

# Integrating nursing informatics into undergraduate nursing education in Africa: A scoping review

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**Background:** Information and communication technologies have become omnipresent in healthcare systems globally, and since nurses comprise the majority of the health sector workforce, they are expected to be adequately skilled to work in a technology-mediated environment. Integrating nursing informatics into undergraduate nursing education is a cornerstone to nursing education and practice in Africa.

**Aim:** This scoping review aimed to evidence the integration of nursing informatics into undergraduate nursing education in Africa.

**Methods:** A scoping review of the literature used electronic databases including CINAHL Plus databases; EmCare; MEDLINE Ovid; Scopus; ERIC ProQuest; Web of Science; Google; and Google Scholar to locate papers specific to the African context. From a total of 8723 articles, 19 were selected for critique and synthesis.

**Results:** Selected studies indicated that nursing students used several information and communication technologies tools primarily for academic purposes, and rarely for clinical practice. In Africa, the challenges for teaching informatics in nursing education included: limited information and communication technologies skills among faculty and students; poor teaching strategies; and a lack of standardization of nursing informatics competencies. Successful integration of nursing informatics into undergraduate nursing education in African countries depends on restructuring nursing informatics content and teaching strategies, capacity building of the faculty and students in information and communication technologies, political commitment, and collaborative partnership.

**Conclusion:** Nursing informatics is scarce in undergraduate nursing education in Africa due to the implementation and adoption challenges. Responding to these challenges requires a multi-sectoral approach in the revision of undergraduate nursing curricula.

**Implication for nursing education, practice, policy and research:** This study highlights the importance of nursing informatics in undergraduate nursing education, with its challenges and success. Nursing education policies should support the development of well-standardized nursing informatics content and appropriate teaching strategies to deliver it. Further research is needed to establish which aspects of nursing informatics are integrated into undergraduate nursing education and nursing practice, implementation process, challenges and possible solutions. Collaborative partnerships are vital to developing nursing informatics policies to better prepare graduate nurses for the African healthcare workforce in the digital era.

**Keywords:** Africa, Communication Technologies, Curriculum, Information Technologies, Nursing Informatics, Nursing Education, Systematic Review, Undergraduate

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## Background

Information and communication technologies (ICT) have become omnipresent in the healthcare system (Gole et al. 2017; Webster 2020; WHO 2019), and since nurses comprise the majority of the health sector workforce, they are required to have adequate skills in nursing informatics (NI) such as using computers, accessing and evaluating digital information, and possessing sufficient information management skills (Ibrahim et al. 2019; Robinson-Bassey & Edet 2015; Sapci & Sapci 2017; WHO 2016). Furthermore, NI includes the use of technology-enabled hand-held devices such as smartphones; tablets, wearable technologies, medical monitoring devices, as well as mobile and web-based health applications (Harerimana & Mtshali 2019a, b; McGonigle & Mastrian 2015; Sermeus 2016; Shin et al. 2018; WHO 2018). Nursing education institutions are expected to integrate NI into their curricula to prepare nurses who are capable to use technology in the healthcare environment (Darvish et al. 2014; WHO 2016).

Nursing informatics is a subset of health informatics (McCormick & Saba 2015; Sweeney 2017). Health informatics is 'the integration of health science, information science and cognitive science to assist the management of healthcare information' (Saba & McCormick 2015, p. 232). Furthermore, NI is defined by the Australian College of Nursing (ACN) (2017, p. 1) as 'the specialty that integrates nursing science with multiple information and analytical sciences to identify, define, manage and communicate data, information, knowledge and wisdom in nursing practice'. Similarly, American Medical Informatics Association [AMIA] (2015) defined NI as the 'science and practice (that) integrates nursing, its information and knowledge, with information and communication technologies to promote the health of people, families, and communities worldwide'. Both health informatics and NI promote the use of technology in clinical settings (Sweeney 2017).

NI competencies are essential in all aspects of nursing practice (Kinnunen et al. 2017). The literature indicates that the competencies in NI include computer skills, digital literacy (DL) and health information literacy (HIL), and eHealth literacy (eHL) (Chung & Staggers 2014; Holt et al. 2020; McCormick & Saba 2015; Terry et al. 2019; Tubaishat & Habiballah 2016). Integrating NI into undergraduate nursing education is instrumental in producing competent nurses who are capable of using technology to provide high-quality care. In addition, NI has been reported to promote evidence-based practice, improve documentation and reduce medical errors (Darvish et al. 2014; Gann 2015). Nursing informatics is also used as

part of teaching and learning capabilities in nursing education (Forman et al. 2020; Harerimana & Mtshali 2020b; Honey & Procter 2017; Terry et al. 2019; WHO 2020).

