Review

Are Nurses Ready for Digital Health?

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Abstract

Background and Objectives: Nurses play a crucial role as front-line care providers in every facet of healthcare. Since digital technologies support and augment the quality and responsive healthcare delivery to modern healthcare systems, it is important to assess nurses' preparedness for digital health to provide better care. This review aimed to synthesize literature on nurses' preparedness for digital health mainly based on informatics education, competencies, challenges and barriers.

Methods: A systematic search and a narrative review were carried out using scientific databases such as PubMed, Scopus and Google Scholar to reach scientific literature published in the English language published between 2002 and 2022. A systematic method was followed using PRISMA (2009) flow diagram to select the articles, and data were extracted considering factors such as informative, complete and applicable timeliness of articles. Key findings were synthesized via a narrative review under identified four main areas.

Findings: Twenty-four papers focusing on digital health were identified. Four main areas emerged in the literature, including (i) informatics education (ii) informatics knowledge and skills (iii) digital health practices (iv) challenges and barriers. Nursing Informatics (NI) education is the major concern of improving Nursing informatics knowledge, skills and competencies ensuring that nurses' ability to use informatics to provide safe and quality care.

Conclusion: Findings support the further need for advanced NI education, training, and facilities to improve nurses' capacity to work in digitalized clinical settings. Continuous research is needed to provide clear direction about the required clinical informatics competencies of graduate nurses and practicing nurses. Suggestions for preparing skillful nursing professionals based on NI education and practice are to be discussed in the future.

Keywords*: digital health, nursing informatics, education, knowledge, practice*

Introduction

The use of digital technologies is growing rapidly. It is no secret that they have made significant changes to traditional healthcare practices, transforming them with digital innovations. The World Health Organization (WHO) defines digital health as "the field of knowledge and practice associated with any aspect of adopting digital technologies to improve health" (WHO, 2021). With this rapid advancement of digital technologies and their engagement in the healthcare systems, healthcare professionals are forced to be competent with digital health knowledge and competencies (Edirippulige et al., 2018).

