Chapter 13
Applied Informatics Research in Nursing for eHealth

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Abstract In this chapter, the previous research priorities and defined topics are used to determine the present state of the art of applied nursing informatics. The aim is to describe how recent publications support previous nursing informatics research agendas. The Scopus database was searched to find studies focusing on Nursing Informatics and eHealth in the context of applied clinical informatics. The search yielded publications from the last decade (from 2010 until February 2020). The search results (N = 55) were analyzed and classified using the research topic areas (N = 20) defined by The Nursing Informatics International Research Network (NIIRN). The results revealed that the three highest number of publications of the search focused on "the development of decision support systems specific to nursing practice decisions," "the evaluation of the impact of HIT systems for nursing care on outcomes for patients", and the "evaluation of the impact of standardized nursing documentation content/meaning on the utility of information for feedback and quality improvement." One paper focused on "the development of electronic information systems providing real-time feedback to nurses about their practices/health care delivery to improve safety," which was previously assessed as the most important. Seven defined research areas had no publications. Future research should focus on the missing research priorities, such as the evaluation of quality, the use of telecommunications and social media, the design and management of databases, theory development, and the integration of genomic data. The present nursing informatics research agenda should be updated based on changes in practice and technological advancements. The results should be interpreted with caution, as the analysis purposefully focused on one journal specializing in applied clinical informatics. However, they indicate what we should focus on in applied nursing informatics and eHealth research in the future.

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Learning Objectives for the Chapter
1. Describe the key research topic areas for nursing informatics and eHealth.
2. Reflect the distribution of defined research topic areas during 1998–2013.
3. Assess how the latest research agenda corresponds to the published studies.
4. Define the limitations of the search results.
5. Discuss future research priorities.

13.1 Defining the Nursing Informatics Research Agenda for eHealth

The aim of this chapter is to describe how recent publications (2010–2020) support the nursing informatics agenda set for 2008–2018. Over the years, research agendas have been of interest among nursing informatics researchers (Brennan et al. 1998; Bakken et al. 2012; Dowding et al. 2013; Peltonen et al. 2016). At various times, distinct groups have identified important research topics following not only the overall adoption of Health Information Technology (HIT) but also the development of systems and devices, legislation, and guidelines to ensure confidentiality and the privacy of users and care providers (Block et al. 2011).

The evolving concepts in the field of nursing informatics have emphasized changes in research focus. Perhaps one of the broadest concepts is eHealth, which appeared in the informatics field in the late 1990s (Oh et al. 2005). In terms of nursing practice, the definition by Eysenbach (2001) is often used to describe the widespread use of the Internet and related technologies in health care. In his definition, "e" must not be interpreted only as electronic but also as education, encouragement, empowerment, evidence-based, ethics, and equity. Overall, eHealth means ways to improve efficiency, enhance quality, enable information flow, and extend the scope of health services. Eysenbach stresses that eHealth must not only be regarded as encompassing technical issues but as being more broadly connected to thinking, attitudes, and the commitment to improve health (Eysenbach 2001).

> eHealth characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology. (Eysenbach 2001)

In the early 2000s, eHealth was closely connected to telehealth and mobile health solutions as technological tools emerged in health services. eHealth adoption began among professionals, but patients and their families were soon seen as important actors (Saranto et al. 2017; Koivunen and Saranto 2017). Related to the broad definition of eHealth, clinical decision support, mobile health, big data science, the

evaluation and implementation of standardized terminologies, and education and competencies have been proposed as the five topic areas of nursing informatics research according to a broad international survey (Peltonen et al. 2016). Nursing informatics education and certification have been the leading factors in the implementation and use of technological tools and devices in nursing practice. It has also been obvious that nurses are working within an interdisciplinary context that requires partnership and collaboration not only in practice but also in the development and research of eHealth diffusion (Scott et al. 2017). However, nurses' participation in the development of HIT tools depends on their level of education and training. Nurses also need support from both colleagues and managers to practice on interdisciplinary teams (Brennan et al. 1998; Bakken et al. 2012; Dowding et al. 2013; Peltonen et al. 2016; Block et al. 2011; Oh et al. 2005; Eysenbach 2001; Saranto et al. 2017; Koivunen and Saranto 2017; Scott et al. 2017; Gassert and Salmon 1998; Kinnunen et al. 2019; Hübner et al. 2019).

