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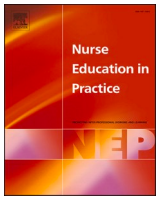

Nursing informatics and undergraduate nursing curricula: A scoping review protocol

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ABSTRACT

Aim: This scoping review aims to review contemporary published literature on Nursing Informatics education in undergraduate nursing education.

Introduction: Nursing is the largest workforce in health care and nurses are increasingly required to work with digital information systems. The need for nurses to understand and embrace information technology is closely linked with the ability to function in the contemporary healthcare workplace. However, despite the early adoption of Nursing Informatics in Australia in the 1980 s, there remain barriers to Nursing Informatics engagement and proficiency, including poor computer literacy, limited professional development and a lack of undergraduate informatics education.

Design: This scoping review will be developed in adherence with the JBI Manual for Evidence Synthesis: Scoping Reviews and the PRISMA-ScR Checklist.

Methods: To be included in this scoping review, papers need to include Nursing Informatics education for undergraduate nursing students in a Bachelor of Nursing program. Undergraduate nursing students are defined as individuals enrolled in a recognised nursing program leading to registration as a Nurse. To meet the requirements for registration as a Registered Nurse, in Australia, individuals are required to complete a Bachelor of Nursing program at a university (Australian Qualifications Framework Level 7) For the purpose of this scoping review, undergraduate nursing students are defined as those individuals undertaking a three year Bachelor of Nursing program at a university. Equivalent international definitions will be also used in the scoping review procedure. Sources of information will be included if they were published between 2015 and 2022 and describe curriculum recommendations (including barriers to implementing Nursing Informatics education). The purpose of the identified timespan is to reflect the rapidly evolving nature of health informatics and digital technologies. The requirement for curriculum recommendations is to reflect the purpose of the scoping review as the basis for a Delphi study, where Nursing Informatics and its integration into Bachelor of Nursing curricula will be explored and described in collaboration with domain experts.

Ethics and dissemination: Ethics approval has been obtained for this scoping review (Project ID: 2156) from the Flinders University's Human Research Ethics Committee and has been determined to be low risk.

1. Introduction

As the largest workforce in healthcare (Australian Institute of Health and Welfare (AIHW, 2016) nurses play a pivotal role in digital health through the use of digital health information systems (Australian Nursing and Midwifery Federation (ANMF, 2018). The need for nurses to embrace information technology, particularly in the clinical setting, has been strongly linked with an ability to effectively function in the contemporary healthcare environment (Chang et al., 2011). In 2014, the Australian Nursing and Midwifery Accreditation Council (ANMAC, 2014, p.4) stated that "the guiding principle for all learning and teaching strategies related to informatics and technology in health is that being technically competent is a fundamental element of caring." These technologies include electronic health records, telehealth and mobile

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smart applications.

1.1. Electronic Health Records (EHRs)

The adoption of electronic health records (EHR) has aimed to reduce costs, enable new models of healthcare delivery and increase the efficiency and quality of health care (Australian Digital Health Agency (ADHA), 2017). In Australia in 2012, the Personally Controlled Electronic Health Record (PCEHR) was launched with the purpose of allowing patients to become more involved in their digital health record (Hambleton and Aloizos, 2019). Subsequently, In 2016, the PCEHR was renamed My Health Record (Hambleton and Aloizos, 2019). Internationally, different digital health records have been implemented (ADHA, 2019). The introduction of EHRs have changed the ways where Nurses practice. Nurses now use EHRs for documentation, medication management, clinical decision-making and care coordination (Kutney-Lee et al., 2019).

1.2. Telenursing

Applications for telenursing have included home monitoring, video consultations, sharing of clinical information between the multidisciplinary team and the provision of support to the primary care provider (Hegney et al., 2007). More recently, telenursing applications have included the use of drones to deliver emergency supplies such as first aid and automated external defibrillators, the use of camera glasses which allow the patient to communicate the information they are seeing to emergency care Nurses and portable mobile healthcare devices which allow patients to have ongoing nursing assessment and monitoring (Balenton and Chiappelli, 2017).

1.3. Smart mobile applications

Mobile applications (apps) are now a mainstay of digital technologies and consumer and clinical health applications are easily accessible on multiple platforms. These mobile technologies are being used to support clinical practice, clinical education and patient safety (Bauman, 2016); but Nurses must be able to critically evaluate the quality of these applications, therefore "computer literacy is a survival skill for the profession" (Callinici, 2017, n.p.). The development of knowledge and skills in the use of information systems, communication technologies and the use of mobile applications, is strongly aligned with safe clinical practice (American Association of Colleges of Nursing (AACN, 2008). Therefore, the development of new knowledge and skills to assist Nurses in better supporting patients to evaluate and use mobile applications is essential (Ferguson and Jackson, 2017).

