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REVIEW

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A systematic integrative review of specialized nurses' role to establish a culture of patient safety: A modelling perspective

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Abstract

Aims: To understand specialized nurses' role in the culture of patient safety and their ability to promote and enforce it within healthcare.

Design: A systematic integrative review using the approach of Whittemore and Knafl.

Methods: Systematic literature search for qualitative, quantitative and mixed-methods studies, followed by data evaluation, quality assessment, analysis and research synthesis with a narrative perspective. Findings were contextualized within a 'framework for understanding the development of patient safety culture'.

Data Sources: Searches were conducted in PubMed [including MEDLINE], Scopus, CINAHL, Web of Science and EMBASE from Jan 2013 until Sep 2023.

Results: Sixteen studies published in English from six different countries were selected and used for research synthesis. Diverse enabling factors and enacting behaviours influencing specialized nurses' roles to promote patient safety culture were identified, mainly focusing on nurses' workload, professional experiences and organizational commitment. Patient safety outcomes focused on medication management, infection prevention, surveillance process in critical care, oversight on quality and safety of nurses' practice, patient care management, continuity of care, adherence to the treatment plan and implementation of a specialized therapeutic procedure.

Conclusion: Specialized nurses can make a significant contribution to promote patient safety culture and support organizational initiatives to prevent adverse events.

Implications for the Profession and/or Patient Care: Stronger participation and leadership of specialized nurses in initiatives to improve patient safety culture requires appropriate investments and support by policy makers and managers in terms of resources and training.

Impact: There is a gap in existing literature on the contribution that specialized nurses can make in promoting patient safety culture. Review results highlight the importance of interprofessional collaboration and teamwork by involving specialized nurses. They inform healthcare policy makers about recognizing their roles and competencies in patient safety culture.

Trial and protocol registration: The systematic review protocol has been registered on the PROSPERO under the registration number CRD42023435463, available from: https://www.crd.york.ac.uk/Prospero/display_record.php?RecordID=435463.

Preferred reporting items for systematic reviews and meta-analysis.
No patient or public contribution.

KEYWORDS
advanced practice, nurse specialists, nursing, nursing, patient safety, safety culture, specialized nurses, systematic review

1 | INTRODUCTION

Patient safety is a central, ongoing aspect in healthcare, whereas nurses play a crucial role (Kim & Seomun, 2023) as they put patients at the centre and act as a pivot in the care process (Manapragada et al., 2019). In addition, patients expect high-quality and safe healthcare when they are referred to acute and long-term healthcare settings (Ullman & Davidson, 2021). Overall patient safety issues in nursing focus on the identification and prevention of adverse events, and the minimization of patient suffering (Rutberg et al., 2016). The International Council of Nurses (ICN) differentiates five important aspects for nurses' roles: informing patients and their relatives about health care risks, active participation in the assessment of safety and quality care, communication with all persons involved in the health care process, immediate and official notification of adverse events, and call for strict programs to prevent patient safety risks (ICN, 2020a).

1.1 | Background

As demonstrated by the international literature, specialized nurses who have higher competency levels are in the best position to handle patient safety issues (Zaitoun et al., 2023). The training of nurses in taking advanced roles is a solution to improve the quality of healthcare, reduce risks and contribute to the excellence of nursing profession (Maier & Aiken, 2018). Globally, a variety of definitions and understandings on advanced practice, as expertise, education and skills associated with nursing roles is available that is diverse and context sensitive. The updated Guidelines on Advanced Practice Nursing (APN) 2020 by the ICN mentioned two types of well-known APN roles with the educational requirements of a master's degree or beyond; the Clinical Nurse Specialist (CNS) and the Nurse Practitioner (NP) (ICN, 2020b). Also, a nurse specialist (NS) is '*a nurse prepared beyond the level of a nurse generalist and authorized to practice as a specialist with advanced expertise in a branch of the nursing field. Specialist practice includes clinical, teaching, administration, research and consultant roles*' (ESNO, 2015, p. 4) Moreover, a NP is someone '*who integrates clinical skills associated with nursing and medicine in order to assess, diagnose and manage patients in primary healthcare (PHC) settings and acute care populations as well as ongoing care for populations with chronic illness*' (ICN, 2020a, p. 6).

Nevertheless, education and training levels in advanced practice are not uniformly defined in European countries, and in some contexts bachelor's degree nurses with special trainings are recognized as specialized nurses (De Raeve et al., 2023). A common agreed characteristic is that specialized nurses have an expanded range of theoretical and practical competencies for patient care in a specific clinical area. Alongside reforms in healthcare systems and scientific advancements, the nurses' education level has significantly progressed. The healthcare systems benefit from specialized nurses through the promotion of the quality of nursing care delivered by them (Tian et al., 2014). Their scopes of role and responsibility encompass making autonomous decisions, assessing and meeting patients' needs, collaboration with other healthcare professionals, and creation of a safe care environment (Nieminen et al., 2011). They are optimal resources to respond to patient needs. Recognition and strategies are required to apply their full competencies for resolving healthcare problems. The competencies of specialized nurse professionals and their roles should be highlighted to be used for the promotion and transformation of healthcare systems since they are close to the process of patient care (Sevilla Guerra et al., 2021). Specialized nurses are recognized as crucial contributors to the healthcare system, fulfilling various roles such as clinical expertise, education, proficiency in evidence-based practice, research and consultancy within their specialized domains. Furthermore, they actively promote and enhance positive work environments (Ulit et al., 2020).

Specialized nurses represent viable solutions for tackling shortages in specialty care. They demonstrate comparable performance to physicians in terms of clinical safety and positive patient outcomes, and even they can meet or surpass physicians in patient education and satisfaction (Carranza et al., 2020). Amid the COVID-19 pandemic, the participation of specialized nurses was essential in addressing the pandemic's difficulties. They played a crucial role in safeguarding patients and staff by offering strategies and standardizing workflow processes throughout the organization (Mamais et al., 2022). It has been shown that their involvement in management tasks reduces patient mortality in critical care settings (Fukuda et al., 2020).

In summary, specialized nurses dealing with advanced practice demonstrate improved healthcare outcomes in various healthcare settings such as quality of life for patients, teaching and mentoring, cost effectiveness, work efficiency, research and leadership (Heerschap & Duff, 2021; Vázquez-Calatayud et al., 2022). Furthermore, a strong connection between patient outcomes and patient safety culture within healthcare settings has been reported (DiCuccio, 2015; Groves, 2014; Lee & Quinn, 2020).

Although a uniform definition for safety culture is unavailable (Bisbey et al., 2021), patient safety culture can be delineated as an overall aspect of the organizational culture, and is described as a phenomenon that includes norms, values and beliefs of the

organization, not of the individual. Safety culture is reflected in the way safety and risks are dealt with, and in the behaviour of those involved (Ausserhofer et al., 2012). It is understood as a shared set of knowledge, values and symbols that increase the capacity of the organization and improve patient safety (Schrappe, 2017). However, the impact of specialized nursing practice on healthcare outcomes in terms of quality and safety has been relatively identified in the international literature. Also, their roles and responsibilities and how they deal with patient safety issues remain unidentified. Additionally, studies reporting an integrated knowledge of improvements in patient safety culture by specialized nurses are currently missing.

