

LIISI MÄGI

Development of patient safety
competence in nursing:
a multimethod study



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Institute of Family Medicine and Public Health, Faculty of Medicine, University of Tartu, Estonia

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*To my family,
for everything beyond these pages*

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LIST OF ORIGINAL PUBLICATIONS

The thesis is based on the following original publications:

- I. **Mägi, L.**; Naustdal, K., Mortensen, M., Uibu, E., Moi, A. L., Kangasniemi, M., Vähi, M., Lember, M., & Põlluste, K. (2025). Translation and validation of the Health Professional Education in Patient Safety Survey (H-PEPSS) in Estonia and Norway: A psychometric analysis. *Scandinavian Journal of Caring Sciences*, 39(4), e70162, doi: 10.1111/scs.70162.
- II. **Mägi, L.**, Põlluste, K., Lember, M., Pöld, M., & Kangasniemi, M. (2025). Nurses' self-perceived patient safety competencies: Associations with education and work-related factors in a cross-sectional study. *Journal of Advanced Nursing*, 82(8), 7836–7846 doi: 10.1111/jan.70400.
- III. **Mägi, L.**, Uibu, E., Moi, A. L., Mortensen, M., Naustdal, K., Põlluste, K., Lember, M., & Kangasniemi, M. (2024). Collaborative learning linking nursing practice and education: Interview study with master's students and teachers. *Nurse Education Today*, 139, 106261, doi: 10.1016/j.nedt.2024.106261.

The contribution of Liisi Mägi (LM) to the original publications is as follows:

- Paper I: LM participated in the conceptualisation and methodological planning of the study, collaborated in the preparation of the ethics committee application, and in the translation and cultural adaptation of the questionnaire, and collected the data in Estonian, conducted the psychometric validation of the questionnaire, collaborated in the formal data analyses, conducted the literature search and synthesis, wrote the original draft manuscript, prepared the visualisation of the results, and managed the submission process and communication with the journals.
- Paper 2: LM participated in the conceptualisation and methodological planning of the study, prepared the ethics committee application, conducted the data collection, collaborated in data curation and formal data analyses, conducted the literature search and synthesis, wrote the original draft manuscript, prepared the visualisation of the results, and managed the submission process and communication with the journals.
- Paper 3: LM participated in the conceptualisation and methodological planning of the study, collaborated in the preparation of the ethics committee application, conducted the interviews in Estonia, performed the data analysis, conducted the literature search and synthesis, wrote the original draft manuscript, prepared the visualisation of the results, and managed the submission process and communication with the journals.

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ABBREVIATIONS

ACSQHC	Australian Council for Safety and Quality in Health Care
AVE	Average variance extracted
CI	Confidence interval
CFA	Confirmatory factor analysis
CFI	Comparative fit index
CPSI	Canadian Patient Safety Institute
CR	Composite reliability
H-PEPSS	Health Professional Education in Patient Safety Survey
ICPS	International Classification of Patient Safety Concepts
IOM	Institute of Medicine
KMO	Kaiser-Meyer-Olkin measure
KSA	Knowledge-Skills-Attitudes
MSV	Maximum shared squared variance
NQPSD	National Quality and Patient Safety
OECD	Organisation for Economic Co-operation and Development
OR	Odds ratio
PaSNEQ	Patient Safety in Nursing Education Questionnaire
PS	Patient safety
PSCNES	The Patient Safety Competency Nurse Evaluation Scale
PSCSE	Patient Safety Competency Self-Evaluation
PSCSRSN	Patient Safety Competency Self-Rating Scale for Nurses
REDCap	Research Electronic Data Capture
RMSEA	Root mean square error of approximation
RN	Registered nurse
SD	Standard deviation
SRMR	Standardised root mean square residual
WHA	World Health Assembly
WHO	World Health Organization

1. INTRODUCTION

As a fundamental principle of healthcare, patient safety is defined as the reduction of risks and prevention of avoidable harm (World Health Organization [WHO], 2009). Patient safety is also conceptualised as a systems-based approach in which organisational culture, clinical processes and human factors interact to prevent and mitigate harm (WHO, 2021). Despite substantial progress in the understanding and development of patient safety principles, unsafe care remains a major international concern. It is estimated that globally about 12% of patients experience harm during their care, and about half of these incidents are considered preventable (Panagioti et al., 2019). Such unsafe care is also associated with more than 3 million deaths each year. In addition, patient harm affects how people experience and trust healthcare. It also impacts healthcare professionals' well-being and places a financial burden on health systems (WHO, 2024).

Achieving patient safety depends on healthcare professionals' competence, which includes the knowledge, skills, and attitudes of safe and high-quality care (WHO, 2022). Patient safety is embedded in everyday clinical work and patient interactions where nurses have a central role in care delivery (Kirwan et al., 2019). Working in complex clinical environments as primary providers of patient care, nurses need to develop technical skills as well as non-technical competencies, such as communication, teamwork, critical thinking and risk management (Canadian Patient Safety Institute [CPSI], 2020; Widad & Abdellah, 2022). Higher levels of patient safety competence have been associated with less missed nursing care (Babaii et al., 2025; Chang & Manojlovich, 2023; H. Qiu et al., 2026), and fewer adverse events (Hafezi et al., 2022; Kakemam et al., 2024; X. Zhang et al., 2024). It has also been linked to safer care delivery (Torkaman et al., 2022) and improved incident reporting (Kakemam et al., 2024).

Ongoing changes in healthcare and nursing practice require the development of patient safety competencies, using flexible and context-sensitive approaches (Eloranta et al., 2026). In nursing education, competency-based and practice-oriented approaches are increasingly emphasised to strengthen clinical readiness and ensure safe patient care (Watson et al., 2026). Despite this, patient safety is still not consistently integrated into healthcare practice and education and is often addressed indirectly within broader subjects (Kirwan et al., 2019). Globally, only a limited number of countries have formally incorporated patient safety into health professional education, and even fewer assess these competencies or incorporate them into licensing systems. Although some progress has been made in Europe, only around 35% of countries have defined core patient safety competencies for healthcare professionals, indicating that these competencies are still not consistently defined or implemented in most systems (WHO, 2024).

Patient safety competencies are trainable and measurable (WHO, 2022), which makes their systematic assessment important (WHO, 2021). It is essential to use reliable and valid instruments (Beaton et al., 2000) to ensure accurate, comparable results across different cultural and linguistic settings to avoid biased

or misleading conclusions (Epstein et al., 2015). While research has increased on the measurement and development of patient safety competencies in undergraduate nursing education (De Rezende et al., 2025; Wang et al., 2026), less is known about these competencies among nurses across clinical and educational contexts. This gap is also evident in different European countries, including Estonia and Norway, where research on patient safety competence remains limited. This highlights the need for culturally adapted and validated instruments to enable context-specific assessment of patient safety competencies and to generate reliable evidence to support targeted educational and organisational strategies. There is also a need for a better understanding of patient safety competencies among nurses and how these competencies can be developed across clinical and educational settings.

2. REVIEW OF THE LITERATURE

To provide an overview of the development, content, and current understanding of patient safety competence in nursing, international policy documents, guidelines, competency frameworks and the relevant scientific literature were analysed. A systematic search of English-language empirical research publications on nurses' patient safety competence published between 2021 and 2026 was conducted (Appendix 1).

2.1 The evolution of patient safety and healthcare professionals' competence

The roots of patient safety can be traced to early work in safety science, which shifted attention toward organisational factors, showing that adverse events arise not only from individual errors, but also from complex interactions between people and technology in socio-technical systems (Reason, 1990). This perspective was introduced into healthcare through the Institute of Medicine (IOM) report *To Err Is Human* (2000), which defined patient safety as a measurable health system problem and a significant public health concern (Institute of Medicine, 2000). The report also highlighted the need for structural reform, transparency, and changes in professional education, and it emphasised patient safety as a core component of healthcare quality (Table 1).

Table 1. Patient safety conceptualisation, evolution and implications for healthcare professionals' competence (PS=patient safety)

Key resource, year	Conceptualisation of patient safety	Evolution in patient safety thinking	Implications for patient safety competence
Reason, J.T. <i>Human Error</i> (1990)	Systems-based view of error. Accidents arise from interactions between active failures and latent system conditions.	Shifted focus from individual blame to identifying systemic causes of failure.	Not specific to healthcare. Introduces fundamental principles of systems thinking and human error science, which later formed the basis for patient safety competencies in healthcare.
Institute of Medicine (IOM). <i>To Err is Human: Building a Safer Health System</i> (2000)	PS as "freedom from accidental injury". Frames safety as a critical component of healthcare quality.	Institutionalised systems thinking in healthcare, framed PS as a measurable public health issue.	Highlights the need for comprehensive system redesign and calls for a greater emphasis on PS in health professional education.
WHO. World Alliance for Patient Safety (2004)	Does not introduce a new formal definition.	Shifted the focus toward global coordination and the sharing of knowledge and resources.	Initiated global safety standards and frameworks that later informed patient safety competencies and professional education.

Key resource, year	Conceptualisation of patient safety	Evolution in patient safety thinking	Implications for patient safety competence
Emanuel et al. What Exactly Is Patient Safety? (2008)	PS as a scientific discipline applying safety science methods and as a property of healthcare systems focused on minimising incidence and the impact of adverse events.	Expanded the IOM perspective by formalising PS as an emergent systems property. Shifted healthcare from a single-cause perspective to a systems approach.	Highlights the need for healthcare professionals to apply systems thinking, interdisciplinary teamwork, and safety science principles. Recognising patient and family as active partners in safety.
EU Council Recommendation on Patient Safety (2009/C 151/01) (2009)	PS as freedom from unnecessary harm or potential harm associated with healthcare.	Institutionalised patient safety within EU governance, moving from fragmented national efforts to a coordinated European framework	Encourages integrating PS into under- and postgraduate education and workforce development. Promotes the development of core patient safety competencies.
WHO. International Classification of Patient Safety Concepts (ICPS) (2009)	PS as “the reduction of risk of unnecessary harm to an acceptable minimum”.	Standardised PS terminology and concepts internationally, creating a global taxonomy.	Introduces the need for a shared safety language as a professional competence. Emphasises risk recognition and incident classification using standardised concepts to ensure effective reporting and analysis.
WHO. Patient Safety Curriculum Guide (2009/2011)	Uses the ICPS definition.	Operationalised PS into a multi-professional framework, including medical education, dentistry, midwifery, nursing and pharmacy.	Introduced explicit PS competency domains categorised into knowledge and performance requirements.
Hollnagel, E. <i>Safety-I and Safety-II</i> (2014)	Safety as system capacity to succeed under varying conditions (Safety II).	Shifts focus from reactive error prevention to proactive resilience and adaptive system performance.	Emphasises the importance of adaptive capacity, situational awareness, resilience and collaborative competence in complex clinical practice.
World Health Assembly Resolution WHA72.6 (2019)	Does not introduce a new definition.	Elevated PS to a global political priority. Shifted the focus from regional initiatives to sustained global commitment.	Emphasises the need to strengthen workforce capacity through global collaboration, mutual learning and the sharing of best practices.
WHO Global Patient Safety Action Plan 2021–2030 (2021)	Provides a systems-based approach to eliminating avoidable harm in healthcare. PS as a core component of universal health coverage.	Operationalised global political commitment into seven strategic objectives for systemic PS improvement.	Highlights the need to strengthen workforce capacity and leadership. Advocates integrating PS into education, training and professional competency frameworks across all health disciplines.

After the IOM report, patient safety became increasingly institutionalised at the international level. In 2004, the WHO took a leading role by establishing the WHO World Alliance for Patient Safety to lead global efforts (WHO, 2004). They started the standardisation of terminology, providing a global taxonomy for analysing and learning from patient safety incidents across disciplines and countries (WHO, 2009). At the European level, Member States were encouraged to develop national policies, non-punitive reporting systems and patient safety focused education and training (Council of the European Union [Council of the EU], 2009). Also, patient safety principles were organised into specific competency areas for multi-professional healthcare education (WHO, 2011) (Table 1). Together, these developments supported the integration of patient safety into healthcare education and professional practice.

Patient safety also became increasingly recognised as a scientific discipline that applies safety science to understand and improve safety in healthcare systems (Emanuel et al., 2008). This knowledge base grew further as the focus moved from reactive error prevention (Safety I) to understanding how systems work well in everyday practice (Safety II), emphasising adaptability and resilience in clinical work (Hollnagel, 2014). Patient safety has since evolved into a global political priority. The World Health Assembly Resolution WHA72.6 recognised it as a global health priority and highlighted the need for stronger leadership, greater accountability and improved workforce development (WHO, 2019). This was formalised in the WHO Global Patient Safety Action Plan 2021–2030, which provides a strategic roadmap to eliminate avoidable harm worldwide (WHO, 2021) (Table 1).

As patient safety has evolved, expectations for healthcare professionals' competence have expanded. Early foundational models shifted the focus from individual perfection to a systems-based understanding, requiring practitioners to identify latent system conditions and situational factors that lead to error (IOM, 2000; Reason, 1990). This shift promoted the development of a just culture that encourages learning from system failures rather than seeking individual blame. International and regional initiatives introduced shared safety language, non-punitive reporting systems and structured education frameworks (Council of the EU, 2009; WHO, 2009, 2011). This required healthcare professionals to know a standardised taxonomy to facilitate incident reporting and mutual learning. More recent conceptualisations highlight adaptive capacity, resilience and collective collaboration (Hollnagel, 2014). Latest documents further highlight the importance of leadership, interdisciplinary teamwork, and engaging the patient as an active partner in the safety process (WHO, 2021) (Table 1).

2.2 Nursing competence in the context of patient safety

Competence is the ability to meet the specific standards of a job, which are socially negotiated and agreed upon within a specific professional environment, developing over time and experience (Eraut, 1998). **Competencies** refer to specific, observable and measurable abilities, encompassing knowledge, skills and attitudes that form this capability (WHO, 2022). A close concept is **confidence**, which is an individual's belief in their own ability and does not necessarily reflect actual performance. High confidence does not always indicate high competence (Stewart et al., 2000).

Patient safety is a core nursing competence (Mitchell, 2008) to ensure safe care delivery (Mrayyan et al., 2023) and best possible patient outcomes (Swift et al., 2025). It involves the knowledge, skills, behaviours, judgement, values and attitudes (Mrayyan et al., 2023), as well as the demonstrated ability to apply these professional attributes in daily practice (Swift et al., 2025). Patient safety competence therefore extends beyond error reporting or compliance with procedures. It includes systems thinking, risk recognition and the ability to adapt proactively to ensure successful outcomes in everyday practice. Nurses are expected to follow procedures as well as to recognise risks and communicate effectively within teams.

Nurses' patient safety competencies have been described in international and regional frameworks (Table 2). These frameworks operationalise patient safety competence through specific domains, making patient safety an explicit requirement in education, workforce development and organisational policy (WHO, 2021). Based on these documents, patient safety competencies can be grouped into several broad domains (Appendix 2). These domains include professional and ethical competencies, as well as interpersonal competencies that support patient-centred care, communication, teamwork and collaboration in healthcare. They also encompass clinical and risk management competencies, together with improvement and learning competencies aimed at strengthening safe clinical practice, risk management, quality improvement and continuous learning. In addition, the framework covers organisational competencies and system-level competencies that contribute to patient safety culture, leadership, systems thinking and safe system design, reflecting a broader systems perspective on patient safety.

Table 2. International frameworks of patient safety competencies grouped into broader categories for comparability across frameworks

Framework, author, year, country	Grouped competency domains	Approach to competency development
Student-focused frameworks		
Quality and Safety Education for Nurses (Cronenwett et al., 2007), USA	• Interpersonal • Clinical and risk management • Improvement and learning • Systems-level	A curriculum-based, competency-oriented approach integrating classroom, clinical and simulation learning, structured around Knowledge–Skills–Attitudes (KSA) to support the progressive development of patient safety competencies.
WHO Patient Safety Curriculum Guide (WHO, 2011), International	• Interpersonal • Clinical and risk management • Improvement and learning • Systems-level	A curriculum-integrated, modular and education-focused approach that supports the development of patient safety knowledge, skills and attitudes through structured teaching, learning and assessment strategies across healthcare education.
The Patient Safety Competency Framework for Nursing Students (Levett-Jones et al., 2017), Australia	• Interpersonal • Clinical and risk management • Improvement and learning	A competency-based, education-focused approach structured according to Miller’s Pyramid, supporting the progressive development and assessment of patient safety competencies from knowledge acquisition to performance in clinical practice.
Education- and practice-focused frameworks		
National Patient Safety Education Framework (Australian Council for Safety and Quality in Health Care [ACSQHC], 2005), Australia	• Professional and ethical • Interpersonal • Clinical and risk management • Improvement and learning • Systems-level	A flexible, competency-based and education-oriented approach that supports the progressive development of patient safety knowledge, skills and behaviours across healthcare roles through training, workplace learning and continuous professional development.
NHS Patient Safety Syllabus (NHS England, 2022), UK	• Improvement and learning • Organisational • Systems-level	A structured, system-based educational approach that supports progressive patient safety learning across roles, focusing on knowledge acquisition, application and continuous improvement rather than formal competency assessment.
System-level frameworks		
The Safety Competencies Framework (CPSI, 2020), Canada	• Interpersonal • Clinical and risk management • Improvement and learning • Organisational • Systems-level	A competency-based, interprofessional and system-level approach that supports the development of patient safety knowledge, skills and attitudes through education, practice integration and continuous learning across healthcare settings.

Framework, author, year, country	Grouped competency domains	Approach to competency development
A Nordic Framework for Patient Safety Knowledge and Skills (Hupa et al., 2024), Nordic countries	• Professional and ethical • Interpersonal • Clinical and risk management • Improvement and learning • Organisational • Systems-level	A system-level, competency-based approach supporting the progressive and lifelong development of patient safety knowledge and skills across the education-practice continuum and across health professions.
The Quality and Patient Safety Competency Navigator (National Quality and Patient Safety [NQPSD], 2025), Ireland	• Interpersonal • Clinical and risk management • Improvement and learning • Organisational • Systems-level	A system-level, competency-based and learner-centred approach supporting the progressive, role-specific and lifelong development of patient safety competencies through self-assessment, reflective practice and continuous learning.

International frameworks focus on competencies and competency development on three levels. **Student-focused frameworks** utilise curriculum-based models to integrate patient safety principles into classroom teaching, clinical training, and simulation. These approaches employ knowledge, skills, and attitudes, and describe competence development as progressing from theoretical understanding to performance in practice (Cronenwett et al., 2007; WHO, 2011). In the nursing student-specific model, Miller’s Pyramid is used to track the transition from a student’s “novice” knowledge to active professional behaviour in a complex environment (Levett-Jones et al., 2017) (Table 2).

Education- and practice-focused frameworks promote the development of competence through training, workplace learning and continuing professional development (ACSQHC, 2005; NHS England, 2022). These frameworks focus on the application of competencies in clinical settings throughout a professional career. **System-level frameworks** take a broader approach by defining competencies for multiple healthcare stakeholders, including policymakers (CPSI, 2020; Hupa et al., 2024) and healthcare leaders (CPSI, 2020; Hupa et al., 2024; NQPSD, 2025). Some frameworks position patients and families as active co-creators of safety and equal partners in the design delivery, and governance of care (CPSI, 2020; NQPSD, 2025) (Table 2).