One of the earliest nursing informatics research agendas was presented in 1992. Since then, research initiatives have been identified by several international and national expert panels (Bakken et al. 2012). The U.S. Public Health Service's National Institute of Nursing Research identified research priorities for nursing informatics in 1992, and the work continued with a Delphi survey in 1998 (Brennan et al. 1998). Many of these research initiatives have identified advances in health services and health informatics, helping patients shift from being passive recipients of care to active users of information technologies to support self-care. The implementation of electronic health records and the need for nursing language terms and taxonomies has been a research priority since the 1990s (Saranto et al. 2013).

Bakken et al. (2012) summarized the two previous initiatives (Brennan et al. 1998) to compile a nursing informatics research agenda for 2008–2018. Three new priority areas were defined in six research topics:

- User Needs

  - Identification of users' (nurses, patients, families) information needs

- Acquisition, Representation and Storage of Data, Information, and Knowledge

  - Develop, validate, and formalize nursing language terms, taxonomies, and classifications.
  - Design and management of nursing information databases for use in patient management, clinical records, and research

- Informatics Support for Nursing and Healthcare Practice

  - Technology development including decision support systems to support nursing practice (integrates human-computer interaction)

- Informatics Support for Patients/Families/Consumers

  - Patients' use of information technology
  - Consumer health informatics (New)

- Design and Evaluation Methodologies

  – Systems modeling and evaluation

- Use of telecommunications technology for nursing practice (New)

  – Professional practice issues (e.g., competencies, confidentiality) (New) (Bakken et al. 2012).

Parallel to Bakken's work, an international network implemented a study to find research priority areas for nursing informatics. The Nursing Informatics International Research Network (NIIRN) comprises a group of experts who are collaborating on developing internationally relevant research programs for nursing informatics. In 2012, NIIRN proposed international priorities for research in nursing informatics for patient care. The priorities were determined using an online survey of 468 respondents. Based on the survey results, 20 research topic areas were identified. The priorities were established based on the WHO world regions, Europe, the Western Pacific, South East Asia, the Americas, the Eastern Mediterranean, and Africa, thus representing the network participants. Although the ranking varied between the regions, the two highest-ranking topics were "the development of information systems that can provide real-time feedback" and "evaluation of the impact of HIT systems on patient outcomes." The two lowest-ranking topics were "theory development" and "the integration of genomic data into clinical information systems"(Dowding et al. 2013). Table 13.1 shows the 10 research priorities from 1998(Brennan et al. 1998) and the 20 research topic areas from 2012 (Dowding et al. 2013).

Both lists of research priorities (Table 13.1) are based on the consensus of individual researchers. Brennan (1998) argued that although already advanced in 1998, the missing topics in her list—imaging technology, formal education in health informatics, signal processing, and bioinformatics—may reflect their relevance to nursing practice. She also stressed the importance of interpreting the results as a national research agenda, prompting discussion on international research. Some 15 years later, the international Delphi panel prioritized 20 research topics, which included all the previously defined topics. However, due to the more descriptive wording of the topics, some previous topics could also be regarded a topic in the new list. Two examples are "patient use of information technologies, including consumer health informatics" and "technology development to support practice and patient care—decision support, human–computer interaction"(Dowding et al. 2013). In this chapter, all 20 research topic areas (Dowding et al. 2013) are used to determine the present state of the art of published applied nursing informatics and eHealth studies.