2 | RESEARCH AIM

This systematic integrative review aimed to understand specialized nurses' role in the culture of patient safety and their ability to promote and enforce it within healthcare. Accordingly, the review question was: 'How do specialized nurses play a pivotal role in fostering and upholding a culture of patient safety within the diverse context of multidisciplinary healthcare'?

The review's aim and process were formulated according to the PICO statement as follows:

P (Population): Specialized nurses as registered nurses (RN) with a bachelor's or master's degree including APN, CNS and NP assigned to a limited specialized function. These nurses have obtained additional education and training in a specific area of nursing practice including geriatrics, oncology, critical care or mental health, among others. Therefore, they possess advanced knowledge and skills in their chosen specialty, allowing them to provide specialized care and support to patients and their family/informal caregivers.

I (Intervention): Specialized nurses' participation and involvement to promote and reinforce patient safety culture as values, beliefs, attitudes and behaviours related to patient safety within a healthcare organization aiming at the prevention or reduction of adverse events or incidents involving healthcare staff, patients and the organization.

Co (Context): Hospital and community care settings in the multidisciplinary nature of the provision of care.

3 | METHODS

3.1 | Design

A systematic integrative review was performed using an integrative approach as it considers a thorough literature search and the inclusion of studies from a wide range of research designs as qualitative and quantitative with a narrative approach for data analysis and research synthesis (Whittemore & Knafl, 2005). Therefore, it helps with the provision of a comprehensive answer to the review question. Based on the Whittemore and Knafl's (2005) suggestion, five steps for performing an integrative systematic review were as follows: problem identification, literature search, data evaluation including quality assessment, data analysis and research synthesis on a narrative basis, and finally the presentation of results. The review process outlined in this section follows the recommendations provided for subheadings in the author guidelines of the journal.

3.2 | Search methods

Studies integrating current knowledge about the contribution of specialized nurses to patient safety culture are widely missing. The identified gap in existing research and international knowledge served as a compelling motivation to undertake this systematic review.

The research team consisted of multinational researchers who had expertise in the fields of specialized nursing, patient safety and systematic review methodology. After establishing a search protocol and its subsequent register on the PROSPERSO, a comprehensive literature search on the electronic databases of PubMed [including MEDLINE], Scopus, CINAHL, Web of Science and EMBASE within the last decade from 01.01.2013 to 30.09.2023 was performed. Our initial investigation revealed that most studies on the reviewed topic have been published in the past 10 years, suggesting an increasing focus among researchers on specialized nurses' roles in patient safety culture.

Besides applying the personal research experiences, a pilot search was conducted on the Google Scholar to specify suitable keywords related to the review phenomenon. The variants of key terms related to specialized nursing and patient safety culture in the healthcare context were used. Search key words were developed based on translating Medical Subject Headings, and all keywords and thesauruses' entry terms into the selected databases (Appendix S1). Search sentences were created using the Boolean method and truncations using the operators of AND/OR.

Furthermore, a manual search was conducted within reputable journals publishing articles on patient safety and specialized nursing and the references' lists of selected articles to improve the search coverage. Grey literature consisted of probably available profiles and guidelines on specialized nurses' roles within patient safety culture used in healthcare settings that were retrievable via a general search on the Google.

3.3 | Inclusion and/or exclusion criteria

All original research-based studies using qualitative, quantitative and mixed-methods designs were included. They should have been published in English and by peer-reviewed scientific journals in the last decade. Reviews, commentaries, letters, case reports, case studies and books were excluded based on a strategic decision aimed prioritizing original research articles that contributed to the current state of knowledge and could bring new insight into the field. Other exclusion criteria were studies on paediatrics, child and neonatal

care; participation of other nursing staff as nurse assistants and associates; published before 2013.

3.4 | Search outcome

Retrieved studies should have met eligibility criteria determined in the systematic review protocol. Inclusion criteria for original and scientific content were as follows: studies focused on the review phenomenon as patient safety culture; in the context of specialized nursing care in acute or long-term/community care; by nurses in special educational levels and competencies as APN, NP and CNS in the multidisciplinary context of healthcare; published in scientific peer-review journals in English.

The search results were shared via the RAYYAN online platform for systematic reviews (Ouzzani et al., 2016). The search process as the screening and selecting of studies based on titles, abstracts and full texts of articles according to the eligibility criteria was performed by the two review authors separately. They exchanged findings and engaged in online discussions to determine the next steps in their search process. In instances where they had differing viewpoints, the review authors engaged in discussions to resolve discrepancies and reach a consensus.

3.5 | Quality appraisal

The quality of selected studies was assessed in terms of trustworthiness, relevance and results of published papers using JBI Critical Appraisal Tools (JBI, 2023). According to the studies' research designs, the tools for the appraisal of analytical cross-sectional, cohort, quasi-experimental and qualitative studies were used. Additionally, the risk of bias in the cohort and quasi-experimental studies was assessed using the Risk Of Bias In Non-randomized Studies—of Interventions (Hinneburg, 2017).

The final decision on whether to include studies in the research synthesis was made after each review author filled out the checklist and provided a detailed description of his/her perspective of the methodological quality of each study. Next, they held discussions and applied their collective opinions regarding the significance and the methodological quality and risk of bias for each study to decide on the inclusion and exclusion of the studies.

3.6 | Data abstraction

For charting and importing data from selected studies, an extraction table was drawn. It helped with collating, summarizing and comparing the studies' findings in relation to patient safety culture by specialized nurses. The review results were presented in a narrative format because the presence of variations in the methods, objectives and outcomes of the studies made it impractical to conduct a meta-analysis.

3.7 | Data synthesis

To establish a modelling perspective, the review findings were contextualized within a framework designed to comprehend the evolution of patient safety culture. Modelling findings provide a structured and systematic approach to interpreting and understanding complex data and to make sense of data in a meaningful way. This also helps with integrating findings from various studies and identifying patterns, relationships and key themes within data. In addition, it facilitates the communication of research outcomes to a broader audience, contributing to the advancement of knowledge in the respective field. Therefore, the review findings were reflected to 'a framework for understanding the development of safety culture'. This framework describes the multi-faceted character of safety culture as a socially constructed and relatively stable concept that is influenced by various factors over time. It identifies seven factors that make it easier for healthcare staff to adopt the values, norms and assumptions of patient safety culture, as well as four specific behaviours that embody these principles. The results of these behaviours provide feedback that can either strengthen or lead to revisions in the existing safety culture, creating a dynamic feedback loop (Bisbey et al., 2021). The reason for our selection of this framework lies in its relatively new identity and as it covers various aspects influencing patient safety culture from psychological, individual, organizational and cultural perspectives to describe the relationship between patient safety culture and safety outcomes.