The evolution of international frameworks reflects a shift from foundational curriculum reform toward strategic organisational governance and system-level design. At the beginning, frameworks focused primarily on addressing educational gaps in degree education to prepare students for the practice (ACSQHC, 2005; Cronenwett et al., 2007; WHO, 2011). Later on, frameworks have expanded to address complexities, including workforce development, organisational governance and system-level design (CPSI, 2020; Hupa et al., 2024; NQPSD, 2025) (Table 2).

Overall, patient safety competence is a multidimensional and dynamic concept. As synthesised from the international frameworks, it encompasses technical clinical and risk management skills, but also non-technical competencies, such as communication, teamwork, systems thinking, organisational learning and leadership. Competence is a continuous developmental process that lasts throughout a professional career. This reflects a broader shift from patient safety as an individual responsibility to understanding it as a collective and system-supported capability.

2.3 Previous knowledge of nurses' patient safety competence

Through systematic literature searches, 22 papers were identified (Appendix 1, Figure 1). Previous research has predominantly relied on quantitative cross-sectional designs, with 19 of the included studies using cross-sectional approaches. Two studies used longitudinal designs, and one applied a mixed methods approach. Studies commonly applied descriptive, correlational or exploratory approaches to assess nurses' patient safety competence and examine its relationship with various individual, work-related and organisational factors. Advanced analytical approaches, such as latent profile analysis, have also been applied (Tai et al., 2024; Xiao et al., 2024; Y. Zhang et al., 2026). Most studies used descriptive statistics and correlational and regression analyses. Almost half of the included studies employed more advanced statistical methods to explore complex relationships, subgroup differences and predictors of patient safety competence. The evidence is provided in Asian and Middle Eastern contexts, particularly in China and Iran. Study samples have typically consisted of registered nurses providing direct patient care, often with minimum clinical experience requirements ranging from a few months to one year. Most research has been conducted in hospital settings, especially in specialised units such as emergency and critical care (Atalla et al., 2025; Babaii et al., 2025; Fu et al., 2022; Habibi Soola et al., 2022; M. N. Park & Roh, 2024; Tasbihi et al., 2025), as well as in psychiatric settings (Setoodeh et al., 2025; Torkaman et al., 2022) (Appendix 3, Table 1).

Instruments used for competence assessment

Five different instruments were used across the included studies to assess nurses' patient safety competence. The most frequently used instrument was the Patient Safety Competency Self-Evaluation (PSCSE), which was used in ten of the 22 included studies. The PSCSE measures patient safety competencies across three dimensions: knowledge and awareness, skills and attitudes and was originally developed to assess the patient safety competency of nursing students. The second most commonly used instrument was the Health Professional Education in Patient Safety Survey (H-PEPSS), which was used in five studies. This instrument measures confidence in socio-cultural patient safety competencies across six domains. The Patient Safety Competency Nurse Evaluation Scale (PSCNES) was used in four studies. It assesses six dimensions in which participants evaluate whether their abilities correspond to the item statements. Another instrument, the

Patient Safety in Nursing Education Questionnaire (PaSNEQ), was used in two studies. This questionnaire evaluates nurses' understanding of patient safety across three categories: academic settings, clinical settings and patient safety competence. Finally, one study used the Patient Safety Competency Self-Rating Scale for Nurses (PSCSRSN), which is available only in Chinese (Appendix 3, Table 1). Most existing instruments combine technical clinical content with non-technical or attitudinal items, whether organised around a knowledge–skills–attitudes structure (PSCSE, PaSNEQ) or around practice-based dimensions (PSCNES). In contrast, the H-PEPSS focuses specifically on health professionals' perceived confidence in the sociocultural aspects of patient safety (Ginsburg et al., 2012). H-PEPSS has been translated and validated across multiple languages, cultures and contexts, reflecting its broad international applicability (Mortensen et al., 2022).

Nurses' patient safety competence

Nurses' patient safety competence is generally reported at moderate to high levels, though there is variation across studies (Appendix 3, Table 2). While some studies explicitly categorise competence as **low** (Torkaman et al., 2022), **moderate** (Kakemam et al., 2025; Yan et al., 2021; Y. Zhang et al., 2026), **medium to high** (Tai et al., 2024; Xiao et al., 2024) or **high** (Atalla et al., 2025; Y. Qiu et al., 2025; Tasbihi et al., 2025), others report only numerical scores without predefined thresholds. In studies using 5-point Likert scales, mean patient safety competence scores have ranged from 2.5 (Torkaman et al., 2022) to 3.8 (Babaii et al., 2025). A recent meta-analysis also reported a **moderate** level of patient safety competence among nurses, with a mean score of 3.7 (Wang et al., 2026).

Previous research indicates that patient safety competence varies across different domains (Appendix 3, Table 2). Nurses often report positive **attitudes** towards patient safety (Chang & Manojlovich, 2023; Habibi Soola et al., 2022; Kakemam et al., 2022, 2025; Setoodeh et al., 2025; Tasbihi et al., 2025; Torkaman et al., 2022) and perceive themselves as confident in **clinical practice-related** aspects of patient safety (Babaii et al., 2025; Fu et al., 2022; Liao et al., 2026; Y. Qiu et al., 2025; Yan et al., 2021), which are among the most frequently reported highest domains. **Knowledge** is consistently identified as the lowest area of patient safety competence (Atalla et al., 2025; Chang & Manojlovich, 2023; Habibi Soola et al., 2022; Kakemam et al., 2022, 2024, 2025; M. N. Park & Roh, 2024; Setoodeh et al., 2025; Torkaman et al., 2022). Similarly, **evidence-based nursing practice** is frequently reported as a weaker domain (Fu et al., 2022; Liao et al., 2026; Y. Qiu et al., 2025; Y. Zhang et al., 2026). A recent meta-analysis has identified **communication** as the highest and **teamwork** as the lowest-scoring domains for nurses (Wang et al., 2026).

Factors associated with patient safety competence

Nurses' patient safety competencies have been studied in relation to individual, work-related and organisational factors (Table 3). Many studies also examine several of these factors within the same study (Appendix 3, Table 3).

Table 3. Synthesised overview of factors associated with patient safety competence (Appendix 3, Table 3.)

Category	Factors
Individual factors	• Psychological factors (resilience, psychological capital, psychological contract, transition shock) • Cognitive and motivational factors (motivation, reflective thinking) • Professional and safety attributes (professionalism, compassion competence, safety attitudes and values, proactive behaviour, love for nursing) • Patient safety training and activities • Systems thinking • Demographics (age, experience, education)
Work-related factors	• Work processes (workload, workflow interruptions, work readiness) • Job and employment characteristics (unit type, shifts, income)
Organisational factors	• Patient safety culture • Workplace environment (workplace violence, leadership, error management climate, psychological safety, nurse–patient/ family conflict) • Teamwork • Organisational support and silence

Individual factors have been widely examined in relation to patient safety competence. Existing research suggests that higher patient safety competence is associated with psychological, cognitive and motivational factors, as well as with professional and safety attributes. Participation in patient safety training and related activities has also been frequently linked to higher competence levels. In addition, systems thinking has been identified as a factor associated with patient safety competence. A smaller number of studies have explored demographic characteristics, reporting positive associations with age, work experience, and education (Table 4).

Table 4. Individual factors positively associated with patient safety competence across studies

Author, year	Psychological factors	Cognitive and motivational factors	Professional and safety attributes	Patient safety training and activities	Systems thinking	Demographics
Atalla et al., 2025					✓	✓
Fu et al., 2022			✓			
Habibi Soola et al., 2022				✓		✓
Kakemam et al., 2022			✓		✓	
Kakemam et al., 2025				✓	✓	
Liao et al., 2026	✓					
M. N. Park & Roh, 2024		✓				
Y. Qiu et al., 2025	✓	✓				
Setoodeh et al., 2025			✓			
Tai et al., 2024			✓			
Xiao et al., 2024			✓	✓		
Yan et al., 2021				✓		
Y. Zhang et al., 2026				✓		✓

Work-related factors have also been associated with patient safety competence. Work processes, such as workflow interruptions and missed nursing care are negatively associated with patient safety competence, whereas greater work readiness showed positive associations (H. Qiu et al., 2026). Several job and employment characteristics have also been examined. Working in certain hospital types (Tasbihi et al., 2025) and specific units (Atalla et al., 2025), as well as having a higher professional title (Yan et al., 2021) are associated with higher competence. In contrast, employment type is negatively associated with competence (Habibi Soola et al., 2022). Positive associations have additionally been identified for night-shift work (Y. Zhang et al., 2026) and higher income levels (Xiao et al., 2024).

Organisational factors have also been linked to patient safety competence. Supportive organisational environments, including positive patient safety culture (M. N. Park & Roh, 2024), aspects of the workplace environment (Habibi Soola et al., 2022; Tai et al., 2024; Tasbihi et al., 2025) and effective teamwork (Habibi Soola et al., 2022; Tasbihi et al., 2025) are generally associated with higher patient safety competence. In addition, organisational support has been positively associated with competence (Y. Zhang et al., 2026), whereas organisational silence (Liao et al., 2026) has been linked to lower patient safety competence levels.

2.4 Development of patient safety competence

Patient safety competencies can be developed through education and training (WHO, 2022). In nursing, there has been a growing effort to include patient safety into curricula across all levels of degree education (Mansour et al., 2018). However, patient safety is often embedded within broader subjects as a “hidden curriculum”, rather than taught as a distinct area of competence (Kirwan et al., 2019; Sollárová et al., 2026). In addition, the implementation of patient safety education is challenged by a shortage of educators with expertise in both patient safety and the specific pedagogy required to teach it (Sollárová et al., 2026).

Current patient safety education has also been criticised for placing greater emphasis on technical and clinical skills than on non-technical competencies such as teamwork, communication, systems thinking, and collaboration (WHO, 2021). This is reflected in students’ self-assessments, as they often report greater confidence in clinical skills (Wang et al., 2026), suggesting that technical aspects receive more attention in nursing education (Kirwan et al., 2019). While targeted educational interventions have shown positive effects on students’ patient safety competencies (De Rezende et al., 2025; H.-Y. Park & Yeom, 2025), evidence suggests that these programmes may be more effective for students in the early stages of education than for those in later stages (H.-Y. Park & Yeom, 2025), highlighting the need for educational approaches adapted to different stages of professional development. There is also limited evidence on whether competencies developed during education are maintained over time and transferred into clinical practice after graduation (Kim et al., 2025; H.-Y. Park & Yeom, 2025).

Although existing research has focused predominantly on degree education, development of patient safety competence continues throughout professional practice and clinical experience (Murray et al., 2018; Vázquez-Calatayud et al., 2021). This ongoing developmental process can be understood through experiential learning theory, which describes learning as a continuous cycle of experience, observation, conceptualisation and active experimentation that occurs in all settings (Kolb, 1984). In clinical practice, patient safety competence develops through practical experience and reflection on clinical situations (Murray et al., 2018; Savio et al., 2025). Collaboration with experienced colleagues and learning from both successes and errors further support competence development in workplace settings (Main & Anderson, 2023). Such experiential learning enables nurses to connect theoretical knowledge with practical situations and adapt competence to complex healthcare environments (Murray et al., 2019; Wang et al., 2026).

Because patient safety competence develops continuously within specific organisational and professional contexts (WHO, 2022), educational needs evolve throughout nurses’ professional careers (Murray et al., 2018; Vázquez-Calatayud et al., 2021). Continuing professional development and other formal and non-formal workplace learning approaches have been identified as important mechanisms for maintaining and developing nurses’ competence throughout professional practice (Rahmah et al., 2022). Together, these findings suggest that current educational approaches may not fully support the development of compre-

hensive patient safety competence across the continuum of nursing education and practice (H.-Y. Park & Yeom, 2025; Vázquez-Calatayud et al., 2021), underscoring the importance of continuous, practice-oriented and career-stage-sensitive professional development (Main & Anderson, 2023).

To address these challenges, a comprehensive, system-wide approach to developing patient safety competence is needed. This requires stronger integration between nursing education and clinical practice, as well as better preparation of nurse educators to teach patient safety effectively (Sollárová et al., 2026). Traditional didactic educational approaches alone appear to have limited effects on nurses' performance and patient outcomes, whereas more interactive and practice-oriented approaches may better support competence development (Main & Anderson, 2023). Because patient safety competence develops through interaction, reflection and shared practice, collaborative learning approaches may be particularly valuable for strengthening non-technical competencies such as communication, teamwork and systems thinking (Jiang et al., 2024; Kim et al., 2025). Collaborative learning emphasises dialogue, social interaction, and the co-construction of understanding among learners, rather than one-way transmission of information (Yang, 2023). Evidence suggests that collaborative and experiential approaches can strengthen communication, collaboration (Choudhary et al., 2025; Main & Anderson, 2023; Savio et al., 2025), adaptability and confidence (Savio et al., 2025), while also supporting performance and improving patient outcomes (Main & Anderson, 2023). As patient safety challenges are often complex and context-dependent, collaborative learning approaches that support shared reflection and knowledge development may be particularly relevant for patient safety education (Yang, 2023).

Understanding how learners and educators experience these approaches is therefore important for developing effective patient safety education. However, qualitative research examining experiences in the development of patient safety competence remains limited. Existing studies often rely on supplementary methods, such as reflective journals or brief interviews, rather than in-depth qualitative designs (Kim et al., 2025). More robust qualitative research is therefore needed to better understand how collaborative pedagogical approaches support the development of patient safety competence in nursing practice and education. Overall, current patient safety education may not yet fully reflect advances in patient safety science and the evolving needs of the healthcare professionals (Mansour et al., 2018), highlighting the need for more integrated, practice-oriented and methodologically robust educational approaches.

2.5 Summary of the background

Patient safety is a well-established area of healthcare guided by international policies, standards and frameworks. Over time, it has become recognised as a core dimension of healthcare quality and a global policy priority. In nursing, patient safety is recognised as a core competence, integrating knowledge, skills

and attitudes to ensure safe care delivery. International patient safety frameworks guiding these competencies have evolved from student-focused curriculum models toward broader system-level approaches that emphasise organisational and system-level responsibility for safety. This reflects a transition from viewing safety as an individual responsibility to understanding it as a collective, system-supported capability.

Previous research on nurses' patient safety competence has been predominantly quantitative and conducted in Asian and Middle Eastern contexts. Nurses generally report moderate to high levels of patient safety competence. Confidence in clinical practice and attitudes toward patient safety are typically rated high, whereas theoretical knowledge, evidence-based nursing practice and teamwork are more often identified as weaker areas, suggesting that practical confidence may develop more strongly than theoretical and collaborative competencies. Patient safety competence has been associated with organisational, work-related and individual factors. However, several important limitations remain in the existing evidence base. Research from European countries, particularly the Baltic, Nordic and Eastern European regions, remains limited. As healthcare systems, nursing education and professional roles differ across countries, findings from non-European contexts cannot be directly transferred to European settings. Furthermore, studies have used a variety of instruments, based on different conceptualisations of patient safety competence and measurement approaches, limiting comparability across studies and countries. Therefore, there is a need to validate widely used patient safety competence instruments and apply them consistently across different healthcare contexts. Previous research has also focused mainly on hospital settings and specialised units, leaving a knowledge gap about the broader nursing population. In addition, research has focused more extensively on nursing students than on nurses, despite competence development continuing throughout professional careers.

Development of patient safety competence begins during nursing education and continues throughout professional practice through clinical experience, experiential learning and continuing education. Although patient safety education has expanded in nursing curricula, it is often embedded implicitly and tends to emphasise technical skills over non-technical competencies. In addition, educational efforts remain strongly focused on degree education, while less attention has been given to continuous professional development across career stages. Current educational approaches may therefore not sufficiently support the long-term development of patient safety competence or respond to nurses' changing learning needs over time. Important knowledge gaps remain regarding educational approaches that support the development of patient safety competencies across professional learning contexts.

Together, these gaps highlight the need for further investigation, including cross-cultural validation of patient safety competence instruments, a broader assessment of patient safety competence among nurses, and a deeper understanding of how collaborative learning as a pedagogical approach supports the development of patient safety competencies in nursing practice and education.

3. AIMS OF THE STUDY

The aim of this study was to advance understanding of the development of patient safety competence in nursing across clinical and educational contexts. The produced knowledge can be used in nursing practice and education to develop nurses' competencies for safe patient care.

The research questions were:

1. What are the psychometric properties of the culturally adapted Estonian and Norwegian versions of the Health Professional Education in Patient Safety Survey (H-PEPSS)? (Paper I)
2. What are the self-perceived patient safety competencies of Estonian nurses, as measured by the H-PEPSS, and how are work- and education-related factors associated with these competencies? (Paper II)
3. How do master's level nursing students and educators in Estonia and Norway perceive and describe collaborative learning as a pedagogical approach for competency development in nursing practice and education? (Paper III)

4. MATERIALS AND METHODS

A multimethod study design (Anguera et al., 2018) was used, comprising two quantitative and one qualitative sub-study conducted in two countries across clinical and educational settings (Figure 1). The quantitative sub-studies utilised standardised knowledge to examine confidence in patient safety and its associations with work- and education-related factors in nursing. The qualitative sub-study explored participants' perceptions and experiences inductively to understand competence development in nursing practice and education. By integrating quantitative and qualitative approaches from clinical and educational settings in two countries, the study provides complementary perspectives (Foss & Ellefsen, 2002) on the development of patient safety competence in nursing.

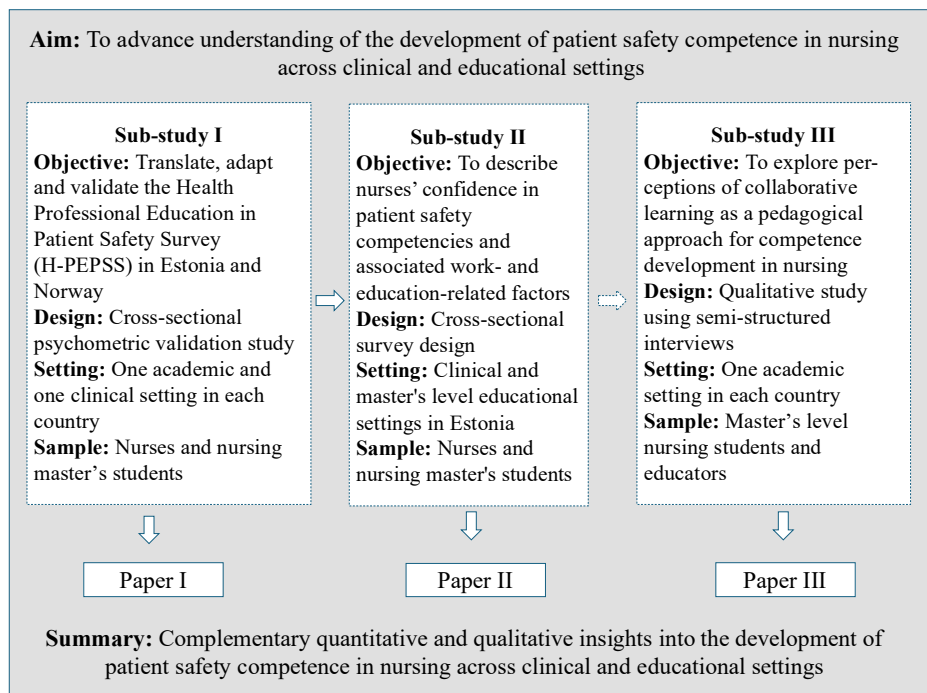


Figure 1. The study design and sub-studies (Papers I–III)

4.1 Research environment

This study was conducted in Estonia and Norway, countries with publicly funded healthcare systems, universal health coverage and nursing professional and educational regulation aligned with European standards. In both countries, nurses are subject to mandatory professional registration and licensing, and nursing education follows the European Qualifications Framework, encompassing bachelor's and master's degree level programmes (EQF) (European Commission, 2018). Both countries face similar challenges related to workforce ageing and staffing shortages in clinical settings (European Commission, 2023).