1.4. Barriers to the use of information technology

Barriers to the use of digital technologies continue to be an issue in the clinical setting, including poor computer literacy (Moule et al., 2010), limited workplace education and support (Kleib and Nagle, 2018), a lack of health informatics education in the undergraduate nursing sector (Borycki et al., 2013; Cummings et al., 2016) and confusion and uncertainty about what constitutes Nursing Informatics (Larson, 2017). Kleib and Nagle (2018, p.413), in exploring the factors associated with Canadian Nurses' informatics competency, concluded that "comprehensive integration of informatics in undergraduate nursing education, especially exposure to informatics applications used in clinical practice, is the key to ensuring Nurses' readiness for informatics prior to joining the workplace". Borycki and Foster (2014) noted that the deficits in undergraduate Nursing Informatics education are further complicated by a lack of Nursing Informatics competencies for graduate nurses, a coherent strategy for the integration of informatics competencies into the undergraduate curricula and investment in informatics technologies which simulate systems used in clinical settings. These findings continue to be relevant, with a recent study - *Are Future Nurses Ready for Digital Health: Informatics Competency Baseline Assessment* (Kleib et al., 2022), identifying key barriers to digital readiness and competence with information technologies including: limited use of EHRs prior to clinical placement, varied access and permissions to use EHRs whilst on clinical placement, limited exposure to more specialised Nursing Informatics applications, such as telehealth and a lack of understanding regarding the need for technology usage by senior undergraduate nursing students. Uncertainty about Nursing Informatics as a discipline and the significance of Nursing Informatics on patient outcomes continue to be ongoing concerns identified in the literature (Ayala et al., 2016; Cummings et al., 2017; Harerimana et al., 2022; Peltonen et al., 2019).

2. Objectives of the scoping review

Historically, there has been a lack of consensus on health informatics and digital health terminologies (Boogerd et al. (2015); Fatehi et al. (2020); Friedman (2012); Rowlands and Health Informatics Society of Australia (HISA (2019)), a lack of consistent Nursing Informatics competencies worldwide (Cummings et al., 2016; Honey et al., 2016), disparate undergraduate nursing education regarding Nursing Informatics (Honey et al., 2016), a lack of university faculty with Nursing Informatics' competence and expertise (Kinnunen et al., 2017) and a healthcare workforce not adequately prepared to work in the digital health sphere (Rowlands and Health Informatics Society of Australia (HISA (2019)). Therefore, this scoping review will address whether a distinct body of knowledge on Nursing Informatics can be further developed to be used to structure education for university faculty and Nurses in the clinical setting, inform undergraduate nursing curricula development and provide a blueprint for the development of Nursing Informatics competencies which align with the graduate attributes for specific tertiary institutions.

The scoping review questions are:

- Can a distinct body of knowledge of Nursing Informatics be developed?
- Can operational definitions for Nursing Informatics be achieved through consensus?
- Can a knowledge map be used to address current deficits in undergraduate nurse education and continual professional development education for nurses in regard to Nursing Informatics?

The overarching question is: *Can a distinct body of knowledge on Nursing Informatics be further developed to be used to structure education for university faculty and nurses in the clinical setting, to inform undergraduate nursing curricula development and provide a blueprint for the development of Nursing Informatics competencies, which align with the graduate attributes for specific tertiary institutions?*

3. Methods

Scoping reviews are a relatively new approach to reviewing literature (Pham et al., 2014; Raitskaya and Tikhonova, 2019; Sucharew and Macaluso, 2019; Verdejo et al., 2021) and are undertaken with the objective of providing an overview of existing evidence, mapping key concepts, defining working definitions and providing a broad overview of a topic (Peters et al., 2020). Scoping reviews tend to use a broader range of studies (than systematic reviews) and are useful when the literature has not been meticulously reviewed or with literature of a heterogeneous nature (Khalil et al., 2016; Munn, Peters, et al., 2018; Peters, Godfrey, Khalil, et al., 2015). They are an effective means of examining emerging evidence, when it may be unclear what additional research questions may be posed and may also be used to identify and map evidence relating to policy that seek to guide practice in a specific field (Peters et al., 2020). Indications for a scoping review include

identification and analysis of current knowledge gaps, clarifying working definitions, key characteristics and concepts in the literature, identification of available evidence in a specific field, examination of types of research in a specific field and as a foundation for a systematic review (Munn, Peters et al., 2018).