Developed countries such as Australia, Canada, Denmark and the United States of America (USA) have taken significant steps in incorporating NI into the undergraduate curriculum (Cummings et al. 2015). In Africa, there is a growing need to integrate ICT in the health sector (Adeola & Evans 2018; Asiri 2016; Tchuitcheu et al. 2020). Furthermore, studies conducted in Ghana, Malawi, Nigeria, Rwanda and South Africa indicated that nursing educational institutions were progressively adopting nursing informatics into undergraduate nursing education (Achampong 2017; Bhebe & de la Harpe 2014; Harerimana & Mtshali 2019a, b; Harerimana & Mtshali 2020a, b; Nishimwe et al. 2016; O'Connor et al. 2016; Robinson-Bassey & Edet 2015).

In Africa, the integration of informatics in nursing education is in the early stage (Achampong 2017; Harerimana & Mtshali 2019b). The capacity for implementing NI in developing countries is limited (O'Connor et al. 2016). There are challenges which hinder the proper integration of NI in undergraduate nursing education in Africa, including lack of infrastructure and ICT tools, inadequate ICT literacy among nurse educators and students, resistance to change and the lack of policies and guidelines (Achampong 2017; Bello et al. 2017; Harerimana & Mtshali 2017, 2018a; Murgor 2015). Furthermore, there is a low presence of NI in the undergraduate curriculum, and a lack of standardization of NI competencies to be included in undergraduate nursing education (Achampong 2017; Nishimwe et al. 2016).

Due to the increasing use of technology in health care in Africa (Faruk et al. 2020; Ladan et al. 2019), it is crucial to ensure nursing students are competent to use ICT in the clinical setting upon their graduation. Hence, this scoping review sought to obtain evidence about the integration of NI into undergraduate nursing education in Africa.

## Aim of the study

The scoping review aimed to obtain, critique and synthesize the evidence of the integration of NI in undergraduate nursing education in the context of Africa.

## Methods

The authors conducted a scoping review on the integration of NI in undergraduate nursing education in Africa. Scoping reviews map a given field, summarizing a range of evidence to convey the breadth and depth of the field with five

distinctive steps (Levac et al. 2010, p. 3). The following essential five steps guided this study:

- 1 'Identifying the research questions'
- 2 'Identifying relevant studies'
- 3 'Selecting the studies'
- 4 'Charting the data'
- 5 'Collating, summarizing, and reporting the results' (Levac et al. 2010, p. 3).

The following inclusion criteria were used: peer-reviewed articles providing information, discussions and policies on the integration of NI in nursing education and/or the challenges and success factors to the integration of NI, be conducted in the context of Africa, be published in English, and be published between 1 September 2009 and 30 September 2019. Exclusion criteria were studies conducted outside Africa and studies about NI in postgraduate or post-registration curricula.

#### Step one: Identifying the research questions

Identification of relevant research questions provides 'a roadmap for subsequent stages. Research questions are broad and seek to provide a breadth of coverage' (Levac et al. 2010, p. 3). This scoping review addressed the following three research questions:

- 1 What components of NI are integrated into undergraduate nursing education in Africa?
- 2 What challenges are impeding the integration of NI in undergraduate nursing education in Africa?
- 3 What are the success factors for the integration of NI in undergraduate nursing education in Africa?

#### Step two: Identifying relevant studies

Prior to the identification of relevant studies, search strategies were developed which included search terms; databases; time span; language; and type of sources as recommended by Levac et al. (2010). Publication dates were limited to a period of 10 years (2009–2019) due to the rapid advancement of ICT in Africa.

The following electronic databases were searched: CINAHL Plus databases; EmCare; MEDLINE Ovid; Scopus; ERIC ProQuest; Web of Science. Furthermore, a hand search strategy was conducted in Google and Google Scholar to obtain additional articles which might have been missed with the electronic database searches.

Furthermore, key terms were developed mainly from MeSH Headings (MH) and customized keywords, to suit the search strategies of different databases. The following were the key terms used in this study:

- 1 (MH "Nursing Informatics") OR (MH "Health Informatics+") OR (MH "Medical Informatics") OR (MH "Informatics+")

- 2 (MH "Education, Nursing+") OR (MH "Education, Nursing, Baccalaureate+") OR (MH "Education, Nursing, Continuing") OR (MH "Education, Nursing, Graduate+") OR (MH "Education, Nursing, Practical") OR (MH "Education, Nursing, Associate") OR (MH "Education, Nursing, Diploma Programs") OR "Nursing Education"

- 3 (MH "Africa+")

- 4 (S1 AND S2)

- 5 (S3 AND S4)

#### Step three: Selecting relevant papers

From the search, a total of 8723 articles were retrieved, including 8700 from databases and 23 from hand searches. After removing the 2617 duplicates, 6106 remained for title screening. Ninety-one articles were chosen for further screening of the abstract based on the inclusion and exclusion criteria. After the abstract screening and assessing the full text, 19 articles were considered relevant to be included in the data set for analysis (Fig. 1). The selection of articles was mainly based on the research question and minimum standards of quality were considered based on the 'Mixed Methods Appraisal Tool (MMAT)' (Hong et al. 2018, p. 2). In this study, quantitative, qualitative and mixed methods articles published in peer-reviewed journals were considered.

