full partners in their care” (World Health Organization, 2021, S. 9).

Within German health care facilities, regular infection prevention training is mandatory for all staff. The aim of these training sessions is to translate evidence-based knowledge about hygiene into standardized behaviors for all staff. “An area of weakness of patient safety in many parts of complex health care systems, is called the “knowing-doing gap”. It is the slow translation of evidence of effectiveness into routine practice” (World Health Organization, 2021, S. 10). “Gaps are discontinuities in care” (Cook et al., 2000, S. 791). A safety gap is, for example, an discontinuous provision of hand disinfectants, which can lead to healthcare-associated infections (World Health Organization, 2009). Considering the complex and particular environment of nursing homes, which includes healthcare in residents' rooms, the subdivision into the 12 German social codes defining different healthcare sectors, there is still a lack of consistent application of evidence-based infection prevention and control (IPC) methods. In addition, there is a lack of methodologically precise research to evaluate the effectiveness of IPC strategies involving patients, their relatives and staff. (Allegranzi et al., 2022; Gould et al., 2021; Lotfinejad et al., 2021).

2.1 Theoretical Background

2.1.1 The human factors approach

Safety in a health care organizations is a complex sociotechnical system (World Health Organization, 2012, 2021). To become and remain a safe health organization, staff at all levels have to commit to ensuring consistently safe operations, despite the inherent complexity and risks (Dekker & Woods, 2010). Ensuring safety in healthcare facilities involves multiple internal and external components that interact with individual, structural,

and organizational factors, as well as external policies and regulatory and legal contexts (Carayon et al., 2006). Ultimately, it is reflected in the safety behaviors of individual team members and in the patient safety outcomes of patients. (Carayon et al., 2006; Reason, 2000; Vincent et al., 2000). Organizational and patient safety is based on the human factors approach, which is “concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and methods to design to optimize human well-being and overall system performance” (International Labour Office (ILO) and the International Ergonomics Association [IEA], 2021, S. 34). The human factors perspective examines how these complex healthcare organizations operate to improve patient safety and gain insights into how systems are influenced by environmental, organizational, workplace, human and individual factors that affect workplace behaviors based on a shared situational awareness (Carayon et al., 2014).

2.1.1.1 The integrative model of workplace safety

To address the existing inconsistencies between human factors studies and empirical findings, Christian et al. constructed a framework grounded on theories and meta-analysis, called the Integrative Model of Workplace Safety and its Determinants (IMWS). The IMWS is based upon further theoretical models e.g., the Model of Workplace Safety (Griffin & Neal, 2000; Neal & Griffin, 2004). Workplace safety is influenced by three main categories of factors: individual factors, job/task factors, and organizational factors (Christian et al., 2009).

Individual factors encompass personal characteristics, attitudes, and behaviors of employees. Factors such as knowledge, skills, risk perception, motivation, and safety-related beliefs and values play a role in shaping individual safety behavior (Christian et al., 2009).

Job/task factors relate to the specific nature of the work environment and the tasks performed by employees. Elements such as job demands, physical and cognitive workload, task complexity, and the presence of hazards or safety risks all impact safety performance (Christian et al., 2009).

Organizational factors encompass the broader organizational context, including management practices, leadership style, safety climate, and the availability of resources and support for safety. These factors influence safety through their impact on staff motivation, job satisfaction, and the overall safety culture within the organization (Christian et al., 2009).

The model assumes a dynamic interaction between these three categories, as they influence and shape one another. This interaction ultimately affects safety outcomes and performance. The IMWS provides a foundation for developing more effective safety policies and strategies that consider the complexity and interplay of these factors to enhance safety performance and prevent workplace accidents and injuries in healthcare organizations (Christian et al., 2009).

The IMWS serves as the first theoretical background for this thesis (Christian et al., 2009). Fig. 1 shows the IMWS.

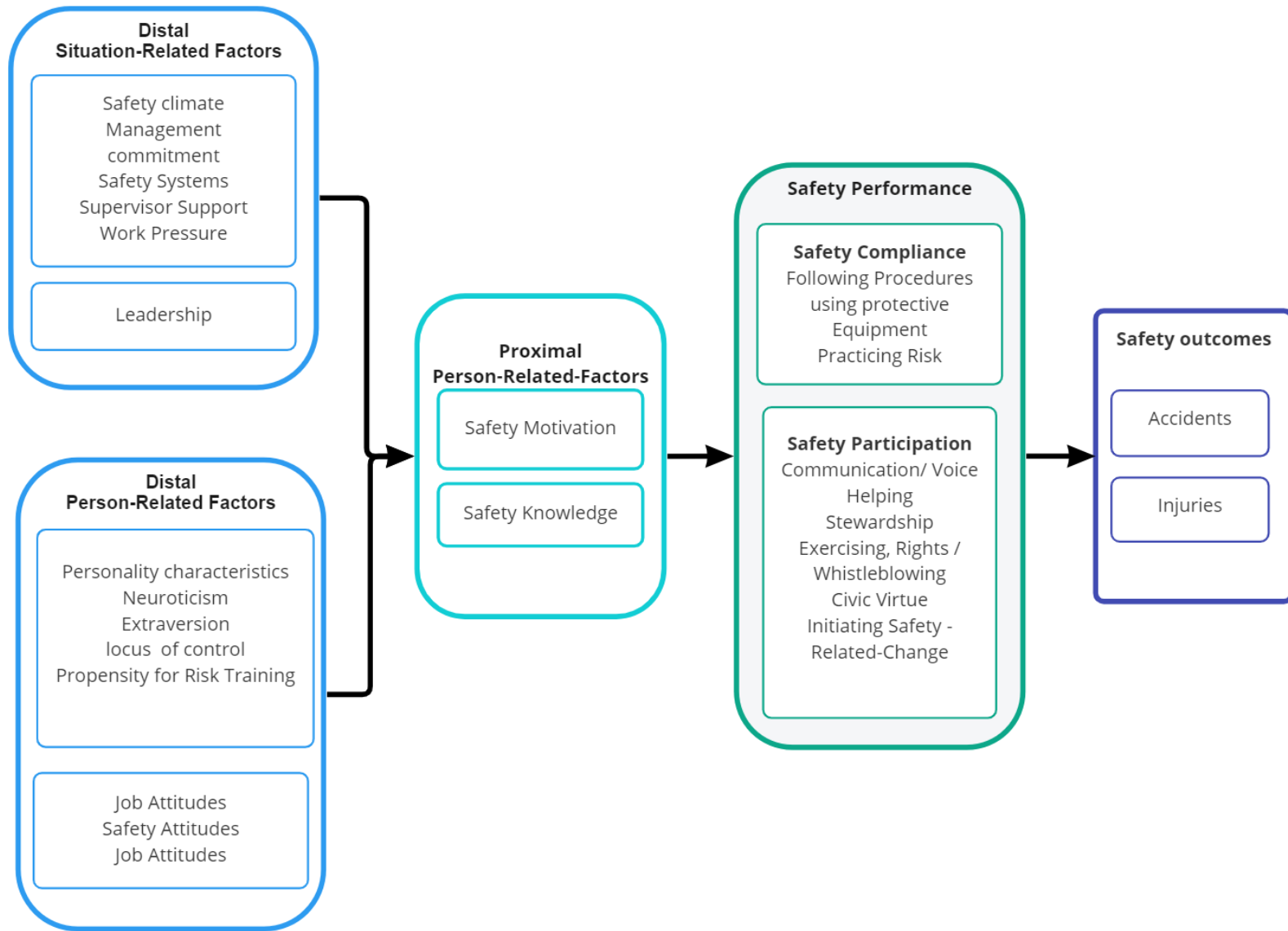


Fig. 1: Integrative Model of Workplace Safety by Christian et al. 2009, p. 1105

2.1.1.2 The Systems Engineering Initiative for Patient Safety Model

Carayon et al. developed an initial model and two extensions of the “System Engineering Initiative for Patient Safety (SEIPS)” model from 2006 to 2020.

The first System Engineering Initiative for Patient Safety (SEIPS) model (Carayon et al., 2006)

SEIPS is a dynamic, descriptive model, suitable to take a look at the work system and reflect about the different aspects of the whole work system, their interactions and possible outcomes. (Carayon et al., 2006).

Table 1: The components and elements of the SEIPS Model (Carayon et al., 2006):

	Components	Elements (examples)
Work system or structure	Person	education, skills, knowledge, motivation, needs, physical- and psychological characteristics
	Organizations	teamwork, coordination collaboration, communication organizational culture, patient safety culture work schedules, social relationships, supervisory, management style, performance evaluation, rewards, incentives
	Technologies and tools	various information technologies: electronic health records, computerized provider order entry, bar coding medication administration, medical devices, other technologies and tools, human factors characteristics of technologies and tools.
	Tasks	variety of tasks, job content, challenge and utilization of skills, autonomy, job control, participation, job demands (e.g., workload, time pressure, cognitive load, need for attention)
	Environment	layout, noise, lightning, temperature, humidity, air quality, work station design
Process	Care process and other processes	information flow, purchasing, maintenance, cleaning, process improvement activities
Outcomes	Employee and organizational outcomes	job satisfaction, attitudes, stress, burnout, employee safety and health, turnover, organizational health
	Patient outcomes	Patient safety, quality of care

The Systems Engineering Initiative for Patient Safety (SEIPS) 2.0 model (Holden et al., 2013)

The SEIPS 2.0 model (Holden et al., 2013) is specifically designed to incorporate input from patients, families, and non-professionals. SEIPS 2.0 introduces three new elements to the original model: configuration, engagement, and adaptation (Holden et al., 2013).

Configuration emphasizes the dynamic and interactive nature of socio-technical systems and provides a snapshot of how health-related performance is shaped at a given point in time (Holden et al., 2013).

Engagement refers to the involvement of different individuals and teams in health-related activities, including patients, caregivers, and non-professionals (Holden et al., 2013).

Adaptation serves as a feedback mechanism that illustrates how dynamic systems evolve in both planned and unplanned ways (Holden et al., 2013).

The Systems Engineering Initiative for Patient Safety (SEIPS) 3.0 model (Carayon et al., 2020)

Carayon et al. developed the SEIPS 3.0 model in 2020, building upon the foundation of the earlier SEIPS (Carayon et al., 2006) and SEIPS 2.0 (Holden et al., 2013) models.

SEIPS 3.0 introduces several key developments, including considering the interplay of various factors in complex healthcare systems and expanding the process component by using the concept of the patient journey to describe the spatio-temporal distribution of patients' interactions with multiple care settings over time (Carayon et al., 2020). This new approach takes into account both the locations where patients interact with care settings and the timing of these interactions, providing a more comprehensive understanding of the patient journey and its relationship to patient safety (Carayon et al., 2020).

The SEIPS 3.0 model poses challenges for HFE researchers and professionals, such as multiple perspectives, genuine participation, and work at care setting boundaries (Carayon et al., 2020). However, it aims to enhance patient safety and healthcare outcomes by providing a comprehensive understanding of the patient journey and factors influencing safety within complex healthcare systems (Carayon et al., 2020)

Patient Journey Perspective: SEIPS 3.0 incorporates the concept of the patient journey, involving patients' interactions with different care settings over time. This perspective

enables a more holistic understanding of patient safety and care coordination throughout the continuum of care (Carayon et al., 2020).

Multilevel Analysis: SEIPS 3.0 emphasizes a multilevel analysis approach, recognizing that patient safety is influenced not only by individual and team factors but also by organizational and system-level factors. This comprehensive analysis allows for a more in-depth understanding of the complex interactions within healthcare systems (Carayon et al., 2020).

Health Information Technology (HIT) Integration: SEIPS 3.0 acknowledges the increasing role of health information technology in healthcare delivery. It considers how HIT integration affects patient safety, workflow, and communication among healthcare professionals (Carayon et al., 2020).

Patient-Centeredness: SEIPS3 places a strong emphasis on patient-centered care, recognizing the importance of patient engagement, preferences, and involvement in their care decisions to improve patient safety outcomes (Carayon et al., 2020).

Work System Design: SEIPS3 focuses on the design of work systems within healthcare organizations, exploring how work processes, resources, and organizational structures impact patient safety and quality of care (Carayon et al., 2020).

In order to effectively and sustainably improve patient safety, it is essential to consider not only individual employees but also the entire work system. The SEIPS model provides a useful framework for this, valuable for describing current or desired situations and planning interventions. While the model presents different components of the work system separately, it also highlights their mutual interactions (Carayon et al., 2020).

The SEIPS 3.0 Model, developed by Carayon et.al 2020, serves as the second theoretical background for this thesis. Fig. 2 shows the SEIPS 3 Model.

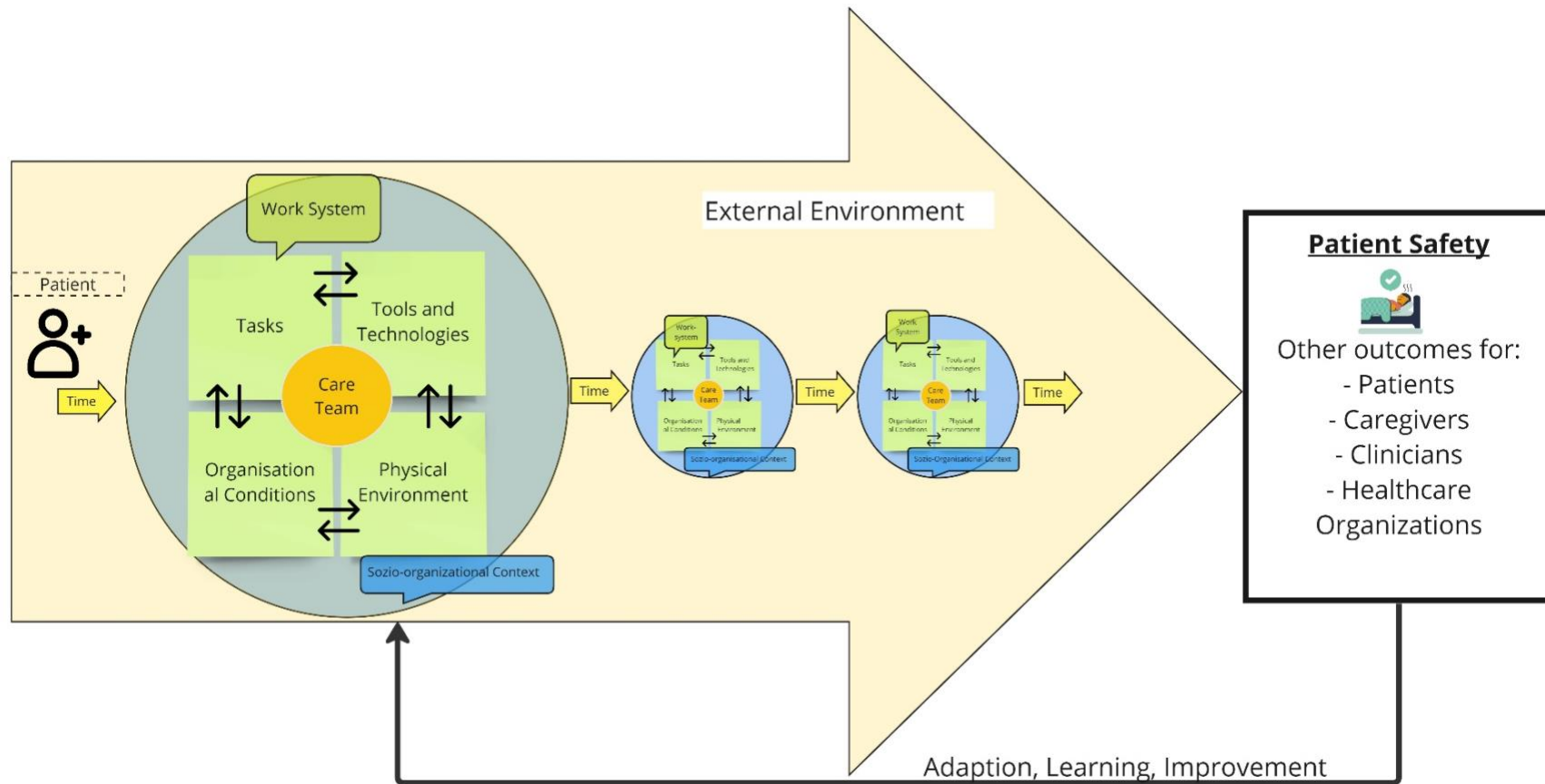


Fig. 2: SEIPS 3.0 Model: A Sociotechnical Systems Approach to Patient Journey (Carayon et al., 2020).