This scoping review protocol has been developed in adherence with Chapter 11 of the JBI Manual for Evidence Synthesis: Scoping Reviews (Peters et al., 2020) and the PRISMA-ScR Checklist (Tricco et al., 2018) for the purpose of undertaking a scoping review of Nursing Informatics and undergraduate nursing curricula. A description of the planned search of protocols and registrations, inclusion criteria, search strategy, source of evidence selection, data extraction, analysis of the evidence and presentation of the results are detailed below.

3.1. Protocols and registrations

In adherence with Chapter 11 of the JBI Manual for Evidence Synthesis: Scoping Reviews (Peters et al., 2020) and the PRISMA-ScR Checklist (Tricco et al., 2018), a search of existing review protocols should be performed. A search of both Cochrane and the JBI databases was performed in December 2020 and no existing review protocols were identified.

Registration of an a priori scoping review protocol is recommended, particularly if publication of the completed scoping review is intended (Pollock et al., 2021). This scoping review protocol was uploaded to OSF (Open Science Frameworks) on 10 August 2022 (https://osf.io/7qe39/; accessed 23 October 2022) but at the time of publication remains private.

3.2. Inclusion criteria

A scoping review protocol needs to clearly identify the eligibility or inclusion criteria and the types of sources of information to be included (Peters et al., 2020; Tricco et al., 2018). Peters et al. (2020) recommend the use of the PCC mnemonic (population, concept and context) to identify the focus and context of the review. The population of this scoping review is *undergraduate nursing students*, the concept is *Nursing Informatics* and the context is *education*. To be included in this scoping review, papers need to include Nursing Informatics education for undergraduate nursing students at any time during a Bachelor of Nursing program (or equivalent). Sources of information will be included if they were published between 2015 and 2022 and described curriculum recommendations (including barriers to implementing Nursing Informatics education). The purpose of the identified timespan is to reflect the rapidly evolving nature of health informatics and digital technologies. The requirement for curriculum recommendations is to reflect the purpose of the scoping review as the basis for a Delphi study, where Nursing Informatics and its integration into undergraduate nursing curricula will be explored and described in collaboration with domain experts.

3.3. Information sources

The description of the databases used to search for sources of information and the date of the most recent search should be identified (Peters, Godfrey et al., 2020; Tricco et al., 2018). "For the purposes of a scoping review, the *source* of information can include any existing literature, e.g. primary research studies, systematic reviews, meta-analyses, letters, guidelines, websites, blogs, etc." (Peters, Godfrey et al., 2020, p. 417). To identify potentially relevant sources, the following databases will be searched - CINAHL, Ovid, ProQuest, PubMed and Scopus and will include scholarly journals, books, reports, conference papers and proceedings. A search of the grey literature and a search of bibliography sources will be performed following the review of databases.

3.4. Search strategy

"The search strategy for a scoping review should ideally aim to be as comprehensive as possible in the constraints of time and resources tp identify both published and unpublished (grey or difficult to locate literature) primary sources of evidence, as well as reviews" (Peters, Godfrey et al., 2020, p. 418). A three-step strategy should be used (Peters, Godfrey et al., 2020) – the first step requires an initial limited search of two databases and analysis of text words in the title and abstract. The second step requires that all identified keywords be used across all included databases. The final step requires that the reference lists of selected full-text sources should be examined and included in the review (if relevant to the phenomenon of interest). In addition, the search strategy for at least one database should be described, so that it could be repeated if required (Peters et al., 2021). These requirements as described by Peters et al., (2020, 2021) will be adhered to and described in the scoping review.

3.5. Selection of sources of evidence

Following searches of the database using the a priori protocol and the removal of duplicate sources, the results will be screened using Covidence. Covidence is "a web-based collaboration software platform that streamlines the production of systematic and other literature reviews" and aids in the uploading of search results, the screening of abstracts and full text, completing data collection, review by two or more reviewers and exporting of data (Veritas Health Innovation, 2022).