EndNote™ X9, a computer-based management software program, was used to rate each citation in order to indicate whether the citation was assessed as potentially relevant or not. The rating ranged from 1 to 5, with the latter indicating the likelihood to be included. Selection of studies was done through discussion and consensus among research team members, and the inclusion and exclusion criteria guided the process.

Of the 19 articles included in the study, 11 were quantitative studies, seven were qualitative studies, and one was a mixed methods study. Figure 1 reports the final number of selected studies after completing the appraisal, and a Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow diagram was used (Moher et al. 2009, p. 3). Selecting relevant papers was in line with the recommendations from Levac et al. (2010) who stated that selecting the studies should be guided by the eligibility criteria, research questions and the familiarity of the subject matter through reading the title, abstract and the full paper.

#### Step four: Charting the data

Nineteen articles included in this study were read several times, to ascertain that all necessary information was included. Extracted data were presented in the form of a table which contained: Authors, year of publication, country,

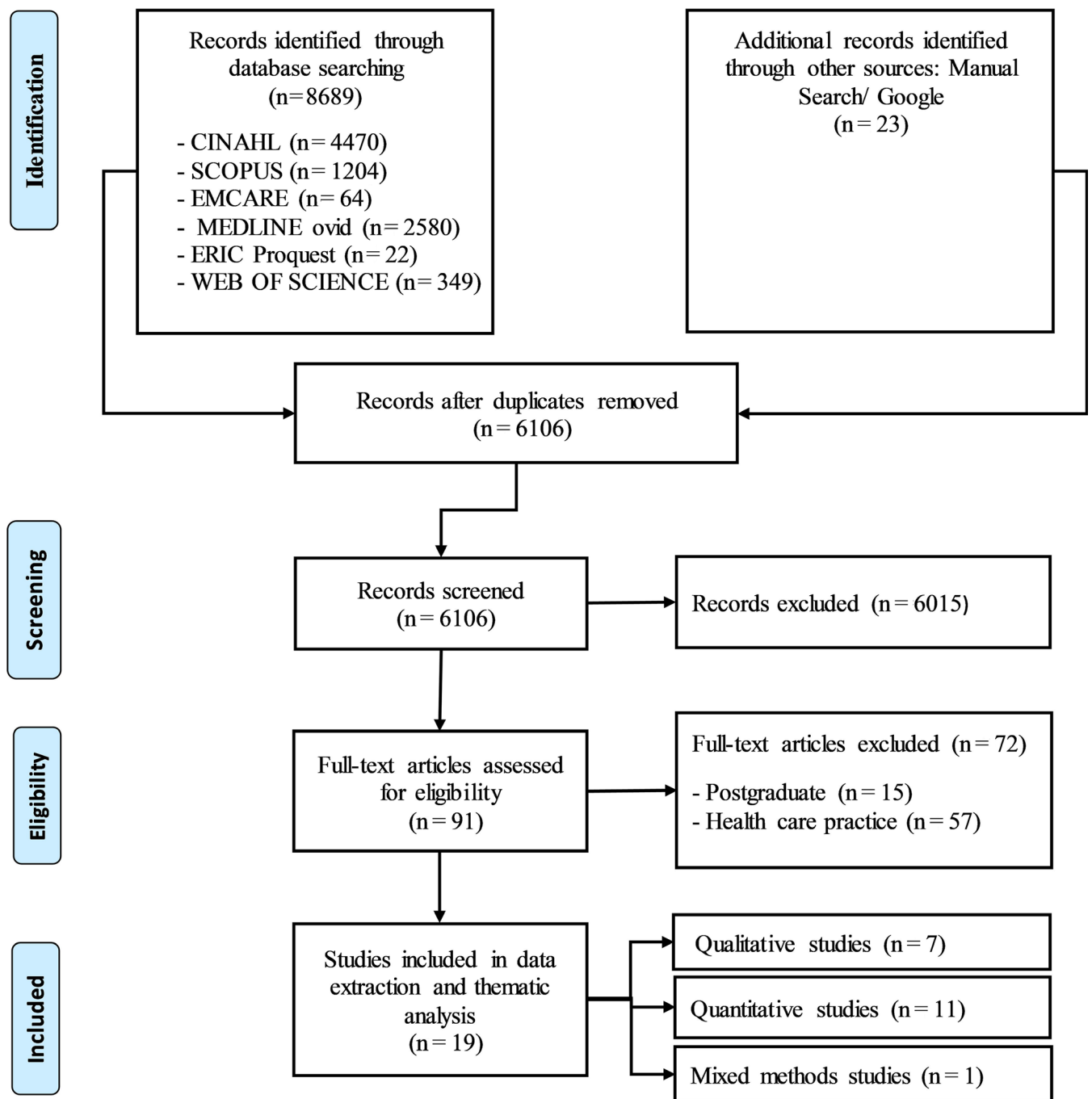


Fig. 1 PRISMA flow chart.

study design, population and sample size, and key findings. According to Levac et al. (2010), it is vital to develop a data charting form and use it to extract the information from each study.