2.2 Empirical Background

The development of patient safety has evolved considerably since the first reports and publications on human error in the medical field. Healthcare systems and the healthcare environment are subject to constant dynamic change, influenced by internal and external factors. Maintaining patient safety benefits from studies that have an adaptive, empirical research approach that accounts for and responds to these multiple influences. (Kohn et al., 2000; Reason, 1990; World Health Organization, 2021).

At the focus of the current patient safety movement is the enablement of patients and their families (Dugdale et al., 2023; Fancott et al., 2021). This focus is highlighted by the global campaign "Elevate the voice of patients!" for World Patient Safety Day 2023 (World Health Organization, 2023a).

Healthcare-associated infections have a significant impact on the quality of healthcare, patient safety and healthcare costs (Erasmus et al., 2010; Rodríguez-Acelas et al., 2017; Schreiber et al., 2018; World Health Organization, 2023b). In this context, patient and external visitor engagement in infection prevention, particularly in interrupting the chain reaction, is becoming paramount, as has been emphasized in the context of the COVID-19 pandemic (Erasmus et al., 2009; Erasmus et al., 2010; Smiddy et al., 2015).

Empirical studies on compliance with hand hygiene guidelines have highlighted the positive and challenging impact of campaigns such as the "Clean Care is Safer Care" initiative on reducing healthcare-associated infections (Erasmus et al., 2010; Mouajou et al., 2022; Smiddy et al., 2015).

Human factors models provide a valuable framework to better understand the complexities of hand hygiene and address the widespread problem of non-compliance with hand hygiene guidelines in health care settings (Carayon et al., 2020; Christian et al., 2009). The WHO "Clean Care is Safer Care" campaign introduced a multimodal strategy that included five key components: 1) initiating systems change; 2) training and educating healthcare workers; 3) introducing assessment mechanisms and performance feedback; 4) integrating workplace reminders; and 5) promoting an institutional safety climate to improve hand hygiene practices in the global healthcare system (World Health

Organization, 2009). These theoretical models, when applied and adapted, are essential tools to improve the complex dynamics of hand hygiene compliance.

To ensure patient safety and workplace safety in infection prevention for staff and residents in nursing homes, multiple situational and person-related factors have to be considered (Carayon et al., 2020; Christian et al., 2009; World Health Organization, 2016b). Ongoing research in this area continues to provide insights for development of more effective measures to prevent HAI and protect patient health. By addressing these environmental, organizational, and individual factors, healthcare settings can create an environment that supports and encourages proper hand hygiene practices, ultimately reducing the risk of HAI transmission.

2.3 Objectives and Aims

The main aim of this thesis is to improve patient safety in nursing homes by gaining a deeper understanding of infection prevention and factors of safety performance. Specifically, the research aims to explore individual and organizational factors that influence hand hygiene behaviors among nursing home staff and general practitioners, as well as the role of safety performance in healthcare provider's ability to promote patient safety.

- 1) The first objective was to explore the influences of individual and organizational factors of hand hygiene in nursing home staff, with a particular focus on the function of role modeling by nursing managers.
- 2) The second objective was to explore hand hygiene behaviors of general practitioners in nursing homes, their attitudes toward infection prevention measures and the enablement of nursing home residents to perform hand hygiene measures.
- 3) The third objective was to provide a general perspective on safety performance and gain an understanding of how this construct influences the work of HCP to ensure patient safety.

By pursuing these objectives, the research seeks to identify opportunities for improving infection prevention and safety performance in healthcare organizations, leading to better patient outcomes.

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3 Publications

This dissertation comprises three articles published in international peer-reviewed journals indexed in Web of Science: Two publications are based on data from the PränosInAA study, which was conducted by the Institute for Hygiene and Public Health at the University Hospital Bonn with the cooperation of the Institute for Patient Safety (IfPS) between 2011 and 2015. One publication is based on data from the SPOHC study, which was conducted at the Institute for Patient Safety of the University Hospital, Bonn (IfPS) between 2018 and 2020.

3.1 Publication 1: Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: A cross-sectional mixed-methods study

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RESEARCH ARTICLE

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Nurses' knowledge, behaviour and compliance concerning hand hygiene in nursing homes: a cross-sectional mixed-methods study



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Abstract

Background: Effective hand hygiene is one of the most important measures for protecting nursing home residents from nosocomial infections. Infections with multi-resistant bacteria, associated with healthcare, is a known problem. The nursing home setting differs from other healthcare environments in individual and organisational factors such as knowledge, behaviour, and attitude to improve hand hygiene and it is therefore difficult to research the influential factors to improve hand hygiene. Studies have shown that increasing knowledge, behaviour and attitudes could enhance hand hygiene compliance in nursing homes. Therefore, it may be important to examine individual and organisational factors that foster improvement of these factors in hand hygiene. We aim to explore these influences of individual and organisational factors of hand hygiene in nursing home staff, with a particular focus on the function of role modelling by nursing managers.

Methods: We conducted a mixed-methods study surveying 165 nurses and interviewing 27 nursing managers from nursing homes in Germany.

Results: Most nurses and nursing managers held the knowledge of effective hand hygiene procedures. Hygiene standards and equipment were all generally available but compliance to standards also depended upon availability in the immediate work area and role modelling. Despite a general awareness of the impact of leadership on staff behaviour, not all nursing managers fully appreciated the impact of their own consistent role modelling regarding hand hygiene behaviours.

Conclusion: These results suggest that improving hand hygiene should focus on strategies that facilitate the provision of hand disinfectant materials in the immediate work area of nurses. In addition, nursing managers should be made aware of the impact of their role model function and they should implement this in daily practice.

Keywords: Infection prevention, Hand hygiene, Nursing homes, Nurses role, Nursing manager, Nursing, Patient safety

Background

Healthcare-associated infections are a major cause of morbidity and mortality in nursing homes [1, 2]. In 2015 there were 426.277 cases of infections with multi-resistant bacteria associated with health care registered in Europe [3]. The most effective single measure for infection prevention

in various health care settings, including nursing homes is (antiseptic) hand rubbing [4–6].

This term refers to “applying an antiseptic handrub to reduce or inhibit the growth of microorganisms without the need for an exogenous source of water and requiring no rinsing or drying with towels or other devices” [7]. The 5 moments of hand hygiene define care situations that should always lead to a hand rub [7]. Previous research has pointed to individual knowledge deficits influencing safe hand hygiene practices in nursing homes such as correct duration of hand washing and deficits in

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hand rub recommendations [8–10]. It was also shown that the incidences of serious infection could be reduced after the introduction of a multifaceted hand hygiene program to improve hand hygiene adherence and compliance in nursing homes [11, 12]. However, it has been pointed out that the application of hospital infection control guidelines to nursing homes is often unrealistic in terms of system differences and different available resources for infection prevention [13]. For example, the absence of a sink was found to be a major hindrance to hand hygiene in the nursing home setting [14]. Individual factors of nurses such as knowledge of the 5 moments of hand hygiene, behaviours including not wearing hand and arm jewellery while nursing, and applying their learnings from the latest hygiene training, to improve compliance of hand hygiene measures, are important prerequisites for infection prevention. Yeung et al. [11] showed that hygiene programmes and education could effectively increase adherence to hand rubbing and reduce the incidence of serious infections in nursing homes. Thus, apart from these individual factors, effective hand hygiene also requires adequate organisational factors including availability of hand rub, stock of protective clothing, and strong local efforts from the nursing management such as role modelling. Role modelling is defined by Merton as; a person who sets a positive example and is worthy of imitation [15]. Huis et al. have shown that hand hygiene was performed more frequently when group members with a higher hierarchical position disinfected their hands [16]. Schneider et al. found that adherence of junior practitioners improved under the supervision of adherent role models [17]. Furthermore, Lankford et al. pointed out that healthcare workers in the presence of a senior who is not washing his hands are also less likely to wash their hands [18]. In contrast to other care settings, improvements in nursing homes are often compromised by the prevailing goal conflict between preserving a homelike environment and social care on the one hand, and the adoption and control of infection prevention measures on the other [13, 19, 20]. In times of demographic change and the post-antibiotic era, the challenges to organisational and individual framework conditions in nursing homes are shifting. Residents' expectations of the time they spend in nursing homes have changed in terms of quality of life, active participation and protection against multi-resistant pathogens [21, 22]. Generally, the interventional approaches to hand hygiene in nursing homes do not seem to differ from those in other care settings. However, in the nursing home setting, change processes towards improved hand hygiene outcomes are often non-transparent [8, 9, 14, 23]. While a large proportion of multidrug-resistant infections in nursing homes could be avoided through appropriate hand hygiene behaviour of nurses, this behaviour is influenced by organisational

factors such as hygiene training, availability of resources and improved role modelling of nursing managers [24–28].

This study intends to contribute to an improved understanding of infection prevention with a focus on hand hygiene in nursing homes. We explore the impact of organisational factors on hand hygiene behaviour with a particular focus on role modelling. We combine the perspectives of nurses and nursing managers to do this.

Methods

Aim of the study

The aim was to improve understanding of the organisational factors related to compliance with infection prevention management, focussing on hand hygiene in nursing homes. Our research questions considered the perspectives of nurses and nursing managers on their hand hygiene knowledge (*What knowledge do nurses have / How do nursing managers perceive nurses' knowledge concerning hygiene management and infection prevention?*), their hygiene practices and compliance with hygiene guidelines (*Which hygiene behaviours do nurses report / nursing managers observe in their staff?*) as well as how these behaviours are supported or hindered by organisational aspects and role modelling by nursing managers (*What are the perceptions of nurses and nursing managers of organisational structures and processes supporting hand hygiene? In what way do nurses perceive nursing managers / do nursing managers regard themselves as role models for hand hygiene?*). We applied a mixed-methods approach, collecting survey data on nurses' knowledge, behaviour, and compliance regarding hand hygiene as well as interview data on nurse managers' perspectives of organisational influence on infection prevention, to explore multiple perspectives in relation to our research questions. We provide a rich description of the organisational factors that have to be considered when aiming to improve hand hygiene in the nursing home setting.

Context of the study

This study was part of a larger cross-interventional project (2012–2015) which aimed to positively influence infection prevention practices, with a focus on hand hygiene in nursing homes for elderly care, through educational and supportive measures for nurses and general practitioners, to improve hygiene practices and rational use of antibiotics. This study reports on the baseline assessment from the nursing perspective.

Study setting

A pool of 542 nursing homes was identified. After purposeful sampling i. e. nursing homes caring for older residents each with a mix of care levels ranging from basic support to full nursing provision to meet all aspects of resident care' and a minimum of 80 residents per nursing home, six institutions were randomly selected and invited to

participate in the project. The participating nursing homes cared for 80–130 residents and have four to eight residential areas. In the participating nursing home, there were several managerial and nursing roles: The nursing home managers held the overall responsibility for the whole facility including all employees. They each had a nursing background and additional management qualifications. Nursing managers were responsible for ensuring continuous quality of care and had the responsibility for all nursing staff. In addition to being fully qualified nurses, they had additional training or an academic degree in nursing management. Nursing staff was registered or geriatric nurses. Registered nurses had received three years of training before state examination. This qualifies them to work in acute or long-term care in hospitals, nursing homes and ambulatory care settings without additional training. Geriatric nurses had an additional three years of specialty training with state examination. Geriatric nurses are qualified to work in the care and support of the older people in nursing homes, ambulatory care settings or hospitals with a specialisation of geriatric medicine. They were responsible for the quality and evaluation of the care plan, the practical training of nursing students and treatments such as wound care and the administration of drugs. Nursing aids with one year (or no formal) training follows the nursing care plan while working directly with the residents. All hygiene representatives were registered nurses with additional training in hygiene and infection prevention.

Study design

We employed a mixed-methods design with a concurrent triangulation strategy to support our analyses from multiple sources [29]. Quantitative and qualitative data were analysed independently by several researchers. At the triangulation stage, both data sources were combined and given equal weight in the interpretation of data. This approach of integrating findings from the quantitative and qualitative strand of the study at the interpretation stage contributes to a more complete, balanced and insightful portrait of the phenomena under investigation [29, 30].

Quantitative strand

Staff survey

For the PānosInAA study, we developed a survey for nurses in German based on a literature overview that focuses on the perceived knowledge and behaviour of nurses in nursing homes. Content expert members of the research team were involved in its development and cognitive pretesting of the survey items through an iterative process involved five nurses working in older people care. The survey was intended as a tool to collect descriptive data for a series of independent items, not as a questionnaire designed to measure underlying constructs

[29, 31]. In line with the research questions, the survey covered the following topics:

- knowledge of hand hygiene (e.g. duration of hand rub);
- perceived behaviours concerning hand hygiene;
- perceived compliance with hygiene standards and integrated hygiene training in practice;
- organisational management of hygiene issues (e.g. communication between nurses and nursing managers, general practitioners);
- organisational factors related to structures and processes hindering or facilitating hand hygiene practices (e.g. access to gloves); and
- perceived role modelling by nursing managers.

The survey comprised 23 main questions, five of which had a total of 34 subcategories. To obtain more detailed information most items could be answered in subcategories and multiple answers were possible. In order to capture data on nurses' knowledge, we used nominal response categories (i. e. "correct" and "wrong"). For other topics, we used items with a five-point Likert scale with response categories "always", "often", "sometimes", "rarely" and "never". The survey did not contain any open-ended questions. Divulging socio-demographic data was optional. We calculated the percentages of participants answering "always" or "often" on each item. To explore the differences between the main groups (i. e. Registered nurses, nursing aides/students) we used Fisher's exact test on all survey data (see Table 2). The full survey is not published and available from the corresponding author on request. However, the relevant items for this study are provided in Table 2.

Data collection

During January through March 2013, we conducted a baseline survey with nurses with different levels of training in the participating nursing homes. This was prior to any training intervention relating to the overall project.

Qualitative strand

Data collection

An interview guide, based on our initial literature review Method. In line with the survey for nursing staff it consisted of open-ended questions concerning the following topics:

- contact persons regarding questions concerning infection prevention;
- hygiene topics in handovers;
- possibilities of hand hygiene during care;
- accessible supply of hygienic material;
- compliance to hygiene standards; and
- role modelling with regard to infection prevention.

To identify similarities and differences between particular aspects of phenomena [29] in relation to our research questions, we invited 36 nursing managers from the participating nursing homes for semi-structured interviews in February and March 2013. Acknowledging their managerial experience, individual perspectives and perceived influence on hygiene management and hand hygiene, we explored their multiple perspectives until data saturation was obtained [32, 33].

Each interviewee was informed about the purpose and voluntary nature of the study, data anonymity and security, interviewers' professional background and role in the project. After obtaining informed consent, interviews were conducted by a team comprising of one lead interviewer and one or two observers with a background in nursing. The duration of the interviews was not fixed. All interviews were audio-recorded and transcribed according to standard linguistic conventions [34].

Data analysis

Quantitative data analysis

During a quality check, surveys with missing value rates $\geq 80\%$ were excluded from the analysis. Survey results were summarised via descriptive statistics (mean, standard deviation, frequency of each answer (see Table 2). Data management and analysis were conducted using the IBM software SPSS for Windows release version 22 (SPSS, Inc., 2013; Chicago, IL; <http://www.spss.com>).