3.6. First pass – title and abstract screening

The screening process will determine whether each article meets the eligibility criteria and will be included in the scoping review. This process will involve two specific stages: First Pass or Title and Abstract Screening and Second Pass or Full-Text Screening. The numbers of sources screened and assessed for inclusion and exclusion criteria and the reasons sources have been excluded at each stage, should ideally be presented in a flow diagram (Peters et al., 2021; Tricco et al., 2018). The procedure of selecting sources of evidence and resolving disagreements between reviewers must also be included in the scoping review (Peters et al., 2020; Tricco et al., 2018). This requires a narrative description of the source of evidence selection process, including how disagreements between reviewers were resolved (Duffett et al., 2013; Tricco et al., 2018). During Title and Abstract Screening, the PhD candidate will screen sources using the Covidence program in consultation with the PhD supervisors in weekly meetings and each source will be reviewed and discussed. To enhance trustworthiness of the screening process, an Excel spreadsheet will be developed and each excluded source will be categorised.

3.7. Inclusion of additional sources

The scoping review search can "be quite iterative as reviewers become more familiar with the evidence base, additional keywords and sources and potentially useful search terms may be discovered and incorporated into the search strategy" (Peters, Godfrey et al., 2020, p. 418). Therefore, other sources, from both grey literature and scanning reference lists of included sources, should be considered to ensure a comprehensive literature search is performed (Tricco et al., 2018).

Following the First Pass – Title and Abstract Screening, every reference list from the included sources of information will be reviewed for inclusion of additional relevant sources of information. The identified additional sources will then be added to Covidence for screening and possible inclusion.

Tricco et al. (2018) advises that a detailed account of the search for grey literature should be documented. *Grey Matters: a practical tool for searching health-related grey literature* (CADTH (Canadian Agency for

Drugs and Technologies in Health), 2021) is identified in the PRISMA-SCR as providing an approach to search for grey literature. A search of grey literature will be conducted using this tool. Identified additional sources will then be added to Covidence for screening and possible inclusion.

3.8. Second pass– full-text screening

This stage involves examining the full text of each source to determine if it meets the eligibility criteria and providing coherent reasons for exclusion of sources (Uni SA, 2021). During the second screening process, two reviewers will read the full text of articles for potentially relevant sources. Disagreements on study selection will be discussed in weekly PhD meetings with the PhD supervisors to arrive at a consensus.

3.9. Data extraction

Data extraction for a scoping review "should include extraction of all data relevant to inform the scoping review objective/s and question/s" (Peters, Godfrey et al., 2020, p. 435). The first requirement is to develop a standardised data extraction template and then pilot testing the use of this template with two or more reviewers extracting data from two to three papers (Pollock et al., 2021). The development of the template occurs during the scoping review protocol stage and is tested to ensure consistency and trustworthiness of the data extraction process; however, the template may be refined as the scoping review progresses. (Peters et al., 2021; Pollock et al., 2021). The process of data extraction requires two reviewers to limit the risk of errors and researcher bias and "can be an iterative process, often requiring multiple refinements to be able to best meet the objectives and research question(s) of the scoping review" (Peters et al., 2021, p. 8).

Prior to importing the sources to the Covidence platform, an excel spreadsheet will be developed in consultation with the PhD supervisors. The data extraction spreadsheet will record key information including authors, the reference, year of publication, country of origin, the aim and purpose of the study, the population and undergraduate curricula recommendations. This process will be used, in conjunction with the development of the search strategy, to ensure that the population (undergraduate nurses) concept (Nursing Informatics) and context (education) are reflected in the retrieved articles.

Once the sources of information have been imported to the Covidence platform, the data extraction template will be developed online (in consultation with the PhD supervisors). The data extraction template will replicate the data extraction spreadsheet by recording key information including authors, the reference, year of publication, country of origin, the aim and purpose of the study, the population and undergraduate curricula recommendations. Other information which will be added to the template include the sampling procedure, study design, possible conflicts of interest for authors and inclusion and exclusion criteria. It is recognised that this is an iterative process and additional categories may be identified at this time.

3.10. Analysis of the evidence

Methods of data analysis in a scoping review may include descriptive qualitative content analysis, frequency counts of the population, concepts and context or basic coding (Peters, Godfrey et al., 2020; Peters et al., 2021; Pollock et al., 2021) with results presented "in a logical, diagrammatic or tabular form, or in a descriptive format that aligns to the objectives and scope of the review" (Khalil et al., 2016, p. 121). Peters, Godfrey, et al., (2020, p. 421) caution that "qualitative content analysis in scoping reviews is generally descriptive in nature and reviewers should not undertake thematic analysis/synthesis…as this would be beyond the scope of a scoping review". The way where data is analysed and presented, predominantly depends on the purpose of the scoping review and the authors' judgment and it is therefore essential that the authors use a transparent and explicit approach which justifies the methodological decisions made (Peters, Godfrey et al., 2020).