Table 13.1 NI Research priorities in 1998 and 2013

NI research priorities 1998 (N = 10) (Brennan al. 1998)	Rank	Research topic areas 2013 (N = 20) (Dowding al. 2013)	Rank
Standardized language/ vocabularies—development, testing, mapping	1	The development of electronic information systems that can provide real-time feedback to nurses about their practices/health care delivery to improve safety	1
Technology development to support practice and patient care—decision support, human-computer interaction	2*	Evaluation of the impact of HIT systems for nursing care (e.g. EHR) on outcomes for patients (safer care, better patient outcomes)	2
Data base issues (architecture, construction, access, cost etc.)	2*	The development of decision support systems specific to nursing practice decisions	3
Systems evaluation issues—re-engineering nursing, effectiveness	3	Investigation of the impact of HIT systems for nursing care (e.g. EHR) on nurses' work practices and workflow	4
Using telecommunications technology for nursing practice telenursing, home care, etc.	4*	The design and management of nursing information databases for use in patient management, clinical records and research	5
Putting technology into practice—systems models, demonstrations, etc.	4*	Effective ways of training nurses in the use of HIT to support new care delivery models	6
Information needs of nurses and other clinicians	7	The identification of outcomes associated with the quality of nursing care that are important to patients, which can be used to evaluate the quality of care provided by nurses	7
Patient use of information technologies, including consumer health informatics	8*	Evaluation of the impact of e-prescribing systems on nursing care, medication safety and patient outcomes	8
Nursing intervention innovations for professional practice electronic delivery of nursing interventions, testing effectiveness	8*	The role of patient-held electronic records on participation in their care, and quality of care	9
Professional practice issues (competencies, confidentiality)	9	Evaluation of the impact of HIT systems for nursing care (e.g. EHR) on outcomes for staff (e.g. less documentation, faster documentation)	10
		Evaluation of the impact of standardized nursing documentation content/meaning on the utility of information for feedback and quality improvement	11
		Identification of users' (nurses, patients, families) health information needs to inform the design of HIT systems	12
		The role of mobile technology (e.g. use of smart phones, tablet devices) in supporting nurses deliver high quality and safe health care	13

Table 13.1 (continued)

NI research priorities 1998 (N = 10) (Brennan al. 1998)	Rank	Research topic areas 2013 (N = 20) (Dowding al. 2013)	Rank
		Assessment of if and how decision aids for patients improves shared decision making between patients and nurses	14
		Investigation of how telecommunications technology and telehealth initiatives impact on nursing practice (e.g. in providing care to individuals in remote and rural areas)	15
		The development, validation and formalization of nursing language terms, taxonomies and classifications to support interoperability between HIT systems	16
		The development of more advanced methods for measuring the impact of HIT nurses' work and communication patterns	17
		Investigation of how social media (e.g. twitter, Facebook) may affect the ways patients interact with health care providers including nurses.	18
		Theory development to support the design of HIT that better meets the information and practice needs of nurses	19
		Integrating genomic data (information specific to the genetic makeup of patients) into the HIT systems used by nurses to inform nursing care content/meaning on the utility of information for feedback and quality improvement	20

*equal rank

13.1.1   The Review Process

A search of the Scopus database revealed various studies focusing on nursing, informatics, and eHealth in the context of applied clinical informatics, concepts that were also used as the keywords. Based on the published nursing research agenda in 1998 (Brennan et al. 1998), in 2012 (Bakken et al. 2012), and in 2013 (Dowding et al. 2013) the time frame was set as 2010–2020. The search result (N = 55) was extracted from the database, including bibliographic information for the papers and abstracts with keywords. The first screening of the titles revealed three papers that focused purely on medicine. Based on the abstracts, 10 papers that did not focus on nursing or patient care or that were more strategic in nature were identified. These were excluded. All the other studies were included in the review. Thus, 42 papers were accepted for the review (Fig. 13.1).