As front-line healthcare professionals, nurses need to have informatics knowledge and competencies to provide better care in this growing digital health environment (Jones et al., 2022). Patient care decisions should be supported by timely clinical information, reflecting the best evidence possible (Green et al., 2006). Nursing Informatics (NI) is a specialty in nursing practice with core competencies of nursing science, information science and computer science that enable safe and quality care in digitalized environments (Harerimana et al., 2020). It has advanced the nursing profession by bridging the gap from nursing as an art to nursing as a science (Saba, 2001). The potential of NI to enhance nursing practice, clinical problem solving, effective information management and ultimately improve the quality of care has been a long-standing expectation in the domain of nursing (Hebert, 2000). Further, increasingly sophisticated and powerful i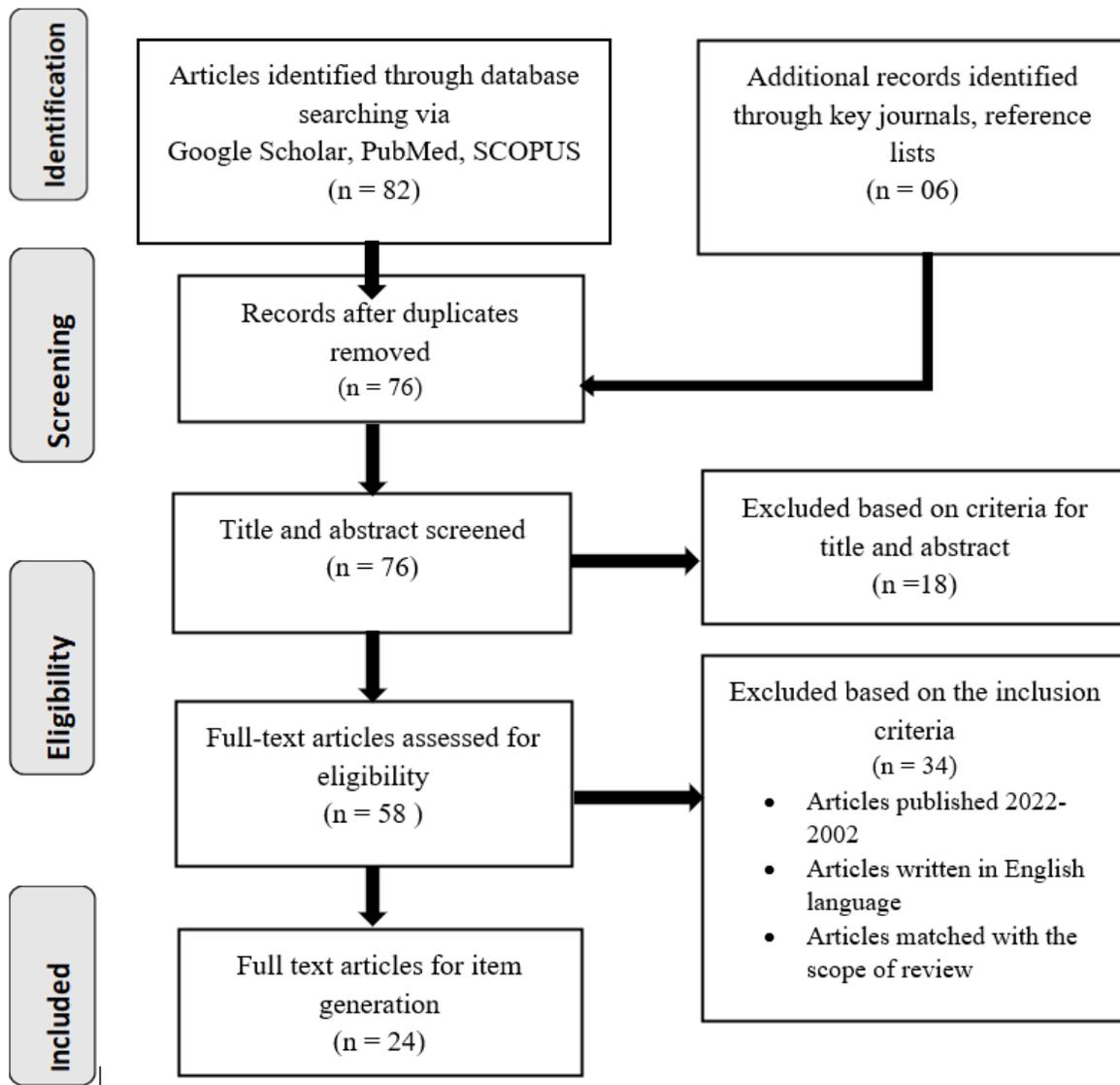nformation systems have the potential to affect the work of nurses in clinical practice, education, administration and research in digitalized environments (Sweeney, 2010). Therefore, present and future nursing professionals should have the capacity to use informatics knowledge and technology to facilitate critical decision-making for optimal patient outcomes.

The movement of NI began approximately three decades ago when nursing education was limited to general nursing rather than specialization in certain countries worldwide (Ranchal et al., 2015). Nurses in a few developed countries have the opportunity to become specialists utilizing well-established NI applications integrated into digital health solutions while developing countries are under considerable strain to acquire informatics knowledge and competencies (Cummins et al., 2016). Certain challenges and barriers may hinder their digital health education, preparation, and adaptation (Rooney et al., 2019). As a responsive profession, present and future nurses must be prepared to take advantage of digital support for decision-making, nursing information management and knowledge development, as well as to envision new ways of carrying out work in a digital environment. Therefore, outstanding gaps in digital health capacity among nursing students and nurses have been a significant concern among nursing educators, healthcare administrators, policymakers and researchers at present (Forman et al., 2020). This narrative review aimed to assess the preparedness of nurses to utilize nursing informatics knowledge, skills and competencies in the healthcare sector.

Methods

An extensive literature survey was carried out using PubMed, Scopus and Google scholar. Additional records were identified through key journals and reference lists. Articles were searched based on the key terms "digital health" OR "Nursing Informatics" AND "nursing informatics competencies" OR "informatics skills" OR "informatics knowledge" AND "nursing education" OR "informatics education" AND "informatics practice" OR "digital health practice" AND "nurses preparedness" OR "challenges" OR "barriers". A systematic process was followed using PRISMA (2009) flow diagram to select the articles for the study (Moher et al., 2009). The flowchart of the process is illustrated in Figure 1.

