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Article

REVIEW

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Digital nursing practice theory: A scoping review and thematic analysis

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Abstract

Aims: This scoping review aims to identify existing theories associated with digital nursing practice to add a lens on the future use of digital technologies by nurses.

Design: A review of theories related to digital technology in nursing practice was conducted following the framework described by Arksey and O'Malley. All published literature until 12th May 2022 was included.

Data sources: Seven databases were utilized including Medline, Scopus, CINAHL, ACM Digital Library, IEEE Xplore, BNI and Web of Science. A Google Scholar search was also performed.

Review Methods: The search terms included (nurs* AND [digital OR technol* OR e-health or ehealth or digital health or telemedicine or telehealth] AND theory).

Results: The database searches yielded 282 citations. After screening, nine articles were included in the review. These described eight distinct nursing theories.

Conclusion: The focuses of the theories included the role of technology in society and nursing. How technology should be developed to support nursing practice, health consumers' use of nursing informatics, the use of technology as an expression of caring and the preservation of humanness and the relationship between human persons and non-human actants and the creation of nursing technologies as caring in addition to existing technologies. Three themes were identified including the role of technology as an agent within the patient environment; nurse interactions with technology to achieve 'knowing' of patients and the necessity of technological competence among nurses. Then, using Actor Network Theory (ANT), a zoom-out lens to map the concepts was proposed (The Lens for Digital Nursing [LDN]). This study is the first to add a new theoretical lens on digital nursing.

Impact: This study provides the first synthesis of key concepts of nursing theories to add a theoretical lens to digital nursing practice. This can be used in a functional capacity to zoom-in different entities.

No patient or public contribution was made in this study due to it being an early scoping study on a currently understudied area of nursing theory.

KEYWORDS
AI, competency, digital, framework, nursing, practice, robots, technology, telemedicine, theory

1 | INTRODUCTION

The digital revolution in healthcare is now well underway and technology is becoming increasingly ubiquitous in clinical environments internationally. Increased utilization and in some cases, dependence on digital systems may have several impacts. The potential benefits include improved diagnostics, decentralized monitoring, reduced dependence on hospital inpatient care and empowerment of patients to be more active role in the monitoring and even diagnosis of their own conditions (Perakslis & Ginsburg, 2021). However, it is important for nurse leaders to recognize the potential negative impacts of digital innovation. Despite the advantages offered by digital technologies without sufficient planning, digital technologies risk becoming another entrenched source of health inequality (Nguyen et al., 2021). Individuals with limited digital skills or Internet access are most likely to miss out on the benefits of the digital revolution. Future public health strategies should seek to address this issue, for example, by providing teaching in schools on the use of digital technologies for health purposes. Recognition of people at risk of digital deprivation with potential implications for current or future health should be identified by nurses working with these patient groups and interventions put in place to mitigate these issues (Fotis, 2022).

2 | BACKGROUND

The impacts on nursing practice are varied and arguably call for radical reconsideration of current nursing theory and models of care. Popular theories of nursing currently consider the interactions of patients with their environments, their social settings and economic situation and their medical conditions in relation to interactions with nursing professionals (Roy, 2018). However, traditional theories of nursing do not adequately consider the impact of patients' digital identities, the impact of digital influences on health and well-being or the role of nurses in managing these novel technologies. Despite this, it is evident that nurses already engage in a broad range of digital activities when performing their roles, including in clinical contexts (de Jong et al., 2020) and in the context of undertaking research (O'Connor, 2017) where it is already recognized that digital technologies offer new opportunities to better understand patients' needs.

In developing understanding of the digital on clinical nursing practice, it is essential that nurses also begin to consider the potential unintended consequences of digital innovation. In a recent study by Ziebland et al. (2021), these consequences were highlighted and include patients 'gaming' systems to access care they want rather than need, clinical staff feeling as though they are being watched by managers and disrupted power relations between health professionals. Notably, the authors discussed the importance of anticipating sources of 'e-iatrogenesis', patient harm related to the use of digital technologies. It is likely that this will become a key focus on the safety agenda for future nurse leaders. In addition to the threat of e-iatrogenesis, the limitations of current evidence supporting the use of new digital technologies presents a potential threat to future patients and subsequent litigation against healthcare organizations. The rapid development of new technologies has outpaced the ability of researchers to develop and publish robust studies indicating their value and arguably new research methodologies are needed to efficiently evaluate these new technologies (Guo et al., 2020). It is essential that nurse leaders adopting these technologies are cognizant of this fact and develop strategies to robustly evaluate these technologies. There have been cases where even after data has demonstrated that a digital solution is less efficacious or safe than non-digital approaches the digital approach has been retained (Mathews et al., 2019). This demonstrates the stickiness of these solutions and the importance of recognizing the complex interactions between digital technologies and their human operators to mitigate risks posed by uncritical adoption of digital solutions in clinical practice.