Despite these shared structural features, the two countries differ in the historical development of nursing education, workforce capacity, and the maturity of national patient-safety systems. Norway has a substantially larger nursing workforce and one of the highest nurse densities in Europe, while Estonia has a smaller workforce relative to population size (OECD, 2023). The transition towards academically based nursing education began several decades earlier in Norway than in Estonia (Ernits et al., 2019; Råholm et al., 2010) (Table 1).

Table 5. Description of Estonian and Norway healthcare and nursing education systems

Characteristics	Estonia	Norway
Nursing workforce (N)	~9,600	~121 000
Nurse density per 1,000 population	~6.5	~21
Transition to professional higher education	1996	1983
Master's level nursing education established	1998	1979
Nurses with postgraduate education	12%	38%

Sources: Ernits et al., 2019; National Institute for Health Development, 2023; OECD, 2023; Råholm et al., 2010; Republic of Estonia Health Board, 2023; Statistics Norway 2025, 2026

Patient safety has been a visible national priority in Norway for nearly 20 years, beginning with the establishment of the National Unit for Patient Safety in 2007 (Norwegian Institute of Public Health, 2009). In contrast, the formalisation of patient safety as a national policy priority in Estonia began more recently, with major legislative and regulatory reforms introduced in 2024 (European Observatory on Health Systems and Policies, 2024). These differences indicate varying levels of maturity in national patient safety systems.

4.2 Instrument validation study in Estonia and Norway

The objective of the first sub-study was to translate, culturally adapt and psychometrically evaluate the Estonian and Norwegian versions of the Health Professional Education in Patient Safety Survey (H-PEPSS) in relation to the original instrument (Ginsburg et al., 2012). The H-PEPSS was selected because of its

focus on system-level dimensions of patient safety, rather than solely individual clinical performance, and it has demonstrated good validity and reliability across different educational, cultural and healthcare contexts (Mortensen et al., 2022).

4.2.1 Study instrument

The H-PEPSS was originally developed to measure the self-perceived confidence of new health professional graduates in sociocultural patient safety competencies (Ginsburg et al., 2012). It comprises seven domains and 20 items (Table 6). *Clinical safety* was added as the first domain to help respondents differentiate between clinical and sociocultural aspects of patient safety (Ginsburg et al., 2012). This domain was therefore excluded from the results in this study, consistent with the original instrument, which identified a concise six-factor, 16-item model as the final measurement structure for sociocultural PS competence (Ginsburg et al., 2012). Each item is phrased as: “*I feel confident in what I have learned about...*” and is rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). An additional response option “*I don’t know*” is available and is coded as zero (Ginsburg et al., 2012). The H-PEPSS has been translated and validated in multiple languages, cultures and contexts, consistently demonstrating acceptable psychometric properties (Alidousti-Shahraki et al., 2022; Bergs et al., 2021; Boloré et al., 2023; Bressan et al., 2016; Chen et al., 2019; Taskiran et al., 2020; Wundavalli et al., 2022).

Table 6. The domains, shortened expressions and number of items of the Health Professional Education in Patient Safety Survey (H-PEPSS) instrument

Domain	Shortened domain name	Items
Clinical safety		4
Working in teams	Teamwork	3
Communicating effectively	Communication	3
Managing safety risks	Safety management	3
Understanding human and environmental factors	Human and environmental factors	2
Recognising and responding to adverse events	Response to adverse events	2
Culture of safety	Safety culture	3

4.2.2 Translation and cross-cultural adaptation

The translation and cross-cultural adaptation were conducted simultaneously in Estonia and Norway by a transnational research team (Figure 2). Forward translations (Beaton et al., 2000) were performed independently in each country, followed by joint discussions among the research team to reach consensus on

semantic, conceptual and operational equivalence (Beaton et al., 2000) across the language versions.

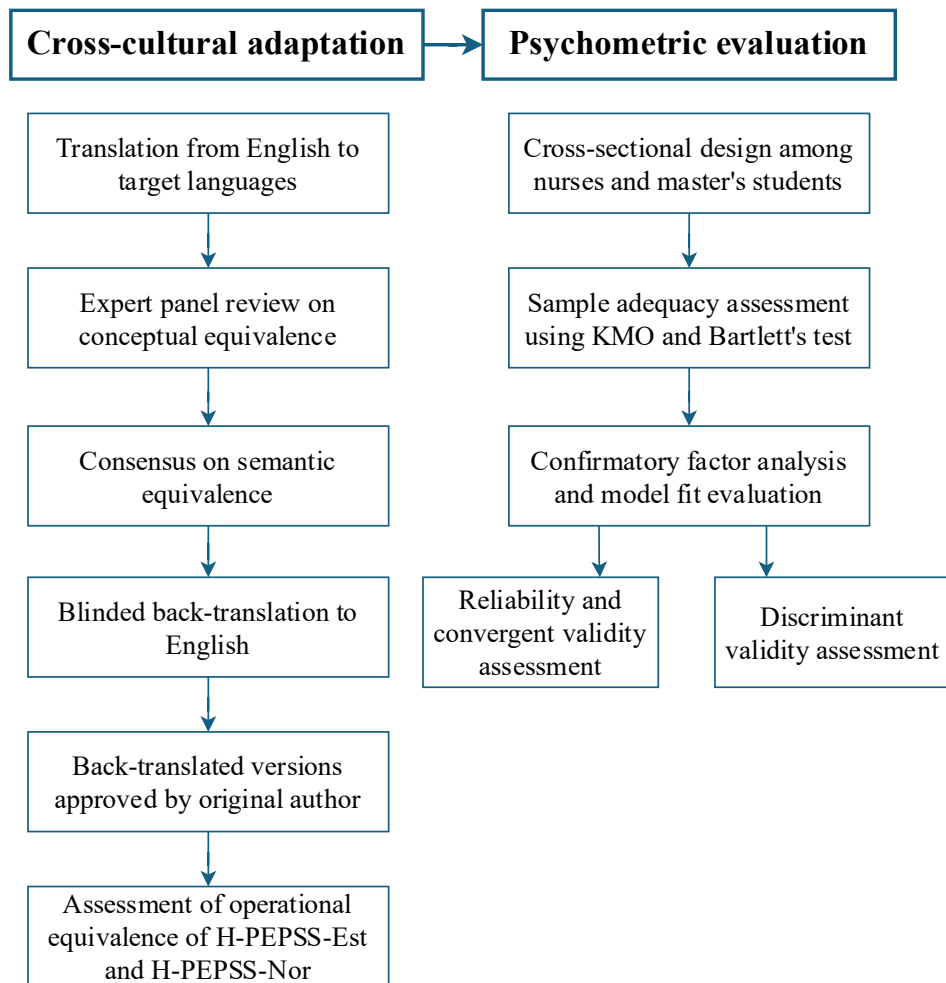


Figure 2. Cross-cultural adaptation and psychometric validation process of the H-PEPSS conducted simultaneously in Estonia and Norway (adapted from Beaton et al., 2000, Ginsburg et al., 2012 and Epstein et al., 2015)

The instrument was translated from English into Estonian and Norwegian using forward translation by qualified native speakers. This was followed by an expert panel (n=3 in each country) to assess equivalence of healthcare- and patient safety-related terminology in target languages. Agreement on semantic and conceptual equivalence was established collaboratively by the experts and translators in both languages. A blinded back-translation was subsequently performed by

independent translators. The original developer of the H-PEPSS reviewed and confirmed the accuracy of the Estonian and Norwegian back-translated versions. Final refinements were to ensure operational equivalence of the translated instruments (Figure 2).

4.2.3 Sampling and data collection

For the psychometric evaluation, data were collected between March 2021 and November 2021 using cross-sectional survey design in Estonia and Norway. The target population comprised nurses and midwives (hereafter referred to as nurses) employed at university hospitals, as well as students enrolled in master's-level nursing or healthcare programmes at participating higher education institutions (Table 7). Participants were recruited using convenience sampling approach (Etikan et al., 2016) from one university and one hospital in each country. Participants were recruited in collaboration with hospital and university contact persons, who distributed information letters containing links to the online survey via institutional email addresses. Eligible participants received one initial invitation and two reminder emails. The survey consisted of the H-PEPSS questionnaire and additional background questions addressing demographic and professional characteristics, including gender, age, level of education, work experience and previous education in patient safety. A conservative target sample size of approximately 300 respondents was specified based on established confirmatory factor analysis guidelines and model complexity (Hair et al., 2019). Incomplete responses and responses marked “*I don't know*” were excluded from psychometric analyses.

Table 7. Samples used for psychometric validation of the H-PEPSS

Country	Setting	Participant group	N
Estonia	University hospital	Nurses and midwives	1,400
	University	Master's students in nursing science	81
Norway	University hospital	Nurses	1,281
	University of applied sciences	Master's students in healthcare	281

4.2.4 Psychometric evaluation of factor structure, reliability and validity

All psychometric analyses were conducted separately for the Estonian and Norwegian datasets. Prior to confirmatory factor analysis (CFA), preliminary data screening was conducted to assess sampling adequacy using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity (Hair et al., 2019). A KMO value above 0.80 was considered indicative of sampling adequacy, and a signi-

ficant Bartlett's test, p-value below 0.05, indicated that the correlation matrix differed from an identity matrix (Hair et al., 2019; Kaiser & Rice, 1974). Construct validity was examined using confirmatory factor analysis (CFA), and model fit was evaluated using the root mean square error of approximation (RMSEA), the standardised root mean residual (SRMR), the normed chi-square, and the comparative fit index (CFI). Acceptable model fit was defined as RMSEA and SRMR < 0.08, normed chi-square (χ^2/df) between 2 and 3 and CFI ≥ 0.95 (Hair et al., 2019; Sun, 2005).

Reliability and convergent validity were assessed using complementary indicators. Internal consistency was evaluated using Cronbach's alpha and composite reliability (CR) coefficients, with values of 0.70 or higher indicating acceptable reliability. Convergent validity was assessed using standardised factor loadings (SFL ≥ 0.5) and average variance extracted (AVE ≥ 0.5) (Hair et al., 2019). Discriminant validity was evaluated by comparing AVE with maximum shared squared variance (MSV), with AVE exceeding MSV indicating adequate discriminant validity (Hair et al., 2019; Sun, 2005). Following psychometric evaluation, a descriptive analysis of demographic variables and mean scores across H-PEPSS domains was conducted to provide an initial overview of the instrument's application in both datasets. All analysis was performed using SAS version 9.4 and Microsoft Excel.

4.3 Cross-sectional survey in Estonia

The objective of the second sub-study was to describe nurses' self-perceived confidence in patient safety competencies and to explore associations between confidence and selected work- and education-related factors in Estonia.

4.3.1 Sampling and data collection

In this sub-study, a cross-sectional survey design was used, and a non-probability sample of nurses and health sciences master's students was included. Eligible participants were: 1) all nurses and midwives (hereafter referred to as nurses) employed under contract with healthcare service providers in Estonia during the study period (N = 9,399), and 2) all students enrolled during the study period in the Master of Nursing Science programme at the University of Tartu and the Health Sciences master's programmes at the Tartu Healthcare College and Tallinn Healthcare College (N = 256). Nurse assistants and assisting nursing students without qualification as registered nurses were excluded.

Participants were invited through professional email lists of associations and educational institutions and through social media platforms. Three reminder messages were distributed during the data collection period. The online survey, administered using REDCap, was open from 1 May to 30 September 2023. Self-perceived confidence in patient safety competencies was measured using the Health Professional Education in Patient Safety Survey (H-PEPSS), in which

respondents rate their confidence in what they have learned across multiple patient safety domains. In addition, the questionnaire included background questions on demographic, educational and work-related characteristics.

4.3.2 Data analyses

Only formally submitted questionnaires were included in the analyses. Descriptive statistics were used to summarise background characteristics, with frequencies and percentages reported for categorical variables and means and standard deviations (SD) for continuous variables. For patient safety competencies, domain scores were calculated by averaging item scores within each domain and mean domain scores with SDs were reported (Ginsburg et al., 2012).

To examine associations between background variables and nurses' confidence in patient safety competencies, multivariable logistic regression analyses were conducted (H.-A. Park, 2013). Each patient safety competency domain was analysed separately, resulting in six regression models. For regression analyses, domain scores were dichotomised and treated as binary dependent variables, categorised as "confident" (mean scores 4–5) or "not confident" (mean scores 1–3). Independent variables included education (three categories), years of work experience (continuous), previous patient safety training (yes/no) and workplace setting (four categories).

Cases with missing data on any variables included in the regression models were excluded using listwise deletion. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, with an OR greater than 1 indicating a higher likelihood of confidence, and an OR less than 1 indicating a lower likelihood. Statistical significance was set at p-values less than 0.05. Analyses were conducted using Stata statistical software package.

4.4 Qualitative interview study in Estonia and Norway

The objective of the third sub-study was to explore how master's-level nursing students and educators in Estonia and Norway perceive and describe collaborative learning as a pedagogical approach for competence development in nursing practice and education.

4.4.1 Study environment and target group

A qualitative descriptive design was employed (Hammarberg et al., 2016) to capture perceptions of collaborative learning within nursing education and practice. The study was conducted within two master's-level nursing programmes: the University of Tartu in Estonia, where the curriculum includes nursing management and didactics, and Western Norway University of Applied Sciences in Norway, with a focus on clinical and critical care nursing. The target group comprised nurses engaged in these programmes as students or educators,

representing a range of professional roles and career stages. A purposive sampling strategy was used to ensure representation from both sides of the educational process (Etikan et al., 2016). During the study period, the Estonian programme included 63 students and nine educators, while the Norwegian programme included 35 students and six educators.

4.4.2 Participant recruitment and data collection

In each country, a designated university contact person distributed an electronic information letter to eligible participants. Altogether, three invitations were sent. Data were collected in 2021 using focus group interviews to facilitate interaction and shared reflection among participants with diverse educational and professional experiences (Powell & Single, 1996). A semi-structured interview guide (Kallio et al., 2016), informed by existing literature (George et al., 2019; Saragih et al., 2024), structured the discussions around four topics: (1) previous experiences with collaborative learning, (2) suitable topics and target groups, (3) perceived benefits and challenges and (4) strategies for organising and evaluating collaborative learning. The guide was shared with participants in advance; however, the collaborative learning was not explicitly defined to avoid influencing participants' interpretations. Participants were encouraged to share concrete examples and reflect on their experiences. At the end of each interview, participants completed a background form to capture information on their nationality, gender, age, profession, current position and prior exposure to collaborative learning.

Separate focus groups were organised for students and educators in each country to minimise potential power imbalances and support open discussion (Powell & Single, 1996). In Estonia all focus group interviews were conducted online via Microsoft Teams (Saarijärvi & Bratt, 2021). In Norway, educator focus groups were conducted online, using Zoom, while student focus groups were conducted face-to-face. Each focus group included three to five participants, resulting in eight focus groups in total (four per country). All interviews were audio-recorded with consent. Interview durations ranged from 48 to 79 minutes, yielding approximately nine hours (544 minutes) of recorded material.

In total, 33 participants enrolled, with 14 from Estonia and 19 from Norway, comprising 17 students and 16 educators. Most participants were female (97%). All held at least a bachelor's degree in nursing or a related health profession, and the majority (90%) reported prior experience with collaborative learning in clinical or educational settings. Eight participants reported multiple experiences. The most frequently mentioned contexts were during formal studies (39%), in the educator role (33%) and in collaboration with co-workers in clinical practice (33%).

4.4.3 Data analysis

The data were analysed using inductive content analysis, following the three-stage process of preparation, organisation and reporting (Elo & Kyngäs, 2008). During the preparation phase, interviews were transcribed verbatim, resulting in 109 pages of text. Transcripts were read repeatedly to gain an overall understanding of the data. Segments related to collaborative learning were identified as meaning units of varying length. In the organisation phase, meaning units were condensed and coded independently by two researchers in each country. The codes were subsequently translated into English and reviewed collaboratively by the research team. During this process, the codes were found to reflect complementary, rather than contrasting perspectives. Therefore, all codes were merged and analysed as a single dataset. Codes were grouped into sub-categories and further abstracted into broader generic categories through iterative discussions. In the reporting phase, categories were synthesised into higher-level themes capturing the central dimensions of collaborative learning as described by participants.

4.5 Ethical considerations

In this study, research ethics values were followed, including respect for persons, reliability and honesty (All European Academies, 2023; Estonian Research Council, 2023). Respect for persons was ensured through autonomy, including voluntary participation, informed consent and confidentiality. Participants were informed about the purpose of the study, their right to decline participation or skip questions without consequences, and their right to withdraw at any time. For the quantitative sub-studies, completion of the survey was considered as informed consent. For the qualitative interviews, participants received written and oral information about the study and provided informed consent prior to participation. Confidentiality was maintained throughout the study, and no personally identifiable information was collected or analysed. No sensitive personal data was collected, and only minimal background information necessary for the study aims was gathered. All interview data were anonymised during transcription, and findings are reported at the group level to protect participants' privacy.

Reliability was ensured through appropriate and previously established research methods and rigorous data collection and analysis procedures. Research procedures were clearly described and applied consistently across all parts of the study. The translation and adaptation of the instrument followed a systematic process, and permission was obtained from the original author. These steps support the methodological soundness and reproducibility of the research. Honesty was ensured by transparent and accurate reporting of the research process and findings. Results are presented truthfully and without fabrication, falsification, or inappropriate data manipulation. Methodological limitations are acknowledged, supporting the credibility and trustworthiness of the study.

Ethical approval for the study was obtained from the relevant institutional review boards in Estonia and Norway, in accordance with national and institutional requirements. In Estonia, two approvals were granted by the Research Ethics Committee of the University of Tartu: one covering the instrument validation and qualitative interview studies (No 327/T-13 and No 337/M-28), and a separate approval for the cross-sectional quantitative survey study (No 376/T-7). In Norway, a single approval from the Norwegian Centre for Research Data AS (ID 213029) covered the instrument validation and qualitative interview studies.