Identification

Articles identified through database searching via Google Scholar, PubMed, SCOPUS (n = 82)

Additional records identified through key journals, reference lists (n = 06)

Screening

Records after duplicates removed (n = 76)

Title and abstract screened (n = 76)

Excluded based on criteria for title and abstract (n =18)

Eligibility

Full-text articles assessed for eligibility (n = 58)

Excluded based on the inclusion criteria (n = 34)
- Articles published 2022-2002
- Articles written in English language
- Articles matched with the scope of review

Included

Full text articles for item generation (n = 24)

Figure 01: Flow chart of the review process

Through a comprehensive literature search, 88 articles were identified and additional records were selected through reference lists, websites and organizations. Following duplication removal, titles and abstracts were screened to identify and remove articles based on the inclusion criteria. Scientific articles written in the English language published between 2002 to 2022 were included in the review. Thereafter, the articles included were assessed for eligibility by careful review of the full texts. Articles that were not compatible with the scope of the review were excluded. Finally, 24 articles including quantitative, qualitative and mixed method studies were selected for the review process considering factors such as the informative, complete and applicable timeliness of the articles. Qualitative and quantitative findings were synthesized as a narrative review under four key areas in nursing education and nursing practice.

Results

Four main areas emerged in the literature were, (i) informatics education (ii) informatics knowledge and skills (iii) digital health practices and (iv) challenges and barriers in adhering to digital health.

Nursing informatics education

One of the major concerns in improving NI knowledge, skills and competencies is informatics education ensuring their ability to use informatics skills to provide safe and quality care (Lall et al., 2019).

The first healthcare informatics curriculum started at the State University of New York and thereafter various graduate certificate and master's programs and a few nursing

informatics doctoral programs were available in certain developed countries (Englebardt & Nelson, 2002). Training programs, curricula integrating nursing language and terminology, and collaboration informatics educational programs with clinical agencies to create opportunities to use informatics are implications in informatics education (Feneley, 2009). Further, certain strategies were developed to assess how informatics incorporate into nursing education and practice. For example, in 2013, the Canadian Association of Schools of Nursing developed an information and communication technologies (ICT) competency tool to identify the ICT needs of nursing students, and nurses and offered specifics about how to incorporate informatics training throughout nursing educational programs (Haldar et al., 2013). Another tool was developed to address the informatics knowledge level nursing students need prior to graduation (Kleib & Nagle, 2018). Moreover, certain studies have reported that nursing degree programs should integrate informatics into the curriculum by developing program objectives that reflect informatics outcomes (Jedamzic et al., 2019; Lall et al., 2019). However, only a few developed countries have well-established informatics education providing bachelor, master, or doctoral degrees while developing countries still try to establish such strategies in nursing education (Cummins et al., 2016).

Numerous studies have been conducted to assess nursing students' and nurses' digital health educational status (Boyd, 2014; O'Brien et al., 2015). A mixed-methods study used the Quality and Safety Education

for Nurses (QSEN) initiative to assess undergraduate preparedness for informatics use (Boyd, 2014). More than half of the participants in the quantitative part expressed that their nursing curriculum should have placed more emphasis on Electronic Health Records (EHR) use. EHR is an important use of digital health which enable nurses to document real-time nursing interventions in the plan of care and a strategy for nursing education that is frequently reported in previous studies (O'Brien et al., 2015). The participants of the quantitative part expressed that QSEN knowledge, skills, and attitudes in academic preparation are very important for daily professional practice (Boyd, 2014). NI education is necessary for nursing undergraduates and all academics and educators including nursing program administrators, directors, managers, or deans of nursing programs. Most of the recent academic courses have facilities to use electronic resources and nursing students have the opportunity to use them. Although students are given this privilege nurses and nurse managers have to acquire digital health literacy and skills in the clinical setting (McNeil et al., 2005).

Nursing informatics knowledge and skills of nurses

Digital health literacy is required to use digital technologies effectively in clinical environments. In a few observational studies, nursing students have self-rated their digital health literacy levels. Brown et al(2020) stated that most nursing students have basic computer knowledge and skills, and they are competent to use the internet to locate and download items of interest.

However, they are least competent in the clinical informatics role and in using nursing informatics (Brown et al., 2020; Ragneskog & Gerdner, 2006). Further, nursing students' knowledge of digital health and understanding of digital health applications in their practice is very low in developing countries (Edirippulige et al., 2018). However, it was reported that nurse educators have more knowledge and skills to handle information technologies such as operating computers, word processing and access to the internet (Ragneskog & Gerdner, 2006).