The impacts on society at large must also be considered. Digital technologies have generated opportunities for communication on a scale which were previously not possible. This has potential public health impacts as has been witnessed throughout the COVID-19 pandemic with the rapid spread of misinformation related to infection control measures (Wang et al., 2022). Nurses are arguably well placed to evaluate the impacts of digital communication on health outcomes and should be included in efforts to develop strategies to mitigate the risks associated with digital communication on a large scale. Finally, cultural shifts in the willingness to share personal data are likely to have an impact on nursing practice (Seltzer et al., 2019). More data are available now on individuals, including health data, than at any point in history. While this also represents an opportunity for new, large-scale research projects and remote clinical trials (Marra et al., 2021) it also presents new ethical challenges. Nurses must consider these and reflect on the use of patient data to ensure that potential harms caused by misuse of this data are mitigated.

The role of theory in nursing practice has been the subject of significant debate, much of which was a result of the blurred professional boundaries of the nursing profession and nursing knowledge (Colley, 2003). However, recent work by Younas and Quennell (2019) investigating the usefulness of nursing theory-guided practice demonstrated that nursing theory is an important guide for both research and clinical practice. Crucially, without a robust theory, it is impossible to define what nursing is and what nurses need to know. Theories are broadly defined as interrelated constructs (concepts), definitions and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena (Parahoo 2014). Theories can be broken down further into descriptive, explanatory and predictive (Colley, 2003). These describe the nature of a phenomena, explain how the aspects of a phenomena relate to one another or predict the precise relationships between aspects of a phenomena will occur respectively. Theories of nursing are typically also classified by their range. Grand theory provides a broad conceptual framework under which the key concepts and principles of the discipline are identified, for example, Orem's (1987) self-care theory.

This focuses on the actions taken by individuals to support their own health and proposes that the main aim of the nurses is to address issues preventing the individual from self-care. Middle-range theory considers specific aspects of nursing practice and, unlike grand theories, describe the relations between empirically measurable variables, for example, Becker's (1974) health belief model.

Traditional theories of nursing care do not currently account for the complex interaction of nurses and patients with the digital aspects of modern life in the developed world. Nursing theories are considered important in the improvement of the quality of nursing care and allow nurses to articulate what they do for patients and why they do it (Younas & Quennell, 2019).

3 | THE REVIEW

This scoping review aims to explore and identify key concepts, gaps in the literature and map any existing theories associated with digital nursing practice. Due to the infancy of this area of scholarship, 'digital nursing' was considered to relate to any theory which explored concepts exploring to the use of digital technologies by nurses. There is currently no consensus in the literature on what constitutes 'digital nursing', although a significant early reference was made by Clark (2007) who called for a '*digital nursing future*' and suggested that '*nurses must be involved in the development and design of digital systems*' (p.6) and Fotis (2022) has used the term to relate to nurses becoming '*innovators and digital technology enablers*'. It may be that in future 'digital nursing' is a distinct and regulated specialized area of clinical practice, however, this is not currently the case and there are currently no clear, robust definitions which can be used to support this review beyond nurses as users and enablers of digital technologies.

A scoping review methodology was taken for this review in order to identify gaps in current theory and identify existing theories associated with digital nursing practice. The objectives of this review did not include any formal evaluation of research quality and instead aimed to broadly map and synthesize current literature on the research objective, this indicates the appropriateness of a scoping review approach (Munn et al., 2018). As the theories included do not all relate to the use of digital technologies for the same specific function or purpose, there is little value in performing an evaluation of the quality of these theories. The objectives of the review are focussed on mapping and generating a broader understanding of how and why, and what nurses use digital technologies for, from a theoretical perspective. The quality of individual theories related to this is therefore of little use in helping establish an initial grand conceptual model for what, how and why nurses utilize digital technologies using theory-based literature. In addition, although evaluation criteria have been suggested by Fawcett (2005), these criteria are highly subjective and do not offer an objective view of the quality of any specific theory. It is also relevant to note that these criteria have never been utilized previously in the context of a scoping review including theories

on varied clinical practices. This is likely due to the lack of value in comparing the quality of theories on varying concepts with different core theoretical functions.

4 | AIMS

Research question: What theories exist on the use of digital technologies in nursing practice?

The aim of the review was as follows:

Identify existing theories associated with digital nursing practice to enhance the future use of digital technologies by nurses.

The objectives were:

1. To identify theories that currently exist relating to the use of digital technologies by nurses.
2. To map and synthesize theoretical concepts which may form the focus of future empirical study and theorization on the role of digital technology in nursing.

5 | DESIGN

The review was conducted following the framework for scoping reviews described by Arksey and O'Malley (2005). As there was no systematic evaluation of research quality within this review, the review was not registered. No protocol was published for this review.