ChatGPT (GPT-5.6 Sol, OpenAI) and Claude Sonnet 5 (Anthropic) were used for language editing and to improve the clarity and readability of this dissertation. NotebookLM (Google) was used to assist with organising and reviewing source material selected by the author. All scientific content, interpretations, analyses, and conclusions are the author's own. All AI-assisted outputs were reviewed and verified by the author, who takes full responsibility for the final content of the dissertation.

4.6 Rigour of the study

Throughout the research, the principles of good research practices were followed. The rigour of the multimethod design was ensured by the use of both quantitative and qualitative sub-studies to address the research aims from complementary perspectives (Esteves & Pastor, 2003). The different parts of the study were designed to address the same research focus (Anguera et al., 2018) and to contribute to a broader understanding of the research problem. The quantitative and qualitative sub-studies were conducted and analysed separately, in line with a multimethod design. Together, the use of different methods provides complementary insights, strengthening the overall validity of the study.

For the quantitative sub-studies, rigour was ensured across the planning, data collection, analysis and reporting phases (Marquart, 2017). In the planning phase, a previously developed and widely applied instrument was selected, and the target groups were clearly defined. Systematic translation and cross-cultural adaptation procedures were followed to ensure conceptual and linguistic equivalence (Beaton et al., 2000). During data collection, the questionnaire was administered in a standardised manner to ensure consistent responses. In the analysis phase, appropriate statistical methods were used to examine the instrument's reliability and validity, as well as associations between variables (Hair et al., 2019), supporting the accuracy of the measurements. In the reporting phase, results were presented clearly and transparently, supporting the interpretability of the findings.

For the qualitative interview study, trustworthiness was guided by the criteria of credibility, dependability, confirmability and transferability (Kynge et al., 2020). Credibility was enhanced through purposive sampling of participants with relevant experience and the use of semi-structured focus group interviews. Dependability and confirmability were supported by a transparent and systematic research process, including verbatim transcription, inductive analysis and indepen-

dent coding, followed by collaborative discussions to minimise researcher bias and ensure consistency in analytical procedures. Transferability was addressed by providing detailed descriptions of the study context, participants and analytical procedures, enabling readers to assess the applicability of the findings to other clinical and educational settings.

5. RESULTS

5.1 Psychometric evaluation of H-PEPSS-Est and H-PEPSS-Nor (Paper I)

5.1.1 Factor structure, reliability and validity

The H-PEPSS instrument was translated into Estonian (H-PEPSS-Est) and Norwegian (H-PEPSS-Nor) using a blinded back-translation procedure. The Estonian version adopted the past perfect tense to better support broader self-assessment contexts beyond immediate post-training use.

For **data suitability**, KMO values exceeded 0.90 in H-PEPSS-Est and H-PEPSS-Nor, indicating strong inter-item correlations. Bartlett's test of sphericity was statistically significant in both samples, indicating that the correlation matrices differed from identity matrices. For **factor structure** and **model fit**, confirmatory factor analyses conducted separately in the Estonian and Norwegian samples supported the proposed six-factor structure of the H-PEPSS in both datasets. Goodness-of-fit indices indicated acceptable model fit for H-PEPSS-Est and H-PEPSS-Nor (Table 8).

Table 8. Summary of psychometric properties for the H-PEPSS-Est and H-PEPSS-Nor

Measure	Threshold	H-PEPSS-Est	H-PEPSS-Nor
Data suitability			
Kaiser-Meyer-Olkin	> 0.8	0.930	0.904
Bartlett's test of sphericity	< 0.05	< 0.0001	< 0.0001
Model fit			
χ^2/df	2–3	2.2	2.2
Comparative fit index	> 0.95	0.959	0.949
Root mean square error of approximation	< 0.08	0.075	0.079
Standardised root mean residual	< 0.08	0.035	0.045
Reliability and convergent validity¹			
Composite reliability in domains	> 0.7	0.80–0.88	0.66–0.89
Cronbach's alpha in domains	> 0.7	0.80–0.88	0.66–0.88
Standardised factor loading in domains	> 0.5	0.74–0.91	0.69–0.95
Average variance extracted (AVE) in domains	> 0.5	0.68–0.78	0.50–0.80
Discriminant validity¹			
Maximum shared squared variance in domains	< AVE	0.63–0.71	0.46–0.70

¹ Values represent ranges across domains

For **reliability and convergent validity**, standardised factor loadings exceeded 0.50 for all items, with most exceeding 0.70. Composite reliability (CR) and Cronbach's alpha values were generally above 0.70, indicating satisfactory internal consistency across domains. One exception was the domain *human and environmental factors* in H-PEPSS-Nor, which showed lower reliability, with both CR and Cronbach's alpha values below 0.70. For **discriminant validity**, results were not fully supported across all domains, as some maximum shared variance (MSV) values exceeded the average variance extracted (AVE), suggesting overlap among certain constructs (Tables 9a and 9b).

Table 9a. Psychometric properties and domains of H-PEPSS-Est

Domain	Indicators cut-off				MSV (< AVE)
	SFL (0.5)	AVE (0.5)	CR (0.7)	alpha (0.7)	
Teamwork	0.78–0.86	0.68	0.86	0.86	0.71¹
Communication	0.74–0.89	0.69	0.87	0.86	0.71¹
Safety management	0.86–0.89	0.75	0.88	0.88	0.71
Human and environmental factors	0.80–0.83	0.68	0.80	0.80	0.68¹
Response to adverse events	0.86–0.91	0.78	0.88	0.88	0.71
Safety culture	0.81–0.83	0.68	0.86	0.86	0.63

¹ MSV > AVE.

Abbreviations: SFL = Standardised factor loadings; AVE = Average variance extracted; CR = Composite reliability; alpha = Cronbach's alpha; MSV = Maximum shared squared variance

Table 9b. Psychometric properties of the H-PEPSS-Nor

Domain	Indicators cut-off				MSV (< AVE)
	SFL (0.5)	AVE (0.5)	CR (0.7)	alpha (0.7)	
Teamwork	0.77–0.95	0.73	0.89	0.88	0.46
Communication	0.80–0.87	0.68	0.86	0.86	0.70¹
Safety management	0.81–0.85	0.70	0.87	0.87	0.64
Human and environmental factors	0.69–0.72	0.50	0.66¹	0.66¹	0.70¹
Response to adverse events	0.86–0.91	0.80	0.87	0.88	0.52
Safety culture	0.72–0.89	0.68	0.87	0.86	0.56

¹ reliability coefficient (CR or alpha) < 0.70 or MSV > AVE.

Abbreviations: SFL = Standardised factor loadings; AVE = Average variance extracted; CR = Composite reliability; alpha = Cronbach's alpha; MSV = Maximum shared squared variance

5.1.2 Sample characteristics

The sample for instrument validation comprised 226 respondents from Estonia and 212 from Norway. In Estonia, the response rate was 13% among nurses and 60% among master's students, while in Norway, the corresponding rates were 13% and 22%, respectively. In both samples most respondents were female. In the Estonian sample, nurses had a mean age of 43.0 years (SD = 10.7) and master's students 36.9 years (SD = 8.9). Mean years in practice were 18.1 (SD = 12.1) for nurses and 10.5 (SD = 8.0) for students. Most Estonian participants held a bachelor's degree and two-thirds reported no prior patient safety training. In the Norwegian sample, mean ages were 40.0 (SD = 11.1) for nurses and 38.5 (SD = 8.05) for master's students. Corresponding mean years of practice were 17.9 (SD = 10.7) and 11.1 (SD = 6.3), respectively. A notable proportion of Norwegian nurses reported postgraduate qualifications and prior patient safety training was more common in Norway than in Estonia (Table 10).

Table 10. Socio-demographic characteristics of validation samples

	Estonia (N = 226)		Norway (N = 212)	
	Nurses (n = 178)	Master's students (n = 49)	Nurses (n = 164)	Master's students (n = 48)
Gender (%)				
Female	97	98	86	92
Male	3	2	14	8
Degree (%)				
Vocational	12	0	0	0
Bachelor's	57	76	33	100
Post degree	8	22	51	0
Master's or higher	23	2	16	0
Previous training in patient safety (%)				
Yes	25	22	64	73
No	75	78	36	27

5.1.3 Descriptive self-perceived patient safety competence scores

Overall, mean scores across domains in both countries ranged from 3.1 to 4.0, indicating generally above-average self-perceived patient safety competence. Self-perceived competencies varied across domains in both samples, with *team-work* consistently receiving the lowest ratings across participant groups. No single domain consistently emerged as the highest-rated across groups. Within the Estonian sample, master's level students reported slightly higher confidence than nurses in most domains. In the Norwegian sample, nurses reported higher confidence than master's level students across all domains. The largest between-country differences were observed in *safety culture* and *response to adverse events* (Figure 3).

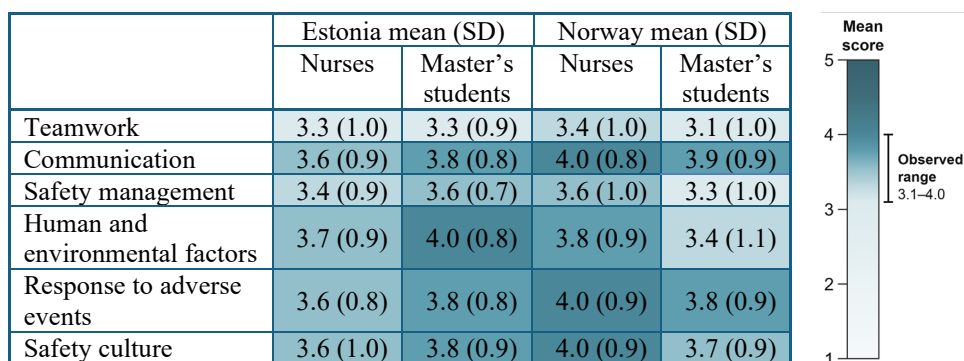


Figure 3. H-PEPSS domain mean scores (SD) for nurses and master's students by country on a 5-point scale

5.2 Nurses' self-perceived patient safety competence in Estonia (Paper II)

5.2.1 Sample characteristics

A total of 551 respondents started the survey. After excluding 175 partially completed questionnaires, 376 complete questionnaires were included in the analysis. Most of the respondents were female (99%) and worked as nurses (77%). Participants' ages ranged from 24 to 72 years (mean 44.5; SD 10.8), and years of work experience ranged from 0.5 to 55 years (mean 19.1; SD 12.8). Respondents represented a range of healthcare workplace settings and educational backgrounds. The largest proportions of respondents worked in outpatient settings (31%) and regional hospitals (28%) and had education corresponding to EQF level 5 or 6 (Table 11).

Table 11. Workplace settings and educational background of the study participants (n = 376)

Characteristic		n (%)
Occupation	Nurse	287 (77)
	Midwife	74 (20)
	Other	12 (3)
Workplace setting	Outpatient care	115 (31)
	Regional hospital	105 (28)
	Central hospital	86 (23)
	Small hospitals	66 (18)
Educational background	EQF ¹ 5 and 6	209 (56)
	EQF 7 and 8	90 (24)
	Master's level students	76 (20)

¹ EQF: European Qualification Framework: EQF 5 and 6 corresponds to vocational education and a bachelor's degree, respectively; EQF 7 and 8 reflect MSc and PhD degrees, respectively.

5.2.2 Self-perceived patient safety competencies

Across the six H-PEPSS domains, mean scores ranged from 3.55 to 4.04. The proportion of respondents reporting confidence (agree/strongly agree) within each domain ranged from 39% to 73.4%. Confidence was highest in *human and environmental factors*, while *teamwork* received the lowest ratings (Figure 4).

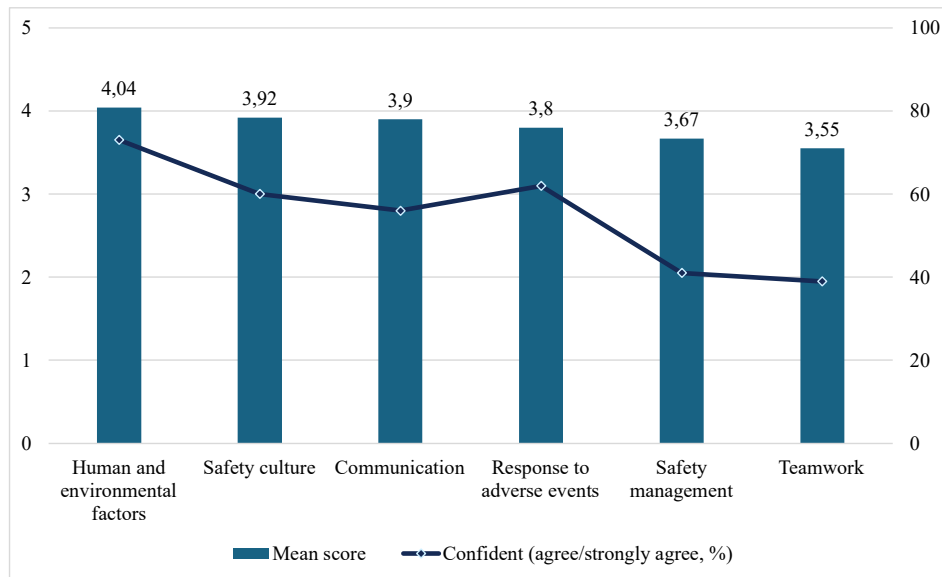


Figure 4. Mean scores and proportion of respondents reporting confidence (agree/strongly agree) across H-PEPSS domains.

5.2.3 Associations between patient safety competencies and work- and education-related factors

Each additional year of work experience was associated with higher odds of confidence in *teamwork* (OR = 1.03, 95% CI: 1.01–1.05) and *safety culture* (OR = 1.02, 95% CI: 1.00–1.04). Nurses employed in smaller hospitals had more than twice the odds of reporting confidence in *safety management* compared with those working in regional hospitals (OR = 2.19, 95% CI: 1.14–4.21). Being enrolled as a master's level student was associated with higher odds of reporting confidence in *response to adverse events* (OR = 2.16, 95% CI: 1.17–3.99) and *safety culture* (OR = 2.26, 95% CI: 1.22–4.19). Prior patient safety training was associated with higher odds of confidence in *teamwork* (OR = 1.64, 95% CI: 1.06–2.55), *safety management* (OR = 1.79, 95% CI: 1.16–2.75) and *response to adverse event* (OR = 1.56, 95% CI: 1.01–2.41). No statistically significant associations were observed for the domains *communication* and *human and environmental factors* (Table 4 in Paper II).

5.3 Collaborative learning linking nursing education and practice (Paper III)

Based on our findings, collaborative learning in nursing practice and education is the aggregation of diverse learners' experiences and reflections while working towards shared aims. This supports the development of competencies at multiple levels. The organisation of such learner-driven education requires careful planning and synchronisation between clinical and educational organisations (Figure 5).

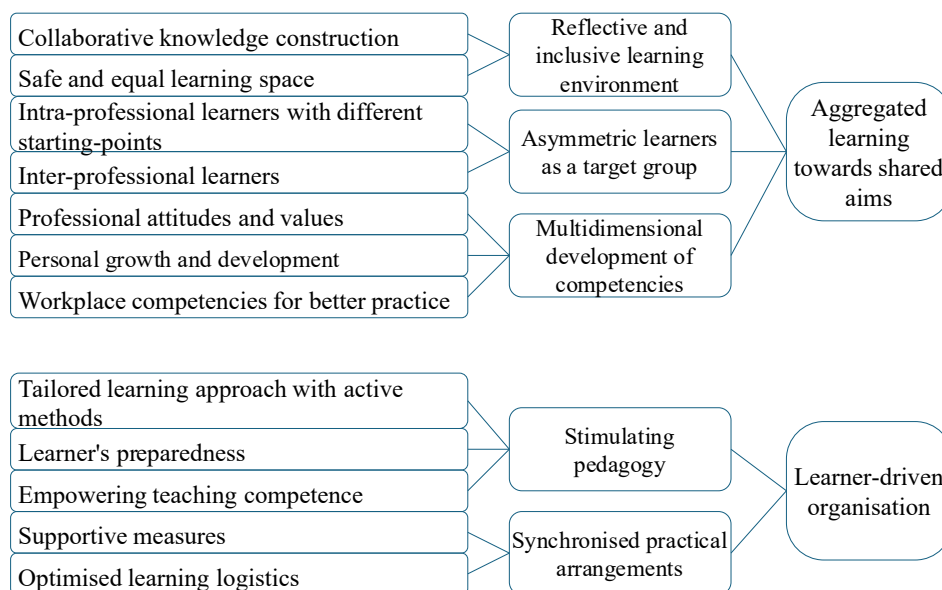


Figure 5. Sub-categories, categories and main themes about collaborative learning dynamics and pedagogical strategies

5.3.1 Aggregated learning towards shared aims

Participants described collaborative learning as a **reflective and inclusive learning atmosphere** in which learners with diverse backgrounds engage in mutual knowledge exchange, open dialogue and reflection. A safe and equal learning space was considered essential, where hierarchical distinctions are minimised to foster respect and active engagement. **Asymmetric learners as a target group**, including participants with different professional backgrounds, roles and levels of experience, were viewed as a strength rather than a barrier. Such diversity enables richer discussions, broader perspectives and deeper insights. Participants perceived that this interaction supports the **multidimensional development of competencies**, including technical skills, professional attitudes and interpersonal capabilities, benefiting both novice and experienced professionals. Collaborative learning was also seen as particularly valuable for addressing complex clinical

situations, ethical dilemmas, and patient safety issues that require teamwork and effective communication (Figure 5).

5.3.2 Learner-driven organisation

Participants emphasised that the organisation of collaborative learning is supported by **stimulating pedagogy** and requires deliberate planning and structured organisation. This involves active, practice-oriented learning approaches, learners' readiness to engage and share experiences, and educators' ability to facilitate and guide group processes. Participants identified key enabling factors as including the use of tailored methods for heterogeneous groups and educators' competence in balancing participation. **Synchronised practical arrangements** were identified as essential for enabling collaborative learning. Practical arrangements, such as coordination between clinical settings and educational institutions, flexible scheduling, and access to resources, were considered critical for reducing barriers and ensuring equitable participation. Logistical factors, including timing, location, and support infrastructure, were also central to sustaining engagement in collaborative learning activities (Figure 5).

6. DISCUSSION

The aim of this study was to advance understanding of the development of patient safety competence in nursing across clinical and educational contexts, by examining patient safety competencies and exploring collaborative learning as a pedagogical approach for competence development. This study showed that the Estonian and Norwegian versions of the H-PEPSS are suitable for use across different contexts, while also highlighting methodological and conceptual challenges in assessing patient safety competence. Nurses generally reported confidence levels above the midpoint across most patient safety domains. *Human and environmental factors* received the highest ratings in the Estonian samples, whereas *teamwork* was consistently rated lowest across participant groups, suggesting differences in how individual- and team-related patient safety competencies are perceived and evaluated. Collaborative learning appeared to support the development of patient safety competence, while also highlighting the importance of psychologically safe, inclusive and well-supported learning environments for effective collaboration.