Qualitative data analysis

All audio-recordings of interviews were anonymised during transcription. Interview transcripts were discussed by a multidisciplinary team consisting of 9 researchers with backgrounds in medicine (2), healthcare management (2), nursing science (2) and psychology (3), in weekly meetings and analysed for emergent themes following an investigator triangulation approach [35]. The themes emerging from this analysis were grouped into six major categories:

- perceptions of nurses' knowledge concerning hygiene standards;
- perceptions of impact for nurses' hygiene training;
- nursing managers' perceptions of nurses' hand hygiene behaviours;
- nursing managers' perceptions of nurses' compliance with hygiene standards;
- nursing managers' perceptions of organisational factors facilitating or hindering hand hygiene; and
- nursing managers' reflections on their function as role models.

These themes were then used by the researchers for interview coding (using software MAXQDA version 11; Copyright ©1995–2017, VERBI GmbH). Coding

discrepancies were discussed among the researchers and resolved by consensus. In a final step, each transcript was individually summarised to a content analysis following the principles of Bogdan and Biklen [36]. This extract allowed for interpretation at the individual level as well as for comparison between nursing homes.

Concurrent triangulation

During concurrent triangulation [29] the relationships, differences, and interactions between the mixed data and the theoretical concept of the study became apparent. During this process, the different perspectives and inputs from the multidisciplinary research team were crucial. Their professional experiences and theoretical backgrounds allowed for a diverse discussion and deep reflection of affirmative and contrasting results.

Results

Quantitative strand: staff survey results

The overall response rate was 42% (183 out of 431 surveys). We excluded ($n = 18$; 10%) surveys due to $\geq 80\%$ missing values. Our final sample was 165.

Survey participants

The majority of the sample was female ($n = 132$; 80%) (Table 1). Survey respondents were licensed nurses ($n = 85$; 52%) with an average age of 47 years. The majority of nurses had job tenures of ≤ 5 years in their institution ($n = 46$; 28%) and worked in day shifts ($n = 104$; 63%).

Table 2 presents mean percentages and 95% confidence intervals for the complete sample, nursing aides and registered nurses. Based on Fisher's exact test, only two items demonstrated a statistically significant difference between professional groups.

Nurses' knowledge concerning hygiene management and hand hygiene

Correct hand hygiene is the most effective activity to prevent nosocomial infections. Therefore, we asked nurses what the recommended duration of hand rub is. The correct answer of 30 s was known by 79% of the respondents (Fig. 1). When asked if wearing gloves substitutes a hand rub, 68% answered correctly with "never". 52% of the nurses knew they always have to use hand rub after using gloves. 61% of staff answered that hygiene standards were completely understandable to them (Fig. 2). Finally, 25% of the participants saw licensed nurses as their main contact for questions concerning hygiene issues.

Nurses' self-reported hand hygiene behaviour and compliance with hygiene standards

Concerning their own hygiene behaviour, 56% reported that it was always possible to perform hand hygiene while taking care of residents. 21% of the nurses

Table 1 Characteristics of survey and interview participants

Survey participants					Interview participants	
Participant characteristics	Frequency (N = 165)	Mean	SD +/-	% of sample	Frequency (N = 27)	% of sample
Gender	148			90	27	100
Female	132			80	24	89
Male	16			10	3	11
Age	123	47	12	75	27	100
< 29	11			7	2	7
30–39	27			16	2	7
40–49	23			14	8	30
50–59	50			30	9	33
> 60	12			7	6	22
Staff profession	155			94	27	100
Director of Nursing	–			–	6	22
Licensed Nurse / Geriatric Nurse	85			52	15	56
Nursing Aid / Nursing Assistant	65			39	–	–
Nursing Students	5			3	–	–
Hygiene Specialist (nursing background)	–			–	4	15
Hygiene Specialist (other professional backgrounds)	–			–	2	7
Shift	149			90	27	100
Day	104			63	27	100
Night	6			4	–	–
Day and Night	39			24	–	–
Job tenure in the institution (years)	128	10	7	78	27	100
< 5	46			28	4	15
6–10	25			16	4	15
11–15	26			16	8	30
16–20	18			11	6	22
21–25	11			7	5	19
> 25	1			1	–	–

An overview of responses to the staff survey is given in Table 2 as well as in Figs. 1 and 2.

reported wearing hand and arm jewellery always or often while caring for patients. 41% of respondents reported always applying the learnings from their last hygiene training in their daily work. Concerning their perceived compliance with the hygiene standards, 47% of nurses indicated that they always follow standards. Furthermore, 35% of nurses expressed that in cases of existing infectious diseases, hygiene standards were always discussed during shift handover.

Nurses' perceptions of organisational influences on hand hygiene

Nurses reported that there was always (79%) suitable gloves in the residential area and there was always (67%) an accessible stock of protective clothing. 15% answered that they cannot disinfect their hands during active care because

there is no hand rub available in the resident rooms. The nurses perceive their direct supervisor as a role model for compliance with hygiene standards (38% "always").

Qualitative strand: results of nursing manager interviews

Sample characteristics

All the interviewed nursing managers worked in one of the six participating nursing homes. We invited all nursing managers to participate in the study and had a participation rate of 100%. Interviews lasted an average of 14 min (min. 9; max. 40). Most of the interviewed nursing managers were female (89%) and between 50 and 59 years old (33%). More than half of the interview participants (55%) worked as unit managers. All interviewees worked day shifts and had worked between 11 and 15 years (37%) in the participating nursing homes.

Table 2 Descriptive survey findings from registered nurses' and nursing aides' knowledge and perceived behaviour concerning hand hygiene and infection preventions

	Percent of "Always" or "Often" (Group means and 95% confidence intervals)					
	Complete sample (N = 165)		Nursing Aides/ Students (n = 57)		Registered Nurses (n = 80)	
1. What knowledge do nurses have concerning hand hygiene?						
Could wearing gloves substitute a hand rub?	6.1%	±3.7%	3.8%	±5.3%	10.0%	±6.6%
Should you rub your hands after taking off gloves?	81.8%	±5.9%	86.5%	±9.4%	81.3%	±8.6%
Do you ask the registered nurse/geriatric nurse questions concerning hygiene?	46.1%	±7.6%	63.5% ^a	±13.2%	30.0% ^a	±10.1%
Do you ask the nursing aide/nursing assistant questions concerning hygiene?	6.7%	±3.8%	7.7%	±7.3%	3.8%	±4.2%
Do you ask the hygiene representative nurse questions concerning hygiene?	29.1%	±7.0%	15.4% ^b	±9.9%	35.0% ^b	±10.5%
Do you ask the nursing students questions concerning hygiene?	1.8%	±2.0%	1.9%	±3.8%	1.3%	±2.5%
Do you ask the residential nurse questions concerning hygiene?	32.7%	±7.2%	36.5%	±13.2%	33.8%	±10.4%
Do you ask the director of nursing questions concerning hygiene?	21.8%	±6.3%	13.5%	±9.4%	21.3%	±9.0%
Do you ask the executive director questions concerning hygiene?	9.7%	±4.5%	7.7%	±7.3%	6.3%	±5.3%
Do you ask the general practitioner questions concerning hygiene?	7.9%	±4.1%	1.9%	±3.8%	11.3%	±7.0%
2. Which behaviours do nurses report in relation to hand hygiene?						
Is it possible to disinfect your hands while taking care of a resident?	72.7%	±6.8%	65.4%	±13.1%	75.0%	±9.5%
Do you wear hand or arm jewellery during work?	20.6%	±6.2%	19.2%	±10.8%	26.3%	±9.7%
Does the use of gloves damage your skin?	5.5%	±3.5%	9.6%	±8.1%	3.8%	±4.2%
Do you apply the content of the last hygiene training in your daily work?	83.6%	±5.7%	82.7%	±10.4%	83.8%	±8.1%
3. What do nurses report about their compliance with hygiene standards?						
Do you apply the hygiene standards?	82.4%	±5.8%	82.7%	±10.4%	82.5%	±8.4%
Have you ever not disinfected your hands for personal reasons?	3.6%	±2.9%	7.7%	±7.3%	2.5%	±3.4%
Possible reason: "I had a skin defect."	1.8%	±2.0%	3.8%	±5.3%	1.3%	±2.5%
Possible reason: "I was under time pressure"	4.8%	±3.3%	3.8%	±5.3%	5.0%	±4.8%
Possible reason: "I didn't think of it."	3.6%	±2.9%	1.9%	±3.8%	6.3%	±5.3%
Possible reason: "When my hands are moist with hand rub, I cannot put on the gloves."	17.0%	±5.7%	15.4%	±9.9%	20.0%	±8.8%
Possible reason: "My skin does not tolerate the hand rub."	5.5%	±3.5%	11.5%	±8.8%	3.8%	±4.2%
Possible reason: "I wear gloves instead of disinfecting my hands."	6.7%	±3.8%	7.7%	±7.3%	8.8%	±6.2%
Is adherence to hygiene standards discussed during staff handovers? (For example, in case of existing infectious diseases)	58.8%	±7.5%	65.4%	±13.1%	58.8%	±10.9%
4. What are nurses' perceptions of organisational structures and processes to improve infection prevention?						
Are suitable gloves always available in your residential area?	93.9%	±3.7%	92.3%	±7.3%	95.0%	±4.8%
Is there always an accessible stock of gloves on your residential area?	95.2%	±3.3%	92.3%	±7.3%	97.5%	±3.4%
Is there an accessible stock- pile of protective clothing (gown, mask, and cap) in your residential area?	79.4%	±6.2%	78.8%	±11.2%	77.5%	±9.2%
Do you remember a situation that prevented you from doing a hand rub for operational reasons?	0.6%	±1.2%	0.0%	±0.0%	1.3%	±2.5%
Yes, because there was no hand rub available on the corridor of the residential area.	3.0%	±2.6%	0.0%	±0.0%	5.0%	±4.8%
Yes, because there was no hand rub on the care cart.	0.6%	±1.2%	0.0%	±0.0%	1.3%	±2.5%
Yes, because there was no hand rub in the work room.	1.2%	±1.7%	0.0%	±0.0%	1.3%	±2.5%
Yes, because there was no hand rub in the community room.	4.2%	±3.1%	1.9%	±3.8%	7.5%	±5.8%

Table 2 Descriptive survey findings from registered nurses' and nursing aides' knowledge and perceived behaviour concerning hand hygiene and infection preventions (*Continued*)

	Percent of "Always" or "Often" (Group means and 95% confidence intervals)					
	Complete sample (N = 165)		Nursing Aides/Students (n = 57)		Registered Nurses (n = 80)	
Yes, because there was no hand rub at the nursing station.	1.8%	±2.0%	0.0%	±0.0%	2.5%	±3.4%
Yes, because there was no hand rub in the resident's room.	19.4%	±6.1%	23.1%	±11.6%	20.0%	±8.8%
5. Do nurses see nursing managers as role models regarding infection prevention?	66.7%	±7.2%	73.1%	±12.2%	63.8%	±10.6%

Note: Fischer's exact test was used to compare different groups, and only two items resulted in a statistically significant difference between registered nurses and assistant nurses

^a *p* < 0.001

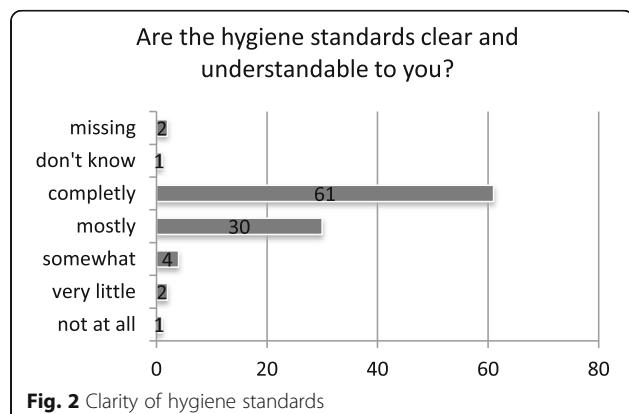
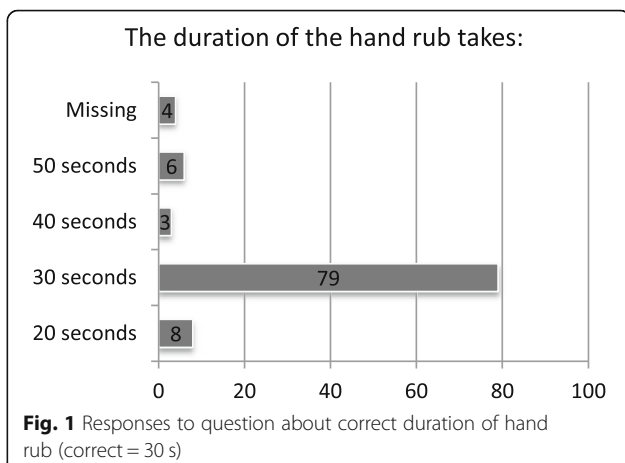
^b *p* = 0.016

Nursing managers' perceptions of nurses' knowledge concerning hand hygiene

Our interviews revealed a broad range of nursing managers' perceptions of nursing staff knowledge of hand hygiene practices in place to maintain and further this knowledge. For all nursing homes, it was highlighted that nurses have access to the nursing and hygiene standards at all times to independently further their knowledge. "First of all, we've got a binder with hygiene standards. It is also available in the residential areas, where staff can check things in case of uncertainty. If the material isn't helping, I've got the hygiene representative to back me up, who's in contact with sources outside this house, where additional info can be obtained." (quote 1, Interview partner (IP)1). Nursing managers stated that the terminology used in the hygiene standards was easy to understand and that standards were clearly structured. One nursing home manager had responded to the fact that many nurses are non-native speakers by ensuring access to relevant information in native languages for staff and by providing collegial support for learning about hygiene standards. "There are different approaches to ensure that most nurses understand the standards.

One opportunity is to engage nurses. Our hygiene standards are created by staff members and individual training is carried out while nursing. (...), if residents come back from the hospital with an (...) infection, we always talk about what's important in the handover, (...), and include the hygiene standards." (quote 6, IP15). Another nursing manager also discussed this. "You also notice that some employees ask questions that need to be explained in more detail. Likewise, for foreign employees, you sometimes need to have a more specific conversation. But, oh well, that's what we're here for." (quote 2, IP2). Nursing managers also described that in nursing homes, similar approaches were offered to help nurses improve their knowledge. "I also get support from the practice instructor (educational role) who is very ambitious for everything to run smoothly, just as provided in the hygiene standards." (quote 3, IP6).

Another factor mentioned as influencing nurses' knowledge was text comprehension; particularly concerning unfamiliar terminology and the transfer of expert knowledge into practice. Several strategies of knowledge transfer were described by interview participants however their expectations concerning this knowledge transfer varied greatly. While one nursing manager indicated that everything was clear from the documentation, another manager



stated that the nurses do not understand all the standards. *"I always say what's written it is reasonable for everyone. There're also these illustrative pictures."* And *"Sometimes you need to read the principles three or four times before understanding them. Many things are written in percentages, this is not clear to some people. For them, it was learned once at school and was then ticked off."* (quote 4, IP3 and quote 5, IP5).

Perceptions of impacts on nurses' hygiene training

In one nursing home, proactive planning and employee-oriented alignment of training were referred to as a well-functioning management system (quote 2, IP2). This notion was supported by another nursing manager who expressed a need for hygiene standards to be communicated frequently and actively practiced. *"It still is the case, that we are a little blind, the standards are there, you could become better and say: Hey, look it could be even better! It [standards?] often goes down in daily routine. Honestly, I'm that way too sometimes."* (quote 15, IP9). One interviewee explained that the main hygiene management strategy was to empower employees (quote 6, IP15).