**Step five: Collating, summarizing and reporting the results**  
 In this stage, NVIVO (Version 12), 'a qualitative data analysis computer software package' (Hilal & Alabri 2013, p. 182), was used to organize extracted data and assisted in coding

extracted data into different themes. According to Levac et al. (2010, p. 6), this step involves 'collating, summarizing and reporting the results'. Furthermore, it involves using 'a thematic construction to provide an overview of the breadth of the literature' (Levac et al. 2010, p. 3). In this study, the thematic analysis helped to identify, analyse and narrate the patterns from the dataset. Furthermore, the above-stated research questions guided the data analysis. In this study, a numerical summary was provided indicating the characteristics of the studies including number of the selected studies, countries of the study, type of the study design, characteristics of the population and categories emerging from the study (Arksey & O'Malley 2005). Table 1 shows the characteristics of the included studies.

## Results

Nineteen selected articles were from eight African countries. The majority of the articles were from South Africa (6) and Nigeria (5). Two articles each were from Ghana and Egypt, while a single study was from each of these countries: Libya, Malawi, Namibia and Rwanda. Eleven studies used a quantitative research approach, another 7 were qualitative, and only one study used mixed methods. The targeted population were undergraduate nursing students in 11 studies, faculty in 6 studies, and the curricula in two studies.

In selected studies, the majority of nursing students were between 20–25 years, and females represented between 50.7% and 90.4% of the respondents (Bello et al. 2017; Buabeng-Andoh 2018; Elewa & El Guindy 2017; Harerimana & Mtshali 2018b; Harerimana & Mtshali 2019b; Irinoye et al. 2016). One of the six studies whose population was faculty indicated the demographics of the population, and it was noted that 50% of the sample was between 40–49 years, and the majority (84%) had a bachelor's degree. Furthermore, the same study indicated that 97% of the faculty were female (Akpabio & Ella 2015).

Upon completion of the analysis of the selected articles about the integration of NI into undergraduate nursing programmes, the following categories emerged: (1) components of informatics used, (2) challenges and (3) success factors.

### Category 1: Components of informatics tools and applications used

Selected articles indicated that nursing students used several ICT tools such as laptops, tablets, smartphones and Internet (Elewa & El Guindy 2017; Harerimana & Mtshali 2018b; Harerimana & Mtshali 2019b; Pimmer et al. 2018). Additionally, it was noted that students used ICT applications and programmes such as e-mails, Internet search tools, word

processors, Excel<sup>TM</sup>, PowerPoint<sup>TM</sup>, reference managers such as EndNote<sup>TM</sup>, Turnitin<sup>TM</sup>, data analysis software (Buabeng-Andoh 2018; Elewa & El Guindy 2017; Harerimana & Mtshali 2019b; Nishimwe et al. 2016) and social media platforms such as WhatsApp (Pimmer et al. 2018).

Selected studies revealed that these ICT tools and applications were used by undergraduate nursing students, mainly for academic purposes and rarely in clinical practice (Elewa & El Guindy 2017; Harerimana & Mtshali 2018b; Harerimana & Mtshali 2019b; Pimmer et al. 2018). In education, students used informatics tools for communication and collaboration with peers and the faculty, accessing online resources and course content from learning management systems, and completing academic work such as assignments and projects (Buabeng-Andoh 2018; Harerimana & Mtshali 2018b; Harerimana & Mtshali 2019b). In clinical practice, informatics tools were mainly used to access health information, communicate and collaborate with peers, clinical instructors, nurses and experts, as well as reflect on their clinical practice (Ajuwon et al. 2018; Pimmer et al. 2018; Willemse 2015; Willemse et al. 2019).

Eight studies have shown that the emphasis is mainly placed on developing basic computer literacy, and the academic use of nursing informatics. Four studies reported the type of content and competencies in NI included in the undergraduate curriculum (Achampong 2017; Akpabio & Ella 2015; Elewa & El Guindy 2017; Nishimwe et al. 2016). The reported content included historical background of NI, ICT tools, using patients' electronic records at different stages of the nursing process, using Internet and search tools, NI standards and lastly, IT terminologies and contemporary issues related to nursing and midwifery informatics (Achampong 2017). Furthermore, one study reported that NI should include the application of informatics in education, telemedicine and ethics in informatics and hospital information system (Elewa & El Guindy 2017).