6.1 Cross-cultural assessment of patient safety competencies

The validation of the culturally adapted Estonian and Norwegian versions of the Health Professional Education in Patient Safety Survey (H-PEPSS) demonstrated a comparable factor structure and acceptable psychometric properties in both languages (Paper I). Previous studies have validated H-PEPSS in different countries and languages separately, with generally consistent findings (Boloré et al., 2023; Bressan et al., 2016; Taskiran et al., 2020). However, studies have used different versions of the H-PEPSS instrument, including 38-item (Boloré et al., 2023), 31-item (X. Zhang et al., 2024), 23-item (Bressan et al., 2016; Taskiran et al., 2020) and 16-item versions (Bergs et al., 2021; Chen et al., 2019). A particular strength of the present study was that the instrument was translated and validated simultaneously across two countries using the same original 16-item version originally developed (Ginsburg et al., 2012). This approach reduced methodological variation, supported more consistent evaluation across contexts and enabled assessment of semantic and conceptual equivalence during the translation process (Epstein et al., 2015). Rigorous evaluation of measurement properties is particularly important in cross-cultural adaptation studies and is widely recommended in psychometric research (Cheung et al., 2023). However, there is no universal consensus on the most appropriate approaches to the construct validation of competence self-assessment instruments (Cheung et al., 2023; Hair et al., 2019; Kyriazos, 2018). In this study, the psychometric evaluation followed the methodological approach used in the development of the original H-PEPSS, including confirmatory factor analysis and model fit evaluation to assess the underlying structure of the instrument (Ginsburg et al., 2012), thereby ensuring methodological continuity with the original instrument. The simultaneous cross-cultural

validation of the same instrument across two countries using a consistent methodological approach highlights the importance of such approaches for enabling meaningful assessment and comparison of patient safety competencies across healthcare and educational settings.

While the H-PEPSS was originally developed for newly graduated healthcare professionals (Ginsburg et al., 2012) and is commonly used to assess and compare patient safety learning in classroom and clinical settings, the present study applied the instrument to a more experienced population, including nurses and master's-level nursing students from two countries. An important strength of the study was therefore the extension of the H-PEPSS beyond its original target population to participants with more advanced clinical and educational backgrounds in different national contexts. Given participants' prior education and clinical experience, the instrument was used to assess overall patient safety competence rather than distinguishing between classroom and clinical learning contexts (Papers I and II). This approach is supported by the understanding that patient safety competence develops across the professional lifespan (Murray et al., 2018; Vázquez-Calatayud et al., 2021), and that assessment should not be limited to early-career professionals. This broadened the applicability of the instrument and supported the assessment of competence as a developmental and lifelong process rather than a competence limited to initial professional education.

However, some domain-specific limitations were identified. In particular, the *human and environmental factors* domain in the H-PEPSS-Nor showed lower internal consistency (Paper I). This domain consists of only two items, which may partly explain the lower reliability estimates, as it is recommended to have at least three items to adequately capture a construct (Hair et al., 2019). Another domain, *response to adverse event*, also consists of only two items, but did not show similar reliability concerns. This suggests that lower reliability in the *human and environmental factors* domain may relate not only to item quantity but also to their content. The items in this domain may capture related but distinct aspects rather than a single coherent construct, resulting in weaker internal consistency when items have little in common (Nunnally & Bernstein, 1994). In addition, as the original H-PEPSS was developed more than a decade ago (Ginsburg et al., 2012), evolving understandings of patient safety competence, including greater emphasis on continuous competence development, patient partnership and engagement, and the increasing complexity of technology in healthcare (Eloranta et al., 2026), raise questions about whether these aspects are sufficiently reflected in the existing domains and items. This highlights the challenge of maintaining the relevance of patient safety assessment tools in rapidly evolving healthcare environments.

In H-PEPSS-Est, discriminant validity was not fully supported for the domains of *teamwork*, *communication*, and *human and environmental factors*, while in the H-PEPSS-Nor, this issue was identified in *communication* and *human and environmental factors* (Paper I). Although the overlap was relatively small, it may partly reflect the interconnected nature of patient safety competencies within a complex sociotechnical healthcare system, where teamwork, communication and human

factors are closely related in clinical practice (Rosen et al., 2018). As discriminant validity concerns the distinctiveness of factors measured by different sets of indicators (Sun, 2005), these findings warrant cautious interpretation of domain-level scores, although the overall structure of the instrument remained acceptable. At the same time, the findings suggest that patient safety competencies may be closely interconnected, which may make strict separation between domains challenging.

6.2 Balancing individual and team competence in patient safety

In this study, *understanding human and environmental factors* was the highest-rated patient safety competency domain in both the Estonian validation sample and the larger national survey (Papers I and II). In the H-PEPSS instrument, this domain covers the effect of human factors, such as fatigue, on patient safety, as well as the safe use of health technology (Ginsburg et al., 2012). Similarly high ratings in this domain have been reported in some nursing contexts, although findings remain inconsistent. Similar findings have been reported among nurses studying in master's programmes (X. Zhang et al., 2024) and in a global H-PEPSS study (Gleason et al., 2021). However, high ratings in this domain are not commonly reported in patient safety self-evaluations (Wang et al., 2026), including the Norwegian sample of nurses and master's students in the present study (Paper I). The studies reporting higher ratings in this domain, including the present study, have generally involved participants from relatively diverse educational and professional backgrounds (Papers I and II), whereas many studies have focused on more homogeneous samples. While homogeneous groups may better reveal context- or profession-specific strengths and weaknesses, heterogeneous samples may provide findings that are more transferable across broader nursing and healthcare populations (Messinger et al., 2025). The variability across studies suggests that findings on patient safety competence may differ depending on the educational and professional diversity of the study population, warranting further comparative research across diverse nursing populations.

The interpretation of competence in *human and environmental factors* may also be influenced by respondents' understanding of the concept of human factors itself. Although the standardised conceptual framework for patient safety terminology was introduced some time ago (WHO, 2009), the concept of human factors continues to be interpreted inconsistently in education and practice. Some approaches define it primarily as individual attributes, such as stress, fatigue or personal feelings, whereas others conceptualise human factors as an interaction between humans and system elements (Sheehan et al., 2022). In daily clinical work, nurses routinely encounter workload pressures, fatigue, and interruptions (Thomas et al., 2017). Because these issues are highly visible in everyday practice, respondents may perceive human factors as familiar, knowledge-based aspects that are easy to evaluate positively in self-reports. Research has also

shown that nurses recognise the negative impact of overwhelm (Roth et al., 2023) and exhaustion on patient safety, regardless of their level of experience or workplace setting (Li et al., 2024). Similar interpretations may also apply to environmental factors related to health technology. Digital systems and artificial intelligence are increasingly embedded in everyday nursing practice, making technology awareness and safe technology use highly visible components of professional work (Vasquez et al., 2023). As these factors are experienced directly in daily clinical practice, nurses may feel more confident in recognising and evaluating them. These findings suggest that high self-ratings in human and environmental factors may reflect not only competence itself but also the familiarity, visibility, and interpretability of these issues in everyday nursing practice. Further research could help clarify how nurses conceptualise human factors and how these interpretations influence self-perceived patient safety competence.

In this study, *teamwork* was consistently the lowest-rated domain across all participant groups, both in the validation samples and the larger national survey in Estonia (Papers I and II). Similar findings have been reported in previous research, where teamwork is often identified as one of the least confidently evaluated areas of patient safety competence (Wang et al., 2026). Unlike competencies that are perceived at the individual level, teamwork depends on complex interpersonal and organisational processes, including coordination, mutual trust and shared mental models within teams (Salas et al., 2005). These aspects are reflected in the H-PEPSS through items addressing interprofessional conflict, shared authority and decision-making, and speaking-up behaviours within healthcare teams (Ginsburg et al., 2012). Although nurses are increasingly recognised as autonomous professionals, they may still experience difficulties in these aspects. One possible explanation is the hierarchical nature of healthcare organisations (Piper-Vallillo et al., 2023), which can shape communication patterns and influence staff's speaking-up behaviours (Essex et al., 2023). Nurses may hesitate to question senior colleagues and physicians due to perceived power differences (Lee et al., 2023). While some degree of hierarchy is necessary for effective functioning in complex clinical environments (Skyberg & Jenssen, 2024), it may also constrain teamwork and limit the expression of concerns. Previous research further suggests that intraprofessional conflicts as well are closely related to hierarchical relationships and power differentials, which may limit openness, communication and psychologically safe participation in teamwork (Bajwa et al., 2020). Speaking up is therefore not solely an individual characteristic but is influenced by organisational factors such as trust, recognition and perceived support (Pinho et al., 2023). Even in settings that formally encourage openness, power dynamics can persist, leaving some professional perspectives more dominant than others and influencing which voices are heard in practice (Skyberg & Jenssen, 2024). Nurses often recognise the importance of raising concerns but hesitate to act due to fear of negative consequences (Lee et al., 2023), which may weaken team functioning in hierarchical healthcare environments (Essex et al., 2023). These findings suggest that challenges in teamwork competencies in patient safety are shaped not only by individual abilities, but also

by organisational culture, hierarchy and psychological safety, which influence how confidence in teamwork is perceived in practice. Further qualitative research is needed to better understand how nurses conceptualise teamwork and team relationships in patient safety, including who is perceived as part of the healthcare team in clinical practice.

In this study, longer work experience was associated with higher self-perceived competence in teamwork and safety culture (Paper II). Similar associations between work experience and patient safety competence have been reported in previous research (Atalla et al., 2025), suggesting that these competencies may develop through continued participation in clinical and organisational environments. This may also reflect the importance of collaboration between professionals with different levels of clinical experience within healthcare teams (Roth et al., 2023). These findings are important given the strong association between teamwork and patient safety outcomes. Previous research indicates that weak teamwork is associated with missed nursing care (Kohanová et al., 2024), whereas effective teamwork supports patient-centred care (Baek et al., 2023). Moreover, hierarchical structures, lack of support and poor working environments not only affect teamwork but are also associated with staff wellbeing (Essex et al., 2023) and contribute to turnover (Bahlman-van Ooijen et al., 2023). Together, these findings highlight that teamwork competencies in patient safety are shaped through both learning and workplace environments, requiring organisational cultures that support collaboration, reduce hierarchical barriers and promote psychological safety.

These differences between competency domains may also reflect broader professional and social developments in nursing. Recent literature suggests that modern nursing is moving from a group-centred professional identity toward an individualised orientation, especially among younger generations, who are increasingly focused on personal agency and self-expression (Tussing et al., 2024). Competencies related to human and environmental factors may therefore appear more familiar and easier to evaluate, whereas teamwork competencies depend more strongly on collective processes, organisational culture and professional relationships. At the same time, experiences commonly perceived as individual, such as fatigue and stress, are also shaped by teamwork, workplace culture and managerial support (Pi et al., 2025), highlighting the interconnected nature of individual and collaborative aspects of patient safety competence. These findings highlight the need for collaborative approaches that support learning across professional and organisational boundaries to develop not only individual aspects of competence, but also communication, teamwork and collaborative learning within healthcare environments.

6.3 Collaborative learning for competence development

Collaborative learning emerged as a meaningful approach to strengthening patient safety competence in nursing education and practice, particularly through communication, teamwork and shared reflection. Participants highlighted the importance of diversity in learning groups, both within nursing and across professions, which they perceived as supporting broader perspectives, deeper reflection, and multidimensional competence development (Paper III). Interprofessional collaborative learning has received considerable research attention, with generally positive effects on learners' competence, professional confidence, teamwork, and attitudes toward interdisciplinary collaboration (Saragih et al., 2024; Vermeulen et al., 2025). In contrast, intraprofessional collaborative learning has received far less attention, despite recommendations from some nursing professional organisations more than a decade ago that educational institutions and healthcare organisations need to promote it more actively in nursing education and practice (Registered Nurses' Association of Ontario, 2016).

Although research among nurses remains limited, existing studies among nursing students suggest that intraprofessional collaborative learning may improve communication, mutual respect and understanding of relationships within nursing teams (George et al., 2019). Taken together, these findings suggest that collaborative learning may support patient safety competence by fostering non-technical competencies development. At the same time, the findings highlight the limited attention given to intraprofessional collaborative learning within nursing. Future research is therefore needed to better understand how intraprofessional collaborative learning may support patient safety competence and its potential to strengthen professional relationships within nursing practice.

Furthermore, participants in this study suggested that intraprofessional learning groups could include students, nurses and educators who learn together through shared reflection and the exchange of knowledge and experiences. At the same time, hierarchy and unequal power relations were identified as important barriers to collaboration and participation. Participants described collaborative learning as most effective in psychologically safe environments, where hierarchical barriers were minimised (Paper III). Previous research has similarly demonstrated that psychological safety and feeling that a team is safe for interpersonal risk-taking, supports communication, teamwork and error prevention (Grailey et al., 2021). Bringing together learners from different professional backgrounds may nevertheless be challenging. While interprofessional stereotypes, institutional hierarchies and unclear professional roles can create uncertainty, weaken group cohesion and hinder psychologically safe learning environments (Dong et al., 2025), hierarchical and hostile intraprofessional behaviours may similarly negatively influence learning environments, collaboration, and professional socialisation – even as early as during nursing education and clinical training (Sanner-Stiehr & Ward-Smith, 2017). Therefore, collaborative learning should be provided not only for interprofessional learners but also for strengthening intraprofessional relationships and flattening hierarchies, which may substantially

influence communication and teamwork (Bajwa et al., 2020). Hierarchical behaviour and incivility may additionally threaten learners' sense of belonging and professional engagement within nursing education and practice (Patel et al., 2022). Moreover, low psychological safety in practice may negatively affect team functioning and patient safety (Grailey et al., 2021). Strengthened intraprofessional relationships have additionally been associated with improved job satisfaction and higher quality of patient care (George et al., 2019). While previous research has emphasised the need to prepare nursing students to manage nurse incivility (Patel et al., 2022), the present findings suggest that collaborative learning involving students, nurses and educators may also offer opportunities to reduce hierarchical barriers and foster more respectful and supportive intraprofessional relationships. These findings highlight the potential importance of collaborative learning approaches in supporting both patient safety competence and professional relationships within nursing practice. Strengthened intraprofessional relationships may furthermore provide a foundation for interprofessional collaboration, as nurses who communicate and collaborate confidently within their own profession may be better positioned to engage assertively within interprofessional teams. Future research could examine whether strengthened intraprofessional relationships also support nurses' confidence and engagement within interprofessional teams.

The findings of the present study show that the success of collaborative learning depends not only on learner diversity and psychological safety, but also on deliberate pedagogical and organisational support. Participants emphasised the importance of active and practice-oriented learning methods, educators' facilitation skills and organisational structures that enable participation and collaboration across educational and clinical settings (Paper III). Previous research confirms that collaborative learning in healthcare requires more than simply bringing together learners from different professional backgrounds, as effective collaboration depends on structured opportunities for discussions and reflections within authentic clinical contexts (Broukhim et al., 2019). Educational approaches to teamwork should also reflect clinical realities, including disagreement, uncertainty, power differentials and challenging communication situations commonly encountered in healthcare practice, as these competencies do not develop automatically but require structured learning opportunities that explicitly address communication, hierarchy and collaboration within healthcare teams (Bajwa et al., 2020). Professional learning also appears most effective when organisations support the integration of new knowledge into clinical practice by creating opportunities for workplace learning, application of skills and reflection on practice (Mlambo et al., 2021). Evidence suggests that well-planned pedagogical strategies may help reduce professional silos and hierarchical barriers (Piper-Vallillo et al., 2023). In addition to pedagogical design, organisational conditions may substantially influence opportunities for collaborative learning and continuing professional development, which are often constrained by a lack of time, insufficient organisational support, and limited access to suitable learning opportunities (Mlambo et al., 2021). Therefore, collaborative learning environ-

ments may be particularly valuable in rapidly changing healthcare systems, where educational institutions can contribute current evidence-based knowledge while nurses provide clinical expertise and contextual understanding from practice. The development of patient safety competence through collaborative learning therefore requires practice-oriented and well-supported learning environments that enable reflection, communication, and collaboration across professional contexts.

Together, the findings imply that collaborative learning is not only a pedagogical method but also a relational and reflective learning process that depends on inclusive and psychologically safe learning environments. Collaborative learning approaches should therefore promote respectful dialogue, inclusion, psychologically safe participation and supportive intraprofessional relationships to strengthen both patient safety competence. Future research should examine whether competencies developed through collaborative learning translate into observable safety behaviours in clinical practice and, ultimately, improved patient-level outcomes. As patient safety is a continuously evolving phenomenon shaped by technological developments, changing healthcare systems, emerging risks and evolving professional roles, competence development increasingly requires collaborative and systems-oriented learning approaches that support shared reflection and exposure to diverse professional perspectives. This aligns with contemporary views of patient safety as a collective and systems-oriented capability rather than solely an individual professional responsibility.

6.4 Strengths and limitations

The strengths and limitations of this doctoral study relate to the multimethod design, methodological choices and the study's contextual scope. One of the major strengths of the multimethod approach is the ability to obtain different types of data, thereby providing a broader and more comprehensive understanding of the phenomenon under study, while addressing the weaknesses and limitations of individual methods (Esteves & Pastor, 2003). In this study, the use of quantitative and qualitative sub-studies across clinical and educational settings in Estonia and Norway enabled the examination of patient safety competence development through complementary methodological approaches. Multimethod research also presents methodological challenges, including a limited number of application examples, a lack of consolidated standards for reporting and evaluating methodological quality, and the requirement for researchers to be familiar with multiple methodological approaches (Esteves & Pastor, 2003). To address these limitations, established standards appropriate to each sub-study were followed and transparently reported, while the findings from the different sub-studies were interpreted together in the discussion to enable triangulation and support a deeper understanding of patient safety competence development in nursing.

Regarding the methodological choices, the strength of this study was the simultaneous translation, cultural adaptation, and psychometric evaluation of the

H-PEPSS in two languages, using a rigorous blinded back-translation process (Beaton et al., 2000), pilot testing and psychometric analyses, resulting in the first validated versions of the instrument for assessing self-perceived patient safety competence among nurses in Estonia and Norway. However, some methodological limitations should be acknowledged. In the translation process, a single translator was used for the initial forward translation and another for the blinded back-translation for each language version, which may have increased the risk of translation bias (Beaton et al., 2000). To reduce this limitation, multiple rounds of discussion were conducted with national translators, expert groups, and a transnational research team, to ensure conceptual and linguistic equivalence, and the final back-translations were approved by the original developer of the H-PEPSS. In addition, a quantitative assessment of content validity (Polit et al., 2007) was not conducted. Furthermore, although psychometric analyses were performed for the Estonian and Norwegian datasets, formal measurement invariance between the language versions was not assessed (Hair et al., 2019): therefore, comparisons between the groups should be interpreted with caution. Participants were recruited from one academic institution and one clinical setting in each country, which may limit the representativeness of the validation samples relative to the broader populations of nurses and students in Estonia and Norway; therefore further validation across a wider range of institutions, healthcare settings and healthcare professionals groups would strengthen confidence in the instrument's broader applicability.