5.1 | Search methods

5.1.1 | Data sources

The database search utilized seven databases (Medline, Scopus, CINAHL, ACM Digital Library, IEEE Xplore, BNI and Web of Science) which were identified from previous scoping reviews exploring digital aspects of nursing (Huter et al., 2020; Krick et al., 2019). In addition to literature sources accessible via google scholar which relate to the research aims. See Table 1 for the full search strategy.

5.1.2 | Eligibility criteria

Included papers had to report or discuss new or developed existing theory in the context of clinical nursing and digital technology or technology in a general sense. Articles were excluded if they did not discuss theory in the context of clinical nursing practice or focused specifically on non-digital technologies. Articles presenting theories on nurse education using technology were not included. One of the three reviewers made exclusion decisions. No restriction on country of origin or year of publication was used. Only articles written in English were included. Duplicates were screened using the

TABLE 1 PICo framework with search terms.

Population	Clinical nurses	Nurs*
		AND
Interest	Digital technology	Digital OR technol* OR virtual OR e-health or ehealth or digital health or telemedicine or telehealth
		AND
Context	Theory	theory (title only)

Mendeley desktop application. The most recent search was conducted on 12th May 2022.

5.1.3 | Data items

The data variables for which data were sought included authorship, publication year, country of origin, title of theory, broad focus of the theory, summary of the theory and methodology used to derive the theory. As per the scoping review approach, no assessment of methodological quality of the included studies was performed.

5.1.4 | Data synthesis

A critical synthesis of themes common across the existing theories was performed to identify potential metaconcepts which could be used for the development of future empirical study and theorization on the use of digital technology in nursing practice. Themes were identified via reading of the literature and development of an initial thematic framework based on the main concepts explored within the theories. The Thematic Framework approach (Gale et al., 2013) was taken due to the broad conceptual nature of the themes explored within the review, the multidisciplinary demography of the research team and the lack of attachment to any epistemological viewpoint. It is proposed that these factors indicate that the framework method is most likely to yield an objective synthesis of current thinking in contemporary nurse theorizing on digital technologies. Once a final framework was obtained, the themes were validated by a second researcher.

6 | SEARCH TERMS

Table 1.

7 | RESULTS

The database searches yielded 103 citations. One additional article was identified via Google Scholar. After de-duplication, 23 remained for the abstract screening process. After screening, all 23 full-text articles were sought, however, four were unretrievable. Following

the second stage of screening, six articles were included in the review. Full details of the search can be seen in Figure 1.

8 | SEARCH OUTCOME

The retrieved studies described eight distinct theories related to technology and nursing practice. The theories focused on various aspects of nursing practice in relation to technologies. Details of the retrieved studies can be seen in Table 2. Key themes across the theories have been identified and a narrative is provided for each theme. The coding framework can be seen in Table 3.

9 | SYNTHESIS

9.1 | *Knowing the person* (what nurses do)