Furthermore, only less number of nurses are familiar with NI competencies and their ability to use digital health technologies in practice is considerably low (Brown et al., 2020). One of the main reasons for the low ability to use digital health is not having access to training on digital health and limited permission and opportunity to do electronic documentation in clinical practice (O'Brien et al., 2015). Nurses experience a general awareness of their knowledge deficits, focusing on hands-on or clinical practicums concerning some theoretical NI learning nevertheless they expressed a lack of understanding of basic NI concepts with sufficient depth and awareness regarding technology use in nursing practice (Brown et al., 2020).

Attitudes of nurses toward digital health

In certain countries, academic programs have examined either nursing faculty's and students' perceptions about the need for informatics or competencies within educational programs. Nursing graduates have positive attitudes toward academic

programs regarding NI and they reported that NI academic programs are "very effective" to improve NI competencies and "somewhat effective" in providing students with the necessary knowledge and skills for nursing practice (Boyd, 2014). Importantly, nurses below 30 years expressed more positive attitudes toward digital technologies than older nurses (Brumini & Petrovecki, 2005). However, students generally have not expressed positive views about technology use for care provision in certain developing countries (Edirippulige et al., 2018). Most nurses believe their informatics knowledge and skills are critical to use electronic health records effectively in acute care settings (O'Brien et al., 2015). However, they reflect that it takes more time and months to become comfortable with digital health applications and tools (Miller et al., 2014).

Practices of nursing informatics

Nurses use social media platforms (a form of digital technology) for different purposes in their personal and professional life showing their ability to handle digital technologies. Increasingly, proper training for health professionals to utilize applied digital technologies is recognized as an important need, since improper usage may lead to misbehavior in digital professionalism (O'Connor et al., 2021). There are specific gaps between informatics knowledge and skills among new nurses and nurse managers. Although a few new nurses and nurse managers receive coursework on digital health during nursing school, most of them are receiving training in their current workplaces (Xu et al., 2013). However, according to Miller et al., (2014) majority of novice nurses are highly skilled in sending

emails, internet usage and use search engines, word processing, lab results retrieval, keyboarding, and nursing note documentation while senior nurses who have not had substantial exposure to digitalized environments show the least confidence in digital health. Additionally, they reported that the reduction in their workload was due to digital technologies emphasizing the need for proper training (Miller et al., 2014).

Challenges and barriers in adhering to nursing informatics

Although there is a growing global interest in digital health, some developing countries still have not made much progress. Inadequate NI education, access to technology, inadequate investment in health care, poor infrastructure and misplaced priorities have hindered developments in digital health interventions (Rooney et al., 2019).

Lack of previous clinical experience and exposure and hospital orientation of nurses are the most affecting factors for knowledge and skills on digital health (Miller et al., 2014). It was noted that nurses were not provided with enough opportunities to translate their knowledge and attitudes about informatics into skills for actual practice (Boyd, 2014). If the nursing staff have a poor experience with the initial implementations in digital health, they are less likely to accept its continued use in practice. Most nurses often viewed telehealth as an additional responsibility, rather than as a strategy to support efficient caseload management (Mair et al., 2008). Sharing responsibilities with others and

adhering to new digital health environments could also cause workplace-related anxiety (Sharma et al., 2018). Nurses' level of trust in technology and confidence in safety and reliability are some barriers to adhering to digital health (Mair et al., 2008). Addressing ongoing barriers and challenges is crucial to digital health implementations and if not addressed their acceptance remains low (Brewster et al., 2014). However certain studies reported that most of the digital health implementations had been initiated as pilot studies, but not continued or not integrated into routine clinical practice (Messikh, 2006; Giordano et al., 2011).

Discussion

Results of the review indicate that certain aspects in the domain of nursing affect nurses' preparedness for digital health. Nursing education, knowledge and attitudes on digital health, infrastructure and other facilities that affect digital health practice are the most frequently reported aspects that hinder digital health usage among nurses.