The papers were classified according to the research topic areas (N = 20) defined by NIIRN (Dowding et al. 2013). Papers were classified by the authors separately, and in four cases consensus was reached through discussion.
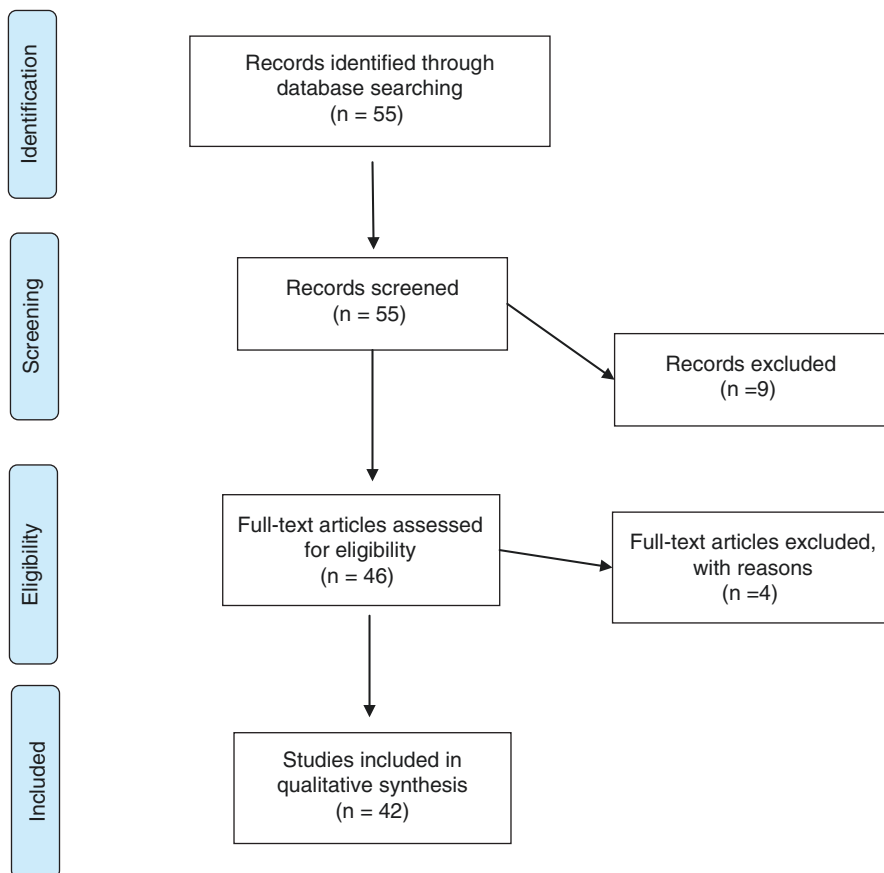
Fig. 13.1 Flowchart of literature search. (Moher et al. 2009)

13.1.2 Research Evidence Based on Nursing Informatics Research Agenda

The studies (N = 55) found in the literature search represent different WHO world regions: Europe (n = 11), South East Asia (n = 3), and the Americas (n = 41). The number of papers based on publication year are as follows: 2019 (Scott et al. 2017); 2016 (Koivunen and Saranto 2017); 2015 and 2011 (Oh et al. 2005); 2014 (Block et al. 2011); 2017, 2013, and 2012 (Peltonen et al. 2016); 2018 and 2010 (Dowding et al. 2013); and 2020 (Brennan et al. 1998). After exclusion and based on the analysis of the papers (n = 42), the results show that the three highest number of publications in the research topic areas focused on "the development of decision support systems specific to nursing practice decisions" (n = 8), "the evaluation of the impact of HIT systems for nursing care (e.g., EHR) on outcomes for patients (safer care, better patient outcomes)" (n = 6), and "evaluation of the impact of standardized

nursing documentation content/meaning on the utility of information for feedback and quality improvement" (n = 6). Table 13.2 describes the state of the art based on the number of papers in each prioritized research category and the ranking in 2013 and 2020 (Table 13.2).