In this nursing home, the knowledge and implementation of hygiene standards were also part of annual agreed targets with nurses who can make suggestions during appraisal regarding specific areas they would like to be trained in that year.

While it was described as common practice to motivate nurses to independently actively close knowledge gaps concerning hand hygiene, interviewees, however, were not always confident that the relevant information was actively sought often enough in cases of uncertainty or that questions were openly asked to clarify any hygiene issues. Some nursing managers even expressed doubts concerning the basic requirement of reading hygiene standards. *"I don't think anyone from this house has read the hygiene standards. I'm firmly convinced of that. I reckon everyone has signed off on the standards but no one has read them. And I do give them time (for it), but they don't do it."* And *"To be honest, I don't think that non-registered nurses have even read them (hygiene standards)."* (quote 7, IP5 and quote 8, IP4).

All nursing managers expressed their belief that the standards need to be repeated regularly through staff training otherwise they will be forgotten. In one nursing home, the managers highlighted their long-term task of ensuring relevant knowledge is acquired and nurses are applying correct behaviours. They stressed that standards need to be discussed individually as well as collectively.

However, keeping up to date and obtaining support concerning hand hygiene was described as challenging. For example, one manager expressed her frustration when aiming to obtain additional information. *"Sometimes I ask*

the nursing home manager, but she doesn't always know everything in detail. I google more often. I research at home, for example for multi-resistant pathogens and often the GPs don't know what to do, either." (quote 9, IP5).

Nursing managers' perceptions of nurses' hand hygiene behaviours

When nursing managers described nurses' hand hygiene behaviour they often discussed the availability and use of hand rub during the nursing care of residents. Some interviewees argued against a permanently available hand rub inside resident rooms and bathrooms while nursing. Their reasoning reflected the risk that a cognitively impaired resident might consume the toxic alcohol-based hand rub. The consequence of having to leave a resident's bathroom frequently for hand rubs was described as unsatisfactory by one residential nurse. *"Most staff wear their wedding rings during care. I (...) try to give them various short internal training. A while ago, I asked the director of nursing for a written guideline about artificial nails and jewellery and she prepared it. But after a little while, some nurses asked me: Why can't we wear our nails like the colleagues on the other units? I don't know why it was so inconsistent! ...and since then it has been a constant topic and caused much disagreement in my team."* (quote 14, IP24). The danger for residents from transmitted pathogens was frequently described as being lower than the risks from drinking denatured hand rub. However, this risk assessment was different when describing care for a resident with an infection. *"They have to go out (to the hallway). To the care trolley, yes. (...) But, in special resident rooms, we have it. (...) In case of infection there is a dispenser in the room."* (quote 10, IP24). In two other nursing homes, single-use or mobile hand rub bottles were available for staff to take into the resident rooms. *"It is possible; nurses have a care cart that can be placed in front of the door. And you can also take the disinfectant inside the resident's room, as we don't have fixed dispensers on the carts. We also have little bottles for our coats."* And *"We have the possibility to put these little bottles in our jackets or aprons. But the staff rarely does this."* (quote 11, IP5 and quote 12, IP1). Nevertheless, this example demonstrates that it is not sufficient to simply provide hand hygiene equipment without staff training and guidance.

Nursing managers' perceptions of nurses' compliance with hygiene standards

The interviewees described consistent leadership and decision-making, the adoption and awareness of role modelling, and empowerment of staff by nursing managers all had an influence on staff compliance with hygiene standards. Nevertheless, nursing managers also described challenges in achieving this in daily work, as

illustrated. *"There are colleagues who wear jewellery. They are repeatedly made aware of it not being okay. We have got very clear guidelines. They also know this but they think they can always cheat their way through. Other colleagues present their hands and fingernails as prescribed in the hygiene standards. Because these nurses know I pay attention to it."* (quote 13, IP8).

The interviews also highlighted the inconsistency in leadership in single units compared to the leadership of the whole nursing home. *"Most staff wears their wedding rings during care. I (...) try to give them various short internal training. A while ago, I asked the director of nursing for a written guideline about artificial nails and jewellery and she prepared it. But after a little while, some nurses asked me: Why can't we wear our nails like the colleagues on the other units? I don't know why it was so inconsistent! ...and since then it has been a constant topic and caused much disagreement in my team."* (quote 14, IP24).

Nursing managers indicated that the verification of compliance is impossible for most areas of care because the care takes place in closed resident rooms. Nevertheless, when care observations were conducted, they frequently noted that hygiene standards were not adhered to. One interviewee reported regularly carrying out inspections and participating in team meetings of all residential areas to verify compliance to hygiene standards. Another interviewee also highlighted the importance of strong, attentive leadership. During regular inspections, she verifies compliance and alerts staff in cases of deviations. Repeated orientation towards the standards within the daily work routine was described as being challenging. *"It still is the case, that we are a little blind, the standards are there, you could become better and say: Hey, look it could be even better! It [standards?] often goes down in daily routine. Honestly, I'm that way too sometimes."* And *"Sometimes I observe that the compliance to standards, for example during the catheter change was not completely adhered to."* (quote 15, IP9 and quote 16, IP14).

Nursing managers' perceptions of organisational factors facilitating or hindering hand hygiene

The challenge of balancing the competing goals of implementing hygiene measures whilst simultaneously preserving social care and a homelike environment was frequently highlighted in the interviews. The assessment of hygiene management in the nursing home was often compared with one's own home environment and appeared to frame the interpretation of infection prevention in nursing homes. *"Maybe even too much here and there. Because in the nursing home almost everything should be like at home."* (quote 17, IP17). The lack of clear conceptualisation of the nursing home as a health-care facility as hindering a consistent organisational

approach to hygiene management was also evident in the variable use of disinfecting agents described by nursing managers. IP4: *"Handrub during caring? We have a care trolley always in front of the door, so that you can grab things on the side."* Interviewer: *"And what happens while caring for residents with infections?"* IP4: *"Then we have special sets in front of the room."* And *"After that, the General Practitioner will be contacted. Then we prepare the room, a single room, we do have two alternative rooms here."* (quote 18, IP4 and quote 19, IP1).

Generally, nursing managers reported a change in infection prevention practices and organisational procedures supporting these behaviours in cases of infection. For example, all nursing managers reported that there was always a sufficient supply of gloves and protective clothing available in residential areas. This was ensured by weekly orders. In most facilities, central "Pandemic boxes" containing additional protective material were available to manage pandemic outbreaks or unforeseen infectious diseases. In the case of newly detected infectious diseases, some nursing homes had the capability for resident separation (quote 19, IP1).

Nursing managers' reflections on their function as role models

Nursing managers were partially conscious of being seen as a role model by the nurses. While some pointed out that leading by example requires discipline, some also realised, during the interview, that their role modelling was not as consistent as it should be. *"Although I ask myself now, am I a good role model, if I wear rings myself? (...) I also like to wear the watch on my wrist, but one also tries to discipline oneself and say: I take it (the watch) off now."* (quote 20, IP1). Interviews also revealed a lack of nursing managers' self-reflection even for hygiene topics covered in the recurrent training. *"I don't wear jewellery. But, I wear the wedding ring, yes! (...) (Laughs) I never thought about it. (...) Perhaps because nothing has happened until now or perhaps because I don't know about it. I can't give you an answer to this. But, sure, we repeatedly have training on that topic. You shouldn't do it. That's true!"* (quote 21, IP13).

Triangulation

Convergent results

When triangulating data sources, data converged around similar themes expressed by nurses and nursing managers. Both groups shared the perception that hand hygiene and infection prevention are important themes in daily work and recurring education with annual, mandatory hygiene training help to keep knowledge current. We also found shared views on the availability of hygiene equipment, hygiene standards and organisational procedures supporting

a need for better understanding of infection prevention practices.

Complementary results

It was relevant for nurses and managers that they themselves, their direct supervisors, and the licensed nurses comply with hygiene standards. Thus, most participants reported that during work they orient themselves towards what they learned in hygiene training courses. At the same time, however, referring to their own behaviour, some participants described wearing artificial nails or jewellery on their hands and arms. This inconsistency was often not noticed by study participants. Nursing managers also showed a lack of self-reflection concerning their function as role models. While they highlight the importance of hygiene management in the nursing home, they orient their behaviour towards their own conceptualisations of infection risks and personal attitudes instead of their organisation's hygiene standards.

Divergent results

We found divergent views of nurses and nursing managers concerning knowledge, perceived behaviour and perceived attitudes concerning hand hygiene. While most nurses gave correct answers to questions about hygiene practices such as the duration of hand rub, nursing managers were frequently in doubt about the level of understanding among staff. Furthermore, while nursing managers perceived nurses' behaviour as adhering to standards most of the time there were pronounced gaps where organisational procedures such as not allowing alcohol disinfectant in resident rooms and bathrooms hindered hand hygiene. The risk of poisoning a resident with disinfectant was perceived as more real than the possibility of nosocomial infection. However, this reasoning was abandoned when a resident was known to have an infection since under those circumstances the disinfectant would be used and deposited in the resident room.

Discussion

Due to the explosive nature of antimicrobial resistance on the health of the world's population, the Secretary-General of the United Nations makes it very clear that there is no time to wait for the strengthening of infection prevention in health facilities, as it is central to minimising disease transmission and the incidence and transmission of human disease. To address the unresolved and increasingly global problem of multi-resistant pathogens, hand hygiene in nursing homes is an important topic for study [1–3, 37–39].

In our study, we aimed to improve understanding of the individual and organisational factors relating to compliance with infection prevention management perceived by nursing staff and nursing managers, with the focus

on hand hygiene in nursing homes by applying a mixed-methods approach. We collected survey data on nurses' knowledge, behaviour, and compliance regarding hand hygiene as well as interview data on nurse managers' perspectives of organisational influence on infection prevention, to explore multiple perspectives in relation to our research questions. Applying a concurrent triangulation approach, we integrated the main results from the staff survey with nursing manager interviews. Those data described their multiple perspectives concerning relevant knowledge, behaviour, compliance and role modelling and were analysed to identify and clarify parallels and discrepancies in the views expressed at the staff and nursing management level.

Since nurses described their hand hygiene behaviour as being influenced through role modelling from nursing managers, the attitudes and resulting management decisions and behaviours of nursing managers might have an impact on the compliance of staff [40, 41]. However, nursing managers who did not thoroughly reflect on their role modelling behaviour described several inconsistencies in their reasoning and hand hygiene compliance due to personal preferences sometimes linked with outdated knowledge. Educational interventions should specifically address this topic to support nursing managers to act more responsibly and consistently as role models within their organisation.

In our results, we found two statistically significant differences between registered nurses and nursing aides/students regarding the importance of hand hygiene. The registered nurses would ask their peer's hand hygiene questions whereas the nursing aides/students would also ask the registered nurses hygiene related queries, rather than asking their peers. This is a positive sign from a patient safety perspective and unusual compared to the results of similar studies [42, 43]. To sum up, in the current study, the sample does not show any significance on most questions, which is interesting, because the knowledge, attitude, and behaviour on the subject of hand hygiene are similar, despite their different professional qualifications.

Our results indicated one in five nurses had correct knowledge of practical implementation of the hygiene training contents. The 30 s duration time of hand rub was answered correctly by 79%. In contrast, Aiello et al. found that only 40% knew the correct duration time of hand rubbing [9]. The fact that wearing gloves is not a sufficient substitute for a handrub was known by two out of three of our respondents. This could mean that 33% of the staff did not disinfect their hands after removing the gloves. Application of this knowledge in nurses' practical work has been found to be related to recurrent hygiene training [43]. However, there were uncertainties expressed by nurses concerning more specific knowledge, for example, in handling cases with multi-resistant pathogens. Similar

uncertainties and a corresponding request for special infection prevention training of nurses by nursing managers have also been shown in other studies [17].

Nursing managers shared nurses' insecurities regarding specific knowledge and were concerned about non-compliant hand hygiene behaviour and cross-infections. Tailored training and repeated guidance are required to improve safe hand hygiene behaviour [11, 28, 44]. In addition, in acute cases, nursing managers described taking a more active role by attending shift handovers and discussing contents of the relevant hygiene standards with the nurses to raise awareness and ensure compliance [42].

Our findings on the availability of protective material showed that it is not problematic to organise and wear protective clothing while nursing. Similar studies reveal comparable results [45]. In some of the participating nursing homes in this study, this was not the case due to organisational risk trade-off decisions that put less emphasis on the potential risk due to invisible pathogens than on the possibility of poisoning residents with alcohol-based hand rub. This example highlighted that continuous risk assessment of cross-infections in long-term care was often not a conscious priority for nursing managers. This imbalance was also fuelled by the conceptualisation of a nursing home as a home-like environment rather than a health care facility. This appeared to impact nursing managers' decisions and thus organisational policies concerning hand hygiene management and infection prevention and to influence their risk recognition [9].

Interestingly, nurses, as well as nursing managers, reported a shift in hand hygiene practices when residents were diagnosed with a multi-resistant infection. The risks of infection were then prioritised over potential poisoning or harm to the homelike atmosphere. This shift is in line with other research stating that confirmed infection of a resident, for example after a hospitalisation, brings infection prevention into focus [9]. Specifically, nursing managers described that in this event, disinfectants and protective clothing were stored in resident rooms, or in the entrance area and could more easily be used while nursing. This focused behaviour has also been described in hospital settings [43]. Our findings are consistent with previous work by Russell et al., who found similar results with nurses regarding the knowledge nurses have concerning hand hygiene, compliance and attitudes towards infection control measures [45]. In general, many of our findings support the existing literature [45].

Kingston et al. reported skin sensitivity (17% of cases) and skin damage (13% of the cases) associated with hand disinfectants, which may have resulted in the poor acceptance of the hand rubbing by the users [41]. In our study, only 5.5% of the respondents reported intolerance, skin damages and suffering as possible reasons for not using the hand rub, indicating that skin problems,

though still prevalent, may not be the major obstacle for use of the hand disinfectants.

We also identified some barriers to hand hygiene behaviour. While staff was motivated to apply the contents of hand hygiene training in practice, their actual compliance appeared to be strongly impacted by the direct availability of hand hygiene equipment while providing nursing care in resident rooms. Other studies also highlight that staff compliance depends on the direct access of hand rub while nursing in resident rooms and bathrooms [9].

With our results, we hope to illustrate the multiple perspectives of healthcare providers that need to be considered when striving for a real-life, contextual understanding of the challenges of hand hygiene management and infection prevention in this field. Our findings contribute to a more comprehensive and nuanced understanding of applied hand hygiene and infection prevention in complex care systems by identifying the role of organisational factors in facilitating or hindering the implementation and management of effective infection prevention in nursing homes [46, 47].

Limitations

This study was conducted in six nursing homes with different care levels and a minimum of 80 residents per nursing home. While specific requirements concerning infection prevention may differ across national contexts we believe that the organisational influences identified in our sample may well be relevant to other countries. Also, as with all voluntary studies, there may be a selection bias with nurses interested in infection prevention is more likely to participate. Thus, our data may underestimate the prevalence of the phenomena described here. Further, the sample of nursing managers in the qualitative strand of this study may be considered rather small, thus limiting the generalisability of our findings. It should be noted that a sample of 27 participants is not unusually small for an interview study and that there was a natural limitation to the pool of potential participants in managerial roles in the six participating nursing homes. Because interviews were conducted until data saturation was observed, we believe our findings represent the situation in the participating nursing homes sufficiently well and serve as a good foundation for future studies exploring nursing leadership in infection prevention in more detail and with a larger sample. Finally, within the scope of this study, we were unable to obtain additional qualitative information from nurses. This should be considered in future studies to allow for even richer descriptions.