Data analysis and research synthesis were performed based on various categories and classifications mentioned in this framework. As a result, the findings from the included studies were examined and based on their differences and similarities were reflected to the categories under the selected framework. The authors then engaged in discussions to reach a consensus on assign how the findings from the studies to the categories. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement was applied as guidance to develop and report this systematic review (Page et al., 2021).

4 | RESULTS/FINDINGS

4.1 | Search results and study selection

The search on the databases led to 683 studies. Removing duplicates and irrelevant studies, the screening of articles based on their titles and abstracts, and full-text reading and appraisals led to 16 studies. They were picked up for data analysis and research synthesis. The systematic review and search process according to the PRISMA have been shown in Figure 1.

4.2 | Quality appraisal

The quality appraisal of the selected studies was performed on their full texts using appropriate methodological checklists. Accordingly, cohort studies by Barry and Lee (2020), Purkayastha et al. (2023),

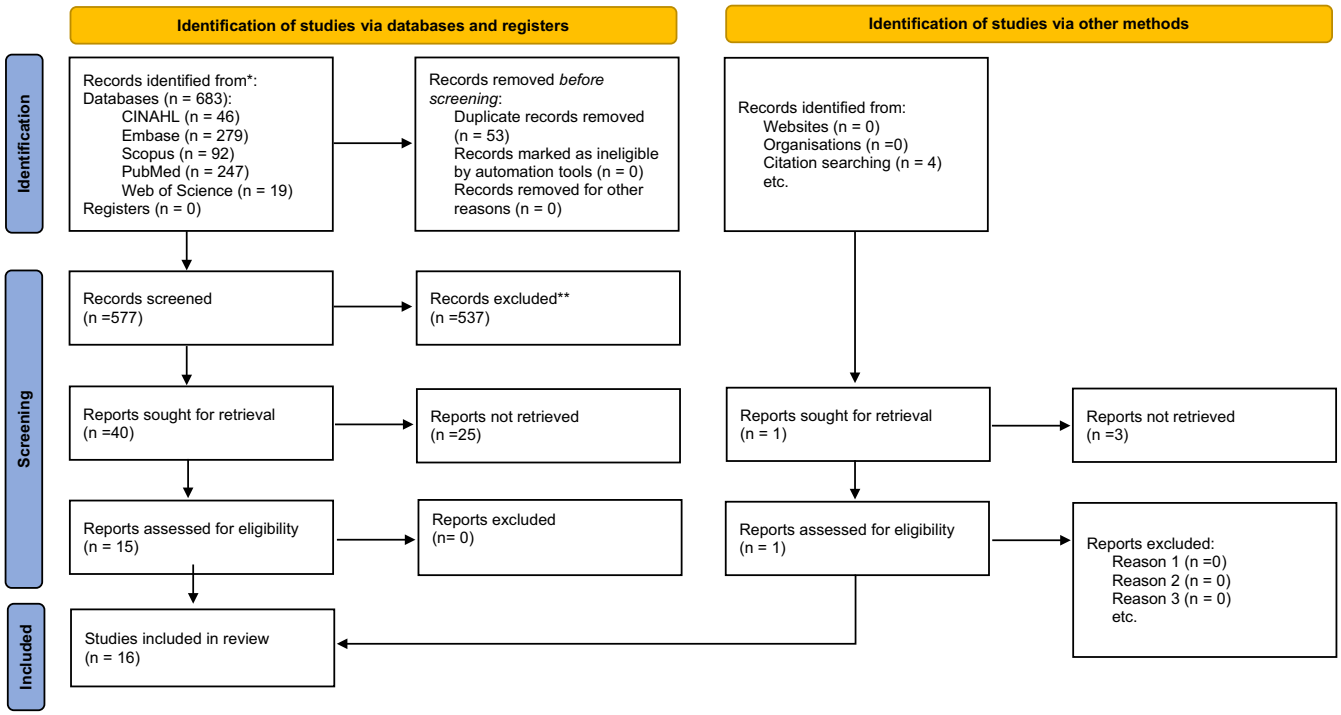

FIGURE 1 Review and search process. *Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/registers). **If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools. From: Page et al. (2021). For more information, visit: http://www.prisma-statement.org/.

Roche et al. (2017), and Kuo et al. (2015) used appropriate processes for recruiting samples, exposure and its measurement and follow up. For cross-sectional studies (Drudge-Coates et al., 2019; Jiao et al., 2018; Pines et al., 2020), criteria for sampling and recruitment, exposure and its measurement were appropriately described. There was only one quasi-experimental study (McKee et al., 2015) on the list of selected studies, which indicated the presence of the causative relationship between variables, sampling and group assignment, follow up and outcome measurement. The cohort and the quasi-experimental study were also assessed with regard to risk of bias (Hinneburg, 2017). A low to moderate risk of bias in relation to confounding, selection of participants, intervention, data, measurement and reporting results were identified in these studies. Therefore, all selected studies were judged to have an appropriate quality in terms of methodological and presentation frameworks to be included in the data analysis and research synthesis.

4.3 | Characteristics of selected studies

The summary of selected studies in terms of authors, aim, method, sample and setting, outcome, main finding and implication for patient safety culture has been presented in Table 1.

The studies were all published in English from 2014 to 2023. Regarding their countries, four studies were from the UK (Drudge-Coates et al., 2019; McKee et al., 2015; McMullan et al., 2017; Purkayastha et al., 2023); seven from the U.S. (Hernandez, 2017; Jiao et al., 2018; Kuo et al., 2015; Lowery et al., 2016; Pate et al., 2022; Pines et al., 2020; Simcock et al., 2014), two from Canada (Barry & Lee, 2020; Milhomme et al., 2018), one each from South Korea (Lee et al., 2022), Slovenia (Klemenc-Ketis et al., 2017) and Australia (Roche et al., 2017).

Their methodologies encompassed cross-sectional (Drudge-Coates et al., 2019; Jiao et al., 2018; Klemenc-Ketis et al., 2017; Lowery et al., 2016; McMullan et al., 2017; Pate et al., 2022; Pines et al., 2020; Simcock et al., 2014), cohort (Barry & Lee, 2020; Kuo et al., 2015; Purkayastha et al., 2023; Roche et al., 2017), quasi-experimental (McKee et al., 2015) and qualitative (Hernandez, 2017; Lee et al., 2022; Milhomme et al., 2018).

5 | PROMOTING AND ENFORCING PATIENT SAFETY CULTURE BY SPECIALIZED NURSES

The review findings were reflected to the framework for understanding the development of safety culture (Bisbey et al., 2021) via the main aspects of enabling factors and enacting behaviours to achieve safety outcomes (Figure 2). They underscored a multitude of factors influencing the roles of specialized nurses and their ability to reinforce patient safety culture within healthcare systems. Our review findings in connection to this framework serve as a guide for policy makers for both practical implementation in healthcare systems and as an introductory structure for future researchers to further explore this phenomenon

TABLE 1 The characteristics of studies included in this review.