Table 13.2 Research evidence in 2020

Rank 2020	Number of papers 2020 (N = 42)	Research topic areas 2020 based on number of publications	Rank 2013
1	8	The development of decision support systems specific to nursing practice decisions	3
2	7	Evaluation of the impact of HIT systems for nursing care (e.g. EHR) on outcomes for patients (safer care, better patient outcomes)	2
3	6	Evaluation of the impact of standardized nursing documentation content/meaning on the utility of information for feedback and quality improvement	11
4	4	Assessment of if and how decision aids for patients improves shared decision making between patients and nurses	14
5	3	Investigation of the impact of HIT systems for nursing care (e.g. EHR) on nurses' work practices and workflow	4
6	3	Identification of users' (nurses, patients, families) health information needs to inform the design of HIT systems	12
7	3	The development, validation and formalization of nursing language terms, taxonomies and classifications to support interoperability between HIT systems	16
8	2	The role of patient-held electronic records on participation in their care, and quality of care	9
9	2	Evaluation of the impact of HIT systems for nursing care (e.g. EHR) on outcomes for staff (e.g. less documentation, faster documentation)	10
10	1	The development of electronic information systems that can provide real-time feedback to nurses about their practices/ health care delivery to improve safety	1
11	1	Effective ways of training nurses in the use of HIT to support new care delivery models	11
12	1	The role of mobile technology (e.g. use of smart phones, tablet devices) in supporting nurses deliver high quality and safe health care	13
13	1	The development of more advanced methods for measuring the impact of HIT nurses' work and communication patterns	17
14	–	The design and management of nursing information databases for use in patient management, clinical records and research	5
15	–	The identification of outcomes associated with the quality of nursing care that are important to patients, which can be used to evaluate the quality of care provided by nurses	7
16	–	Evaluation of the impact of e-prescribing systems on nursing care, medication safety and patient outcomes	8
17	–	Investigation of how telecommunications technology and telehealth initiatives impact on nursing practice (e.g. in providing care to individuals in remote and rural areas)	15

Table 13.2 (continued)

Rank 2020	Number of papers 2020 (N = 42)	Research topic areas 2020 based on number of publications	Rank 2013
18	–	Investigation of how social media (e.g. twitter, Facebook) may affect the ways patients interact with health care providers including nurses.	18
19	–	Theory development to support the design of HIT that better meets the information and practice needs of nurses	19
20	–	Integrating genomic data (information specific to the genetic makeup of patients) into the HIT systems used by nurses to inform nursing care	20

One paper was identified as focusing on the most import defined topic in 2013, "the development of electronic information systems that can provide real-time feedback to nurses about their practices/health care delivery to improve safety." The three lowest-ranked priorities were the same in this review and in the 2013 priority list. Altogether, seven defined research topic areas had no publications.

13.1.3   What Is This All About?

This paragraph summarizes the findings in relation to the Nursing Informatics Agenda for 2008–2018 published by Bakken et al. (2012). The same structure is used as in the beginning of the chapter to highlight the research gaps that need to be addressed in future studies. The observations proposed here must be interpreted in light of the strengths and weaknesses discussed at the end.

User Needs

In software design, users' needs are the basis of a successful system. Some studies addressed the topic "identification of users' (nurses, patients, families) health information needs to inform the design of HIT systems", focusing on both professionals' and patients' needs (Kneale et al. 2016; Rogers et al. 2012). It was ranked fifth based on the publications. Decision support was of interest from two perspectives—"the development of decision support systems specific to nursing practice decisions" and the "assessment of if and how decision aids for patients improves shared decision making between patients and nurses"(Jeffery et al. n.d.). The nursing practice perspective was ranked as highest based on the number of studies, and shared decision making between nurses and patients was ranked fourth in this review. As the latter was ranked fourteenth in 2013, it seems there is evidence that patients have changed from being passive recipients of care to active users of information technologies (Brennan et al. 1998).

There were no publications on the topic "genomic data integration (information specific to the genetic makeup of patients) into the HIT systems and use by nurses. "Obviously, however, this topic has relevance in the future of nursing informatics research.

Acquisition, Representation, and Storage of Data

Nursing documentation structures and terminology use have been widely studied in the previous decades (Saranto et al. 2013). In this review, the topic "evaluation of the impact of standardized nursing documentation content/meaning on the utility of information for feedback and quality improvement" also ranked as the second research area. Further, there were also publications (Applied Clinical Informatics 2017; Hoonakker et al. 2019; Johnson et al. 2013) on "the development, validation and formalization of nursing language terms, taxonomies and classifications to support interoperability between HIT systems" and the "evaluation of the impact of HIT systems for nursing care (e.g., EHR) on outcomes for staff (e.g., less documentation, faster documentation)". Design issues were represented in this area by the topic "the design and management of nursing information databases for use in patient management, clinical records and research." However, we could not find any publication on this topic. Although economic or resource issues were present in the background of the studies, they were not highlighted in the study design as would have been expected (Koivunen and Saranto 2017). All these topics under this research area must obviously be included among the research priorities in the near future.