The use of technologies in order to 'know' patients is a central concept in three of the identified theories (Locsin & Purnell, 2015; Nagel et al., 2016; Shankel & Wofford, 2016). It is broadly theorized that the use of technology may allow nurses to develop a greater insight into the patient by use of technologies. This is characterized in different ways. For example, in the TCCN (Locsin & Purnell, 2015), 'knowing' the patient includes consideration of data yielded from technological devices such as diagnostic or monitoring tools to allow nurses to know patients in the moment. This is expanded in Nagel et al. (2016) who argue that in the virtual domain, nurses must develop skills to synthesize data about their patients from a variety of digital sources to understand the patient. In theory, this should include not only contemporary clinical or biomarker-type data but also data about the patient indicating potential cultural or demographic factors which may influence care decisions. Similarly, Shankel and Wofford (2016) focus on technology to develop an understanding of patient symptoms more efficiently than can be achieved in traditional contexts and disrupt potentially unhelpful spiralling mismanagement leading to poorer clinical outcomes. This last theory provides insight into the potential outcomes of achieving greater 'knowing' of the patient via technological means. Specifically, they hypothesize that healthcare demands can be met more efficiently and efficaciously by exploitation of digital technologies which allow nurses to operate both synchronously and asynchronously in virtual environments to identify and 'know' the nature of patient symptoms. This
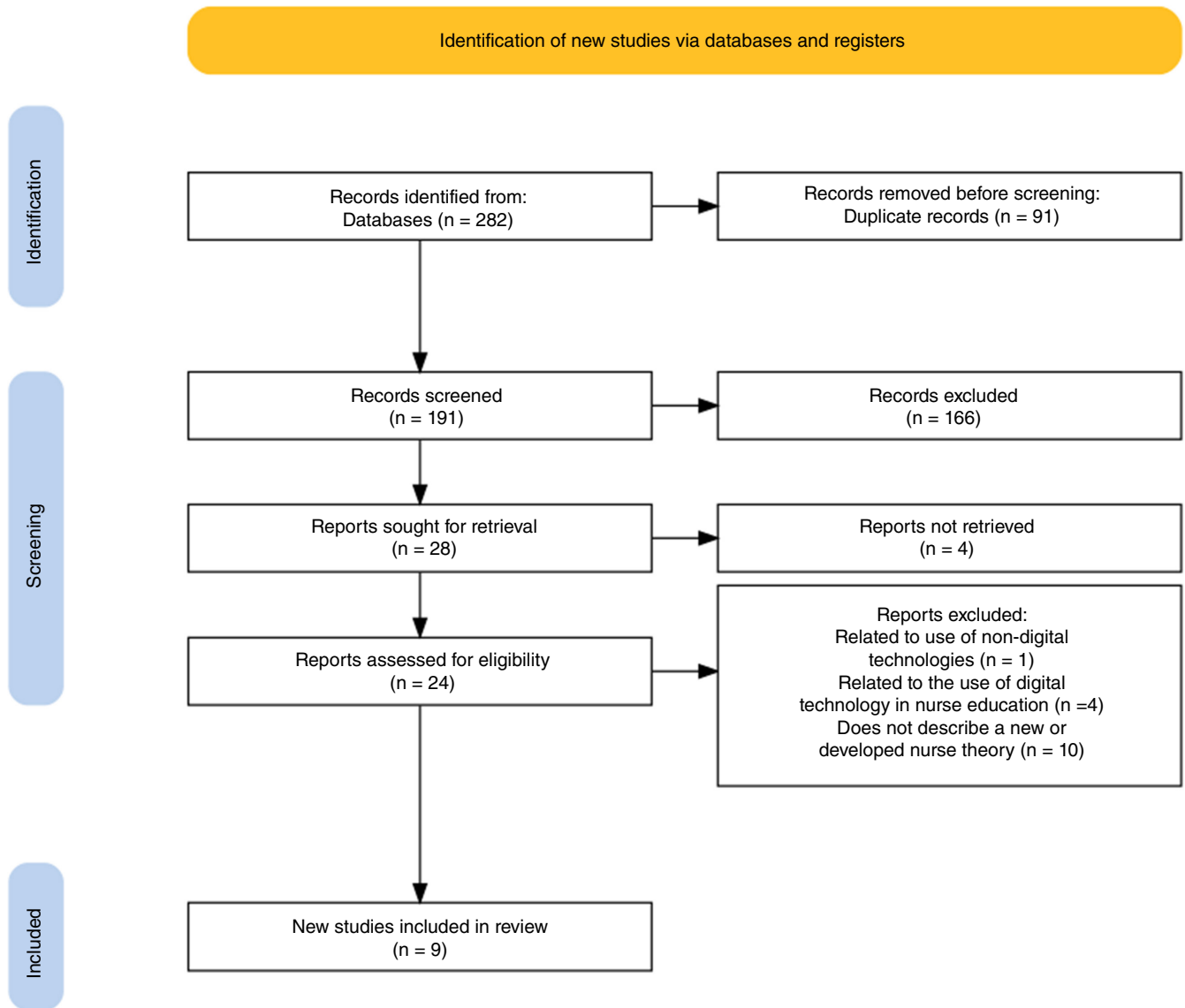
FIGURE 1 PRISMA flow chart.

is by preventing 'minimisation', defined as under-recognition of symptoms and managing 'uncertainty', defined as patient's ambiguity about how to interpret symptoms. By nurses being present and interacting with patients in virtual spaces, these processes can be interrupted by the nurse's increased knowledge of the person and their symptoms.

The theories indicate that to achieve this knowing of patients' nurses need not only competence in the use of technologies (Locsin & Purnell, 2015) but also recognition of the limitations of technology which could cause a nurse to 'get the wrong picture' (Nagel et al., 2016). This was characterized by Nagel et al. (2016) as the impacts of knowledge deficits created by nursing in a virtual space which inadvertently impacted clinical decision making. Notably, the authors report that nurses feel visual data on the patient (i.e. the nurse can see what the patient looks like) is crucial to obtaining sufficient understanding of the patient to support nursing decisions.

9.2 | Technological competence (how nurses do it)

Almost all of the theories explored the role of technological competence in nursing. In some cases, the need and nature of this competence must be inferred. For example. In the Nursing Model of Technology (Abiko, 1999) it is suggested that nurses or 'technologists' should support several key nursing aims via the use of technology including the promotion of health, independence, self-care deficits and the assessment and promotion of adaptation. Although it is not stated explicitly, it is clear that competence in the use of technologies would be necessary to achieve these aims. Building on this notion, Locsin and Purnell (2015) argue that competence in the use of technologies is now essential to express caring in the techno-dense contemporary clinical environment. They perceive caring to be the core role of nurses. This theory is dependent on the notion of a universal technological domain within which technology is now inseparable from the real world which humans inhabit.

TABLE 2 Summary of theories.