Author, year, country	Aim	Design/data collection	Sample and setting	Main finding	Implication for patient safety culture
Barry and Lee (2020), Canada	Evaluating safety of sacubitril/valsartan in a multidisciplinary heart clinic with the assessment and titration of a pharmacist and NP	Retrospective cohort/New York heart association classification, medications' list, does, adverse effects and discontinuation rate	128 patients at a tertiary heart failure clinic	Patients achieved the target dose with similar proportions for the pharmacist and NP. They showed improvements in heart classification and a few discontinued it in spite of adverse effects	Similarity in safety and effectiveness of pharmacist and NP in terms of assessing and titrating medications in a multidisciplinary heart clinic
Drudge-Coates et al. (2019), UK	Evaluating outcomes from a urology NP for assessment and decision-making regarding cancer referrals	Cross-sectional using a Delphi technique/identifying divergent clinical practice, cost analysis, waiting time and patient satisfaction	558 patients, 60 patient cases in a nurse-led outpatient clinic; an expert panel and 100 patients for service evaluation	Possibility of error due to the management plan, modest cost-saving, increased referrals, satisfaction with care, patients' clear understanding of next assessment steps	Appropriate management and assessment of suspected prostate cancer patients and referrals
Hernandez (2017), U.S.	Characterize the meaning of NPs to personal experiences providing care to older adults who take multiple medications for managing complex conditions	Qualitative narrative inquiry using interviews/purposive and network sampling	15 masters' prepared family or adult NP caring for older adults in urban and rural clinics	The 3 themes '*mastering the art of the puzzle*', '*it takes a village*' and '*power in knowledge*' illuminating complexities in medication management	Polypharmacy in older adults; NP can use electronic health record systems to decrease the use of inappropriate medications in older adults and increase medication safety
Jiao et al. (2018), U.S.	Compare the quality of prescribing practice between NP and physician and physician assistant	Retrospective cross-sectional 2006–2012/pharmacological management of chronic diseases and appropriate medication use, patient record form containing care provider, diagnosis, up to eight OTC and prescription medications initiated or renewed	701,499 patient visits in the context of nationwide ambulatory patient visit	Similar quality of prescribing by NP and physician/assistant	In the context of ambulatory prescribing, the quality of medication management delivered by NP and physicians/assistants is similar; expansion of NPs authority for prescribing in outpatient and emergency departments
Klemenc-Ketis et al. (2017), Slovenia	Present health care workers' perceptions of patient safety climates and the quality of collaboration in Slovenian out-of-hours health care (OOHC) between professional groups	Cross-sectional using the five domain Slovenian version of the Safety Attitudes Questionnaire—Ambulatory Version (SAQ-AV)/national online data collection program/maximum score 100 points	250 responses (including 93 physicians, 39 nurses) from whom 43 were NPs working in the 37 OOHC clinics	NP reported lowest SAQ-AV total mean score 56.7; highest mean scores were reported by NPs on collaboration with practice nurses (4.4 ± 0.6); lowest mean scores were reported by practice nurses on collaboration with NP (3.8 ± 0.9)	Relationship between nurses with different professional backgrounds require more attention. Safety culture domains '*communication*' and '*perceptions of management*' require improvement
Kuo et al. (2015)	Examine cost and process of care given by NPs to older adults with diabetes in comparison with physicians	Retrospective cohort study/medication use, adherence to care guideline, potentially inappropriate medications	64,354 patients from a national sample of Medicare beneficiaries in primary care settings	Similarity between NPs and physicians in diabetes mellitus guideline-concordant care; more use of specialist consultations by nurses; lower costs for primary care professional services and inpatient care in the NP group	Professionalism and safety of care by NPs for long-term care in communities; the need for education and support for specialized nurses to reduce the risk of polypharmacy and potential adverse drug events

TABLE 1 (*Continued*)

Author, year, country	Aim	Design/data collection	Sample and setting	Main finding	Implication for patient safety culture
Lee et al. (2022), South Korea	Explore the experience of patient safety culture among South Korean APNs in hospital-based home healthcare	Qualitative descriptive study using individual, face-to-face and semi-structured interviews and inductive/deductive content analyses	20 home healthcare APNs affiliated with primary, general, or tertiary hospitals	The 3 main categories '*teamwork climate*', '*safety climate*' and '*working condition*' were confirmed followed by 8 sub-categories associated with nurses' experiences	Cultivating patient safety culture is crucial for ensuring the safe transition of patients from acute care hospitals to home health care
Lowery et al. (2016), U.S.	Explore NP perceptions of the impact of physician oversight (PO) on the safety and quality of NP practice	Descriptive, correlational design using a 34-item, researcher-designed, survey	1139 NP practicing in the 24 randomly selected states	27.8% of participants agreed that PO promoted safe medication management, while even fewer (18.7%) reported that PO improved provider–patient communication; participants perceived that PO created provider–patient confusion hindered provider–patient trust (52.8%) and impeded transitions to other levels of care (70.4%)	NP perceptions of the impact of PO on the safety and quality of NP experience and state regulatory environment ranking predicted NP practices; participants perceived that requirements for PO influenced their practice and might jeopardize patient safety
McKee et al. (2015), UK	Measuring the effect of a quality improvement program by a stroke specialist nurse	Quasi-experimental using a pre-post intervention design/compliance with regulations, time delay from the event to incidents in periods, rate of missed appointments	1327 patients in two phases: 2006–2008/2010–2012; a neurovascular clinic	Increased referrals, decreased delays from clinical incident to assessment, improved adherence to restrictions, reduced failures to attend an appointment	Faster access to care, and improving compliance with healthcare regulations, efficient use of clinics' capacities leading to unmasking ischemic attack patients
McMullan et al. (2017), UK	Explore relationships among organizational structures, ratings of patient safety culture and adverse anaesthesia-related event (ARE) reporting	Cross-sectional survey study using questionnaire and indexes	336 certified registered nurse anaesthetists (CRNAs) as licensed practitioner with a minimum of 1 year experience in randomly selected hospital/surgical centre	2 of 5 organizational nurse structures, workload and years of experience, were significantly related to adverse ARE	CRNA organizational structures and patient safety culture may be important markers for adverse ARE in patients cared for by CRNAs
Milhomme et al. (2018), Canada	Develop a theoretical explanation of the clinical surveillance process by expert nurses in a critical care context to understand how the process unfolds	Strauss and Corbin (1998) grounded theory approach and three interviews per person (interview 1+3: semi-directed individual; interview 2: Think Aloud Method) between August 2014 and October 2015	15 nurses with expertise in a medical/surgical intensive care unit or in specialized intensive care of a Canadian university health centre	The surveillance process comprises five key elements: managing the risk of complications; collecting data; detecting a problem; making a decision, working in synergy	Vigilant clinical supervision by nurses effectively manages complications and ensures patient safety in critical care

TABLE 1 (*Continued*)