Conclusion

In summary, our study shows that isolated interventions aimed at improved hand hygiene in nursing homes will

demonstrate little effect if not supported by a shared attitude by nurses and nursing managers that hold hygiene management as a priority for resident safety. To raise awareness and facilitate compliant hand hygiene behaviour will require the development of a safety culture along with a shift in nurses' conceptualisation of nursing homes as healthcare settings with high infection risks. In order to minimise the risk of cross-infection among residents, the nursing managers and the staff should be guided by the WHO recommendations for nursing homes [37] and the national "Action-Clean-Hands" initiative (<http://www.aktion-sauberehaende.de>). Nursing managers play a key role in facilitating this process in a leadership role but also as role models [9, 28, 40, 48].

Abbreviations

IP: Interview Partner; WHO: World Health Organization

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Authors' contributions

JH has helped to plan the main study. Both authors, JH and TM, contributed significantly to the conception and design of the study, to the collection of data, the data analysis, and to the interpretation of data. JH and TM worked iteratively on the creation and revision of the manuscript for important intellectual content and both read and approved the final version of the submitted manuscript. JH and TM have agreed to be personally responsible for the author's own contributions as well as to ensure that issues relating to the accuracy or integrity of any part of the work, including those in which the authors have not been personally involved. JH and TM have accordingly examined the data, generated their results, and documented and analyzed them with the help of the relevant literature.

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Availability of data and materials

All datasets of study participants are stored according to the data protection requirements in the archive of the University Hospital Bonn, Germany. The datasets generated and analysed during the study and are not publicly available due to terms of written informed consent to which the participants agreed but are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

For the overall project, we obtained ethics approval from the Ethics Committee of the University Hospital Bonn in December 2012 (Reference number 069/12). Written informed consent was obtained from all participants for participation. A copy of the written consent is available for review by the Editor of this journal.

Consent for publication

Written informed consent was obtained from all participants for publication. A copy of the written consent is available for review by the Editor of this journal.

Competing interests

The authors declare that they have no competing interests.

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3.2 Publication 2: Enablement of nursing home residents in infection prevention during general practitioner visits: A qualitative study

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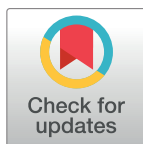
RESEARCH ARTICLE

Enablement of nursing home residents in infection prevention during general practitioner visits: A qualitative study

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Abstract

Introduction

Hand hygiene measures are essential to protect nursing home residents against nosocomial infections. Evidence on the prevention of nosocomial infections for nursing home residents by general practitioners during their medical visits in nursing homes or how they enable nursing home residents to perform hand hygiene measures is lacking. This study aimed to explore hand hygiene behaviors of general practitioners in nursing homes, their attitudes toward infection prevention measures, and the enablement of nursing home residents in performing hand hygiene measures.

Materials and methods

Semi-structured interviews were conducted with general practitioners and nursing home residents in Germany. Interviews were audio-recorded and transcribed. Data were analyzed using thematic content analysis.

Results

Overall, 12 general practitioners and 12 nursing home residents participated in the study. The general practitioners expressed the fact that the possibilities for practicing hand hygiene differ in individual nursing homes. For nursing home residents, the availability of hand rub solutions was limited. Instructions for residents on hand disinfection from general practitioners was not described. Due to the lack of enablement, the residents' knowledge on how to correctly perform hand hygiene was low, although some of the nursing home residents have experience with multidrug-resistant organisms. The nursing home residents varied in their needs for active participation and enablement during the general practitioners visit.

Conclusion

Nursing home residents require continuous enablement by their general practitioners to maintain adequate hand hygiene. Therefore, general practitioners should consider the

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Data Availability Statement: All datasets of study participants are stored in the archive of the University Hospital Bonn, Germany, according to data protection requirements. There are ethical

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Abbreviations: GP(s), General practitioner(s); HAI, Healthcare-acquired infection; I, Interviewer (within the interview passages); R, Nursing home resident (within the interview passages); WHO, World Health Organization.

different needs of nursing home residents to ensure adequate individual hand hygiene and safety for the residents. Existing guidelines for infection prevention and control do not adequately cover the nursing home care setting for the enablement of residents to enquire about hand hygiene.

Introduction

Healthcare-associated infection (HAI) is one of the most severe global public health problems, with 16 million deaths per year [1,2]. The European Center for Disease Prevention and Control estimates that approximately 4.4 million patients acquire an HAI each year in the 27 European member states, and approximately 37,000 deaths result directly from these infections [3,4]. *Staphylococcus aureus* infections are one of the three most common antimicrobial-resistant pathogens [1]. Methicillin-resistant *Staphylococcus aureus* (MRSA) is a type of staphylococcus bacteria that is resistant to many antibiotics [1].

In a healthcare setting, such as nursing homes, MRSA can cause serious infections, such as bloodstream infections and pneumonia, which can lead to sepsis and death [3]. MRSA spreads via the hands of healthcare providers that have been contaminated after touching an infected wound or a contaminated surface. Furthermore, asymptomatic individuals with MRSA can spread the bacteria to others [5]. In 2009, the “Council Recommendation on patient safety, including the prevention and control of HAI” invited the member states to adopt specific strategies on the prudent use of antimicrobial agents with the aim of improving patient safety [6]

In 2017, 3.4 million people were care-dependent as per the definition of the German “Care Insurance Act” [7]. The people are often frail due to age-related chronic diseases. They have complex risk profiles for infections and antibiotic treatment and require special protective isolation measures [8,9]. The infections within these vulnerable populations often lead to suffering, frailty, or death [10,11].

The most effective single measure for infection prevention in various healthcare settings is antiseptic hand rub [12–14]. Antiseptic hand rub inhibits the growth of microorganisms, and compared with hand washing, no other resources, such as water and towels, are needed [15]. In healthcare facilities, the use of alcohol-based hand sanitizers is mandatory because hand washing is not as effective and increases the risk of microbial transmission [16–19].

Studies show a lack of research on infection prevention measures and transmission paths in nursing homes [20–22]. The existing guidelines for infection prevention and control do not adequately cover the nursing home setting, and more research is needed to determine which interventions, such as patient/caregiver education, would be useful to prevent infections in this complex setting [10,20,23,24].

In Germany, most nursing home residents receive medical care almost exclusively from their GP. However, it is not mandatory for a GP to have an overview of all HAIs and all antimicrobial therapies for all nursing home residents [25]. This situation makes it difficult to establish consistent infection prevention and control measures in the work processes in nursing homes, [8,23] which the GP could follow [26]. The sharing of written healthcare information on aspects of infection prevention, control, and antibiotic prescription between healthcare professionals is not mandatory. GPs are not required to take any specialized training in geriatrics or infection prevention and control [27].

Enablement is a process by which the healthcare provider assists patients in recognizing, promoting, and enhancing their health [28]. Enablement in performing hand hygiene

measures could reduce the possibility of the chain reactions of cross-infections and spread to the environment. Little is known about whether and how nursing home residents are enabled regarding infection prevention measures, such as hand hygiene, by their GPs and nursing staff [29–31]. The World Health Organization (WHO) recommends the training of patients and their families on the use and indications of hand hygiene measures to reduce multidrug-resistant organisms [1]. However, thus far, nursing home residents have rarely been involved and enabled in hand hygiene measures on a routine basis [24]; they are instructed in the event of an existing chain of infection, such as a norovirus infection, but not preventively [32]. There is a lack of research on nursing home residents' enablement regarding hand hygiene.

This study aims to explore hand hygiene behavior of GPs in nursing homes, their attitudes toward infection prevention measures, and the enablement of nursing home residents in hand hygiene.

Materials and methods

Study design

This study was part of a more extensive interventional PränosInAA study (2012–2015) with a focus on improving hygiene practices and the rational use of antibiotics in nursing homes. Our study focused on cross-sectional, semi-structured, problem-based interviews with GPs and nursing home residents from the PränosInAA study [22].

Recruitment and informed consent

A pool of 542 nursing homes were identified in the Rhineland Area, Germany. After a purposeful sampling process (i.e., nursing homes for the care of elderly residents with a mix of different care levels ranging from basic to full care, to meet all aspects of resident care, and a minimum of 80 residents per nursing home), six facilities were randomly selected and invited to participate in the project, all of which agreed to participate. These six participating nursing homes were located within a radius of 50 km of Bonn because they were visited weekly by two medical doctors of the PränosInAA study using an antibiotic stewardship program. All long-term nursing home residents were invited to participate in the PränosInAA project. At the beginning of the study, six information events were conducted by the researchers for 588 nursing home residents who were potentially interested in voluntary participation. The residents received oral and written information about data protection, voluntary participation, the aim of the study, the methods and the duration of in the study. Overall, 332 (56.5%) provided written informed consent for participation in the PränosInAA project. If the residents had no cognitive limitations, they gave their own written informed consent to participate in the PränosInAA study. If with cognitive limitations, a court-appointed guardian provided written informed consent. The participants in all six nursing homes gave their additional oral, recorded, and written informed consent directly before the interviews. The inclusion criteria for the purposeful interview sample of nursing home residents were age >65 years, permanent residence in a participating nursing home, and receipt of medical visits by a GP in the nursing homes. The exclusion criteria were diagnoses of cognitive impairment or speech or hearing disorders. Three researchers arrange appointments with nursing home residents. For the GP interviews, 250 GPs in the region of Bonn were invited to participate in the larger project. The inclusion criteria were accreditation with the statutory health insurance and regular medical visits in nursing homes. Twelve GPs provided additional informed consent for the interviews.

Data collection

The 12 interviews with nursing home residents were conducted in 2015 from three female researchers; JH and SE have both master degrees in nursing management and are registered nurses with 10 years of practical work experience in nursing care. NC has Master a degree in health care management and one year of practical work experience in nursing care.

Geriatric nurses introduced the interviewers to the residents because they previously had no direct contact or relationship. The geriatric nurses were known by the residents and explained again the aim of the study, voluntary participation, duration, content of the conversations, and data protection measures in the absence of the interviewers. This approach ensured that the residents did not feel restricted in their decision-making as they were in a state of dependence on their GP. The interview guide, based on our initial literature review. Interview questions from the interview guide were kept as open as possible to allow the residents to answer according to their need for self-protection and maintain well-being. In each case, two researchers visited the residents in their rooms (JH, NC, SE). The interview process was based on a semi-structured interview design with 15 questions for the nursing home residents (see [S1 Appendix](#)). As the interview may be perceived as a stressful situation for the nursing home residents, the interview guide was not piloted due to ethical reasons. Nevertheless, the appropriateness of the interview guide was critically observed during the interviews and judged as adequate. The interviews were conducted on a one-to-one basis, audio-recorded, and transcribed verbatim in German; the second researcher observed the interview and wrote field notes about how the interviewees talked about different aspects. After each interview, the researchers validated the incremental information gathered. After 12 interviews, the researchers established they had sufficient data saturation as only a little incremental information was gathered through additional interviews. Data were sufficient to allow category formation. The category formation was formed in a continuing concentration process during which five main categories were fixed. They were elaborated on by linking the research questions to the focused content. In doing so, relating these five categories to the categories established by the GP interviews was also possible. To avoid changes in meaning and interpretation, the original codes were translated from German to English by a professional translation service in the final step of processing the results.

To start the conversation, the residents were asked to talk about the medical care they needed before they were admitted to nursing home. This procedure was examined to simplify the comparison of the residents' life situation before admission and afterward. Later, they talked about their experiences with infection prevention measures during GP visits. The interviews lasted 9–16 minutes. Sociodemographic information was collected at the end of the interviews.

The 12 interviews with GPs were conducted in 2015. GPs were visited in their offices by an interviewer (JH, NC, SE). At the start, interviewees were written and oral informed about the voluntary participation, data protection, possibility of termination at any time, aim of the study, and duration and content of the interviews. The GP gave their oral, recorded, and written informed consent directly before the interviews. The GP interview guide (see [S2 Appendix](#)), based on our initial literature review. The interviews consisted of 11 general questions, in which GPs could report on their experiences with infection control measures during visits to the nursing homes, their daily experiences with hand hygiene during visiting rounds, and surgical dressing changes. The interview process was based on a semi-structured interview design. The interviews lasted 9–19 minutes. Sociodemographic information was collected at the end of the interviews.

Data analysis

All interviews with nursing home residents and GPs were audio-recorded, anonymized, transcribed verbatim, and coded (MAXQDA version 11; Copyright ©1995–2017, VERBI GmbH).

Data analysis began during data collection and was an ongoing process. The derived thematic content was independently coded [33] by the same three researchers who conducted the interviews. The research team used an open and selective coding process to identify and characterize text units from each conversation [34]. The field notes helped identify meaningful, expressive phrases, pauses, body language, and emotions in interview passages during the coding process. Five major categories were developed in line with the research questions from the PränosInAA study:

1. Perceived organizational commitment to enable hand hygiene practices by developing factors related to structures and processes hindering or facilitating them (e.g., access to alcohol-based hand rubs and medical gloves).
2. Perceived organizational management of hygiene issues (e.g., communication between nursing home residents, nursing staff, and GPs during medical visits).
3. Self-reflection of GPs regarding their compliance with hygiene standards.
4. Perceptions of GPs and nursing home residents regarding their knowledge of hand hygiene.
5. Perceptions of GPs and nursing home residents concerning enablement of hand hygiene.

Relevant categories were discussed by a multidisciplinary team of researchers from the fields of health management, nursing science, and psychology. Any discrepancies of themes were discussed and resolved by consensus. The transcripts or results of data analysis were not discussed with the study participants themselves.

Results

The nursing home residents' average age was 82 years; four were male, and eight were female. The residents suffered from a variety of chronic diseases, such as diabetes mellitus, osteoarthritis and osteoporosis, cardiovascular diseases, and chronic obstructive lung disease. The average age of the GPs was 48 years; 4 out of 12 were female. The GPs had all worked as specialists for >5 years in their medical practices, and they visited patients in nursing homes regularly. In summary, the content analysis enabled the construction of five main categories to explore the perceived hand hygiene behavior of GPs and nursing home residents, their attitudes toward infection prevention measures, and the perceived enablement of nursing home residents in hand hygiene behavior during visits. Subsequently, results are reported for each major category with examples from interview transcriptions.

Perceived organizational commitment to enable hand hygiene practices by developing factors related to structures and processes hindering or facilitating them (e.g., access to alcohol-based hand rubs and medical gloves)

The GPs explained that the more nursing home residents they visit, the more scheduled and structured their visits and prescriptions in the nursing homes are, for example, with a fixed schedule for visits on one or two afternoons a week. In cases of specific questions, GPs prefer to have an accompanying nurse and access to alcohol-based hand rub and medical gloves. The same applies to the deterioration of health or after a hospital stay, especially for residents with

dementia. They expressed that nurses do not often have the time to accompany the GPs during a visit. Some GPs argued that regular visits make it easier for them to coordinate with the nurses and the residents. In cases when a nurse could accompany the visiting GP, the diagnosis and indications for medical prescriptions could be documented directly at the same time in both the residents' charts at the nursing home and the GP's medical file.

I: Is there usually a nurse at the nursing home to assist you during your visits?

GP (male, 22 years of experience): I will make sure of that! Better: I insist on it, >laughs <let us put it like this.

I: In some cases, the GPs could not find a nurse to accompany the visits. Do you know that too?

GP: That is very problematic. They are all in the resident rooms, and you lose much time trying to find someone. The residents are all in relatively poor health. I cannot get anywhere without the help of a nurse because the majority of patients have dementia.

Some GPs reported visiting nursing home residents only for acute emergency calls due to better billing options. In this case, they accept not being actively accompanied by nurses. From the GP's perspective, there are no regulations as to whether and how the visit is documented in the resident's and the GP's medical files when no nurse accompanies the visit. In cases of infections, medical prescriptions and therapy were often documented only in the GP's medical file, sometimes without informing the nursing staff or documenting it in the resident's file.