Nurses should be prepared with informatics competencies to utilize digital health tools and technologies. There is a set of core informatics competencies that have been identified and documented using different approaches. Several researchers have developed research-based lists of nursing informatics competencies during the last few decades (Chang et al., 2011; Gassert, 2008; Westra & Delaney, n.d.). A recent three-round Delphi study conducted using NI experts has validated 281 NI competencies under three sub-categories: computer skills, informatics skills and informatics knowledge (Staggers et al., n.d.). However, few studies have noted that a lack of informatics competencies (in several aspects) is a considerable challenge in the nursing profession (Hebert, 2000; Staggers et al., n.d.). Moreover, the researchers have emphasized that nursing students and nurses should have a positive perception of digital health education and practice (Jedamzic et al., 2019; Lall et al., 2019).

Comprehensive NI education and training is the core area that needs to be strengthened to build up their knowledge, skills and attitudes. Although Godsey et al., (2015) stated that there is a universal agreement among educators and administrators about the inclusion of NI which is highly important for nursing curricula, no adequate details are available about how NI competency education is best delivered. Most of the NI competency assessment tools have been developed as self-assessment tools rather than actual evaluations that may contribute to research quality issues (Godsey et al., 2015). Certain nursing education programs that do not adhere to standardized criteria for teaching nursing informatics are still notable (Forman et al., 2020). However, the current research-based list of informatics competencies for nurses is not available according to the WHO (WHO, 2021). Defining NI, recognizing the role of NI specialists, and developing required NI competencies are crucial initial steps (Green et al., 2006).

Transforming NI education to practice in the digital environment is vital in nursing. Nursing leaders and educators need to recognize the need and importance of the

integration of NI into nursing practice (Green et al., 2006). The usage of Electronic Health Records (HER) or training Electronic Medical Records (EMR) is identified as a better and most effective strategy for training nursing students and nurses on NI in clinical settings (Boyd, 2014). In addition, providing opportunities to work with digital technologies at the beginning under required observation is of paramount importance. These strategies allow trainees to be familiar with the digital environment by getting support for prioritization of patient care, receiving real-time feedback, and increasing confidence in electronic documentation (Warboys et al., 2014).

However, nursing educators believe that they are adequately skillful at operating computers and performing tasks such as word processing, handling e-mails and sending messages. Nevertheless, nursing students have uncertainty or incompetency regarding their overall competency in operating computers (Ragneskog & Gerdner, 2006). This suggests the requirement of NI education and training for all nursing students and nurses. Furthermore, effective and evidence-based educational strategies with core knowledge and skills in NI are necessary for every nursing program to prepare skillful nurses at the national and international levels. Importantly, younger nurses have more positive attitudes towards digital health education and practice than older nurses indicating acceptance of new technologies (Brumini & Petrovecki, n.d.). The possible reason may be the younger generation is more aware of information technologies and

willing to adapt to new technologies compared to the older generation.

End users' acceptance is of paramount importance in implementing Health Information Systems (HIS) (Littlejohns & Wyatt, 2003). If their acceptance is low, the daily routine of patient care may be compromised affecting patient safety and quality of care.

Many challenges and barriers in adhering and accepting digital health are reported among nursing students and nurses. One of the most significant challenges to nurses is finding what and how should be done to advance NI practice in the 21st century. Nursing professionals must develop specific strategies to remain NI as a vital aspect of professional nursing practice. They need to be adequately equipped with technological knowledge and good training to overcome challenges and barriers that hinder their engagement in digital health (Lulin et al., 2020). Necessary resources including human and infrastructure need to be provided to enhance digital health capacity and prepare skillful nurses for a better outcome.

The review pointed out certain areas of nursing education and practice that affect their informatics knowledge, competencies and practice. However, the review did not compare how informatics education and practice levels vary among nurses in underdeveloped and developed countries around the world.

Conclusions

With the digital health revolution, nurses need to be competent with digital health knowledge and competencies as frontline health care providers. However, there is a

growing concern regarding nurses' preparedness to use digital health technologies in health care. Some of the major concerns are nurses' knowledge, skills and attitudes toward digital health which need to be improved further. Developing a standardized list of NI competencies, and integrating NI into nursing curricula are suggested. Certain challenges and barriers in NI education and practice in the digital health environments hinder the nurses' adaptation to digital health. Providing required training, and facilities to improve their NI skills and future research in the field of NI are recommended. The results of this review can be utilized as a basis for further research in the field of NI and nursing care. Future researchers need to identify areas that need to be assessed further and develop effective strategies to advance the field of NI.

Conflict of interest

The authors declare that they have no conflict of interests.

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