Informatics Support for Patients/Families/Consumers

Nursing care is no longer just provided in face-to face appointments; technology is increasingly being used to facilitate remote care (Koivunen and Saranto 2017). Surprisingly, only one study (Ranegger et al. 2014) represents this important evolving service. The topic "role of patient-held electronic records on participation in their care, and quality of care" previously ranked eleventh compared to ninth in 2013 (Dowding et al. 2013). In today's technology-oriented health care, patients' active role in the management of, for example, chronic diseases is increasingly emphasized (Block et al. 2011; Korach et al. 2019; Gartrell et al. 2015). Overall, the role of family is neglected, which is interesting as we found several studies on acute and long-term care where cooperation with families is evident. Further, we did not find any studies in the pediatric context.

Informatics Support for Nursing and Healthcare

In this review, we only found one study (Denecke et al. 2019) focusing on competencies for the topic "effective ways of training nurses in the use of HIT to support new care delivery models". This is surprising, as education and training have been regarded as the main priority in HIT implementation.

Further, as legislation and guidelines to support the confidentiality and privacy of users and care providers was not set as a research topic among the research priorities, we could not identify any studies in the area. However, in previous studies data security has been connected to technology use in health care, especially in secure and more effective communication(Koivunen and Saranto 2017). In our review, communication was often mentioned in the research priorities related to the development of more advanced methods to measure communication patterns.

In many countries, nurses are also involved in e-prescribing(Kannry et al. 2016; European Federation of Nurses Associations (EFN 2015). The topic "the evaluation of e-prescribing systems on nursing care" was internationally ranked eighth in 2013 (Dowding et al. 2013), but we found no papers related to that topic. The changes in roles and responsibilities in providing care call for research from various perspectives. Many studies had a sound theoretical basis. However, we could not identify a single study for the topic "theory development to support the design of HIT that better meets the information and practice needs of nurses."

Use of Telecommunications Technology for Nursing Practice

In the previous survey in 2016, mobile health and data exchange and interoperability were among the 10 research priorities (Peltonen et al. 2016). In this review, the role of mobile technology (e.g., use of smart phones, tablet devices) in helping nurses deliver high-quality, safe health care was addressed in only two studies (Villaseñor et al. 2017; Hayakawa et al. 2013). Surprisingly, there were no papers on topics such as the "investigation of how telecommunications technology and telehealth initiatives impact on nursing practice (e.g., in providing care to individuals in remote and rural areas)" and the "investigation of how social media (e.g., Twitter, Facebook) may affect the ways patients interact with health care providers, including nurses." Bakken et al. (2012) highlighted the importance of focusing research on informatics support for patients, consumers, and families. This would involve future technologies to empower patients and professionals to collaborate more efficiently in various situations. This is also connected to changes in health services, as we need more knowledge about patients' involvement in care processes.

Design and Evaluation Methodologies

Many topics started with the word evaluation (Smith et al. 2019; Bersani et al. 2020), which was connected to the impact of a special focus, such as "evaluation of the impact of HIT systems for nursing care (e.g., EHR) on outcomes for patients (safer care, better patient outcomes)" or the "investigation of the impact of HIT systems for nursing care (e.g., EHR) on nurses' work practices and workflow". These studies focused on usability issues and user satisfaction. As indicated in the phrases, outcome measures are important to prove nurses' input in nursing care. HIT implementation has also been connected to patient safety and, more broadly, to quality of care, which were also focal topics in the publications. The review covered various research designs, not only quantitative and qualitative but also mixed methods. Almost

missing was predictive models or hypotheses testing. However, the review contained studies with the secondary use of registered data (Bowles et al. 2016; Holmgren et al. 2016; Westra et al. 2018). In many studies, an interdisciplinary approach could also be discovered, which was also mentioned in the agenda (Bakken et al. 2012). An interdisciplinary approach can open new possibilities for research funding and advance the dissemination of research results (Scott et al. 2017). As mentioned, we only had one paper classified in the topic relating to informatics competencies "effective ways of training nurses in the use of HIT to support new care delivery models." Therefore, we must not forget that nurses also need competencies in research methods to be able to use standardized instruments in research designs and to participate in the development of tools and technologies and new ways of providing services.