Perceived organizational management of hygiene issues (e.g., communication between nursing home residents, nursing staff, and gps during medical visits)

Regarding their behavior toward nursing home residents diagnosed with multidrug-resistant organisms, the GPs had to weigh the protection of the health of all nursing home residents against the freedom of the individual patient. All GPs saw themselves as mere advisors for maintaining the quality of life of the older people. At the same time, some were aware of the decision-making structures and responsibilities of nursing home management.

GP (male, 12 years of experience): If it is Clostridia or MRSA, then there is a standard in every nursing home for which the hygiene manager is responsible. That means I have nothing to do with their decisions. [...] Of course, I give advice. I always try to find the balance between freedom and isolation, which is not easy because people live there permanently.

Self-reflection of GPs regarding their compliance with hygiene standards

The GPs are external visitors into the nursing homes. For the residents, it can be very dangerous when visitors carry external pathological germs on their hands into the nursing homes. Therefore, GPs are advised in hygiene standards to disinfect their hands before, during, and after every single patient and medical visits. In the interviews, the GPs were asked about their hand disinfection options before and during visits to the nursing homes. They mentioned that the opportunities varied from institution to institution. Only some nursing homes install disinfectant dispensers in the corridors for all visitors. In some cases, they stated that disinfectant is available only upon request or in the wardroom. Therefore, some GPs use their portable hand disinfectant. Some GPs reported disinfecting their hands only in the wardrooms or

workrooms. All GPs reported that there were hardly any hand disinfection options in the residents' rooms and bathrooms. This could be important because there is direct contact from nurses and doctors with the residents in their rooms and bathrooms.

I: And do you carry hand rub with you when going for a visit? Or is disinfectant available in the nursing home?

GP (male, 18 years of experience): No, it is right there, and I use it, yes. In nursing home X, there has now been a hand disinfectant at the front door for a year or so. That is for visitors to use.

I: And do you use it?

GP: Me? Usually not, no.

Microbiological differentiation is used to determine the bacterium and the appropriate antibiotic therapy. If the bacterium is analyzed, it is important that the staff, residents, and relatives are aware of the therapy and the possible multi-resistances of the pathogen. They could initiate effective protective measures in the nursing home, such as hand hygiene, masks, gloves, and protective clothing.

In one case, a GP explained that she rejects microbiological differentiation of the pathogens. If they did not prescribe an effective and appropriate antibiotic therapy, this behavior can have very serious health consequences for the residents. The GP explained the behavior by referring to the quality of life for all the nursing home residents.

GP (female, 27 years of experience): For example, MRSA or ESBL. What beautiful things they are! I cannot lie now, can I? So, with MRSA, I do not think you have to isolate in a nursing home. Absolutely not! Otherwise, people have no quality of life at all. I am already in favor of disinfection, but there is no need to shut down the entire program. Moreover, I am not the type to take three swabs. We know it is serious, but it is also much dramatized.

Element of perceived behavioral control: perceptions of GPs and nursing home residents regarding their knowledge of hand hygiene

The participating nursing home residents noticed when the GP performed hand disinfection. They express their beliefs that their doctors behave correctly hygienically.

I: Can you remember if your GP disinfects his hands while he visits you?

R: Yes, I can. When he comes in, he rubs his hands.

I: And does he do this when he examines you?

R: I think he will do it when he leaves.

Some nursing home residents tried to be polite when asked whether GPs wore a protective gown and gloves during the rounds. The same applied to the question of whether the doctor disinfects his or her hands during the rounds in the room.

I: (. . .) do you remember if your GP wear a doctor's coat when he comes here? Alternatively, does he come in regular clothes?

R: He wears his regular clothes. No, white coat.

I: And does he disinfect his hands when he is in here?

R: Oh, so! I certainly hope so!

I: Can you remember that?

R: I will watch him next time (laughs).

I: Do you dare to tell him?

R: No, he won't come back, or he won't like me anymore (laughs).

I: Maybe he'll be happy about your active participation and help.

R: Maybe. I don't think so.

Perceptions of GPs and nursing home residents concerning enablement of hand hygiene

The participating nursing home residents had various needs for active participation and enablement during their GP visits. Some took the opportunity to ask about “everything” that may be important to them in relation to medication and treatment. They felt “in good hands” during their visits when the GPs visited them more frequently for acute illnesses. The quality of medical care was also noticeable to nursing home residents when the GP came to visit regularly. It was clear to all interviewees that the GP leads the process and the consultation during visits.

I: And can you ask your GP questions about your illness? About the effects and side effects of your medication?

R: About everything! He comes to the house. He's got several residents whom he needs to see, and afterwards, he comes to me. A few weeks ago, when I had a bad cold and was desperate due to a severe cough, he even came at nine o'clock in the evening, and there I had many questions.

I: Can you ask him questions about your illness?

R: He is an excellent doctor. He often comes to me.

Nursing home residents were asked to report their experiences with hand hygiene during the visits. None of the residents described receiving hand hygiene training. None of the interviewees expects their GP to show them preventive behavior. The residents' expectations focused on the therapy of diseases and regular visits. They ask if the GP has time for preventive consultations and if it is the GP's role.

I: Did your doctors or nurses in the hospital show you how to disinfect your hands?

R: No. (. . .).

I: Has a GP ever shown you how to disinfect your hands?

R: (laughs) No, do they do that? They don't have time! (laughs).

Although all nursing home residents reported that they received no hand disinfection instructions from their GPs or during hospital stays, they were able to explain why this measure is essential for infection prevention. During the conversation, they reflected on this sensible measure for themselves and other residents. They became aware that with hand hygiene, they protect not only themselves but also other residents.

I: Did the GP talk to you about hand hygiene, or did he show you how you could do it?

R. No, not that I know. Would it be okay if he showed it to me?

I: (. . .) that way, you could better protect yourself from infections.

R: Yes, that would be good for me, but also for the others here who are even sicker than I am.

Residents did not feel able to talk to their GP about a lack of hand disinfection. None of the residents described receiving hand hygiene training or an explanation of why this is important to their health. However, the interviewees understood that this approach could protect them from infections. They reflected that if they were trained in hand hygiene before and during hospital stays or in nursing homes, their behavior could protect them and others from HAIs. If the GPs do not disinfect their hands, the residents explained it politely as due to a lack of time, never with carelessness, lack of knowledge, lack of opportunity, or bad habits. The same was true for not wearing a gown for visits. They were afraid that the GP would no longer like and visit them if they brought up this issue.

Discussion

Due to the increasing global problem of multidrug-resistant organisms and the global COVID-19 pandemic, the awareness of preventive hygiene measures, such as hand washing and alcohol-based hand rub, remains an important topic. This qualitative study was conducted before the COVID-19 pandemic. The study aimed to explore the hand hygiene behavior of GPs in nursing homes, their attitudes toward infection prevention measures, and the enablement of nursing home residents in performing hand hygiene measures.

This study found a lack of nursing support during GP visits and highlighted the consequences. To receive nursing support during the visits, an appointment between the GP and the nursing staff is required. This regular support can be beneficial for both professions and the residents themselves, as they receive regular care [22].

Due to the legal freedom of medical therapy, GPs in Germany are free to decide on the frequency, duration, scheduling, and execution of their medical visits to nursing homes [25]. The nursing home residents perceive the regular visits as a quality criterion for their GPs. In this study, the residents did not assess the content of the visits in terms of training and health literacy. Maintaining a positive relationship with their GP was more important to them. The GP is supposed to come when they need medical help—this relationship of trust and dependence is evident in all the interviews. The residents trust the GPs to do their job well. In the case of infections, it is important to monitor this process from GPs and nursing staff as early as possible [35]. This overall situation makes it difficult for the nursing home managers to establish consistent infection prevention and control measures in the work processes during visits to nursing homes [8,24].

Sharing written healthcare information on aspects of infection prevention, control, and antibiotic prescription between healthcare professionals is not mandatory. The nursing staff have daily contact with the residents and can assess the altered state of health. Nurses can describe the patient's symptoms, and GPs can base early diagnosis and treatment on this [35]. Many residents have cognitive impairments and are especially dependent on the care and attention of health professionals. This attention helps them clarify current health problems, such as signs of infection, with their GP. In this study, the GPs described different time spans and organizational forms of nursing home visits, which is consistent with the results of previous studies in Germany [27,36]. The GPs' arguments for their preferred type of visit ranged from financial considerations when settling the service with the health insurance companies,

e.g., for spontaneous visits in the event of acute deterioration of the patient's condition, to strict visit schedules and a preference for routine support by the nursing staff. GPs visit shortly after hospitalization to assess the patient's condition and adapt the medication plan to the health status of the patient. When GPs treated more nursing home residents, it was relevant for them to exchange information about patients and suggest treatments with nursing staff [36]. GPs are not required to take any specialized training in geriatrics or infection prevention and control [27]. The fact that German health insurance pays coordinated procedures less than ad hoc visits is highly questionable from the infection prevention perspective [10,18]. Ad hoc visits must be for an acute illness or a change in the state of health. From the perspective of nursing home residents who do not have cognitive impairment and want to make an appointment with their GP, fixed appointments help them prepare for visits and be in their rooms [27,36].

Nursing home residents reported that GP visits gave them "fatherly" and calm emotional support when GPs regularly asked about their health condition. In contrast to Sak et al. (2017) and Fleischman et al. (2016), in the interviews, the GPs' consulting function was not reported, nor was a mutual conversation on eye-level described by both sides [27,37]. Because viruses and bacteria are not visible to the eye, preventive hygienic measures must be taken.[38]. In the interviews, GPs interpreted the hygiene guidelines more freely. For example, the use of hand disinfection according to the WHO's "5 Moments of Hand Hygiene" might indicate a reflection on the GP's own role. In an interview, the GP explained that he does not disinfect his hands when he visits the nursing home because he does not see himself as a "visitor". The same applies to the decision to not record the three swabs in the neck–nose–throat area from residents with MRSA. Here, a deliberate argument was made against the guidelines. Such perceived behavior may not be conscious and should be investigated in further studies. Preventive measures such as hand hygiene could interrupt infective chain reactions [39]. The treatment is based on the principles of hygiene [12,40]. In this study, the GPs did not instruct and train residents hand hygiene. At the beginning of the COVID-19 pandemic, when there were only preventive measures and no vaccinations, paying attention to and understanding the importance of preventive hygiene rose worldwide. Therefore, public and governmental international health organizations (e.g., the WHO, Centers for Disease Control and Prevention, Robert Koch Institute) provided daily information and instructions. In nursing homes, the professionals and residents without mental disabilities made great efforts to follow these instructions, e.g., quarantines and visiting bans [41]. This was particularly difficult at the beginning of the pandemic, as medical supplies and disinfectants were not available in sufficient quantities. In Germany, the number of HAI increased in 2020 [39]. HAI continuously rose during the COVID-19 pandemic, but public awareness has reduced. This can be attributed to the insufficient availability of medical devices and hand disinfectants and the lack of nursing staff [39].

Valensi et al. (2008) focused on patients >70 years of age with type 2 diabetes and similarly found that "caring relationship" was more important than "active participation in decision-making" [42]. In the interviews in this study, the GPs did not report consistent compliance with regulations regarding hygiene during their visits. The GPs were aware of the regulations from the quality manuals and professional exchanges with other colleagues, and two GPs were involved in the preparation of the national guidelines for the treatment and recording of MRSA in nursing homes. However, the implementation of hand hygiene during visits was interpreted differently. None of the nursing home residents were introduced to, or made aware of, infection prevention behavior by their GPs, not even during or after multidrug-resistant infections, which are often the reason for very severe health restrictions, frailty, and deaths [1,2]. The nursing home residents did not describe any active involvement or receipt of instructions for hand disinfection from nursing staff or GPs. Sak et al. (2017) reported that

two-thirds of their sample of older patients were satisfied with their current involvement in medical decision-making and that this group may also have a moderate or lower level of health literacy [37]. The process of active involvement in decision-making processes is often unfamiliar to older patients [37]. The nursing home residents were somewhat uncertain about their expectations regarding active consultation with GPs; the expenditure of time seemed unrealistic to them. Their focus was on the GP's reliability in the case of acute illnesses. The task of the GPs to involve and enable the patient was perceived as appropriate by the nursing home residents. The residents were not only concerned about their health but also infection prevention among the other residents.

GPs described their hand hygiene behavior as being influenced by the availability of hand rub during visits and their perception of infection risks, especially when a resident had multi-drug-resistant infection. GPs did not mention complying with the 5 Moments for Hand Hygiene [43]. Improvements in nursing homes are often hindered by the prevailing conflict between maintaining a homelike environment and a higher standard of living on the one hand and adopting and monitoring state-mandated infection prevention measures on the other [44]. However, infection prevention in nursing homes is vital due to patient proximity and multi-morbidity, as well as multidrug-resistant pathogens. Nursing home residents reported either themselves or someone in their immediate environment having had multidrug-resistant infections with permanent health consequences or death.

There are limitations to be considered in interpreting the findings of this study. The results should be considered as indicative since this exploratory study was conducted based on 24 interviews with purposefully selected interview partners. There may be a selection bias due to the interviewees' interest in the study. The results cannot be generalized to nursing home residents with cognitive impairments, impaired consciousness, or extensive nursing care needs. These nursing home residents are particularly dependent on medical staff to show them preventive measures, guide them, and provide protection through their own preventive measures. Being constantly aware of this responsibility is very challenging and requires a high level of professionalism. The perspectives, perceived behavior, knowledge, and attitudes of hand hygiene measures from nurses and nursing home managers in the PrānosInAA study was published before this study [22]. Social desirability effects might have biased the answers of nursing home residents and GPs. However, the selection criteria, possible selection bias, or social desirability bias might have led to an underestimation of the hand hygiene deficits, not to an overestimation.

Conclusions

This study revealed major gaps in hand hygiene compliance on both the GPs' and the nursing home residents' sides. These deficits emerged in perceived knowledge, attitudes, and perceived behaviors. The asymmetrical paternalistic relationship between nursing home residents and their GPs makes it difficult for nursing home residents to speak up for their concerns. Patient involvement in preventive hygiene measures must become more pronounced during the COVID-19 pandemic. The idea of the patient element has not yet received necessary attention, especially in nursing home care. Not every resident has a cognitive impairment that might prevent them from involvement.

Further research into the COVID-19 pandemic should be conducted on the enablement of older people. The role model function of healthcare professionals and family involvement should also be considered in the development of training programs. Continuous improvements in infection prevention in nursing homes can only succeed if internal and external participants, such as nursing home residents and GPs, adhere to established hand hygiene standards.

Supporting information

S1 Appendix.
(TIF)

S2 Appendix.
(TIF)

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Declarations

Ethics statement

Ethics approval according to the guidelines of the Declaration of Helsinki was obtained from the Ethics Committee of the University Hospital Bonn in December 2012 (reference number 069/12).

Availability of data and materials

All datasets of study participants are stored in the archive of the University Hospital Bonn, Germany, according to data protection requirements. There are ethical restrictions on sharing the present study data publicly. Data cannot be shared publicly because of privacy reasons. Data requests can be forwarded to the attention of the Ethics Committee of the University-Hospital-Bonn: ethik@ukbonn.de

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3.3 Publication 3: Safety Performance in Acute Medical Care: A Qualitative, Explorative Study on the Perspectives of Healthcare Professionals






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Article

Safety Performance in Acute Medical Care: A Qualitative, Explorative Study on the Perspectives of Healthcare Professionals

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Abstract: Healthcare professionals need specific safety performance skills in order to maintain and improve patient safety. The purpose of this study is to get a deeper understanding of healthcare professionals' perspective in acute care on the topic of safety performance. This study was conducted using a qualitative approach. Healthcare professionals working in nursing were interviewed using semi-structured interviews. Using content analyzing, categories were identified which present aspects of safety performance; subcategories were developed deductively. A total of 23 healthcare professionals were interviewed, of which 15 were registered nurses, five were nursing students and three were pedagogical personnel. Nine (39.1%) were <30 years old, 17 (73.9%) were female, and 9 (39.1%) had a leadership function. Results highlight the importance of safety performance as a construct of occupational health rather than of patient safety, and the role of the organization, as well as the self-responsibility of healthcare professionals. Healthcare professionals should be more conscious of their role, have a deeper understanding of the interaction of individual, team, patient, organization and work environment factors.