Reference country of origin	Theory	Focus of theory
Abiko (1999). Japan	The nursing model of technology	The role of technology in society and nursing and how technology should be developed to support nursing
Ji-Young et al. (2007) USA	The Information Communication Technology Acceptance Model (ICTAM)	Health consumers use of nursing informatics
Locsin and Purnell (2015) USA	Technological competence as caring in nursing theory	The use of technology to support both caring and the preservation of humanness. This requires technological expertize.
Shankel and Wofford (2016) USA	Symptom Management Theory as a Clinical Practice Model for Symptom Telemonitoring in Chronic Disease	The use of telemedicine to manage patient symptoms remotely
Barrett (2017) England	A grounded theory of nurses and teleconsultation	The use of teleconsultation technology by nurses
Nagel et al. (2016) Canada	Getting a Picture: Nurses knowing the person in a virtual environment	How nurses come to 'know' patients when using remote patient monitoring
Tanioka (2017) Tanioka et al. (2019) Japan	The transactive relationship theory of nursing (TRETON): A nursing engagement model for persons and humanoid nursing robots	The relationship between human persons and humanoid nursing robots
Bahari et al. (2021) Indonesia	Technological creativity as caring in nursing theory	The creation of nursing technologies as caring

*1—Knowing the person, 2—Technological competence and 3—Technology as an agent within the care environment.

Later, theories have developed the concept of technological competence in more specific nursing contexts including for teleconsultations (Barrett, 2017), remote patient monitoring (Nagel et al., 2016) and the use of artificial intelligence driven nursing robots (Tanioka et al., 2019). The most recently developed theory suggests that nurses should not only be competent in the use of technologies but that by knowing the patient and having technological competence, new technologies can be co-developed by nurses (Bahari et al., 2021). They argue, similarly to

Locsin and Purnell (2015) that the creation of technology itself is also a means to express care for patients. The competencies explored within existing theories extend beyond nurses as technicians but suggest that nurses need to develop skills to synthesize patient data across numerous poorly integrated digital technologies (Nagel et al., 2016), develop skills to evaluate the ethical and clinical implications of using AI (Tanioka et al., 2019) and take an active role in the development of technology (Bahari et al., 2021). Crucially, these competencies reflect a vastly

Key features/premises	Supporting evidence/mode of development	Subthemes and final themes
Proposes that the influence of technology on mankind in the context of nursing should be to mediate the patient environment to encourage health and support the adaptation of patients to their environment. In addition, the authors suggest that the relationship between technologists (nurses) and patients (consumers) should be one of 'intelligent obedience' where patients are placed at the centre. Informed consent is also highlighted as essential in interactions with technology.	Synthesis of traditional nursing theories and speculation on the role technology may have on the future of humanity	2a 3a Final themes: 2,3
An adapted version of the Technology Acceptance Model (TAM) the Information and Communication Technology Acceptance Model (ICTAM) is proposed. This accounts for the unique dynamics of health consumers' use of the Internet to access health information.	Synthesis of previous studies examining variables thought to influence the digital behaviours of health consumers in relation to information seeking	3b Final themes: 3
Individuals exist within a universal technological domain. Through technological competence, nurses can enact caring.	Development of earlier versions of TCCN theory.	1a 2b 3c Final themes: 1,2,3
The experience of symptoms by patients leads to a progression through several stages culminating in 'symptom status outcomes'. These may impact quality of life, morbidity or management of future symptoms. The use of telemonitoring systems can disrupt progression through these stages and increase the chances of more desirable symptom status outcomes.	Development of earlier version of SMT	1b 3d Final themes*: 1,3
The roles and function of nurses in the context of telemedicine focus on 'being there' for patients. This is achieved via 'presence' in four different ways, namely, operational, clinical, social and therapeutic presence.	Grounded theory	2c 3e Final themes: 2,3
Nurses can generate a mental image of the person they are nursing by synthesizing various sources of data. To be most effective, this requires skills beyond those currently provided in general nurse education in addition to the integration and interoperability of technologies.	Grounded theory	1c 2d 3f Final themes: 1,2,3
Nursing is a relationship between and among human beings and intelligent machines. Nurses use technologies of care for practice. Some intelligent machines possess AI that can mimic human interactions and therefore there is a dependency on technology in human-to-intelligent machine relationships. Intelligent machines must be guided by ethics in nursing.	Systematic review and case study	2e 2f 3g Final themes: 2,3
By engaging in the creative process of co-creating nursing technologies with nurse-innovators and collaborators. Care can be expressed, and the nursing process improved.	Grounded theory	2g Final themes: 2

changed context for nursing care. For example, nursing in virtual (cyber) space or indirectly via non-human robot technologies. Barrett (2017) notes that by reconceptualizing the nursing presence in this new digital context, new perspectives on nurses, their role, practice and the nature of the care they provide must be developed. While the theories identified in this review provide some insight into the nature of these roles, for example, the four kinds of 'presence' reported by Barrett (2017), it is evident that further investigation is needed to clarify the role of nurses and the competencies required to perform these roles in the digital context.