### Category 2: Challenges

Nursing informatics competencies are scarce in undergraduate nursing education in Africa (Ndinoshiho 2010; Nishimwe et al. 2016). The implementation of NI tools and concepts in undergraduate nursing education has encountered challenges related to lack of ICT skills and competencies among nursing faculty to teach informatics, along with a lack of standardization of NI competencies. The inadequate delivery of NI was reported to be related to a lack of clear learning goals, insufficient practical aspects of NI and teaching NI in isolation (Achampong 2017; Elewa & El Guindy 2017). Other challenges included the following: limited access to ICT tools such

Table 1 Summary of the data

Author, year, country	Aim	Research design	Participants/Sample	Key findings
Achampong (2017), Ghana	'Assess the current curriculum of the nursing and midwifery informatics course for all the nursing and midwifery training institutions in Ghana'	Qualitative descriptive	Nurse educators ( $n = 59$ )	Description of the course content of nursing and informatics in Ghana NI <sup>†</sup> is taught in the first year Barriers found: Lack of prerequisite of nursing students; unclear expectations from the students; the insufficient practical aspect of NI; lack of skills to teach NI by nurse educators; discrepancies between the course contents and recommendations from International Medical Informatics Association (IMIA), Technology Informatics Guiding Educational Reforms (TIGER) Mobile Instant Messages was used to: Share and discuss information related to teaching practice Provide direction and trigger reflective teaching practice Spark the professional discussions and announce professional development opportunities Maintain a moderating and teaching presence Barriers found: insufficient airtime, power outage, poor network connectivity, poor facilitation of the moderator, tension related to the use of mobile devices in practice
Ajuwon et al. (2018), Nigeria	'To determine the feasibility of using the Mobile Instant Messaging (MIM) platform, WhatsApp, to provide supervision and support for student nurse tutors during a teaching practice placement in Nigeria'	Qualitative descriptive	Nurse tutors ( $n = 19$ )	Positive perception of the role of NI Adequate identification of the skills needed in NI Inadequate level of skills in NI Poor awareness to transition to NI The majority of undergraduate nursing students had good computer skills Good access to computers and the Internet The purpose of accessing Internet included: seminar preparation; research; general information; e-mails; social media; film/news; games Identified stakeholders included: International collaborators; informatics bodies and associations; healthcare professionals; curricula bodies; health education support entities; health education institutes; computer professionals; students; future employers; health facilities; local health organizations; national research fund (NRF); patients; government (local, provincial, national)
Akpabio and Ella (2015), Nigeria	'To investigate NI preparedness of graduate nurses in Calabar, Nigeria'	Quantitative cross-sectional and descriptive	Nurse educators ( $n = 40$ ); nurse administrators ( $n = 3$ ); nurse clinicians ( $n = 58$ )	
Bello et al. (2017), Egypt	'To assess the pattern and utilization of ICT among undergraduate Nursing students at Tanta University, Egypt'	Quantitative, descriptive, cross-sectional	Fourth-year undergraduate nursing students ( $n = 504$ )	
Bhebe & de la Harpe (2014), South Africa	'To identify the stakeholders that can shape the implementation of nursing informatics education programmes'	Qualitative descriptive	Experts; nurse educators, nurses, policymakers (size not provided)	