Author, year, country	Aim	Design/data collection	Sample and setting	Main finding	Implication for patient safety culture
Pate et al. (2022), U.S.	Evaluate the impact of a Central line–associated bloodstream infections rounding team supported by clinical nurse specialist, clinical nurse leader and infection preventionists	Quality improvement project, audits to assess performance and focused education tools within each individual unit	Standardized infection ratio (SIR) from Jan 2020 and Sept 2021 was collected and varied between 0.787 and 3.343 (steep increase correlated with an increase in the average daily census of patients hospitalized with coronavirus disease)	SIR did not demonstrate a consistent decline with ongoing sustainment; lower SIRs correlated to months with the most active team engagement and the highest volume of audits	A collaborative rounding team promotes and enhances awareness of prevention methods and safety culture
Pines et al. (2020), U.S.	Examine the productivity, safety, flow and experience of emergency department's NP	Secondary analysis of 2014–2018 data from the national emergency medicine group	13.02 million patient visits across 94 emergency departments	Higher NPs visits were associated with lower patients/clinician hour; no effect of increasing NPs coverage on the indicators was observed	Higher NPs visits freed up physicians to treat high acuity cases; no adverse effects of nurse coverage on the flow safety and patient experiences indicated low risk of NPs coverage on care
Purkayastha et al. (2023), UK	Evaluate the safety and efficacy of a specialized nurse-led cardioversion service	Retrospective cohort of data 2017–2019/cardioversion procedure	341 patients in a hospital	Most patients were cardioverted, remained in sinus rhythm, a few readmitted and due to complications of cardioversion	Low admission, high remission, and low hospital readmission rates and no complications by the nurse-led service
Roche et al. (2017), Australia	Examining the effectiveness of emergency NP service in caring for patients in rural emergency	Prospective multicentre longitudinal nested cohort/ patient reported outcome, unplanned visits to emergency department, quality of life, NP survey	61 patients in three rural emergency departments	Patients receiving standard service model were 2.4 times more likely to have unplanned visits to emergency department, in the emergency NP service; patients were more satisfied and adhered to follow up	Higher adherence to clinical guidelines and diagnostic accuracy for chest pain, reduced waiting time, delivery of safe care
Simcock et al. (2014), UK	Evaluate the safety of a NP-delivered injection service for the treatment of wet age-related macular degeneration (wAMD) with ranibizumab	Audits conducted every 6 months to assess the safety of nurses' practice (complication rates, incidence of endophthalmitis compared to audit standards and national averages)	2 NPs, trained in the provision of minor lid surgery and sub-Tenon's anaesthesia technique	NPs administered 10,006 injections in the first 5.5 years of the service—represented 84.1% of the total injections performed during this period	Carefully selected and well-trained NPs can deliver a safe and effective wAMD injection treatment service

Abbreviations: APN, advanced practice nurses; NP, nurse practitioner; OTC, over the counter.

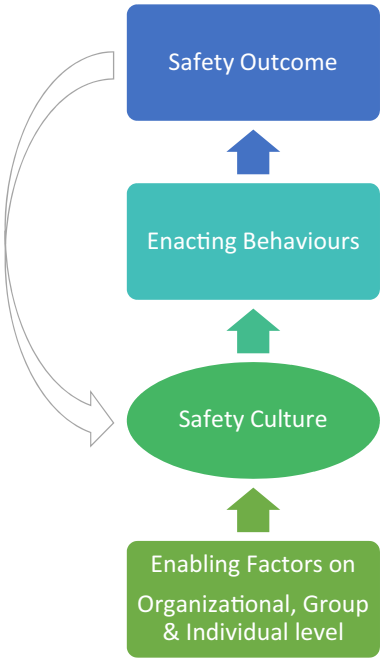

FIGURE 2 A framework for understanding the development of safety culture (Bisbey et al., 2021).

and develop theories on the intricate processes involved in improving patient safety culture by specialized nurses.

Safety outcomes achieved by specialized nurses were diverse and focused on safety culture or safety climate (Klemenc-Ketis et al., 2017; Lee et al., 2022; McMullan et al., 2017); specialized medication management (Barry & Lee, 2020; Hernandez, 2017; Jiao et al., 2018; Kuo et al., 2015; Simcock et al., 2014); infection prevention (Pate et al., 2022); surveillance process in critical care (Milhomme et al., 2018); oversight on quality and safety of nurses' practice by physicians' (Lowery et al., 2016); patient care management in terms of care coverage, continuity of care and adherence to therapeutic plans (Drudge-Coates et al., 2019; McKee et al., 2015; Pines et al., 2020; Roche et al., 2017); as well as implementation of a specialized therapeutic procedure (Purkayastha et al., 2023).

5.1 | Enabling factors

A robust patient safety culture relies on various elements with the organization serving as the guiding force in safeguarding the well-being of patients and promoting a culture of continuous improvement. Leader commitment is required to prioritize patient safety for the entire institution and demonstrate a genuine dedication to patient safety. It fosters safety culture through influencing decision-making processes and resource allocation. Clear and comprehensive safety policies provide the guidelines and expectations that employees need to follow. Training, staffing levels and necessary equipment, are essential for the effective implementation of these policies.

5.1.1 | Organizational factors

Seven studies collectively explored various organizational factors, including leader commitment, prioritization of safety and allocation of policies and resources, to enhance safety culture in distinct ways (Hernandez, 2017; Klemenc-Ketis et al., 2017; Lee et al., 2022; Lowery et al., 2016; McMullan et al., 2017; Pate et al., 2022; Roche et al., 2017).

The results of a cross-sectional survey of certified registered nurse anaesthetists (CRNAs) revealed an association between adverse anaesthesia-related events and two key organizational factors: workload and years of experience. Higher workloads were negatively related to difficult extubating and fewer years of nurses' experiences to difficult extubating as well as inadequate ventilation. The authors concluded by recommending the implementation of the following three organizational strategies: reducing the workload of CRNAs to reduce the number of adverse patient events and improve safety culture (1), clinical support for newly graduated CRNAs including transition to practice programs (2), improving documentation and review of adverse anaesthesia-related events in the department using quality improvement methodologies (3) (McMullan et al., 2017).

In the emergency NP model, the nurses highlighted the need for 'support from within nursing', 'support from medical colleagues', 'organizational support' and 'competence level' (Roche et al., 2017).

In a study explaining healthcare workers' perceptions of the patient safety climate and the quality of collaboration, NP indicated that they perceived management's contribution to the safety climate to be lower than other healthcare professionals (Klemenc-Ketis et al., 2017). Achieving sustainable safety practices and promoting quality initiatives required the full commitment of front-line nurses as well as unwavering support from leadership (Pate et al., 2022).

As home care conditions were more unpredictable than in other healthcare settings, APNs needed to pay more attention to ensure patient safety. In South Korea, while nursing insurance covered some home care equipment, the lack of a reimbursement system for nursing services led to inconsistent care quality. To enhance safety, medical facilities needed to provide companionship during home visits. Government should address threats and unexpected situations and clarify reporting requirements for APNs. Adapting standard guidelines for home care, especially for infection control, required careful consideration (Lee et al., 2022).

To achieve patient safety patient outcomes, a variety of resources were used. One study recommended the use of tools by NPs caring for older people to assist the multiple providers in managing polypharmacy (Hernandez, 2017).