9.3 | Technology as an agent within the care environment (why nurses do it)

It could be argued that all the theories implicitly or explicitly accept technology as an independent agent in the care outcomes of

TABLE 3 Initial coding of subthemes and final themes with definitions.

Subthemes	Final themes and definitions
1a-Technology as a means to understand patient needs 1b-Undestanding patients' conception of symptoms using technology 1c- Knowing the patient through the synthesis of fragmented clinical data	*Knowing the person*—the main function of the use of technologies by nurses to develop an understanding of aspects of an individual which guides clinical decision-making. This can be considered broadly to be what nurses use technology for.
2a- How technology should be used 2b-The expression of care through technological competence 2c-How technology is used by nurses to provide a presence to support patient care 2d-The need for nurses to synthesise clinical data to generate knowledge of the patient 2e- Delegation of appropriate tasks to robot nurses 2f- Appreciation of the ethical implications of AI 2g- Technological creativity as caring	*Technological competence*—the competence of nurses to operate, create and appreciate both the limitations and ethical implications of technology in clinical contexts. This includes the person-centred use of technology to support nursing care. This can be considered broadly how nurses achieve *knowing of the patient*.
3a-The impacts of technology on outcomes 3b-The influence of technology on health consumers' use of the Internet 3c-Limited knowing of patients achieved due to technological competence 3d-Disruption of stages of symptoms management via technological intervention 3e-The influence of technology on the nature of the nursing presence 3f- The impact of the interoperability of technology on clinical outcomes 3g- The dependence of AI driven robot–human relationships on technology	*Technology as an agent within the care environment*—the recognition by nurses that the presence or absence of technology can influence clinical outcomes due to its design or functionality. This can be considered broadly to be the reason nurses must interact with technologies. It also highlights the role of technology for augmenting the reach of nursing care in the absence of human nurses, for example, via the use of AI-driven robots, the user interfaces of digital platforms or highly integrated digital record systems.

patients. For example, in the theory exploring the importance of nurse competence in the universal technological domain (Locsin & Purnell, 2015), it is assumed that, not only might low technological competence impact care outcomes, but also be an indication of an 'uncaring' nurse. This highlights the theorized dynamic relationality between patients, technologies and nurses. If nurses are unable to properly manage the interactions between these domains, then their core professional value is potentially compromised. This notion depends on the assumption that technology can cause harm in the absence of effective management from nurses. Critically, this includes via the omission of the use of technologies, indicating the unique and distinct contribution of technology to the outcomes achieved by nursing practices.

In some theories, the agency of technologies is explored more explicitly. In the Nagel et al. (2016) theory, it is recognized that poor interoperability between digital technologies may influence the ability of nurses to 'know' their patient. This is due to the fragmented data associated with the patient. As such, it is considered necessary for nurses to become developers of technology to mitigate for this in more contemporary theories (Bahari et al., 2021). Within TRETON (Tanioka et al., 2019), the use of AI robots is explored with the role of the nurse detached from the direct care delivered by the robots. Crucially, one of the theoretical assumptions of this theory is that human-to-intelligent machine relationships are dependent on technology. In the ICTAM (Ji-Young et al., 2007) which addresses the use of healthcare consumers' use of nursing informatics, it is recognized

that technological variables such as perceived playfulness and compatibility (the degree to which internet-based services are congruent with a person's pre-existing values and beliefs) may impact health consumers' acceptance of Internet-based health services. This provides further evidence of the theorized agency of digital technologies. The ICTAM provides the first exploration of this in the context of patients utilizing technologies in the absence of nursing professionals.

These theories suggest the nature of technology as agents in patient care and it is proposed that the role of the nurse is to manage these relationships and delegate tasks appropriately to the 'robots'. Figure 1 provides an overview of the key themes identified within this review of existing theory and their relation to the most reported goal of nursing interaction with technologies in the clinical context, knowing the person.

10 | DISCUSSION

The future of nursing is expected to become dominated by increasingly more disruptive and complex digital technology (Gibelli et al., 2021). As such, the theories identified within this review will become of increasing importance for the furtherment of nursing knowledge to account for technological change. Notably, the theories span over a 22-year period within which significant technological change has occurred. While the reviewed theories consistently

draw a link between the interaction with technology by nurses and the central notion of 'care', the nature of those interactions will undoubtedly have changed, not only since the first theory was published, but as technology develops into the future. This highlights the requirement for a theory which accounts for the presence of a changing digital dimension to both the patient and nursing environment and clearer conceptualization of the unique contribution of digital technology to the clinical environment.

Arguably, the ubiquity of technology within modern developed societies means that a lack of access to technology now has implications for health and well-being beyond that which could be imagined during the development of the earliest nursing theory on the subject in 1999. The issue of fitting traditional theories into a world where digital technologies are ubiquitous in many cases was noted by Fronczek (2019). These theories were created in a time where technologies that enable virtual care were considered not only futuristic but also potentially a threat to the practice of nursing care (Fronczek, 2019). Almost all the theories identified in this review made predictions about the ways in which technology may impact nursing in the future. This is of particular interest as engagement with technological development is not currently widely considered part of the nursing role. However, these theories highlight that to be consistent with the nursing metaparadigm in a digital world, such activity may become essential within nursing practice (Bahari et al., 2021).