Table 1 Continued

Author, year, country	Aim	Research design	Participants/Sample	Key findings
Buabeng-Andoh (2018), Ghana	'To investigate undergraduate nursing students' use of mobile learning (m-learning) and the factors contributing to their use of m-learning'	Quantitative descriptive, cross-sectional	Undergraduate nursing students (n = 586)	The majority of students owned smartphones and laptops Mobile devices used for homework, communication via SMS and e-mails, search for course materials, create course materials, and record lectures Undergraduate nursing students perceived that mobile devices would increase their productivity and would allow them to accomplish more tasks quickly and easily The majority had a high score on perceived usefulness, perceived ease of use, attitude and behavioural intention
Elewa & El Guindy (2017), Egypt	'To assess nursing students' perception and educational needs regarding nursing informatics'	Quantitative descriptive, cross-sectional	Undergraduate nursing students (n = 390)	Positive perception of the impact of NI to practice and care The majority access computer at the university and home The majority reported the need for basic computer skills; application of informatics in education; telemedicine; ethics of informatics; hospital system information
Harerimana & Mtshali (2018b), South Africa	'To explore the Internet access and use by undergraduate nursing students at a selected university in South Africa'	Quantitative, descriptive, cross-sectional	Undergraduate nursing students (n = 115)	Purpose of using the Internet: academic, communication, pleasure, and work-related activities Types of social media used: Facebook, Twitter, Myspace, student village Search engines used: Google, Yahoo, Bing, and Ask Barriers found: restricted access to a particular website; slow Internet connection; little training to use computers; limited number of computers
Harerimana & Mtshali (2019b), South Africa	'To explore the types of ICT applications used and the skill levels of nursing students at a selected tertiary institution in South Africa'	Quantitative, descriptive, cross-sectional	Undergraduate nursing students (n = 121) Postgraduate nursing students (n = 29)	Types of ICT devices used: Laptops; Smartphones; tablets, and desktop ICT applications used: MS Word, Excel, PowerPoint, e-mails, social media, learning management platforms, search engines Purpose of using technology: academic work, communication, collaboration, search online, access to electronic resources and learning materials Lower academic levels (1st and 2nd year) had limited skills with ICT tools compared to upper levels (3rd and 4th year)
Irinoye et al. (2016), Nigeria	'To examine attitudes and perceptions of nursing students towards using ICT supports in distance education'	Quantitative descriptive, cross-sectional	Bachelor of Nursing Science nursing students (n = 305)	Positive attitude towards ICT support in distance education Types of ICT applications used: MS Word, PowerPoint and Excel Barriers found: lack of computer training, insufficient ICT skills, lack of personal computers, lack of constant Internet access, lack of constant power supply
Mendoza & Buhat-Mendoza (2014), Libya	'To provide worthy educational data to the Institution in aide of improving educational competence in Nursing Informatics and academic performance as a whole'	Quantitative retrospective case study	Eight undergraduate nursing modules for 1st year, 2nd semester	Relatively good performance of the students in the module of introduction to the computer with NI NI was ranked 5th out of 8 subjects with 56.7%

Table 1 Continued

Author, year, country	Aim	Research design	Participants/Sample	Key findings
Ndinoshiho (2010), Namibia	'To investigate the use of electronic information services (EIS) by undergraduate nursing students at the University of Namibia's Northern Campus'	Convergent mixed methods	Undergraduate nursing students for the survey (n = 163) Undergraduate nursing students for an in-depth interview (n = 15)	Use of e-mails for communication (Yahoo mail; Hotmail, and Teen mail) Only 1.5% use e-database for research daily and 5% monthly Databases used: Medline, EBSCO host databases Barriers found: lack of prior training, shortage of computers, unreliable Internet connection, lack of skills, no university e-mail accounts for students Competencies included in the curricula were: software for documentation, communication and data analysis; basic informatics terminologies and word processing; data exchange and use of Internet Low presence of health informatics competencies in the studied curricula
Nishimwe et al. (2016), Rwanda	'To assess health informatics competencies in existing curricula of the University of Rwanda for undergraduate training of healthcare professionals in Rwanda'	Quantitative, descriptive cross-sectional	Undergraduate curricula from the college of medicine and health sciences (CMHS) (n = 30)	
Nyangeni et al. (2015), South Africa	'To explore and describe the perceptions of nursing students regarding the responsible use of social media'	Qualitative descriptive	Undergraduate nursing students (n = 12)	Nursing students used social media for academic purposes at school and clinical setting The most popular social media platforms were Facebook and WhatsApp, followed by Twitter, YouTube, Instagram Google+, LinkedIn, Mixt, and BlackBerry messaging Reported issues: irresponsible use of social media in clinical practice; lack of accountability; contravention of patient rights and confidentiality; patient medical conditions put on social media; exploitation and manipulation of the vulnerable patient and lack of advocacy, recording of medical procedures in the clinical environment; inappropriate relationships with the patient on social media; failure to obtain patient consent
Olajubu et al. (2015), Nigeria	'To examine nurses' knowledge and attitude to the use of nursing informatics and determine the extent to which nursing informatics is being utilized in practice'	Quantitative descriptive cross-sectional	Nurses (n = 350)	Positive attitude towards the use of NI Barriers found: Poor knowledge of NI; lack of functioning computers; limited access to computers smartphones and Internet connection in the workplace, and not using NI in the provision of care to the patients
O'Connor et al. (2016), Malawi	'Establish a long-term NI capacity in Malawi, Africa'	Qualitative descriptive	Nursing faculty (size not provided)	Establishing NI was facilitated by collaborative partnerships; international partnership; and capacity building of the faculty