This review has some limitations that must be considered. First, this literature search purposefully targeted only one database focusing on applied clinical informatics and eHealth. This naturally results in major bias, but the situation is still described from a certain perspective, thus providing ideas for further research. For the analysis, only papers focusing on nursing or patient care were accepted. Surprisingly, we had to exclude 13 papers, although the term nursing was used as a keyword. These papers were also describing the status of medical informatics or strategy papers. In the strategy papers, the focus was on eHealth in two cases; these were excluded from this review.

The studies in the review represent different WHO world regions—Europe, South East Asia, and the Americas. Studies from the Western Pacific, Eastern Mediterranean, and Africa did not appear in the search, which constitutes a bias. The research topics defined in 1998 were very different in wording compared to those defined in 2013. The topic descriptions in 2013 have nouns such as assessment, development, evaluation, investigation, and identification, which clearly indicate what the research might be about (Peltonen et al. 2016). However, the real focus description—"the identification of outcomes associated with the quality of nursing care that are important to patients, which can be used to evaluate the quality of care provided by nurses"—has many elements that could represent the main aim of a study. Further, the topic "evaluation of the impact of HIT systems for nursing care (e.g., EHR) on outcomes for patients (safer care, better patient outcomes)" was obviously more accurate, as we easily found six studies in this area. There were also studies on this topic published during the whole decade, as there were for the highest-ranked topic, "the development of decision support systems specific to nursing practice decisions." Nevertheless, the structure of in-depth defined topics may have caused problems in interpreting and classifying our review data.

Following are important research topics for the future (slightly re-worded from the previous agenda):

- User needs—from various perspectives (e.g., development of systems, services, usability)
- Acquisition, representation and storage of data from various sources (e.g., registry-data, patient- generated data, data re-use and privacy)
- Informatics support for patients/families/consumers, including empowerment, collaboration, and extension of the scope of health services
- Informatics support for nursing and healthcare, including ethics, economics, and interdisciplinary practice

- Knowledge, skills, and competencies for the evolving care environment
- Use of telecommunications technology for nursing practice and for patient/family participation
- Development and testing of theories in nursing informatics research

In conclusion, the importance of nursing informatics and eHealth research agendas must be stressed because they can be used to find evidence of the state of the art of published research. Nursing informatics research topics are commonly discovered in daily practice routines and address future eHeath research priorities. Research priorities in informatics should be accurate and clearly covering the focus of the research.

Review Questions
1. Reflect on the text in the beginning of the chapter and define the key research priorities for nursing informatics research during the last decade in terms of applied informatics research in nursing for eHealth.
2. How does the research agenda correspond to the publications published during the last decade?
3. How can you define what topics urgently need more research in nursing informatics?
4. What are the limitations of the search results?

Answers
1. The research agenda defined by Bakken et al. (2012) gives guidance, and the list of priorities is presented in Table 13.1.
2. This can be seen in Table 13.2. Almost half of the publications were classified into three research topic areas—the development of decision support systems specific to nursing practice decisions, the evaluation of the impact of HIT systems for nursing care (e.g., EHR) on outcomes for patients (safer care, better patient outcomes), and the evaluation of the impact of standardized nursing documentation content/meaning on the utility of information for feedback and quality improvement. The other half can be classified into 10 research topic areas. Seven research topic areas did not have any publications. Further, several research topics had only a few publications, and the rank based on number was different compared to the early research priority lists.
3. Based on the international priorities for research in nursing informatics, we should focus on those topics not covered in this review. However, we can also use the agenda described by Bakken et al. (2012) and in the paragraphs after the description of the review.
4. The review is based only on the search of one database. The keywords used in the literature search may have been too simple, and more synonyms could have been used.

Glossary

HIT Health Information Technology
NIIRN Nursing Informatics International Research Network

Taxonomy Taxonomy is the process of naming and classifying things such as animals and plants into groups within a larger system, according to their similarities and differences.

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