Keywords: patient safety; occupational safety; safety performance; healthcare professionals; nursing; acute care; qualitative research



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1. Introduction

With an occurrence of 8 to 12% of all hospitalizations in European countries, adverse events have a significant impact on patient outcomes [1]. Hospitalized patient outcomes, such as mortality, hospital-acquired pneumonia, catheter-associated urinary tract infection and pressure sores, are directly associated with nurse-to-patient ratio, training and staffing, and work experience, among other factors [2–4]. Patient safety and health do, therefore, directly depend on healthcare professionals (HCP), especially nurses skills, knowledge and well-being [5–7]. The nurses' safety, well-being and safe care of patients are related to nurses' working environment [2,3,5,7–11]. The National Academy of Science identified in nurses' work and work environments several aspects which are evolving over time and influencing patient safety in a clinical setting: more complex, multimorbid clinical conditions of patients, shorter hospital stays, redesigned work, changes in the deployment of nursing personnel, frequent patient turnover, high staff turnover, long work hours, a rapid increase in new knowledge and technology and increased interruptions and demands [9].

These factors indicate that organizational and technical aspects, along with team and individual elements, affect patient safety. The human factors approach aims to improve patient safety by questioning and establishing how systems work and how this complexity

affects patient safety [12,13]. Human factors and ergonomics are scientific disciplines that aim to produce knowledge to redesign and improve processes [12–14]. Human factors refer to environmental, organizational and job factors, and human and individual characteristics that influence behavior at work [15]. It follows that organizational factors will affect patient safety, but the team and individual aspects will equally influence the behavior of nurses and other HCPs concerning safe patient care [12,13,16].

As a construct consisting of safety participation and safety compliance, HCPs' safety performance plays a key role in providing safe care, consequently maintaining and improving patient safety [17]. The term safety compliance is used to describe the core activities that need to be carried out by individuals to maintain workplace safety [17]. These behaviors include adhering to standard work procedures and wearing personal protective equipment. The term safety participation is used to describe behaviors that do not directly contribute to individual safety but help develop an environment that supports safety [17,18].

The association of HCP behavior and patient safety has been thoroughly studied, using a quantitative or mixed-method approach [2,4,19–27]. HCPs who work in nursing, and their unique views on safety performance regarding Griffin and Neals conceptualization [18], their role, and expectations for their work environment in acute medical care in Germany are rare. This study aims to explore HCP perspectives on the topic of safety performance with a qualitative approach.

2. Materials and Methods

2.1. Study Design

This qualitative interview study is part of the explorative mixed-methods SPOHC study (Safety Performance of Healthcare Professionals), conducted in 2018–2020. The study received ethical approval from a local ethics committee in Germany (number 075/19). SPOHC is built upon the integrative workplace safety model and focuses on safety performance as a construct of safety compliance and safety participation [28,29]. The SPOHC data collection methods comprised qualitative interviews and a cross-sectional written survey with healthcare professionals. The SPOHC survey results focus on the testing and validation of two instruments (a workplace health and safety instrument and situational judgement test) to measure the safety performance of HCP in Germany. Both instruments show acceptable psychometric properties, allowing new possibilities to measure the construct of safety performance [24,30].

2.2. Sample and Study Setting

The sample was based on convenience sampling and consisted of registered nurses, nursing students (last year of training) and pedagogical personnel working in nursing in one university hospital, two university teaching hospitals and two nursing schools. Registered nurses in Germany generally undergo a three-year training program integrated into nursing schools with a state examination. University qualifications in nursing, which are standard internationally, have only a short tradition in Germany and, so far, account for only a small proportion of about one to two percent of the nursing teams in hospitals [31]. Nursing schools are traditionally part of hospitals; consequently, nursing students work on the frontline from the beginning of the training program, attended by their supervisors. The focus of their work is to assist patients with physical care, assist team members, provide guidance and supervision to patients and their families. In some long-term psychiatric departments, staff with a pedagogical education are also part of the multiprofessional nursing team. They take on nursing-therapeutic tasks, especially in areas of child and adolescent psychiatry, and care for patients in these contexts. Nursing-therapeutic tasks can be e.g., developing the structure of the day or monitoring of the patient in working groups. The multi-professional nursing team can therefore consist of registered nurses, nursing students and pedagogical personnel to ensure high quality care on several levels. Nurses who have completed a one or two-year training program to be a nursing assistant were excluded from the study.

Nursing managers and headmasters of nursing schools were informed about the study via email and personal contact. The SPOHC project was presented during regular team meetings by a researcher with a clinical and nursing science background, and questions regarding goals, data protection, process, and effort could be answered directly. All HCPs were precisely informed about the protection of their person and data as well as the publication of the results. It was ensured that participation was completely anonymous and that no conclusions could be drawn about individuals or teams. If the HCP expressed interest in participating, they were subsequently contacted by email, with data protection documents and consent forms. Subsequently, with the HCP's consent, an appointment was made for the interview.

2.3. Data Collection

Two female researchers with a nursing science background, and a female student assistant with a psychology background, conducted semi-structured, face to face interviews with HCPs who were working in nursing between July 2019 and March 2020. Both researchers and the student assistant are trained in qualitative data collection and data analysis topics.

The semi-structured interview content was developed with the CRSS method to develop interview guidelines: C = collect, R = review, S = sorting, S = summarize [32]. The first step was a brainstorming process to collect questions, followed by a review step to sort out all closed, evaluative, and suggestive questions [32]. In the next step, questions were sorted by content and in the last step, summarized [32]. The brainstorming process and first collection of questions in step one was influenced by own prior clinical experience, publications on safety performance, and the theoretical model (the integrative workplace safety model) on which the overall SPOHC study is based [28,29].

The guidelines consisted of four key questions regarding aspects and barriers of safety performance, the own role and enhancements for work on the frontline (detailed information about the key questions is presented in Figure 1). The key questions were designed to achieve descriptions of specific situations and procedures at the frontline to explore realistic situations and let the participant reflect on their performance and role as a HCP. The semi-structured interview was pre-tested with a study nurse working in health services research and with clinical experience.

Key questions:

1. Tell me, what do you generally understand by safety performance.
2. Please describe situations in which you have behaved safely.
3. Please describe situations in which unsafe behavior was observed.
4. If you think about your role, how would you assess your safety performance?
5. What do you actively do to ensure that your colleagues behave safely?
6. What would have to be different in everyday life for you to behave as safely as possible?

Figure 1. Key questions of the semi-structured interviews.

All interviews were conducted at the workplace in separate rooms without any interruptions. At the beginning of the interview, the researcher introduced herself and explained their clinical background to establish a trustworthy situation. HCPs were informed about voluntary participation, data protection, the possibility of termination at any time, and the study's aim. Sociodemographic information was collected at the end of the interviews.

2.4. Data Analysis

Each interview was audio-recorded, fully transcribed, pseudonymized and coded using content analysis. Categories were developed deductively, main categories were identified from the guideline, subcategories were based on the human factors model of patient safety [12]. The four main categories which have been identified as the most relevant for patient safety were (1) Organizational/Managerial; (2) Workgroup/Team; (3) Individual Worker; (4) Work environment [12]. We used these categories and an additional category (5) Patient/Caregiver as the subcategories in the performed content analysis. One female researcher with a background in nursing science and clinical nursing, and a female student assistant with a psychology background, who both were responsible for the data collection coded the interview transcripts independently and discussed all text segments and codes using the software MAXQDA (version 18/20, VERBI GmbH, Berlin, Germany). Afterwards, the text segments were paraphrased, generalized, and reduced, based on the content analysis recommendation form of content structuring of Mayring [33]. All anchor quotes were translated into English by a translation agency. All findings were discussed by a multidisciplinary team of researchers working in patient safety with a background in health services research, nursing science, and psychology. The transcripts or results of data analysis were not discussed with the interview partners themselves.

2.5. Trustworthiness of the Study

To ensure credibility, transferability, dependability and confirmability, our study is built upon the framework presented by Korstjens and Moser [34]. To ensure credibility, investigator triangulation was used, and two researchers coded, analyzed and interpreted the data. To ensure transferability, we sought to provide thick descriptions of context, as well as behavior and experiences. To ensure dependability and confirmability, we endeavored to report the different qualitative research steps we conducted in a transparent manner.

3. Results

3.1. Sample Characteristics

Fifteen registered nurses, five nursing students and three pedagogical personnel, all working in nursing, were interviewed. From these 23 interview partners, nine (39.1%) were <30 years old, 17 (73.9%) were female, and nine (39.1%) had a leadership function. A total of 15 (65.2%) had worked longer than five years in nursing, and 13 (56.5%) had worked longer than five years in the same department.

3.2. Aspects of Safety Performance

In general, the interviewed HCP understood the general aspects of safety performance to mean everyday behavior related to the safety of patients, their family members and hospital staff. The focus was mainly on reducing risk factors and observing occupational health and safety, observing protective measures and theories on the occurrence of errors, which are typical, practical examples of accident prevention.

Well, no idea, that there are no power cables on the floor that you can trip over. (IP01)

Well, for example, that you, when you've moved a patient from one room to another, that you then lower the bed again, that you, I don't know, also explain to the patient how the nurse call button works, adjust the lights, that, if it's dark, you might also turn on the light and explain to the patient how to turn on the light. (IP05)

It's also about sharps disposal, correct waste disposal, avoiding situations that are potentially dangerous for patients, right? (IP08)

Well, let's start with patient safety; so, there, I would say that, for example, when the floor is mopped, that some sign is placed stating that like/that the floor is wet. (IP14)

We had a construction site here a little while ago. So we had to be careful, too; there was scaffolding here on the patio, so we locked the patio door to make sure that patients do not go there and possibly climb up. (IP19)

3.3. Aspects of Safety Performance—Organizational/Managerial

In the interviews, concerning aspects of safety performance that address the organizational level, establishing rules and checking them was a particular focus. It was reported that management specifications, assessments, standards, and guidelines influence HCP safety performance. This also includes the mandatory use of Critical Incident Reporting Systems, checklists, patient wristbands and other instruments to increase patient safety. It should be emphasized that the organization's rules should be reviewed by management to ensure consistent compliance.

I believe at our facility, it's that our director and deputy director are both people who pay very close attention to that. And if any mistakes are made, they communicate that. And they have very high quality standards for our team. And that as a result, I believe, a lot is actually achieved/that, well, people do act properly because we know that this is kind of demanded and required from us. (IP10)

In the interviews, HCPs emphasized that the organization offers regular training programs and that all HCPs (e.g., physicians) are required to attend the training courses.

I believe, that is really because the people all receive really good initial training, a good briefing, and continued education. So, it's not like someone just says: "Come on, let me show you the emergency kit really quickly", but there is an actual continued education event where you sit down for two hours and where each drug is discussed, too, what its indication is and when to use it. (IP07)

From the interviewees' point of view, the organization's responsibility to provide a safe workplace is important. This includes good personnel key, personnel with sufficient language skills and the establishment of appropriate structures and processes, like emergency call systems, occupational safety committees, mandatory meetings after adverse events, monitoring of patient data protection, etc.

3.4. Aspects of Safety Performance—Team

Based on the interviews, HCPs emphasized the importance of sharing knowledge about patient safety within the team. The knowledge from training programs should be passed on in teams, managers must pass on their knowledge to their employees about safety issues and current measures; there should be regular team-internal meetings focusing on patient safety.

That is, you then also have to take a second step and not only inform people but to somehow also enable them to act accordingly. And typically, this is best done by, well, by showing them how to do it. (IP11)

The interviewed HCPs reported that teamwork in the inter-professional and nursing team is characterized by responsibility, openness towards mistakes, and safety. It is about agreements, open communication, trust and the perception of problems and uncertainties of colleagues. The cooperation between different professions should be reflected upon, and ambiguities should be addressed and solved through supervision. From the HCPs' point of view, teamwork described as good and relaxed promotes patient safety and safety culture within the team.

That is, if we had a reanimation here last time, then the medical team was brought in, then I asked that we reflect again on what we did, how we did it, how everyone experienced it, how everyone felt in the process, and we try to reflect on that again on the larger scale and simply do better in the future to simply ensure patient safety that way as well. (IP06)

According to the participants, a team assumes a control function to detect errors early, familiarize new colleagues, and enable trustful teamwork.

And we actually train our physicians a little bit in this way because: “Well, do this, do that”, no physician order. Now, we don’t do anything without a physician order. And sometimes, many physicians actually then try to verbally delegate things somehow, but we just don’t do it. And then they got used to it. (IP03)

3.5. Aspects of Safety Performance—Individual Worker

On an individual level, adherence to safety-related rules played a major role for the interviewed HCPs. The correct wearing of protective and work clothing was mentioned here; being informed about current safety-relevant standard operating procedures and measures, carrying out room checks, protecting patients from falling, observing hygiene rules and confidentiality, and working in a de-escalating manner.

And most of it, well, it’s very important that personal protection, that it is always paramount. Because, if I’m down sick, I can no longer help others. That’s why I always start with myself. (IP17)

Based on the interviews, HCPs should be aware of their function, have a role model status, be responsible for transferring knowledge, seek inter-professional help in case of uncertainties, and admit mistakes. It involves keeping agreements, making routine situations safe, developing an awareness of dangerous situations.

And especially the last case, it just showed me that even I, with twenty years of job experience, still need to always reflect. Work on myself. And that gave me a little more security, to still feel that. If I had gone in there indifferently and came out indifferently, I would have been rather worried, or actually, probably not. (IP17)

HCPs should be responsible for participating in further training programs, continually expanding their knowledge, and passing it on.

And that you, as I said, participate in continued education, if you learn something from the continued education, that you just pass that on in the team, too. (IP15)

3.6. Aspects of Safety Performance—Work Environment

On the work environment level, structural measures such as clearly arranged departments, escape routes, emergency doors, fire alarms, alarm systems, and safe windows and doors have been mentioned as aspects that influence safety performance. Medical products such as bed rails, alarm mattresses and protective equipment for nursing professionals, as well as training courses on technical aspects of everyday work (digitalization in nursing), were mentioned by the HCP here.

An example is, well, if a patient is infectious and isolated, you have to put on specific protective clothing if you perform activities near the patient so that you then leave the microbes in the room when you take off the protective clothing. (IP11)

The correct handling of medication by HCP was also mentioned. Here, hygienic aspects played a role as well as control mechanisms, storage systems and the placing and administration of these.

Another topic is the administration of medications; for example, infusions, when I administer them. Or injections that I administer. There as well, it’s important that I make sure, for instance, to disinfect the puncture site, or disinfect the connectors to which the infusion is hooked up to ensure that I do not expose the patient to microbes through the injections or infusions. (IP11)

3.7. Aspects of Safety Performance—Patient

At the patient level, the aim is to avert dangerous situations and adverse events. Measures to protect patients must be initiated at an early stage; patients must be closely monitored to be protected immediately in case of risks—for example, the WHO checklist for avoiding adverse events during surgical procedures.

For instance, storage, repositioning, patient admission, to ensure that data are appropriately collected, documented, and that this is a continuous cycle. The patient, for example, which side is operated on, is it the right patient, is the name correct, the information, etc.? Is the patient placed on the correct table? Have we brought up the correct X-rays? It runs through all of that. Well, those are the patient-relevant data that, I think, do play a major role. Because mix-ups have been described over and over. And of course, they should be avoided if at all possible. (IP22)

So, of course, as I already mentioned, with regard to hazardous objects, escape routes, that patients have been informed, too, for instance, what to do in case of fire. Because something like that can happen at any time even without external influences. (IP13)

HCPs act as patient advocates; they are mainly responsible for patient safety. This includes providing support when uncertainties arise, providing information and assistance in decision-making, and communicating patience and time so that the patient feels supported, understood, and safe.