Table 1 Continued

Author, year, country	Aim	Research design	Participants/Sample	Key findings
Pimmer et al. (2018), Nigeria	'Examine the use of the instant messaging platform WhatsApp by nursing students during placements and potential associations with socio-professional indicators'	Quantitative, descriptive cross-sectional	Bachelor of Nursing Science (BNS) nursing students (n = 196)	WhatsApp enhanced communication among students, and between students and nurses during clinical placement In the clinical placement, WhatsApp was associated with the development of the professional identity of the students, placement satisfaction and reduced feelings of isolation from the professional community
Willemsse (2015), South Africa	'To enhance and promote learning through the incorporation of a social media application, WhatsApp, as a mode of communication for enhancing the integration of theory and clinical practice'	Qualitative descriptive	Undergraduate nursing students (n = 21)	Positive experience in using WhatsApp Using WhatsApp to integrate theory into practice Using WhatsApp to support learning (getting resources, and support from teachers and peers) Barriers found: Inadequate device to support WhatsApp; Battery running flat
Willemsse et al. (2019), South Africa	'To explore the experiences of undergraduate nursing students who participated in an authentic mobile learning enactment aimed at enhancing their learning experiences'	Qualitative descriptive	Undergraduate nursing students (n = 101)	Mobile learning enhanced authentic learning context, authentic activities; access to expert performance; collaborative learning; reflective learning; and authentic assessment Mobile learning allowed coaching and scaffolding of the teacher in the critical time Barriers found: poor network access; cost of data bundles; and negative attitude towards the use of mobile devices

<sup>†</sup>Nursing Informatics

as computers, Internet and hand-held devices, and low capacity to implement NI in education and practice due to resource constraints (Ajuwon et al. 2018; Akpabio & Ella 2015; Harerimana & Mtshali 2018b; Irinoye et al. 2016; Ndinoshiho 2010; O'Connor et al. 2016; Olajubu et al. 2015; Willemse 2015).

One study indicated that due to poor preparation of the students to use informatics in clinical practice in Africa, there is a growing negative attitude towards the use of mobile devices in clinical environments (Willemse et al. 2019). One study identified that students use their mobile devices irresponsibly and unethically by posting confidential information and procedures to social media (Nyangeni et al. 2015).

In Africa, nursing informatics in nursing education is under-researched, and two articles pointed out this issue (Bhebe & de la Harpe 2014; Olajubu et al. 2015). The majority of the selected articles (58%) were from only two countries, namely South Africa and Nigeria. None of the studies indicated the process of implementing NI in undergraduate nursing curricula. One study indicated the guidelines which informed the choice of competencies to include in the undergraduate nursing curriculum, namely the guidelines from Technology Informatics Guiding Educational Reforms (TIGER) and International Medical Informatics Association (IMIA) (Achampong 2017). Furthermore, only six of the 19 studies included the faculty (Achampong 2017; Akpabio & Ella 2015; Bhebe & de la Harpe 2014; O'Connor et al. 2016; Olajubu et al. 2015; Pimmer et al. 2018), and only two studies covered the capacity building of the teaching faculty in NI (Achampong 2017; O'Connor et al. 2016).

### Category 3: Success factors

Educational reforms in nursing appear to favour the integration of NI; however, they were in their early stages in many African countries (Achampong 2017; Akpabio & Ella 2015; Bhebe & de la Harpe 2014; Elewa & El Guindy 2017). Evidence from the selected studies showed that only two countries in Africa – Ghana and Nigeria – have successfully made reforms to undergraduate nursing education to include NI competencies. The nursing councils of these countries played an essential role in the accreditation of the developed curricula (Achampong 2017; Olajubu et al. 2015).

Restructuring NI content and mode of delivery are essential in nursing education in African countries (Achampong 2017; Bhebe & de la Harpe 2014; Harerimana & Mtshali 2019b). One study recommended that the content development and delivery of NI should be in line with the recommendations of IMIA and TIGER (Achampong 2017). Three studies identified that there is a need for a standardized list of competencies in

NI, and they should be integrated at all levels of education (Achampong 2017; Akpabio & Ella 2015; Nishimwe et al. 2016).

Capacity building of the teaching faculty was reported by two studies to be an essential driver to the incorporation of NI in undergraduate nursing education in Africa. Nursing faculty need to be educated in NI, either through on-the-job training or formal education, to be able to teach informatics competencies in undergraduate nursing education (Achampong 2017; O'Connor et al. 2016).

Collaborative partnerships between universities in Africa, and those from developed countries such as the USA and Canada, were reported to be pivotal to NI (Bhebe & de la Harpe 2014; O'Connor et al. 2016). For this partnership to be successful, mutual goals need to be put in place and take into consideration education and healthcare needs (Olajubu et al. 2015). Furthermore, political commitment was essential in ensuring that a conducive environment is created and resources and opportunities are provided for a smooth integration of NI in nursing education (Achampong 2017; Bhebe & de la Harpe 2014; Olajubu et al. 2015).