In the field of NP practice, physician supervision (PO) and NP practice were inextricably linked with work experience. Less experienced NPs were more receptive, but overall, 74.4% considered PO as hindering provider-patient relationships and jeopardizing patient safety (Lowery et al., 2016).

5.1.2 | Group characteristics

Two studies addressed the characteristics of the group with the inherent group cohesion and the aspect of psychological safety (Drudge-Coates et al., 2019; Klemenc-Ketis et al., 2017). Group cohesion and mutual support among healthcare teams was vital in ensuring that all team members worked collaboratively toward the goal of patient safety. Appropriate communication was needed for sharing critical information and acting cohesively in high-pressure situations. Psychological safety entailed the creation of an environment where team members felt comfortable speaking up about safety concerns, without fear of retribution. An open and non-judgmental atmosphere helped identify and address potential errors or lapses in care leading to the prevention of practice errors.

Teamwork was addressed in the study by Klemenc-Ketis et al. (2017) and was seen essential to achieve quality and safety in the management of patient care.

Nurse-led clinics for urology assessments demonstrated efficiency. Following initial triage by the doctor, patients were allocated appointments in one of four weekly nurse-led clinics to undergo full assessment. The urology NP classified patients to no, low, intermediate and high risks for prostate cancer as identified their needs for biopsy or radiological testing. It could avoid unnecessary prostate biopsies and improve diagnostic accuracies. The expert panel of urologists showed complete consensus that clinical information provided by the nurses was sufficient for effective clinical assessment. There was consensus that the nurse-led assessment was better than they would have expected from a urology trainee and staff grade doctor. A modest saving was observed compared to any grade of urologists. Patients reported satisfied with seeing a nurse instead of a doctor for the first appointment. Upon the first hospital visit, they had a clear understanding of what the next step for assessment would be. The initial waiting time from referral to urology assessment was halved. The nurse-led clinic showed a significant increase in service delivery, leading to overall saving in reducing outpatient follow up costs (Drudge-Coates et al., 2019).

5.1.3 | Individual factors

Individual factors, such as nurses' safety knowledge and skills, sense of control and commitment to safety, play a crucial role in preventing adverse events. Nurses with a solid foundation in safety protocols, continuous learning and a sense of agency contribute to a robust patient safety culture. Their proactive approach in identifying risks and reporting incidents, combined with a collective commitment to prioritize safety in patient care, forms the foundation for a strong safety culture in healthcare settings.

Individual factors for patient safety culture were reported in a total of 11 studies focusing various care settings and patients' needs (Barry & Lee, 2020; Hernandez, 2017; Jiao et al., 2018; Kuo et al., 2015; Lee et al., 2022; McMullan et al., 2017; Milhomme et al., 2018; Pines et al., 2020; Purkayastha et al., 2023; Roche et al., 2017; Simcock et al., 2014).

Nurses in advanced roles facilitated safe patient transitions to home care, managing complex needs, educating and collaborating for a teamwork climate. Patients' individual home environment (e.g. slippery floors, pets) or cognitive impairment might affect discharge education and therefore patient safety (Lee et al., 2022), but NPs had also a major impact on managing complex medication management in older adults (Hernandez, 2017). Carefully selected and specially trained NPs with advanced skills were imported for the delivery of injection treatment services as evaluated in a study by Simcock et al. (2014). Nevertheless, no relationship between CRNS level of education and adverse anaesthesia-related events could be established (McMullan et al., 2017).

The emergency NP model for chest pain improved diagnostic accuracy, reduced unplanned visits, but highlighted the risks of missed interventions and unnecessary testing (Roche et al., 2017). Emergency NP in ambulatory setting treated patients based on the input from physicians and consultation was taken when the patient was high risk or showed abnormal signs and symptoms. They called back patients, made triage and simple procedures. They independently evaluated critically patients and no substantial difference in the practice patterns of NP and physicians' assistants was reported (Pines et al., 2020).

In a heart failure clinic, nurse-led medication management was comparable to physician/pharmacist initiatives, indicating quality and safety. NP performed assessment, medication review and monitoring (Barry & Lee, 2020).

Also in ambulatory care services', a survey showed that NPs provided quality care similar to physicians, meeting standards across various indicators, especially crucial in rural settings. No statistically significant differences were found in the quality of prescribing between NPs and others (Jiao et al., 2018).

Advanced life-support-certified cardiac specialist worked independently in a monitored environment carried out the electrical direct current cardioversion with access to medical and anaesthetic support if needed. Cardiac nurses followed up patients in their 6-week outpatient clinic. The cardioversion success rate was 90% indicating the effectiveness of the nurse-led service. No patient was readmitted within 3 months as the direct consequence of the procedure indicating the long-term safety of a nurse-led service, and the remission rate was high (Purkayastha et al., 2023).

In critical care, whereas nurses had the responsibility to manage complex and risky situation, clinical surveillance was considered essential component to patient safety focusing on following five key elements: managing the risk of complications (1), collecting data (2), detecting a problem (3), making decisions (4) and working in synergy (5). Using a grounded theory approach, a link between the successful management of complication risk and the individual vigilance of intensive care nurses as a component of their every action was shown. Their professional experience influenced sensitivity to potential hazards and supported the approach that healthcare organizations should employ experts in critical care (Milhomme et al., 2018).

Comparing the care process for patients with diabetes mellitus between NPs and physicians in community settings showed that patients in the nurses' group received similar care regarding disease-related

monitoring in terms of examinations and tests as well as referral visits to professionals in comparison to patients in the physicians' groups. Also, the groups had no differences in prescribing medications and related adverse drug reactions, but costs for primary care professional services and inpatient care were lower for the nurses group (Kuo et al., 2015).

5.2 | Safety culture

Safety culture is built upon a foundation of norms and artefacts manifesting through visible practices and symbols. These include safety protocols and layout of healthcare facilities. Norms and artefacts convey a tangible commitment to safety, making it an integral part of the healthcare environment. Values as shared principles underscore the importance of patient well-being and emphasize that safety is a non-negotiable priority. Assumptions, though often implicit, underpin the collective mindset, driving behaviours and decisions related to patient safety. In a culture where the assumption is that safety is everyone's responsibility, individuals are more likely to take proactive measures, such as reporting errors and addressing potential risks. Overall, the alignment of norms, artefacts, values and assumptions in healthcare settings fosters a robust safety culture that places patient welfare at its core.

Measures of safety culture were reported in four of our identified 16 studies (Klemenc-Ketis et al., 2017; Lee et al., 2022; McMullan et al., 2017; Pate et al., 2022).

A qualitative study of NP experiences in hospital home care confirmed the 'teamwork climate', 'safety climate' and 'working conditions' were of importance in promoting a culture of patient safety. Subcategories in teamwork climate encompassed collaboration among patients, caregivers and nurses, teamwork within medical institutions and cooperation in community partnerships. Safety climate subcategories involved nurses' dedication to patient safety, institutional commitment to patient safety and government's role in patient safety. Working conditions subcategories encompassed frontline working environments and institutional support for effective work settings. In conclusion, fostering a patient safety culture was vital for ensuring a safe transition in healthcare (Lee et al., 2022).