The data analysis process aims to provide the reader with a logical, descriptive summary of the data which will be aligned with the previously established objectives and questions of the scoping review. Qualitative content analysis seeks to elicit meaning from the data by using the stages of decontextualisation, recontextualisation, categorisation and compilations to code and categorise data (Bengtsson, 2016). Content analysis can be used to quantify data by objectively identifying specific data in the text. Content analysis can be undertaken manually or by research software; at this time it is anticipated that manual coding will be used for this study with a content analysis framework.

4. Presentation of results

Collation and presentation of the results aims to identify the implications for policy, practice and research, with the conclusion reflecting the objective of the scoping review (Khalil et al., 2016). The method of data presentation should be described in the scoping review protocol (Peters et al., 2021). Peters et al. (2021) suggest the use of two sections; the first section provides a description of the search strategy results (with the inclusion of the PRISMA flow diagram); and the second section details the key information relevant to the scoping review questions.

Results will be presented with a description of the search strategy including the PRISMA flow diagram. Findings will be synthesised in narrative and tabular formats with recommendations for policy, practice and research reflecting the objective of the scoping review. Each source's summary will include key information including the authors, the reference, the year of publication, the country of origin, the aim and purpose of the study, the population and any undergraduate curricula recommendations. The findings will be classified as conceptual groups, for example: basic computer literacy, implementation strategies, barriers to implementation and benefits of implementation. A narrative summary will be provided which reflects the three scoping review questions and the overarching question.

5. Limitations

Tricco, n.p.) et al. (2018) identified that limitations in the scoping review process must be reported and any "deviations from guidance (for example the JBI methods guidance) or the scoping review protocol should be noted". As discussed previously, this scoping review protocol has been developed in adherence with Chapter 11 of the *JBI Manual for Evidence Synthesis: Scoping Reviews* (Peters et al., 2020) and the *PRISMA-ScR Checklist* (Tricco et al., 2018) and detailed descriptions have been provided for all of the required items.

In *A scoping review of scoping reviews: advancing the approach and enhancing the consistency*, Pham et al. (2014) noted that the most frequently reported limitation was the potential omission of relevant studies. The authors attributed this limitation to database selection, exclusion of grey literature, time constraints and exclusion of sources not published in English; these issues will now be discussed. As addressed in *Information sources*, CINAHL, Ovid, ProQuest, PubMed and Scopus have been selected as relevant databases; however, the authors acknowledge that other databases may be relevant for the review and this is a limitation in this approach. As addressed in *Additional Sources*, grey literature will be explored through the use of *Grey Matters: a practical tool for searching health-related grey literature* (CADTH, 2021). Scoping reviews are often viewed as aiming to rapidly map key concepts in a given research area (Arksey and O'Malley, 2005); however, caution must be exercised in approaching a scoping review in a thorough and thoughtful manner (Daudt et al., 2013). The authors acknowledge, that due to the time constraints of a PhD candidacy, there may be some time limitations; however, the focus will be on developing an in-depth and thorough review. The exclusion of sources, not published in English, was identified as an inherent limitation in the seminal work by Arksey and

O'Malley (2005, p. 24) *Scoping studies: towards a methodological framework,* with the authors noting that "whilst we had to adopt these limits for practical reasons, it is worth pointing out that potentially relevant papers could have been missed". Similarly, studies may be omitted from the proposed scoping review, if there is not access to an English translation and, consequently, relevant papers may be missed; however, this will be identified in the scoping review discussion.

Pham et al., (2014, p. 379) reported that other limitations included: "the balance between breadth and depth of analysis", a lack of critical appraisal of sources of information and a lack of methodological rigor. Tricco et al. (2016, n.p.) noted that "scoping reviews have inherent limitations because the focus is to provide breadth rather than depth of information in a particular topic". This finding is also reflected in other studies on scoping reviews, with Peters et al. (2021, n.p.) stating that "Any limitations in terms of the breadth and comprehensiveness of the search strategy should be detailed and justified". To justify the comprehensiveness of the search strategy, the authors will provide a complete search strategy for one database, so that the search can be replicated. In addressing the lack of critical appraisal of sources of information, Peters et al. (2021, n.p.) stated that critical appraisal is "generally not recommended in scoping reviews because the aim is to map the available evidence rather than provide a synthesized and clinically meaningful answer to a question". However, methodological rigor is essential and scoping reviews should be "well planned and driven by protocol" (Peters et al., 2021, n.p.). The development of this scoping review protocol aids in meeting these criteria.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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