A strength of the cross-sectional study design was the ability to include a diverse nursing population across a range of workplace settings (Carlson & Morrison, 2009). In this study, the target population comprised nurses working in different healthcare settings, regardless of workplace characteristics or professional experience, enabling a broad overview of nurses' self-perceived patient safety confidence in Estonia. In addition, the demographic composition of participants closely reflected the characteristics of the Estonian nursing population during the study period, supporting the generalisability of the findings (Paper II, Table 1). However, cross-sectional studies reflect a single point in time and do not allow assessments of causality (Carlson & Morrison, 2009). Furthermore, the reliance on self-assessment may have introduced response bias, as participants may over- or underestimate their competence. Participation was voluntary, and differences between respondents and non-respondents were not assessed; selection bias affecting the generalisability of findings can therefore not be ruled out (Cheung et al., 2017). Finally, the study was conducted in Estonia, a small European country with a specific healthcare and educational context, which may limit the applicability of the findings to other healthcare systems and cultural settings (Carlson & Morrison, 2009).

An international approach was a strength of the qualitative sub-study, as it enabled the inclusion of diverse perspectives across two countries, thereby enhancing the richness and robustness of the findings (Powell & Single, 1996). The study also benefitted from the use of semi-structured interviews, which allowed nurses involved as students and educators in master's education in nursing to

focus on issues that were meaningful to them (Kallio et al., 2016), generating rich insights into collaborative learning in nursing education and practice. However, some limitations should be acknowledged. As the interviews were conducted in Estonian and Norwegian, two different interviewers were involved, which may have reduced standardisation across interviews. To minimise this limitation, a shared English-language semi-structured interview guide was used, and continuous discussions within the research team helped clarify the concept of collaborative learning across contexts and ensured that the same key topics were addressed in both languages (Kallio et al., 2016). The qualitative sub-study was purposively conducted within one academic institution in each country and focused specifically on nursing master's students and educators; therefore, the findings are not generalisable but may offer transferable insights relevant to similar contexts (Kyngäs et al., 2020).

6.5 Implications of the study

The findings of this doctoral study have implications for the development of patient safety competence across healthcare organisations, educational institutions, policy, research, and society, highlighting the need for coordinated efforts across clinical, educational, organisational and system levels.

Implications for healthcare organisations

Patient safety competence should not be understood solely as an individual professional attribute, but as a competence that develops and is enacted within organisational and professional contexts. Healthcare organisations and leaders, therefore, play a central role in supporting the development of nurses' patient safety competence throughout the professional lifespan. Organisational approaches to patient safety should recognise the influence of workplace culture, teamwork, and learning opportunities on safe practice. Healthcare organisations should foster psychologically safe and collaborative workplace cultures in which nurses feel supported to communicate openly about patient safety concerns and learn from incidents without fear of blame. Speaking up should be normalised as part of everyday practice, rather than relying on individual courage or confidence. Reducing excessive hierarchy within healthcare teams may support more open communication, stronger teamwork and safer patient care.

The findings of this study also highlight the importance of continuous workplace learning, supportive professional relationships and knowledge sharing across different career stages. Healthcare organisations and leaders should therefore support reflective practice, mentoring and continuous professional development through adequate managerial support, accessible learning opportunities and protected time for learning. Attention should also be paid to supporting collaboration within multigenerational nursing teams, as nurses at different career stages may contribute complementary perspectives and expertise that enrich workplace learning and support job satisfaction, retention and quality of care.

Implications for nursing education

Educational institutions have an important role in strengthening the foundations of patient safety competence and preparing nurses for continuous competence development in practice. The findings of this study support the value of collaborative and inclusive pedagogical approaches in nursing education. Learning activities involving learners with diverse professional and experiential backgrounds may strengthen critical reflection, communication skills, mutual understanding and patient safety awareness. The findings also highlight the importance of strengthening intraprofessional relationships within nursing education. Educational approaches should therefore foster collegiality, mutual respect, openness and understanding of the complementary strengths and roles within nursing teams, rather than focusing solely on managing workplace conflict and hostility. While interprofessional education has become increasingly established internationally, intraprofessional collaborative learning has received less attention. In the Estonian context, where both approaches remain relatively limited, opportunities may exist to integrate inter- and intraprofessional learning more systematically from the early stages of nursing education. Patient safety should be systematically integrated into nursing curricula as a longitudinal and explicit component of education. Attention should be paid to non-technical competencies, which require continuous interaction and practice within social and clinical contexts rather than relying solely on individual learner capability.

Closer collaboration between educational institutions and healthcare organisations may help align the learning needs of students and healthcare professionals while supporting more efficient use of educational resources through shared learning activities in the context of rapidly evolving healthcare environments. Nurse educators have a particularly important role in the development of patient safety competence. Educational institutions should therefore ensure that nurse educators possess not only clinical expertise, but also pedagogical competence and understanding of patient safety. Clinical expertise alone does not automatically ensure competence in teaching complex patient safety-related competencies.

Policy and system-level implications

At the policy level, patient safety competence should be recognised as a strategic component of healthcare quality and workforce sustainability. In the Estonian context, stronger national coordination of patient safety competence development across healthcare and educational systems may be beneficial and should align with national and international nursing and healthcare strategies. National policies should also consider patient safety competence within professional competence assessment and licensing processes.

Policymakers should recognise healthcare organisations and educational institutions as interconnected structures and provide greater structural and financial support for shared educational activities and lifelong learning across clinical and educational settings. Clinical and educational sectors should not function as isolated structures in the development of patient safety competence, but rather as collaborative partners working towards common patient safety and professional

development goals. Professional organisations may further support the development of patient safety competence by promoting intraprofessional collaboration, knowledge sharing and stronger partnerships between nurse leaders and nurse educators. The findings also highlight the importance of establishing clear expectations and standards for nurse educators. Policymakers and professional organisations should recognise that high-quality nursing education requires educators with both clinical and pedagogical competence.

Research implications

The findings highlight the need for continued research on the development of patient safety competence across clinical and educational settings. Further research should examine how different dimensions of patient safety competence are conceptually understood and enacted in practice, and whether they can meaningfully be assessed as distinct domains. Researchers should aim for greater methodological consistency when adapting and validating patient safety competence instruments across different contexts and populations. Greater comparability between studies may strengthen international benchmarking and support cumulative knowledge development in the field. Continuous critical evaluation and revision of patient safety competence instruments are also needed to ensure that they remain relevant within rapidly changing healthcare environments and evolving professional roles.

Patient safety competence should further be studied as a lifelong developmental process rather than focusing primarily on undergraduate students or early-career nurses. Future studies should therefore include wider nursing populations across different career stages and healthcare settings. Longitudinal and intervention studies would be valuable for understanding how patient safety competence evolves over time and how educational and organisational interventions influence both professional development and patient outcomes.

Societal implications

The findings highlight the importance of recognising nurses as autonomous professionals within modern healthcare systems. Supporting nurses' active participation within healthcare teams without unnecessary hierarchical barriers may strengthen both professional confidence and patient safety practices. The findings also emphasise the broader societal importance of valuing the contributions of different healthcare professions and promoting mutual respect across professional groups, as safe, high-quality healthcare depends on collaborative and respectful professional relationships.

7. CONCLUSIONS

This doctoral study advanced the understanding of the development of patient safety competence in nursing across educational and clinical contexts. Patient safety competence can be assessed in Estonian and Norwegian contexts using the H-PEPSS. Simultaneous validation of patient safety competence instruments across multiple countries and contexts using consistent methodological approaches should be encouraged to support international benchmarking and consistent comparisons across healthcare and educational systems. Patient safety competence domains appeared partly interconnected rather than fully distinct, and self-assessment instruments require continuous revision to remain relevant as healthcare environments evolve.

Estonian nurses reported the highest confidence in understanding human and environmental factors, which differs somewhat from previous research, possibly reflecting differences in study populations. Consistent with prior studies, teamwork was the lowest-rated patient safety competence domain across participant groups, likely reflecting its dependence on organisational and interpersonal processes rather than individual ability alone.

Collaborative learning in inter- and intraprofessional teams may support the development of non-technical patient safety competencies. Collaborative learning within nursing teams and across career stages may help strengthen intraprofessional relationships in nursing practice. Hierarchical relationships remain present in nursing practice and education, potentially constraining teamwork and collaboration needed for patient safety. Introducing collaborative learning approaches from undergraduate nursing education onward may help reduce these hierarchical barriers and support more equal professional relationships. Effective collaborative learning requires organisational and educational support.

Overall, patient safety competence in nursing emerges as a context-dependent, lifelong and socially developed capability, shaped through the interaction of education, clinical experience, organisational environments and collaborative learning. Strengthening it requires coordinated efforts across measurement, education and organisational systems to support collaborative professional practice and safer patient care.

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SUMMARY IN ESTONIAN

Patsiendiohutuspädevuse kujunemine õenduses: mitmemeetodiline uuring

Sissejuhatus

Patsiendiohutus on üks suurimaid väljakutseid tervishoius kogu maailmas. Hinnanguliselt kogeb ravi käigus kahju ligi 12% patsientidest, nendest juhtumitest umbes pooli saaks vältida (Panagioti et al., 2019). Tervishoiuteenus, mille käigus ei ole tagatud patsiendiohutus, suurendab suremust ja tervishoiukulusid ning mõjutab negatiivselt patsientide usaldust tervishoiusüsteemi vastu ja tervishoiutöötajate heaolu (WHO, 2024).

Viimase kolme aastakümne jooksul on patsiendiohutuse käsitlus oluliselt muutunud. Varem keskenduti peamiselt isiklikele eksimustele (Reason, 1990), kuid praegusel ajal võetakse kahjujuhtumeid üha enam süsteemsete tegurite ja sotsiaal-tehniliste protsesside tulemusena (Institute of Medicine, 2000). Maailma Terviseorganisatsiooni järgi on patsiendiohutus tervishoiu üks aluspõhimõtteid, mille eesmärk on vähendada riske ja ennetada vältivat kahju (WHO, 2009), ning kogu süsteemi hõlmav käsitlus, kus kahjude ennetamine ja leevendamine põhineb organisatsioonikultuuri, kliiniliste protsesside ja inimtegurite koostoimel (WHO, 2021). Patsiendiohutus oleneb otseselt tervishoiutöötajate pädevusest. Patsiendiohutuspädevust mõistetakse kui teadmiste, oskuste ja hoiakute kogumit, mis võimaldab pakkuda ohutut ja kvaliteetset abi (WHO, 2022). Nüüdisaegne käsitlus rõhutab, et pädevusel on mitu tahku, mis peale kliiniliste oskuste hõlmavad suhtlemist, meeskonnatööd, süsteemset mõtlemist, riskijuhtimist ning organisatsioonilist õppimist ja juhtimist (CPSI, 2020; WHO, 2021).

Tervishoiusüsteemis puutuvad patsientidega kõige enam kokku õed, seega on neil keskne roll patsiendiohutuse tagamisel (Kirwan et al., 2019). Teadusuuringute järgi peavad õed oma patsiendiohutuspädevuse taset üldiselt mõõdukaks kuni kõrgeks (Wang et al., 2026), kuid valdkonniti ei ole asjatundlikkuse tase ühtlane. Kõrgemalt hinnatakse patsiendiohutuse hoiakuid (Setoodeh et al., 2025; Tasbihi et al., 2025) ja kliinilisi oskusi (Babaii et al., 2025; Liao et al., 2026). Vähem kindlana tunnevad õed end teoreetiliste teadmiste (Atalla et al., 2025; Setoodeh et al., 2025), tõenduspõhise praktika (Liao et al., 2026; Y. Qiu et al., 2025) ning meeskonnatöö (Wang et al., 2026) vallas. See viitab ebakõlale praktiliste oskuste ning teoreetiliste ja analüütiliste seisukohtade vahel.

Patsiendiohutuse pädevust hakatakse kujundama tasemeõppes ning jätkatakse kliinilises praktikas koostöö ning kogemusõppe kaudu (Kolb, 1984; Murray et al., 2019). Samas on patsiendiohutuse õpetamine sageli killustatud ning napib küllaldase ettevalmistusega õppejõude, et loimida patsiendiohutus süsteemselt õppetöösse (Kirwan et al., 2019; Sollárová et al., 2026). Uuringute põhjal tunnevad õppijad end enesekindlamalt tehnilistes kliinilistes oskustes (Wang et al., 2026), mis viitab sellele, et õendushariduses on keskendutud rohkem tehnilistele kui mittetehnilistele pädevustele (Kirwan et al., 2019; WHO, 2021).

Teaduskirjandust patsiendiohutuspädevuse kohta on endiselt vähe, eriti Balti riikides, Põhjamaades ja Ida-Euroopas ning tervishoiusüsteemi, õendushariduse ja õdede kohustuste erinevuse tõttu ei saa tulemusi eri riikidele üle kanda. Samuti on patsiendiohutuspädevust hinnatud eri mõõdikutega, mistõttu ei saa uuringute tulemusi alati võrrelda. Senised teadustööd on keskendunud peamiselt haigla-keskkonnale ja õendusüliõpilastele, ent õdede patsiendiohutuspädevus ning selle kujunemine kogu tööelu jooksul on saanud vähem tähelepanu. Ühtlasi ei pruugi praegused hariduslikud lähenemised piisavalt toetada selliste pädevuste arengut, mis vastaks õdede muutuvatele õpivajadustele. Seepärast on vaja täiendavaid uuringuid, et valideerida hindamisinstrumente erinevates riikides ning paremini mõista, kuidas toetada nii tehniliste kui ka mittetehniliste patsiendiohutus-pädevuste arengut.

Eesmärgid

Doktoritöö eesmärk oli süvendada arusaama sellest, kuidas kujuneb patsiendiohutuspädevus õenduses nii kliinilises vallas kui ka hariduse kontekstis ja sel viisil toetada õdede pädevuste arendamist ja parandada patsiendiohutust. Eesmärgi täitmiseks püstitati järgmised uurimisküsimused:

- 1) millised on patsiendiohutuspädevuse hindamise mõõdiku *Health Professional Education in Patient Safety Survey (H-PEPSS)* kultuuriliselt kohandatud eesti- ja norrakeelse versiooni psühhomeetrilised omadused?
- 2) millised on Eesti õdede hinnangud oma patsiendiohutuspädevustele H-PEPSS mõõdiku alusel ning kuidas seostuvad need valitud töö- ja haridusteguritega?
- 3) kuidas kirjeldavad ja tajuvad magistritaseme õendusüliõpilased ja õppejõud Eestis ja Norras koostööst õppimist kui pedagoogilist lähenemist pädevuste arendamisel õenduspraktikas ja -hariduses?

Metoodika

Doktoritöös kasutati mitmemeetodilist uuringudisaini (Anguera et al., 2018), mis hõlmas kahte kvantitatiivset ja ühte kvalitatiivset alauuringut.

Esimeses alauuringus tõlgiti ja kohandati kultuuriliselt patsiendiohutuspädevuste hindamise mõõdik *Health Professional Education in Patient Safety Survey (H-PEPSS)* (Ginsburg et al., 2012) rahvusvaheliste juhiste järgi eesti ja norra keelde, kasutades tõlke-tagasitõlke meetodit ja pimetagasitõlget (Beaton et al., 2000; Epstein et al., 2015). Andmed koguti 2021. aastal läbilõikelise veebiküsitluse abil Eestis ja Norras, mõlemas riigis olid kaasatud ühe ülikoolihaigla õed ja ämmaemandad ning ühe ülikooli õenduse magistritaseme üliõpilased. Psühhomeetrilisi omadusi hinnati kinnitava faktoranalüüsi ning reliaabluse ja valiidsuse näitajate alusel (Hair et al., 2019).

Teises alauuringus kirjeldati Eesti õdede hinnanguid oma patsiendiohutus-pädevusele ning analüüsiti hinnangute ja valitud töö- ja haridustegurite vahelisi

seoseid. Kasutati läbilõikelist küsitlusuuringut, milles osalesid Eestis töötavad õed ja terviseteaduste magistriõppe üliõpilased. Uuritavad värvati kutseorganisatsioonide, haridusasutuste ja sotsiaalmeedia vahendusel. Andmeid koguti 2023. aastal veebiküsitluse kaudu. Uuritavate patsiendihutuspädevuste kindlustunnet hinnati H-PEPSS mõõdiku abil (Ginsburg et al., 2012), lisaks koguti andmeid demograafiliste, hariduslike ja tööalaste tunnuste kohta. Patsiendihutuspädevuste seoste hindamiseks töö- ja haridusteguritega kasutati kirjeldavat statistikat ja mitmemõõtmelist logistilist regressioonanalüüsi (H.-A. Park, 2013).

Kolmandas alauuringus kirjeldati Eestis ja Norra magistritaseme õendusüliõpilaste ja õppejõudude kogemusi ja arusaamu koostöisest õppest kui pedagoogilisest lähenemisest pädevuse arendamisel õenduspraktikas ja -hariduses. Uuringus rakendati kvalitatiivset kirjeldavat uurimisviisi (Hammarberg et al., 2016). Uuritavad värvati sihipärase valimi alusel (Etikan et al., 2016) ühest magistritaseme õendusõppe programmist Eestis ja Norras. Sihtrühma kuulusid magistritaseme õendusõppes õppivad või õpetavad õed erinevatest professionaalsetest rollidest ja karjäärietappidest. Andmed koguti 2021. aastal fookusgruupiintervjuude teel (Powell & Single, 1996), kasutades poolstruktureeritud intervjuukava (Kallio et al., 2016), mis käsitles varasemaid kogemusi koostöise õppega, selle eeliseid ja väljakutseid ning korraldamise ja rakendamise võimalusi. Kokku tehti kaheksa fookusgruupiintervjuud, milles osales 33 inimest, 14 Eestist ja 19 Norrast. Intervjuud salvestati ja transkribeeriti sõna-sõnalt. Andmeid analüüsiti induktiivse sisuanalüüsi meetodil, mille käigus eristati andmetest tähendusüksused, mis kodeeriti ning rühmitati iteratiivsete arutelude käigus alakategooriateks ja üldisemateks kategooriateks. Kategooriad sünteesiti peateemadeks, mis kirjeldasid koostöise õppimise olulisi tahke (Elo & Kyngäs, 2008).

Eetilised aspektid

Doktoritöös järgiti teaduseetika üldpõhimõtteid (All European Academies, 2023) ja head teadustava (Estonian Research Council, 2023) sealhulgas tunnustati osalejate autonoomiat, ning tagati uuringu usaldusväärsus ja ausus. Osalejate autonoomia tagati vabatahtliku osalemise, teadliku nõusoleku ja konfidentsiaalsuse kaudu. Konfidentsiaalsus tagati kogu uuringu vältel, isikut tuvastada võimaldavaid andmeid ei kogutud. Uuringu usaldusväärsus tagati sobivate uurimismeetodite ning süstemaatilise andmekogumise ja -analüüsi kaudu, järgides läbipaistvat ja järjepidevat uurimisprotsessi. Tulemuste esitamisel arvestati uuringu piirangutega. Uuringule saadi Tartu Ülikooli inimuuringute eetika komitee (Nr 327/T-13, 337/M-28 ja 376/T-7) ja Norra teadusandmete keskuse (*Norwegian Centre for Research Data AS*, ID 213029) kooskõlastus.