My staff knows exactly, if I'm not well, that I simply know I can always address that. And to give the patient this psychological, well, safety; I do think that is part of patient safety as well. (IP06)

4. Discussion

Our qualitative study aimed to explore the perspectives of HCPs who are working in nursing in acute medical care on the topic of safety performance. Categories were developed deductively based on the human factors model of patient safety, and represent aspects of safety performance experienced by HCPs at the frontline [12,13]. Results highlight the importance of safety performance as a construct of occupational health rather than of patient safety and the role of the organization. The interviewed HCPs struggled to describe what safety performance means individually, and situations related to safety performance or general safety issues. The focus of interview participants was more on occupational safety aspects (for example, handling injection needles or technical handling of medication) or organizational or management aspects, than patient- or team-related aspects of safety. Safety performance was described as a functional construct of occupational health, e.g., to ensure that patients do not fall, the work environment is secured, or work clothes are worn. It involves factual information about aspects of occupational health and safety. The interview partners were asked to describe their experience with safe situations. The HCPs stated that, beyond the functional safety performance, factors regarding teamwork, communicational skills and responsibility aspects can also be classified as a level of interactive safety performance. Their roles and responsibilities regarding patient safety became clearer and structured while talking about their perspective on safe and unsafe situations.

However, it became apparent that one's safety performance and role as a HCP in the hospital system were only superficially reflected upon, and the organization and management were described as playing a more important role. The organization should establish rules for constant compliance with high safety standards (e.g., using critical incident reporting systems, standardized handovers, safety rounds and speak up initiatives [35,36]) and checking them was a particular focus for the HCPs who work in nursing. Rules, checklists, and standards for nursing and physicians must be more strictly observed and verified by the management to improve safety performance. This is contrary to a previous study which found that nurses with higher autonomy by the organization also made fewer medication errors, and that this aspect was the only structural aspect related to patient safety [37]. The authors of this study attribute this effect to nurses' higher education. The higher the qualification, the higher the autonomy, and the rarer the patient safety errors [37]. Other studies underline the correlation between safety performance and job autonomy as well [38–40]. Registered nurses in Germany are typically trained for three years, but not on university/college level, which is the international standard for becoming a registered nurse [31]. A 2015 survey found that 1% of all nurses in Germany who work in direct

patient care have a college degree [31]. Future studies should clarify whether curricula differences in terms of safety performance between college and vocational training might contribute to the need for more monitoring management. One aspect of safety performance in all subcategories is the implementation and participation of training and qualification programs that address patient safety topics in education, training, continuing education, or degree programs for HCPs. The organizational offer of regular training programs and the self-responsibility to get regularly trained are important to provide safe and evidence-based care for patients. HCPs, as well as nursing students, in Germany are not explicitly required to attend special patient safety compliance and improvement trainings on a regular basis. Consequently, it is not ensured that HCPs are trained in topics such as speaking up, using critical incident reporting systems, standardized handovers in all clinical areas and can work safely. This aspect is the subject of numerous health policy debates to improve education and training in nursing and medical fields [41,42]. This underlines the importance of a safety culture and safety performance in acute care once more. Empowerment training for nurses that aimed to improve safety culture was found to significantly impact the clinical practice [43,44]. It focused especially on communication domains like openness, speaking up and error communication [43], aspects which were mentioned as important but also inadequate at the frontline in this study.

Limitations

There are several limitations to our research that should be considered when interpreting the results of our study. Social desirability bias may have affected our results. The topic of safety performance in acute care can be particularly influenced by social desirability, and consequently the interviewees may not have spoken openly about sensitive events, such as errors in acute care settings. The study results' generalization could be limited by the self-selection bias, as the volunteer participants may not be representative of the entire healthcare professionals. And a self-serving bias could also have influenced the response behavior and limited the interviewees' ability to reflect on their performance and role as HCPs. Furthermore, our sample consists of registered nurses, nursing students and pedagogical personnel, so the interviews primarily reflect the perspectives of these professions. The special training as a registered nurse in Germany, the involvement of students from the start of training, and the involvement of pedagogical personnel in nursing teams must be taken into account while interpreting the results. Future studies should be based on heterogeneous samples so that the average of HCPs in Germany is represented. Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

5. Conclusions

This study aimed to examine HCPs' perceptions about safety performance with a qualitative approach. Results indicate on the one hand that HCPs fail to have a more comprehensive and complex picture of safety performance at the frontline and, on the other hand, that organizational aspects have a huge impact on safety performance, and compliance to rules and standards. HCPs need regular trainings in safety performance and patient safety, provided by their organization. Based on these findings, HCPs working in nursing should be more aware of safety performance and patient safety to be more conscious of their role and have a deeper understanding of the interactions between individual, team, patient, organization, and the work environment. The necessary basic qualification of nurses should also be critically examined for Germany against the background of the international standard of higher education qualifications in nursing.

Further studies should focus on interventions to socialize nurses for patient safety and safety performance from the beginning of their education and explore inter-professional teams' experiences to get a deeper understanding of safety performance at the frontline.

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4 Discussion

Three publications are the basis of this dissertation, which aims to gain a more in-depth understanding of how relevant infection prevention in nursing homes and factors of safety performance in acute care are for patient safety.

This aim was achieved through

- 1) The exploration of individual and organizational factors of hand hygiene in nursing home staff, with a particular focus on the function of role modelling by nursing managers using a mixed methods approach;
- 2) The study of hand hygiene behaviors of general practitioners in nursing homes, their attitudes toward infection prevention measures, and the enablement of nursing home residents in performing hand hygiene measures based on qualitative data;
- 3) The exploration of HCP perspectives and experience on the topic of safety performance with a qualitative approach.

Two publications are based on the data of the “PränoInAA study”, which focuses on the cross-sectoral care of older people in nursing homes with the aim of preventing nosocomial infections and the rational use of antibiotics. The project was conducted between 2012 and 2015. The German healthcare system is legally divided into 12 “Social Code books (SGB)” (Bundesministeriums der Justiz, 1973). The SGB V regulates the legal right in the inpatient care sector, which includes hospital- and GPs medical treatments (Gesetzliche Krankenversicherung, 1989). The SGB XI regulates the ambulatory healthcare sector, including nursing homes (SGB XI, 1992). However, the complexity arising from this system's division poses challenges to cohesive infection prevention and control across healthcare sectors (Ruscher et al., 2015; Ruscher et al., 2012).

The first publication is based on mixed methods, by surveying 165 nurses and interviewing 27 nursing managers from German nursing homes (Hammerschmidt & Manser, 2019). The findings emphasized the need for multifaceted strategies to improve hand hygiene, particularly by highlighting the significance of immediate access to hand rub within the

work areas of nursing staff (Hammerschmidt & Manser, 2019). The contemporary SEIPS 3.0 model adopts a human-centric approach, integrating the complex spatio-temporal dimensions of patients' interactions across varied care settings over time (Carayon et al., 2020). This advanced model notably emphasizes the pivotal roles played by patients, family caregivers, and non-professionals within healthcare systems, as highlighted in the second publication. As it had not yet been published during the periods of preparation of my first and second dissertation manuscripts, it was not integrated into these works. Additionally, it underscores the critical importance of considering engagement, configuration, and adaptation within the intricate dynamics of healthcare environments. The two publications from the PränosInAA study (Hammerschmidt et al., 2022; Hammerschmidt & Manser, 2019) point to the development of a safety culture as an aid to improving hand hygiene and suggest several strategies targeting different components of the work system to achieve the intended results. Specifically, the strategies should aim to optimize the physical environment (i.e., the immediate work area of nursing staff) by facilitating the provision of hand rub, and the organization of work (i.e., policies and procedures) to emphasize the importance of hand hygiene. In addition, training and education should be provided to enhance staff knowledge and skills related to hand hygiene practices. Finally, the social environment (i.e., leadership and culture) should be addressed by creating a culture of safety that values hand hygiene and encourages staff to comply with recommended guidelines. Overall, these strategies should be designed to support the integration of various work system components and achieve the best possible outcomes in terms of hand hygiene compliance and infection prevention. Recent evidence in a meta-analysis suggests a sustained potential for a significant reduction of HAI rates in the range of 35%–55% associated with multifaceted interventions in health care organizations (Schreiber et al., 2018). In addition, nursing managers should be aware of the positive impact of their role model function in infection prevention and hand hygiene practice (Hammerschmidt & Manser, 2019). The integrative model of workplace safety supports the findings by relating the role of the organization in workplace safety and leadership aspects to role model attitudes (Christian et al., 2009).

The second publication is based on semi-structured interviews, which were conducted with 12 general practitioners and 12 nursing home residents within the “PränosInAA study” in Germany (Hammerschmidt et al., 2022). The findings suggest that GPs should consider

the different needs of nursing home residents when providing hand hygiene (Hammerschmidt et al., 2022). Existing guidelines on infection prevention and control did cover the nursing home sector, but they require continuous, multimodal support, which could be very well planned, implemented, and evaluated using the SEIPS 3 model. (Gould et al., 2018; Schreiber et al., 2018). Active enabling and involving patients in their safety is important but was not mentioned by the interviewed GPs (Carayon et al., 2020; Hammerschmidt et al., 2022; World Health Organization, 2021). It was shown that the doctor-patient relationship and aspects of communication had effects on various objective and subjective health parameters (Hammerschmidt et al., 2022; Riedl & Schüßler, 2017). The integrative model of workplace safety supports these results by emphasizing the importance of distal person-related and situation-related factors on proximal person-related factors like safety motivation and safety knowledge. (Christian et al., 2009). The socio-technical system approach SEIPS 3.0 for the patient journey and patient safety offers the opportunity to take into account the genuine participation of all internal and external groups, which can mean a real improvement in patient safety and quality of care and would lead to a high level of satisfaction in the long term in relation to a genuine safety culture. This is a methodologically and administratively very demanding task and certainly an even greater challenge in view of the long-standing shortage of nursing staff and the fact that the issue of patient safety still receives too little attention as a watershed in healthcare facilities in Germany.

The third publication was based on data of the project “Safety Performance of Healthcare Professionals — SPOHC”, which was conducted between 2018 and 2020 in acute care settings in Germany (Heier et al., 2021). The project explores HCP perspectives on their experiences and views on safety performance in their everyday work (Heier et al., 2021). The integrative model of workplace safety served as the theoretical background of this publication (Christian et al., 2009). The results indicate that healthcare professionals should be more aware of their role and have a deeper understanding of the human factors approach and the interplay between individual, team, patient, organizational, and work environment factors (Carayon et al., 2014; Heier et al., 2021). On the organizational side, the results show that more specific rules need to be established to improve safety performance (Heier et al., 2021). The results underline the relevance of the human factors approach and the theoretical constructs of the integrative model of workplace safety for

improving safety performance and safety perspectives in acute health care settings (Carayon et al., 2014; Christian et al., 2009; Heier et al., 2021). Overall, the three publications suggest that a multifaceted approach, including leadership, role modeling, patient involvement, and attention to the complex interplay of contributing factors, is necessary for improving safety in healthcare settings, particularly in infection prevention and control.

4.1 Limitations and Strengths

The aim of this thesis is to gain a more profound understanding of how relevant the factors of infection prevention and safety performance for patient safety in nursing homes are. The aims of this thesis could be answered by using human factors approaches to identify different perspectives on the subjects. All presented data are part of explorative studies and, accordingly, limited in terms of their generalizability. The three studies reviewed show the importance of health services research in complex health care organizations regarding infection prevention and safety performance factors for improving patient safety.

The publications used mixed methods and qualitative research methodology, which focus mostly on individual experiences and are not intended to provide a generalization as quantitative research methodologies do. The triangulation of methods and the theory-driven approach have facilitated the human factors and the facility-focused factors of workplace safety in the studies and has been confirmed successful. A strength of the thesis is the inclusion of analyses of a vulnerable group with regard to their expectations of infection prevention during GP medical visits.

The data of the PränosInAA study show perceived knowledge, behavior, and attitudes toward infection prevention in nursing homes before the COVID-19 pandemic. Today, the infection prevention situation may be different, and new and broader studies may explore the actual situation under the new conditions. There is the limitation of selection bias in all studies due to the recruitment strategy and possible adequacy of sampling procedures in the outpatient and inpatient healthcare organizations. In addition, methodological limitations, such as rating bias or item difficulties, are possible.

The inclusion and integration of two human factors theories (Carayon et al., 2020; Christian et al., 2009) in this thesis provides a broader analytical framework. This approach reflects an effort to explore different theoretical perspectives and their relevance to the research context in order to improve the understanding of complex elements in the research field.

4.2 Implication for Practice & Research

This dissertation is relevant for understanding the difficulties and facilitating factors in implementing patient safety and safety performance factors in complex healthcare settings. The findings show knowledge deficits of HCP regarding safety performance and patient safety.

Measures like providing sufficient protective material directly at work areas could support the implementation of existing standardized safety guidelines for infection prevention. Equally important is the role of managers as role models for improving safety in the workplace, which is based on human factors theories. Staff, patients, and visitors in healthcare organizations need to make it as simple as possible to perform their hand hygiene. The academization of nursing staff not only equips them to apply established safety guidelines for infection prevention more consistently but also fosters a perspective where they recognize their significance within the healthcare organization. This recognition enables them to more readily integrate themselves as essential factors, facilitating a seamless reflection of this understanding in their practice. The WHO (World Health Organization, 2009), the German “Aktion Saubere Hände (Nationales Referenzzentrum für Surveillance von nosokomialen Infektionen, 2022)” and the German Patient Safety Alliance (Aktionsbündnis Patientensicherheit, 2016) offer a variety of practical infection prevention actions, websites, and brochures to educate all involved people, e.g., HCP and patients and their relatives with regard to workplace and patient safety topics. The websites and brochures could help to make healthcare safer and prevent suffering through HAI. The thesis shows that all facilities should have sufficient protective material in their direct workplaces to make it easier to implement the existing standards. It was shown that theory-led thinking could help to look at one's own working environment systemically. The role model function of the management level should be

self-present and could be used as a positive influence on nurses to improve patient and workplace safety. The academization of German nursing professions and an interprofessional and longitudinal patient safety knowledge transfer across all health professions could have been very useful steps (Ewers, 2018).

The requirements and implementation of COVID-19 infection prevention measures have shown how important is functional infection prevention, especially for frail and elderly people in nursing homes (European Centre for Disease Prevention and Control, 2020). The active participation of patients and their relatives is crucial in health service research (Paasche-Orlow et al., 2005; Sørensen et al., 2015), followed by a bundle of safe decisions and actions by governments and healthcare facilities (Schreiber et al., 2018; World Health Organization, 2021). It could help to evaluate patients' individual perspectives of their safety needs and their needs for enabling safety performance (McGuckin & Govednik, 2013; World Health Organization, 2013). Governments and scientists must be aware that frail people do not have the power and cannot raise their voice loud enough to protect themselves against HAI and unsafe care (World Health Organization, 2021). The enabling and participation of patients and their relatives in their safety is hopefully and logically the next consistent step.

4.3 References

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6 Statement

When creating the content for this doctoral thesis, I used the software “DeepL” and “Chat GPT” for translation. In addition, I utilized the professional editing services of “Mentorium” for professional editorial support, plagiarism screening and formatting assistance to clarify the presentation of this thesis.

7 List of Publications

Manuscripts (peer reviewed)

Hammerschmidt, J., Heier, L., Ernstmann, N. Enablement of nursing home residents in infection prevention during general practitioner visits: A qualitative study. *PLoS One*. 2022 Apr 7; 17(4):e0266502. <https://doi.org/10.1371/journal.pone.0266502>.

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