The implementation of a variety of evidence-based measures and the use of multi-professional ward rounding teams led by specialized nurses to conduct safety audits raised awareness of preventive measures and promoted a safety culture thriving on collaboration. Involving CNSs and clinical nurse leaders in the fight against bloodstream infections caused by central lines was highly effective; not only promoting the use of evidence-based prevention packages, but also establishing standardized practices through ongoing coaching and mentoring (Pate et al., 2022).

In the study provided by Klemenc-Ketis et al. (2017), large differences were found between healthcare workers in terms of perceived safety culture, with teamwork being reported as the highest dimension of safety culture.

Another study focusing on certified RN anaesthetists demonstrated that negative perceptions of the overall safety culture were related to adverse events, for example, difficult intubation, inadequate ventilation and inadequate oxygenation. In addition, they found that fewer years of nurse experiences and not having a hospital magnet accreditation status were connected to inadequate ventilation. The authors concluded that these findings supported the assumption that a positive safety culture in hospitals led to a higher quality of care and lower patient safety events (McMullan et al., 2017).

5.3 | Enacting behaviours

In promoting patient safety, nurses should actively engage in communication, teamwork and incident reporting. Sharing critical information and fostering collaboration among healthcare teams are crucial for optimal patient care. Incident reporting allows for the identification and analysis of adverse events, contributing to continuous improvement. Recognizing and rewarding nurses for their commitment to safety, coupled with fair disciplinary actions, reinforces the organization's dedication to patient safety. Three studies were identified, which concentrated on enacting behaviours (Hernandez, 2017; Klemenc-Ketis et al., 2017; McKee et al., 2015).

In a neurovascular clinic, a stroke NS streamlined services for older adults with suspected minor strokes, coordinating appointments, reinforcing driving regulations and initiating neuroimaging and medications. The program, involving interdisciplinary teamwork, significantly reduced delays, decreased driving ban violations and improved clinic attendance, bridging the gap between primary and secondary care (McKee et al., 2015).

Teamwork collaboration between NPs and other healthcare professionals was indicated crucial to establish a positive safety culture. Nevertheless, the relationship between NP and practice nurses required more attention and as well as a clear description of professional roles (Klemenc-Ketis et al., 2017).

A qualitative study highlighted the complexity of medication management in older adults suffering from multiple diseases, taking multiple medications and seeing multiple physicians. The perceptions of NPs were identified in three themes of '*mastering the art of the puzzle*', '*it takes a village*' and '*power in knowledge*'. APNs act as coordinators of care, mastering the puzzle, managing complex health needs and 'prescribing cascades' provided by different healthcare providers. As they were close to the patient, APNs experienced a broader nurse–patient relationship like in a village than in clinical settings, including family members or friends. Finally, APNs had the power to act as educators for patients, family, friends, but also healthcare providers with a great potential to reduce polypharmacy or medication errors (Hernandez, 2017).

6 | DISCUSSION

This systematic integrative review examined how specialized nurses contribute to patient safety culture within multidisciplinary healthcare, examining their roles in promoting and enforcing patient safety

measures leading to the improved patient care outcomes. In summary, 16 studies with various research methods within the chosen context and timeframe were identified and included in the research synthesis. Nursing roles in this review included specialized nurses consisting of APN, NP, certified RN anaesthetist, CNS, clinical nurse leader and critical care nurse.

While the available evidence regarding the influence of nurse specialization on care outcomes is uncertain and lacks a clear conclusion (Whitehead et al., 2019), our review findings indicated their role effectiveness in improving patient safety culture in various clinical areas. Based on the framework for understanding the development of safety culture (Bisbey et al., 2021), different enabling factors and enacting behaviours to promote a culture of safety were identified.

The majority of studies focused on enabling factors on the individual level, including continuous trainings and a proactive approach in identifying and managing patient safety risks by specialized nurses (Barry & Lee, 2020; Hernandez, 2017; Jiao et al., 2018; Kuo et al., 2015; Lee et al., 2022; McMullan et al., 2017; Milhomme et al., 2018; Pines et al., 2020; Purkayastha et al., 2023; Roche et al., 2017; Simcock et al., 2014).

On the organizational level, leadership commitment (Klemenc-Ketis et al., 2017; Pate et al., 2022) and resource allocation play a central role. Our review emphasized the need for strategic tools and measures (Hernandez, 2017; Lee et al., 2022), but also workload reduction (McMullan et al., 2017), support programmes for new professionals (Roche et al., 2017) and a critical evaluation of physician oversight in NP (Lowery et al., 2016). Organizational structures such as specialized nurses' practice models, work settings, workload, level of education and work experience together with the experienced safety culture were significant markers for adverse anaesthesia-related events (McMullan et al., 2017). Policy makers, nurse educators, physicians, stakeholders, regulators and legislators strongly influenced the regulatory processes for specialized nurses to deliver high quality and safe care given their position to support mentoring and transition programmes (Lowery et al., 2016).

Group dynamics emphasized the importance of cohesion and psychological safety in care teams. The success of specialist nurse-led clinics demonstrated the efficiency and effectiveness of teamwork (Drudge-Coates et al., 2019; Klemenc-Ketis et al., 2017).

Identified measures of patient safety culture included both, quantitative (Klemenc-Ketis et al., 2017; McMullan et al., 2017) and qualitative studies (Lee et al., 2022; Pate et al., 2022). In general, patient safety culture is known as a social concept that evolves gradually, influenced by factors at multiple levels. Enabling factors establish conditions that facilitate employees' adoption of safety culture values, assumption and norms, which in turn guide their behaviours offering feedback that can either strengthen or modify the established values, assumptions and norms (Bisbey et al., 2021). The culture of patient safety varies from one country to another, and it is affected by contextual factors such as the recognition of the nursing profession and the level of education. Recognizing the pivotal role of specialized nurses in enhancing patient safety is a significant concern that necessitates greater global recognition (Sharp et al., 2019). The perception of institutional support for individuals affected as second victims is linked to an improved safety culture and reduced emotional exhaustion. Allocating resources to programs aimed at assisting second victims can enhance both the overall patient safety culture and the well-being of nurses (Sexton et al., 2021). Promoting psychological safety within healthcare teams involves both individual and system factors including prioritizing factors such as a commitment to patient safety, a focus on improvement and learning, providing support, fostering familiarity with colleagues, addressing issues related to status and hierarchy, and promoting inclusiveness and recognizing individual differences. These factors play a crucial role in creating a psychologically safe environment for healthcare teams (O'Donovan & McAuliffe, 2020). Promoting a positive safety culture by leaders through enhancing the safety attitudes of nurses, encouraging teamwork and open communication can decrease adverse patient outcomes (Alanazi et al., 2022).