In future, it is evident that greater empirical study is required to explore and develop these theories in addition to the development of new theories to support nursing practice and research in relation to digital technologies. Except for the TCCN (Locsin, 2005), current theories have little empirical evidence supporting them and, in some cases, may be outdated or inconsistent with the current state of technology or its use by patients and nurses. This contrasts with the volume of research already undertaken to investigate the quality of nursing technologies using objective clinical outcome measures (Huter et al., 2020; Krick et al., 2019).

Further theoretical development should be undertaken to support both these studies and define the knowledge required by nurses to enact care and retain value as a profession in a digital age.

One way that we can further interrogate the findings of this scoping review is Actor-Network Theory (ANT). It offers an approach to develop understandings of the way humans interact with non-human actors by placing 'objects' (digital technologies in this case) on a flat ontology with human actors to understand the ways they may be mutually shaping (Callon, 1989; Latour, 1987, 2005; Law, 1992, 2016). ANT has been suggested as a potentially invaluable approach to understanding the complex technological systems in healthcare (Cresswell et al., 2010; Bilodeau & Potvin, 2018). This informed widespread adoption in health, including in the context of nurses' interactions with technology (Booth et al., 2016; Carnemolla, 2018).

Starting with the premise of ANT that '*if I took ANT literally and tried to render the networks visible, I lost the power of the theory altogether*' (Rachel, 1994:810), this study proposes ANT as a lens to map—at broader spectrum—the artefacts and actants important in digital nursing (Figure 2). This 'zoom-out' view is important to create an assemblage of actors and their connections to examine how things come to be constructed (Rachel, 1994).

Secondly, one of the fundamental principles of ANT is the general symmetrical treatment of different entities involved in the process, rejecting dualism and any form of determinism. This seems a useful
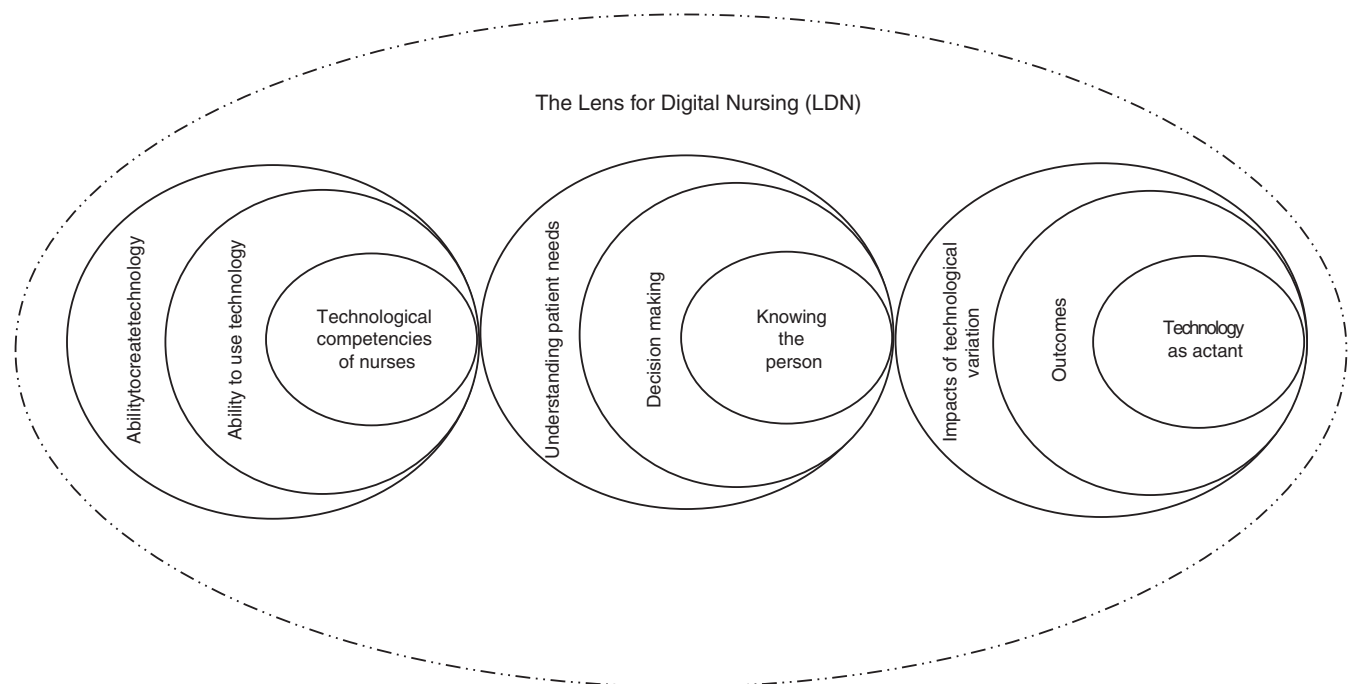

FIGURE 2 Lenses for digital nursing (LDN).

approach in digital health (nursing) context, where often focus in placed on technology (Angerer et al., 2022), without examining what artefacts make humans do well, or what agency is given to objects by humans. Adopting an ANT lens, it is believed that any actant (human and non-human) can generate agency depending on how they are associated in the network (Latour, 2005) For example, non-human entities' agency is conceded by humans, who activate them.