### Discussion

This scoping review indicated the evidence of the integration of NI into undergraduate nursing education in Africa. In this study, three themes emerged: components of informatics tools used, challenges and success factors. Selected articles showed that ICT tools including laptops, tablets, mobile phones and applications are used by nursing students mainly for academic purposes, and rarely in clinical practice (Elewa & El Guindy 2017; Harerimana & Mtshali 2018b; Harerimana & Mtshali 2019b; Pimmer et al. 2018). In Africa, studies indicated that the focus was mainly on developing basic computer skills of nursing students, and few studies described NI content integrated into undergraduate nursing curricula (Achampong 2017; Akpabio & Ella 2015; Elewa & El Guindy 2017; Nishimwe et al. 2016). The negative attitude and the sparse use of informatics tools in clinical settings were associated with low implementation of NI in the nursing schools (Achampong 2017; Nishimwe et al. 2016; Nyangeni et al. 2015; Willemse et al. 2019).

The evidence from this study indicated that successful integration of NI in undergraduate nursing education depended on several factors such as the adequate restructuring of NI content and mode of delivery and aligning expected competencies with the international standards such as those recommended by TIGER and IMIA. Studies showed that the use of informatics tools in nursing schools was a possible driver for integration in nursing curriculum (Buabeng-Andoh 2018;

Harerimana & Mtshali 2019b; Irinoye et al. 2016). Other reported success factors were developing informatics skills for both students and the faculty (Achampong 2017; Akpabio & Ella 2015; Elewa & El Guindy 2017; Nishimwe et al. 2016); and collaborative partnership and political commitment (Achampong 2017; Bhebe & de la Harpe 2014; O'Connor et al. 2016; Olajubu et al. 2015).

This scoping review indicated that there is limited literature on the integration of informatics into undergraduate nursing education in Africa. Only 19 articles were located in a period ranging from 2009 to 2019. These articles were from eight African countries, of which 58% were from South Africa and Nigeria, two economic powers on the continent. It was noted that only six studies involved the faculty, and only two focussed on the faculty capacity development in NI. The majority of the studies were at the exploratory level and not predictive. None of the selected articles indicated the process or a blueprint for the successful implementation of NI into undergraduate nursing curricula.

### **Implications for nursing education, practice, policy and research**

This study highlights the importance of nursing informatics in undergraduate nursing education, with its challenges and success. Nursing education policy should support the development of the evidence-informed standards of NI competencies and content. Policymakers can use the results from this scoping review for establishing policies that foster the integration of NI in nursing education and devise strategies to integrate NI in clinical practice to facilitate the provision of quality care and services.

Nursing education institutions should ensure that NI is integrated into undergraduate nursing curricula. The course content should be developed and delivered effectively. The balance should be made between theory and practice when teaching informatics. Developing informatics skills of both students and faculty are essential in nursing education and practice. Due to limited literature, it is essential to conduct research that helps us to understand what aspects of NI are integrated into undergraduate nursing education, the process of the implementation, the challenges encountered and possible solutions, along with where the gaps in informatics currently lie in undergraduate nursing curricula in Africa.

The development of policies based on collaborative partnerships is vital to the successful integration of NI in undergraduate nursing education. Guided by evidence-based practice, educators, nursing councils and other healthcare bodies should develop more feasible frameworks to guide the timely integration of contemporary and meaningful NI into

undergraduate nursing education. The outcome of NI integration is to better prepare graduate nurses for the African healthcare workforce and for the digital era.

### **Limitations**

This scoping review included published studies only, and the majority of them were from two countries (South Africa and Nigeria), which limits the generalization of the findings to the entire continent of Africa. Limitations also include omission of some relevant studies, particularly those published in a language other than English; or published before September 2009 and after September 2019.

### **Conclusion**

Due to the importance attached to the integration of NI in undergraduate nursing education, developing the ICT skills of nursing students should go beyond teaching basic computer skills and focus on the application of ICT skills in clinical practice. Developing the computer skills of students and faculty, provision of the necessary support and resources, and restructuring NI content and mode of delivery are crucial factors to successfully teaching NI to undergraduate students. Furthermore, a collaborative partnership between developed and developing countries was reported to be essential for NI due to the importance of setting platforms for sharing expertise and resources. This scoping review revealed that there is limited literature around NI in undergraduate nursing education in Africa. Many of the studies were exploratory and not predictive, and none of the studies pointed out the process or blueprint used to facilitate the integration of NI into undergraduate nursing curricula. Hence, further studies need to be conducted to analyse the integration of NI into undergraduate nursing curricula in developed countries, in order to explore best practice to integrate informatics in the education of nurses.

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### **Author contributions**

Study design: AH, KW, NB, KY

Data collection: AH

Data analysis: AH, KW, NB, KY

Study supervision: KW, NB, KY

Manuscript writing: AH, KW, NB, KY

Critical revisions for important intellectual content: AH, KW, NB, KY

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