Identified enacting behaviours of specialized nurses were influenced by safety culture and mainly focused on interdisciplinary teamwork (Klemenc-Ketis et al., 2017; McKee et al., 2015) and the need for appropriate communication, especially in complex care needs as for medication management (Hernandez, 2017).

Medication-related harm and improper symptom management pose significant risks to patients, which are exacerbated by insufficient patient monitoring, as some nurses and other healthcare professionals may not be fully aware of their responsibility to monitor patients and prevent medication-related harm (Jordan et al., 2021). Medication safety entails understanding the medication usage process, recognizing and accommodating differences, engaging in role-playing, prioritizing patient safety and demonstrating authenticity (Smith-Love, 2022). Professionals should possess the competence to effectively utilize digital solutions for the secure management of medications (Turjamaa et al., 2023). Nurses have a pivotal role in ensuring the safety of medication management, and they should be empowered and encouraged to actively participate in medication management initiatives within the multidisciplinary environment, fostering collaboration (Mardani et al., 2022). They have the ability to facilitate communication between residents, nurses and prescribers, thereby overcoming barriers including the unavailability of doctors. They can report adverse drug reactions and side effects, assist with dose adjustments and contribute to de-prescribing, which results in the early identification of medication-related issues (Jordan et al., 2019).

Infection prevention was mentioned as another area in which NSs showed their success in improving patient safety culture (Pate et al., 2022). There is a lack of available literature about nurses engaging in structured infection control training. It is imperative to make deliberate efforts to strengthen the involvement of nursing professionals in infection control initiatives (Monsees et al., 2017). However, it is known that employing certified infection prevention specialists can increase the likelihood of adopting specific infection control measures in healthcare system leading to enhanced patient safety (Hsu et al., 2023).

The impact of advanced levels of training is evident when it comes to facilitating safe patient transitions and managing complex care needs or surveillance process in critical care (Milhomme et al., 2018). According to Sherlock (2022) transitional care models led by NP can significantly reduce 30-day readmission rates.

Specialist nurses safe guarded patient care as they appropriately managed patient care in terms of appropriate care coverage in collaboration with other healthcare professionals, continuity of care and adherence to the therapeutic plan. Within the interprofessional context of healthcare collaboration, healthcare professionals, including nurses, play a vital role in bridging gaps related to professional, social, physical and task-related aspects. They achieve this by negotiating role and task overlaps and by establishing environments that facilitate these interactions (Schot et al., 2020). Specialized nurses have a distinctive opportunity to assume a leadership role, working collaboratively with other healthcare professionals, in influencing healthcare reform. Their extended and expanded skill set, along with their training geared toward enhancing patient outcomes, positions them as key players in shaping the future of healthcare (Heinen et al., 2019). A significant obstacle to achieving interprofessional care and harnessing diverse expertise in healthcare is the lack of clear definitions and awareness regarding each other's roles and competencies. This hurdle can be overcome by implementing interprofessional organization and training programs that are founded on appropriate models, thereby enhancing understanding and collaboration among healthcare professionals (Supper et al., 2015).

The safe implementation of a specialized therapeutic procedure was another area of participation of NSs in patient safety culture (Purkayastha et al., 2023). Since many tasks do not inherently demand the expertise of a physician, there is a growing interest in utilizing nurses to augment the capabilities of the primary care workforce. Substituting nurses for doctors is one strategy employed to enhance access, efficiency and the quality of care (Laurant et al., 2018). In general, nurse-led clinics that oversee specialized care procedures have proven to be cost-effective, resulting in reduced hospitalizations and emergency department visits, lower mortality rates, improved medication adherence and enhanced quality of life (Rush et al., 2019).

6.1 | Limitation of evidence and review process

While conducting this systematic integrative review, some inherent limitations should be recognized and addressed. A few studies were found in international literature on the role of specialized nurses in the culture of patient safety. Therefore, with only 16 papers, this review may not have captured the full breadth and depth of research on this topic. In addition, differences in the methodology, research design and participant characteristics made it difficult to compare and synthesize findings and hindered conducting a meta-analysis or meta-synthesis. As the review was limited to English-language and peer-reviewed articles, we may have overlooked relevant research published in other languages or sources. Therefore, the generalizability of the review's findings to broader contexts requires further research and the integration of its findings into future reviews.

6.2 | Implications for research, policy, future research

This review helps identify gaps in the existing literature regarding specialized nurses' contributions to patient safety culture. It serves as a foundation for future research endeavours that delve deeper into the specific roles, challenges and best practices of specialized nurses in relation to patient safety culture.

Policymakers and healthcare institutions will benefit from our review finding by recognizing the importance of specialized nurses in shaping and maintaining a positive patient safety culture. This awareness can inform policies and guidelines that enhance specialized nurses' participation in the multidisciplinary team aiming at improving the quality and safety of care.

Our review findings suggest the significance of specialized nurses' roles and their abilities to improve patient safety indicating the need for enhanced training and education as well as encouragement and support for nurses to become specialized nurses and better prepare for this profession.

The review's findings highlight the significance of interprofessional collaboration and teamwork in promoting patient safety culture by the participation of specialized nurses. Healthcare institutions can use this information to acknowledge specialized nurses' roles and foster better collaboration between these nurses and other healthcare professionals. Healthcare systems should invest more on resources in terms of staffing and training budgets that facilitate the participation and leadership of specialized nurses in patient care in long-term and community care settings.

The ongoing assessment and evaluation of patient safety culture, with a specific focus on the contributions and challenges faced by specialized nurses leading to a more proactive approach to improving patient safety is also required.

7 | CONCLUSION

Based on our review findings, specialized nurses achieved diverse safety outcomes including safety culture and climate; medication management; infection prevention; surveillance; oversight on quality and safety; patient care management; and advanced therapeutic procedure.

Enhancing patient safety culture by specialized nurses involves identification and clarification of the specific role of specialized nurses in fostering and maintaining patient safety culture. It also needs cultivating values, beliefs, attitudes and behaviours within a healthcare organization to prevent or minimize adverse events affecting healthcare staff, patients and the organization.

Organizational factors, leader commitment, safety prioritization, resource allocation and teamwork can help enhance patient safety

culture by specialized nurses. Creating a psychologically safe environment, where nurses can comfortably voice safety concerns without judgement, prevents practice errors. Individual factors including safety knowledge and skills and commitment are crucial for averting adverse events.

Adequate training, staffing and equipment are essential for specialized nurses to effectively implement safety policies. Healthcare settings' norms and values foster a robust safety culture, prioritizing patient welfare. To promote patient safety, specialized nurses should actively share critical information and collaborate with healthcare teams. Recognizing and rewarding specialized nurses for their safety commitment reinforces their organizational dedication to patient safety culture.

AUTHOR CONTRIBUTIONS

Made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data: MG and MV. Involved in drafting the manuscript or revising it critically for important intellectual content: MG and MV. Given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content: MG and MV. Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: MG and MV.

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CONFLICT OF INTEREST STATEMENT

No conflicts of interest are declared by the authors.

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DATA AVAILABILITY STATEMENT

The data that support the findings of this review are available upon a reasonable request from the corresponding author.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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