Tulemused

Patsiendiohutuspädevuse mõõdiku H-PEPSS valideerimine

H-PEPSS mõõdiku eesti- ja norrakeelse versiooni psühhomeetriline hindamine kinnitas mõõdiku sobivust mõlemas kontekstis. Kinnitav faktoranalüüs toetas kuuefaktorilist struktuuri ning mudeli sobivusnäitajad olid vastuvõetavad mõlemas valimis. Reliaabluse ja konvergentse valiidsuse näitajad olid valdavalt head, kuna standardiseeritud faktorlaadungid ning komposiitreliaabluse ja Cronbachi alpha väärtused ületasid kõigi väidete puhul soovitusliku miinimumtaseme ning enamik neist oli sellest selgelt kõrgem, viidates heale sisemisele kooskõlale pädevusvaldkonniti. Erandina oli norrakeelses versioonis “inim- ja keskkonnategurite” valdkonna reliaablus madalam. Diskriminantne valiidsus ei olnud täielikult toetatud, viidates osalisele kattuvusele konstruktide vahel.

Valideerimisuuringus osales 226 vastajat Eestist ja 212 Norrast. Mõlemas valimis olid vastajad valdavalt naised, kellel oli pikk töökogemus: õdede töökogemus keskmiselt ligikaudu 18 aastat ja magistriõppe üliõpilastel umbes 11 aastat. Eesti valimis oli varasem patsiendiohutuskoolitus vähem levinud kui Norra valimis. Enamikul Eesti osalejatest oli kõrgeima haridusena bakalaureusekraad, samas kui Norra valimis oli suurem hulk õdedest läbinud diplomijärgse täiendusõppe. Mõlemas riigis oli enesehinnanguline patsiendiohutuspädevus üldiselt keskmisest kõrgem, kuid pädevusvaldkondade kaupa esines erinevusi. Kõige madalamalt hindasid nii Eesti kui Norra õed ja magistriõppe üliõpilased meeskonnatööga seotud pädevusi. Ükski patsiendiohutuspädevuse valdkond ei saanud kõikides rühmades kõrgeimat hinnangut. Eesti valimis hindasid magistriõppe üliõpilased oma pädevust enamikes valdkondades veidi kõrgemalt kui õed, samal ajal kui Norra valimis oli vastupidi: õed hindasid oma pädevust kõrgemalt kõigis valdkondades.

Õdede patsiendiohutuspädevus ja sellega seotud tegurid.

Eestis läbi viidud läbilõikeuuringus osales 551 vastajat, analüüs põhines 376 täielikult täidetud küsimustikul. Uuritavad olid valdavalt naised, keskmine vanus 44,5 aastat ning töökogemus keskmiselt 19 aastat. Enamik vastajaid märkis oma töötamise kohaks esmatasandi tervishoiuasutuse või regionaalhaigla. Üle poolel vastajatest oli bakalaureusekraad või sellega võrdsustatud hariduse.

Õdede enesehinnanguline kindlustunne patsiendiohutuspädevuse valdkondades oli mõõdukalt kuni kõrgel tasemel. Kõrgeim kindlustunne ilmnis inim- ja keskkonnategurite mõistmisel, kuid madalaimalt hinnati meeskonnatööga seotud pädevusi. Esile tulid statistiliselt olulised erinevused patsiendiohutuspädevuse ning mitmete töö- ja haridusteguri vahel. Logistiline regressioon näitas, et suurem töökogemus oli seotud suurema enesekindlusega meeskonnatöö ja ohutuskultuuri valdkondades. Väiksemates haiglates töötavad õed hindasid suurema tõenäosusega oma pädevust kõrgemalt ohutusriskide haldamise valdkonnas. Osalus magistriõppes oli seotud kõrgema kindlustundega kahjujuhtumite reageerimise ja ohutuskultuuri valdkondades. Varasem osalemine patsiendiohutuskoolitusel oli seotud kõrgema kindlustundega meeskonnatöö, ohutusriskide haldamise ja kahjujuhtumitele reageerimise vallas.

Koostöine õpe pädevuse arendamisel

Osalejad mõistsid koostöist õpet õenduspraktikas ja -hariduses kui reflektiivset ja kaasavat protsessi, kus eri tausta, ülesannete ja kogemusega õppijad lõimivad oma teadmised ja refleksioonid, et saavutada ühised eesmärgid. Sellise õppija-keskse käsitluse alus on turvaline ja võrdne õpikeskkond, kus hierarhilisi erinevusi on vähendatud, et soodustada vastastikust austust ja aktiivset osalemist. Õppijate mitmekesisust ei nähta takistusena, vaid tugevusena, mis võimaldab sisukamalt arutleda, vaatenurka laiendada ja keerukaid kliinilisi olukordi sügavamalt mõista. Koostöine õpe toetab pädevuste arengut mitmel tasandil, hõlmates nii tehnilisi kliinilisi oskusi kui ka kriitilise tähtsusega mittetehnilisi pädevusi, nagu suhtlemine, meeskonnatöö ja professionaalsed hoiakud. See on eriti väärtuslik olukorras, kui käsitletakse keerulisi eetilisi dilemmasid ja patsiendiohutusprobleeme, mis eeldavad süsteemset mõtlemist ja tõhusat koostööd. Koostöine õpe on kasulik nii alustavatele kui ka kogenud spetsialistidele, sest aitab ühendada teoreetilisi teadmisi praktikaga ning soodustades pädevuste arengut.

Koostöise õppimise edukas rakendamine eeldab teadlikku planeerimist ning struktureeritud pedagoogilist käsitlust. Oluline on kasutada aktiivseid ja praktikas rakendatavaid õppemeetodeid, mis innustavad õppijaid oma kogemusi jagama. Samas eeldab see õppejõult suutlikkust rühmaprotsesse tasakaalustada. Ühtlasi on vajalik koordineerida koostööd haridus- ja tervishoiuasutuste vahel. See hõlmab praktilisi ja logistilisi korraldusi, nagu paindlik ajakava, ligipääs ressursidele ja sobiv õpikeskkond, mis toetab osalejate püsivat kaasatust.

Järeldused

Dokoritöö süvendas arusaama patsiendiohutuspädevuse kujunemisest õenduses nii kliinilise töö kui ka hariduse kontekstis. Tõlgitud ja valideeritud H-PEPSS küsimustik sobib patsiendiohutuspädevuse hindamiseks Eestis ja Norras. Mõõdikute samaaegset tõlkimist ja valideerimist eri riikides ja kontekstides tuleks toetada, kuna ühtne metodoloogiline käsitlus võimaldab teha usaldusväärsemaid ja järjepidevamaid rahvusvahelisi võrdlusi tervishoiu- ja haridussüsteemide vahel. Patsiendiohutuspädevuse eri valdkonnad on omavahel osaliselt seotud, mitte täiesti eristatavad, mistõttu võib nende hindamine eraldi pädevustena olla keeruline. Kuna tervishoiukeskkond muutub kiiresti, vajavad mõõdikud samuti pidevat ajakohastamist, et püsida asjakohasena.

Eesti õed hindasid kõige kõrgemalt oma pädevust inim- ja keskkonnategurite mõistmises, mis erineb mõnevõrra varasemate uuringute tulemustest ning võib kajastada erinevusi uuringutes osalenud sihtrühmades. Kooskõlas varasemate uuringutega oli meeskonnatöö pädevuse hinnang madalaim kõigis osalejarühmades, mis tõenäoliselt kajastab selle sõltuvust organisatsioonilistest ja inimestevahelistest protsessidest, mitte üksnes individuaalsest võimekusest.

Koostöine õpe professionaalsete meeskondade vahel ja sees toetab patsiendiohutuse mittetehniliste pädevuste arengut. Õpet heterogeensetes õendusmeeskondades on seni vähe uuritud, kuid see võib tugevdada kutsealaseid suhteid ja

parandada koostööd õenduspraktikas. Hierarhilised suhted, mis ei ole kadunud ei õenduspraktikast ega -haridusest, piiravad meeskonnatööd, halvendades seeläbi patsiendiohutust. Koostöise õppe rakendamine nii õe põhi- kui täiendusõppes võib aidata vähendada neid barjääre ning toetada võrdsemaid professionaalseid suhteid ning nõnda tugevdada patsiendiohutust. Tõhus koostöine õpe eeldab organisatsiooni ja hariduse tuge.

Kokkuvõttes oleneb patsiendiohutuspädevus õenduses kontekstist, see on elukestev ja sotsiaalselt kujunev võimekus, mida mõjutavad haridus, kliiniline kogemus, organisatsioonilised keskkonnad ja koostöine õpe. Selle arendamine eeldab tervishoiuorganisatsioonides ja haridusasutuste koordineeritud tegevusi pädevuste hindamisel, et toetada koostööl põhinevat ja ohutut õenduspraktikat.

Praktiline väärtus

Dokoritöö tulemused rõhutavad vajadust koordineeritud tegevuste järele tervishoiuorganisatsioonides, haridusasutustes, poliitikakujundamises, teadustöös ja ühiskonnas laiemalt, et arendada patsiendiohutuspädevusi.

Tervishoiuorganisatsioonidel on keskne osa õdede patsiendiohutuspädevuse toetamisel. Tähtis on luua psühholoogiliselt turvaline töökeskkond, kus patsiendiohutuspõrbleemide tõstatamine on igapäevatöös tavapärane ega olene üksnes isiklikust julgusest. Hierarhia vähendamine soodustab avatud suhtlust ja tugevdab meeskonnatööd. Oluline on toetada pidevat tööalast õppimist, professionaalseid suhteid ning eri põlvkondade ja karjäärietappide õdede koostööd, kuna see rikastab õppimist töökohal ning toetab töörahulolu, töötajate püsimist organisatsioonis ja õendusabi kvaliteeti.

Haridusasutustel on võtmeroll, et panna alus tugevale patsiendiohutuspädevusele ning valmistada õdesid ette elukestvaks õppimiseks. Koostöiste ja kaasavate õppemeetodite rakendamine nii õendusmeeskondades kui ka mitmeprofessionaalsetes rühmades juba õendusariduse varases etapis aitab parandada kriitilist mõtlemise ja suhtlemise oskust, vastastikust mõistmist ja kollegiaalsust, suurendades seeläbi patsiendiohutust. Patsiendiohutust peaks olema järjepidevalt õppekavadesse lõimitud, eriti suurt tähelepanu peaks pöörama mittetehnilistele pädevustele. Haridus- ja tervishoiuasutuste tihedam koostöö võib aidata paremini siduda taseme- ja täiendusõppijate õppevajadusi ja kasutada haridusressursse tõhusamat. Õppejõududel peaks olema nii kliiniline kui ka pedagoogiline pädevus ja arusaam patsiendiohutusest.

Poliitikat kujundades on oluline tunnustada patsiendiohutuspädevust strateegilise komponendina tagamaks tervishoiu kvaliteeti ja tööjõu jätkusuutlikkust. Eestis peaks patsiendiohutuspädevuse arendamine olema kooskõlas riiklike ja rahvusvaheliste õendus- ja tervishoiustrateegiatega ning kajastuma professionaalse pädevuse hindamisel. Tervishoiuorganisatsioone ja haridusasutusi tuleks käsitleda omavahel seotud süsteemidena, et soodustada ühiseid õppetegevusi ja elukestvat õpet. Kutseorganisatsioonid saavad seda protsessi toetada, edendades partnerlussuhteid õendusjuhtide ja -õppejõudude vahel. Tulemused viitavad ka

vajadusele koostada selged standardid õppejõudude kliinilisele ja pedagoogilisele pädevusele, sest see on kvaliteetse õendushariduse eeldus.

Edasised **teadusuuringud** peaksid analüüsima, kuidas õed patsiendiohutus-pädevuse eri valdkondi praktikas mõistavad ning mil määral on neid võimalik eraldi hinnata. Mõõdikuid kohandades ja valideerides on tähtis metodoloogiline järjepidevus, et toetada rahvusvaheliste uuringute võrreldavust ja teadmiste arengut. Samuti tuleb mõõdikuid pidevat ajakohastada tervishoiukeskkondade muutuste järgi. Patsiendiohutus-pädevust tuleks vaadelda elukestva arenguna ning kaasata uuringutes eri karjääriastme õdesid erisugustes tervishoiukontekstides. Longituud- ja sekkumisuuringud aitaksid paremini mõista pädevuse kujunemist ajas ning hariduse ja organisatsiooniga seotud sekkumiste mõju.

Ühiskondlikult on tähtis tunnustada õdesid iseseisvate professionaalidena ning toetada nende aktiivset osalust tervishoiumeeskondades liigsete hierarhiliste takistusteta. See suurendab nii professionaalset enesekindlust kui ka patsiendiohutust. Samuti on oluline tervishoiuerialade spetsualistide vastastikune austus ja koostöö, kuna ohutu ja kvaliteetne tervishoid põhineb hästi toimivatel professionaalsetel suhetel.

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APPENDICES

Appendix 1. Literature search strategy for patient safety competence

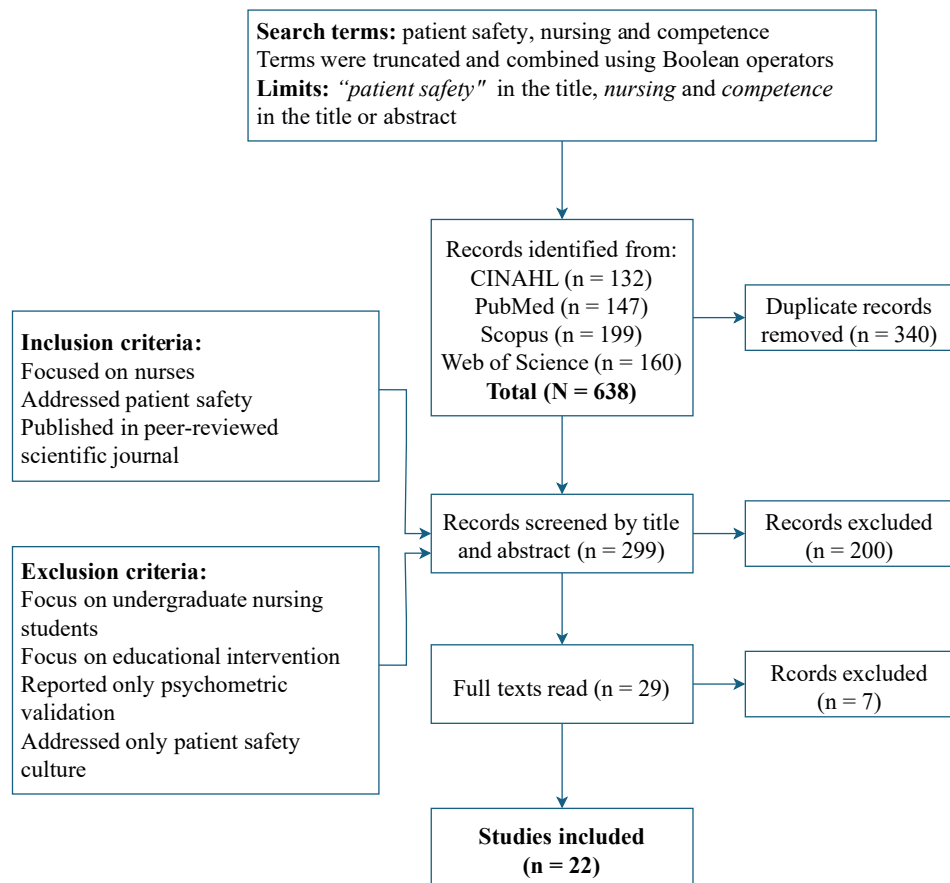


Figure 1. Flow chart of the systematic literature search

Appendix 2. Synthesised mapping of patient safety competencies domains across international frameworks presented in Table 2

	Student-focused frameworks			Education- and practice-focused frameworks		System-level frameworks		
	Quality and Safety Education for Nurses	WHO Patient Safety Curriculum Guide	The Patient Safety Competency Framework for Nursing Students	National Patient Safety Education Framework	NHS Patient Safety Syllabus	The Safety Competencies Framework	A Nordic Framework for Patient Safety Knowledge and Skills	The Quality and Patient Safety Competency Navigator
Professional and ethical competencies								
Professional responsibility in patient safety							✓	
Ethical practice				✓				
Interpersonal competencies								
Patient-/ person-centred care	✓		✓					
Patient partnership and engagement		✓					✓	✓
Communication			✓	✓		✓		
Communication, teamwork and systems								✓
Teamwork and collaboration	✓	✓	✓			✓	✓	
Cultural competence			✓					
Clinical and risk management competencies								
Adverse event and incident management			✓	✓		✓		✓
Risk awareness and management		✓					✓	
Safe clinical practices	✓	✓	✓	✓			✓	
Medication safety		✓						
Infection prevention and control		✓	✓					
Clinical reasoning			✓					

Appendix 3. Reviewed articles

Table 1. Characteristics of included empirical studies (n = 22).