More recently, Latour encourages an exploration of actualities—networks or assemblages which contain unique, complex and changing entities variously entangled together in specific formations or networks (Latour, 2005) to understand how outcomes are impacted and where intervention by humans is of value. The theories identified within this review have recognized the 'universal technological domain' within which technologies and humans interact as a unified collective (Locsin, 2005) and that cyberspace is now an environment in which nurses must act (Ji-Young et al., 2007). However, none of the current theories provide any inscription between these technological domains and implications on different actants, that is, the real-world hardware and software, the virtual cyberspace domain outside of the virtual clinical context, users and the associations between entities. For example, how nurses should account for patients' use of social media platforms and virtual social spaces in their assessment of patient health and subsequent nursing intervention. Fronczek (2019) argued that patients now have access to online sources of health information and potentially clinical guidance from non-professionals online. As such nurses must reconsider their role in relation to patients' use of these technologies to adapt for this reality.

In this context, each lens of The Lens for Digital Nursing (LDN) (Figure 2) can be temporally used for opening the black box in each assemblage and recognize the entangled and unstable relationships (Jackson, 2015) to show how effects are produced (Correa & Domènech, 2013). In theory, actor networks are infinitely extensible, in terms of actants connections. A 'zoom-in' approach into each of the assemblage is possible to explore at more granular levels how human and non-human actors can be mutually shaping. One criticism of Latour's work is the lack of structure. It is possible that other models can be used to deepen the knowledge. For example, the Unified Theory of Acceptance and Use of Technology (UTAUT) can be applied as a lens examine the mutual shaping of technology to digitized nursing, by examining how key demographics of the nursing profession such as gender, age and the voluntariness of use of health technologies may intersect and interact to influence 'technology as actant' and nurse resistance to technology (Salzmann-Erikson & Eriksson, 2016; Sweis et al., 2014). Or Greenhalgh and Stones (2010) adopted concepts from ANT to enhance Strong structuration theory (SST) to study the adoption of new technologies healthcare. In this proposition, the ontology in situ of particular structures and agents (Stones, 2005), included a third technological 'strand' (Greenhalgh & Stones, 2010). This combination of structure, agency and context permits in-depth analysis of users, technologies and their context. Yet, we favour the ontological symmetry between people and technologies retained in ANT and rejected by SST.

Currently, most theories on nursing and technology emanates from the United States and Japan. This may reflect greater use and development of new technologies in these countries. However, due to the varied nature and role of nursing professionals in different locations, it is likely that theory which accounts for this, in addition to variations in the access and use of digital technologies by patients in different countries, will be necessary. The Lenses for Digital Nursing proposal maps key concepts derived from existing theories and proposes a 'zoom-out' lens to explore digital nursing. It also invites the reader to a 'zoom-in' approach into different concepts, which may be done using different ANTs, a combination of ANT and other concepts or simply by considering emerging theoretical and methodological approaches to social theory and technology.

10.1 | Limitations

Although the literature search was extensive within this review, only theories explicitly developed for the context of nursing were included. As such, theories from other fields which may have relevance in nursing practice were excluded. Future integrative reviews should seek to identify relevant theories on the relations between humans and digital technologies from other fields which may be relevant in the nursing context. Finally, due to the lack of primary studies supporting the identified theories, no formal quality appraisal is possible meaning only a scoping study is feasible currently.

11 | CONCLUSION

There are currently eight distinct theories considering how nurses can enact caring in a digital world, covering three broad themes; technology as an agent within the care environment; and the aim of nurse interactions with technology to achieve 'knowing' of patients and, the necessity of technological competence among nurses. This study proposes an additional lens for approaching digital nursing. More empirical study is required to zoom-in each assembly to develop understanding of how caring can be expressed within nursing in the context of a cyberspace real-world universal domain which fully accounts for patients' use of digital technologies. Research should focus on how technologies can be used by nurses to develop patient knowing and crucially, how the agency of digital technologies impacts interactions between nurses, patients and their shared environments.

AUTHOR CONTRIBUTIONS

All authors contributed to the methodology, conceptual analysis and editing of the article.

CONFLICT OF INTEREST STATEMENT

None declared.

PEER REVIEW

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DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study

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