Author, year	Aim	Design	Participants and setting	Data collection	Data analysis
Alshehry, 2022	To examine the association between nurses' perceived nurse-patient/family conflicts and their perceived patient safety competence	Descriptive, correlational and cross-sectional design	320 RNs employed for at least six months and providing direct care to patients in one university hospital in Saudi Arabia	(1) Demographic and work-related information (2) Healthcare Conflict Scale (HCS) (3) Health Professional Education in Patient Safety Survey (H-PEPSS)	(1) Descriptive statistics (2) t-tests and one-way ANOVA (3) Pearson's correlation (4) Multiple linear regression analysis
Atalla et al., 2025	To assess the levels of system thinking and patient safety competencies of nurses and explore the impact of system thinking on nurses' patient safety competencies	Cross-sectional exploratory study	289 nurses with at least six months of experience, providing direct or indirect care in ten critical care units at one university hospital in Egypt	(1) Personal and work-related information (2) Systems Thinking Scale (STS) (3) Patient Safety Competency Self-Evaluation (PSCSE)	(1) Descriptive statistics (2) Pearson's correlation (3) Hierarchical regression analysis
Babaii et al., 2025	To predict missed nursing care based on the nursing workload and patient safety competency	Cross-sectional descriptive-correlational study	307 full-time working nurses with more than one year working experience in emergency department in five hospitals in Iran	(1) Demographic characteristics (2) Task Load Index (NASA-TLX) (3) H-PEPSS (4) The Missed Nursing Care Survey (MISSCARE)	(1) Descriptive statistics (2) Multivariate regression analysis
Chang & Manojlovich, 2023	To examine the relationships among patient safety competency, systems thinking and missed nursing care	Cross-sectional survey study	432 clinical nurses with at least three months experience working in two university hospitals (one local and one tertiary) in South Korea	(1) PSCSE (2) STS (3) MISSCARE	(1) Descriptive statistics (2) Multiple linear regression (3) Hayes's Model 4 and bootstrapping
Fu et al., 2022	To determine the levels of patient safety value, safety attitude and safety competency and to explore the associations among these variables	Descriptive cross-sectional survey study	543 full-time RNs with more than 12 months experience in 10 tertiary and 12 secondary hospital emergency departments in China	(1) Patient Safety Value Questionnaire (2) Safety Attitudes Questionnaire (3) PSCNES	(1) Pearson's correlation (2) Structural equation model (SEM)

Author, year	Aim	Design	Participants and setting	Data collection	Data analysis
Habibi Soola et al., 2022	To assess predictors of patient safety competency among nurses	Cross-sectional correlational research.	254 nurses with at least one year of experience working in five emergency departments in one teaching hospital in Iran	(1) Demographic and professional information (2) Patient Safety in Nursing Education Questionnaire (PaSNEQ) (3) Teamwork questionnaire (STEPPS (T-TAQ)) (4) Psychological safety scale	(1) Descriptive statistics (2) Inferential statistics (t-tests, one-way ANOVA and Pearson's correlation) (4) Multivariate stepwise linear regression analysis
Hafezi et al., 2022	To investigate the associations between nurses' perceptions of patient safety culture, patient safety competency, and adverse events	Cross-sectional design	338 nurses with more than three years work experience, working full time in clinical departments in three university hospitals in Iran	(1) Demographic characteristics (2) Hospital Survey on Patient Safety Culture (HSOPSC) (3) H-PEPSS (4) Nurses' perceptions of adverse events	(1) Descriptive statistics (2) Multiple logistic regression analysis
Kakemam et al., 2024	To measure nurses' levels of patient safety competency and examine the relationship between patient safety competency with the occurrence and reporting of adverse events	Descriptive cross-sectional research	511 clinical nurses providing direct care to patients with a minimum of six months of experience in eight teaching hospitals in Iran	(1) Socio-demographic characteristics (2) Nurses' perceptions of adverse events (3) PSCSE	(1) Descriptive statistics (2) Independent t-tests (3) Binary logistic regression analysis
Kakemam et al., 2022	To identify the relationship between professionalism, systems thinking and patient safety competency	Cross-sectional, descriptive survey study	358 full-time clinical nurses providing direct care to patients with a minimum of 12 months of experience in ten teaching hospitals in Iran	(1) Demographic characteristics (2) STS (3) Professionalism questionnaire (4) PSCSE	(1) Descriptive statistics (2) Inferential statistics (t-tests, one-way ANOVA and Pearson's correlation) (3) SEM (4) Path analysis
Kakemam et al., 2025	To examine the relationship between systems thinking and patient safety competency	Cross-sectional descriptive	384 full-time nurses providing direct care to patients with at least one year of experience in ten teaching hospitals in Iran	(1) Demographic and professional characteristics (2) PSCSE (3) STS	(1) Descriptive statistics (2) Inferential statistics (t-tests, one-way ANOVA and Pearson's correlation) (3) Multiple linear regression analysis

Author, year	Aim	Design	Participants and setting	Data collection	Data analysis
Liao et al., 2026	To examine the relationships among workplace violence, organisational silence behavior, psychological resilience, and patient safety competency	Descriptive cross-sectional correlational design	1440 clinical RN providing direct care to patients with minimum of one year of experience in public hospitals in one province in China	(1) General Information (2) Workplace Violence Scale (WVS) (3) Nursing Staff Organisational Silence Behavior Scale (NSOSBS) (4) Connor-Davidson Resilience Scale (CD-RISC) (5) PSCNES	(1) Descriptive statistics (2) Pearson's correlation (3) Mediated regression analysis
M. N. Park & Roh, 2024	To identify the mediating effect of patient safety culture on the relationship between reflective thinking and patient safety competency	Descriptive correlational design	200 nurses with a minimum of one year of experience working at regional emergency medical centres in the Republic of Korea	(1) General characteristics (2) Reflective Thinking Scale (3) Hospital Survey on Patient Safety Culture (4) PSCSE	(1) Descriptive statistics (2) Spearman's rank correlation (3) Mediation Analysis (4) Bootstrapping
H. Qiu et al., 2026	To examine the impact of workflow interruptions on new nurses' patient safety competency and to explore the mediating roles of work readiness and missed nursing care	Multicentre, three-wave longitudinal design	511 RNs with a minimum of two years of working experience in 14 hospitals in China	(1) Nursing Workflow Interruptions Scale (2) H-PEPSS (3) New Graduate Nurse Work Readiness Scale (4) MISSCARE	(1) Descriptive statistics (2) Pearson's correlation (3) SEM (4) Bootstrapping
Y. Qiu et al., 2025	To examine the relationship among self-determined motivation, psychological capital, psychological contract, and patient safety competency	Descriptive, cross-sectional design	589 RNs with a minimum of six months of working experience in general hospitals in China	(1) Demographic characteristics (2) Work Extrinsic and Intrinsic Motivation Scale (P-WEIMS) (3) Employee Psychological Contract Scale (E-PCS) (4) Revised Psychological Capital Questionnaire (PCQ-R) (5) PSNCES	(1) Descriptive statistics (2) Pearson's correlation (3) Simple and multiple regression analysis (4) SEM (5) Bootstrapping (6) Mediation analysis

Author, year	Aim	Design	Participants and setting	Data collection	Data analysis
Setoodeh et al., 2025	To investigate the relationship between compassion competence and patient safety competency	Descriptive-analytical study	184 nurses employed at least three months in three psychiatric centres in Iran	(1) Demographic information (2) Nurses' Compassion Competence Questionnaire (NCCQ) (3) PSCSE	(1) Descriptive statistics (2) Inferential statistics (t-tests, one-way ANOVA) (3) Pearson's correlation (4) Linear regression analysis
Tai et al., 2024	To identify the latent profiles of patient safety competency of clinical nurses and to explore the influencing factors	Cross-sectional design	782 RNs with more than one year of work experience working in 52 clinical departments in one hospital in China	(1) Participant characteristics (2) Error Management Climate Scale (3) Security Questionnaire (4) Proactive Behavior Performance scale (5) Patient Safety Competency Self-Rating Scale of Nurses (PSCRSN)	(1) Latent profile analysis (4) One-way ANOVA and chi-square test (5) Multinomial logistic regression
Tashihi et al., 2025	To assess the level of patient safety competence and explore its correlations with teamwork and psychological safety	Cross-sectional descriptive-analytical design	472 nurses working in the emergency departments in public hospitals in Iran	(1) Demographic information (2) PaSNEQ (3) STEPPS (T-TAQ) (4) psychological safety tool,	(1) Descriptive statistics (2) Spearman's correlation coefficient (3) The Mann-Whitney U test (4) Multiple linear regression analysis
Torkaman et al., 2022	To examine the relationship between patient safety competence and safe care	Descriptive correlational design	209 nurses working in inpatient wards of two psychiatric hospitals in Iran	(1) Demographic information (2) PSCSE (3) Assessment of Safe Nursing Care (ASNC)	(1) Descriptive statistics (2) Inferential statistics (t-tests, one-way ANOVA) (3) Pearson's correlations (4) Multivariate linear regression analysis
Xiao et al., 2024	To identify potential categories of nurses' patient safety competence and analyze the differences in population characteristics across categories	NR	1996 nurses with minimum of one year of clinical experience in China	(1) General information (2) PSCSE	(1) Descriptive statistics (2) Latent profile analysis (3) Logistic regression analysis (4) One-way ANOVA

Author, year	Aim	Design	Participants and setting	Data collection	Data analysis
Yan et al., 2021	To describe the patient safety competencies of nurses with associate degrees and explore factors	Descriptive, cross-sectional design	451 RNs with associate degrees from 18 hospitals in China	(1) Demographic information (2) PSCNES	(1) Descriptive statistics (2) Inferential statistics (t-tests, one-way ANOVA) (3) Multiple stepwise regression analysis
X. Zhang et al., 2024	The effect of PS competence levels on the occurrence of adverse events	Sequential mixed methods design (quan-qual)	327 nursing master's students from seven colleges in China 15 in qualitative interviews	(1) Demographic data (2) H-PEPSS (3) Personal experience with adverse events (4) Individual interviews	(1) Descriptive statistics (2) Group comparison tests (chi-square test, t-test) (3) Correlation analysis (4) Binary logistic regression (5) Descriptive thematic analysis
Y. Zhang et al., 2026	To identify latent profiles of PSC among newly recruited nurses and explore the influencing factors	Descriptive cross-sectional design	314 newly recruited nurses with 1–24 months of independent clinical practice, participating in a hospital-based training programme from seven tertiary hospitals in China	(1) Sociodemographic questionnaire (2) Transition Shock Scale for Newly Graduated Nurses (3) Nurses' Sense of Organizational Support Scale (4) PSCNES	(1) Descriptive statistics (2) Group comparison tests (chi-square test, one-way ANOVA, Kruskal–Wallis test) (3) Multinomial logistic regression (4) Latent Profile Analysis (5) Descriptive thematic analysis

Table 2. Patient safety measurement instruments and main competence-related findings in the reviewed studies, listed alphabetically.

Author, year	PS instrument (scale/ scoring)	Patient safety competency results		
		Mean score $\pm$ SD and level	Highest domain	Lowest domain
Alshetry, 2022	H-PEPSS (5-point Likert)	Not reported (NR)	Communicating effectively	Teamwork
Atalla et al., 2025	PSCSE (Total 205)	162.74 $\pm$ 23.56 High	Skills	Knowledge
Babaii et al., 2025	H-PEPSS (5-point Likert)	3.97 $\pm$ 0.40	Clinical safety	PS addressed in education
Chang & Manojlovich, 2023	PSCSE (5-point Likert)	3.81 $\pm$ 0.39	Attitudes	Knowledge
Fu et al., 2022	PSCNES (NR)	144.8 $\pm$ 12.8	Clinical practice	Evidence-based nursing practice
Habibi Soola et al., 2022	PaSNEQ (4-point Likert)	2.97 $\pm$ 0.54	Attitudes	Knowledge
Hafezi et al., 2022	H-PEPSS (5-point Likert)	3.84 $\pm$ 0.44	Managing safety risks	Comfort speaking up
Kakemam et al., 2024	PSCSE (5-point Likert)	3.34 $\pm$ 0.74	Skills	Knowledge
Kakemam et al., 2022	PSCSE (5-point Likert)	3.78 $\pm$ 0.50	Attitudes	Knowledge
Kakemam et al., 2025	PSCSE (5-point Likert)	3.65 $\pm$ 0.54 Moderate	Attitudes	Knowledge
Liao et al., 2026	PSNCES (Total 0–175)	107.6 $\pm$ 13.1	Clinical practice	Evidence-based nursing practice
M. N. Park & Roh, 2024	PSCSE (5-point Likert)	3.76 $\pm$ 0.49	Skills	Knowledge
H. Qiu et al., 2026	H-PEPSS (5-point Likert)	NR	NR	NR
Y. Qiu et al., 2025	PSCSE (NR)	153.36 $\pm$ 19.83 High	Clinical practice	Evidence-based nursing practice
Setoodeh et al., 2025	PSCSE (5-point Likert)	3.56 $\pm$ 0.44	Attitude	Knowledge
Tai et al., 2024	PSCSRSN (Total 29–145)	121.31 $\pm$ 19.51 Medium to high	NR	NR
Tasbihi et al., 2025	PaSNEQ (Total 14–56)	47.72 $\pm$ 4.91 High	Attitude	Skills
Torkaman et al., 2022	PSCSE (5-point Likert)	2.54 $\pm$ 0.52 Low	Attitude	Knowledge
Xiao et al., 2024	PSCSE (Total 0–195)	167.62 $\pm$ 27.33 Medium to high	NR	NR
Yan et al., 2021	PSNCES (Total 0–175)	137.18 $\pm$ 16.80 Moderate	Clinical practice	Patient safety culture
X. Zhang et al., 2024	H-PEPSS (5-point Likert)	NR	Human & environmental factors	Adverse events response
Y. Zhang et al., 2026	PSNCES (NR)	3.48 $\pm$ 0.67 Moderate	Patient safety culture	Evidence-based nursing practice

Table 3. Associations and predictors of patient safety competence in the included studies.

Author, year	Correlates of patient safety competencies ¹	Predictors of patient safety competencies ¹
Atalla et al., 2025	Systems thinking (+)	Systems thinking (+) Age (+) Education (+) Work experience (+) Experience in current unit (+)
Fu et al., 2022	Patient safety value (+) Safety attitude (+)	Patient safety value (+) Safety attitude (+)
Habibi Soola et al., 2022	Teamwork (+) Psychological safety (+)	Team structure (+) Leadership (+) Psychological safety (+) Experience in patient safety activity (+) Age (+) Type of employment (-)
Kakemam et al., 2022	Professionalism (+) Systems thinking (+)	Professionalism (+) Systems thinking (+)
Kakemam et al., 2025	Systems thinking (+)	Systems thinking (+) Training in patient safety (+)
Liao et al., 2026	Psychological resilience (+) Workplace violence (-) Organisational silence (-)	Psychological resilience (+) Organisational silence (-)
M. N. Park & Roh, 2024	Reflective thinking (+) Patient safety culture (+)	Reflective thinking (+) Patient safety culture (+)
H. Qiu et al., 2026	Work readiness (+) Workflow interruptions (-) Missed nursing care (-)	Work readiness (+) Workflow interruptions (-) Missed nursing care (-)
Y. Qiu et al., 2025	Self-determined motivation (+) Psychological contract (+) Psychological capital (+)	Self-determined motivation (+) Psychological contract (+) Psychological capital (+)
Setoodeh et al., 2025	Compassion competence (+)	Sensitivity (+) Insight (+)
Tai et al., 2024	Error management climate (+) Psychological safety (+) Proactive behaviour (+)	Error management climate (+) Psychological safety (+) Proactive behavior (+)
Tasbihi et al., 2025	Psychological safety (+) Teamwork (+) Age (-)	Teamwork (+) Psychological safety (+) Hospital type (teaching) (+)
Xiao et al., 2024		Income (+) Safety training (+) Self-learning (+) Love of nursing (+)
Yan et al., 2021		Patient safety training (+) Professional title (+)
Y. Zhang et al., 2026		Organisational support (+) Participation in patient safety training (+) Involvement in patient safety projects (+) Higher education level (+) Night shifts (+) Transition shock (-)

¹ (+) positive association/predictor; (-) negative association/predictor.

PUBLICATIONS

CURRICULUM VITAE

Name: Liisi Mägi
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Education:

2022– University of Tartu, Faculty of Medicine, Institute of Family Medicine and Public Health, Doctoral study in Medicine (PhD)
2014–2018 University of Tartu, Faculty of Medicine, Institute of Family Medicine and Public Health, Department of Nursing Science, Master of Science in Health Sciences (nursing science) (MSc)
2013–2014 University of Tartu, Faculty of Social Sciences, Institute of Education, Special Needs Education (unfinished)
2002–2008 Tartu Health Care College, applied higher education in midwifery and nursing
1999–2002 Hugo Treffner Gymnasium
1992–1999 Kärkla High School

Professional Employment:

2026– University of Tartu, Faculty of Medicine, Institute of Family Medicine and Public Health, Junior Methodologist (0.5 FTE)
2026– Tallinn Health University of Applied Sciences, Health Education Centre, Lecturer (0.25 FTE)
2022– University of Tartu, Faculty of Medicine, Institute of Family Medicine and Public Health, Junior Research Fellow in Nursing Science
2020–2022 University of Tartu, Faculty of Medicine, Institute of Clinical Medicine, Specialist for Continuous Education in Patient Safety
2014–2017 AS South Estonian Hospital, nurse
2008–2017 AS South Estonian Hospital, midwife
2007–2008 Tamme Erakliinik AS, midwife
2004–2006 SA Tartu University Hospital, assisting nursing student

Selected conferences:

2025 Poster presentation, The Scholarship of Teaching and Learning European Conference (EuroSoTL)
2025 Short oral e-poster presentation, Teaching for Learning Conference, University of Tartu
2025 Short oral presentation, The International Association for Health Professions Education conference, AMEE2025
2025 Poster presentation, European Academy of Nursing Science (EANS) Summer Conference

Awards and grants:

- 2024 Group Grant for the Scholarship of Teaching and Learning, University of Tartu
- 2021 Best Poster Award at the Annual Scientific Conference, Faculty of Medicine, University of Tartu

Memberships:

- 2022 Estonian Midwives Association
- 2023 The European Academy of Nursing Science
- 2025 Estonian Nurses Union

Main research interests:

Current research focuses on patient safety and competence development in nursing. Further interests include women's health, midwifery care, and health professionals' education.

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Haridus:

2022– Tartu Ülikool, meditsiiniteaduste valdkond, peremeditsiini ja rahvatervishoiu instituut, õppekava meditsiin ja sport, doktoriõpe (PhD)
2014–2018 Tartu Ülikool, meditsiiniteaduste valdkond, peremeditsiini ja rahvatervishoiu instituut, õendusteaduse õppetool, terviseteaduse magister (õendusteadus) (MSc)
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2002–2008 Tartu Tervishoiu Kõrgkool, rakenduskõrgharidusõppe diplom (ämmaemanda ja üldõe kutse)
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1992–1999 Kärkla Keskkool, põhiharidus

Erialane töökogemus:

2026– Tartu Ülikool, Meditsiiniteaduste valdkond, peremeditsiini ja rahvatervishoiu instituut, nooremteadur (0.5 koormusega)
2026– Tallinna Tervishoiu Kõrgkool, Tervishariduse keskus, lektor (0.25 koormusega)
2022– Tartu Ülikool, Meditsiiniteaduste valdkond, peremeditsiini ja rahvatervishoiu instituut, õendusteaduse nooremteadur
2020–2022 Tartu Ülikool, Meditsiiniteaduste valdkond, kliinilise meditsiini instituut, patsiendihutuse täienduskoolituse spetsialist
2014–2017 Lõuna-Eesti Haigla AS, psühhiaatriaosakond, õde
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2007–2008 Tamme Erakliinik AS, ämmaemand
2004–2006 SA Tartu Ülikooli Kliinikum, uroloogia- ja neerusiirdamise osakond, abiõde

Valitud konverentsid:

2025 Posterettekanne The Scholarship of Teaching and Learning European Conference (EuroSoTL) konverents
2025 Suuline lühiettekanne, TÜ konverents “Õppejõult õppejõule 2025”
2025 Suuline lühiettekanne, *The International Association for Health Professions Education* (AMEE) konverents

2025 Posterettekanne, European Academy of Nursing Science (EANS) konverents

Tunnustused:

2024 Tartu Ülikooli Õpetamise arendamise rühmagrandi saaja

2021 Parima postri auhind, Tartu Ülikooli meditsiiniteaduste valdkonna aastakonverentsil

Kuuluvus ühendustesse:

2022 Eesti Ämmaemandate Ühing

2023 The European Academy of Nursing Science

2025 Eesti Õdede Liit

Teadustöö suunad:

Praegune uurimistöö keskendub patsiendiohutusele ja pädevuse arendamisele õenduses. Edasised uurimishuvid hõlmavad naiste tervist, ämmaemandusabi ja tervishoiutöötajate haridust.

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