The benefits and challenges of using electronic health recording system from nurses' perspective

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Laurea University of Applied Sciences   **Abstract**
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As electronic health recording systems (EHRs) have been taken into use in the clinical field, the patients' data have become interoperable between different health care professionals in different units and in different regions. The EHRs are expected to make a significant impact on health care outcomes and clinical practices. The end users of EHRs include nurses, physicians, secretarial staff, pharmacists, other healthcare professionals, and even patients. End users' experiences are commonly studied for a better design, implementation and development of computer systems. However, most of the EHRs related studies have focused only on physicians' experiences. Few studies directly consider the nurses' perspective on using EHRs. The purpose of this thesis is to describe the benefits and challenges of using electronic health recording systems from the nurses' perspective.

A literature review was chosen as the research method. Peer-reviewed articles were collected through three research databases: Laurea FINNA, CINAHL and ProQuest. Ten articles were then chosen for a thorough review. The results of these articles were analyzed with the inductive content analysis method.

Eight main categories were identified. Three of them describe the benefits of using EHRs: improvements in work efficiency, improvements in the quality of nursing documentation and improvements in patient care. Challenges were categorized into increased workload, record quality and security concerns, patient safety concerns, technology and IT related issues, and insufficient organizational support. The results show that nurses can benefit from EHRs even if there are challenges in the use of these systems.

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1   Introduction

The quality and the quantity of the patient data influence not only the quality of care but also the continuity of the care (Häyrinen, Saranto, Nykänen 2008). Good nursing is dependent on information about the individual patients and their past medical history. Nurses also contribute an essential part of the patient health recording along with other healthcare professionals (Currell & Urquhart 2003).

Advancements in the information and communication technology have changed work routines and practices in practically all the fields. Health care services are also experiencing this transformation. Specifically, in the nursing field, the traditional paper-based nursing documentation has been gradually replaced by electronic health recording systems or EHRs. According to Hämäläinen, Reponen, and Winblad (2015), in Finland, for example, electronic patient records are electronically stored in all of the hospital districts and health care centers. Further still, the next step in progress has been the harmonization of the data formats and the interfaces to allow the exchange of patient information between different hospitals. Hospital district also started joining the national central patient record archive ("Kanta") to make the data interoperable nationwide.

The project of building interoperable electronic health records for entire Finland also includes nursing data (Tanttu 2017). Nursing recording systems are branches of electronic health recording systems, that record the planned and given care to individual patients (Currell, Hardiker, Urquhart 2009). Nursing documentation is not just an administrative tool. A well-designed nursing documentation system can improve patient safety and continuity of care, while an inconsistent and inaccurate recording system may have a detrimental effect on nursing practice and patient care (Currell & Urquhart 2003).

Although there are significant achievements in the adoption and the coverage of the health record systems, the experiences of adopting and adapting to using the electronic health recording system from the end-users should not be overlooked.

The current literature of electronic health record systems focuses on the experiences of adopting electronic health record systems from the perspective of physicians, while few studies examine this from the nursing perspective. This is unfortunate, as nurses, after all, form a large part of the personnel working in health care services and are responsible for a lot of the patient recording. The purpose of this thesis is to review the research literature on benefits and challenges nurses have faced while adopting the electronic health recording system in their daily practice. The methodology chosen for this study is a literature review.

2 Theoretical background

2.1 Electronic Health Record

The International Organization for Standardization defines the electronic health record (EHR) as the "repository of information regarding the health status of the subject of care in computer processable form" (ISO/TR 20514:2005). The purpose of EHR is "the support of continuing, efficient and quality integrated health care" (ISO/TR 20514:2005), the records should be saved and transmitted securely, and they must be accessible by multiple authorized users. The records must also have "standardized or commonly agreed logical information model" and the information should be usable retrospectively, concurrently and prospectively. (ISO/TR 20514:2005)

The digitalization of patient records did not occur until recent years when the information technology, the Internet, and mobile technology started blooming. Before that, the data, including handwritten notes, typed reports, and test results were all stored in a paper file system. The US non-governmental Institute of Medicine (IOM) committee suggests that by improving clinical data infrastructure building, integrating the evidence-based knowledge into clinical decision making, and by ensuring continuity of care, medical errors can be prevented dramatically. The development of the information technology has enabled the health care professionals to share patients' information and the patients to get access to their records, make appointments, or have an online diagnosis and prescription (Gartee 2012).

As the technology of electronic health recording has evolved, the terminology related to the electronic health record systems has been developed as well. The term EHR has frequently been used interchangeably with electronic medical recording (EMR) and personal health record (PHR). Their meanings are not the same, however, as shown in Figure 1.
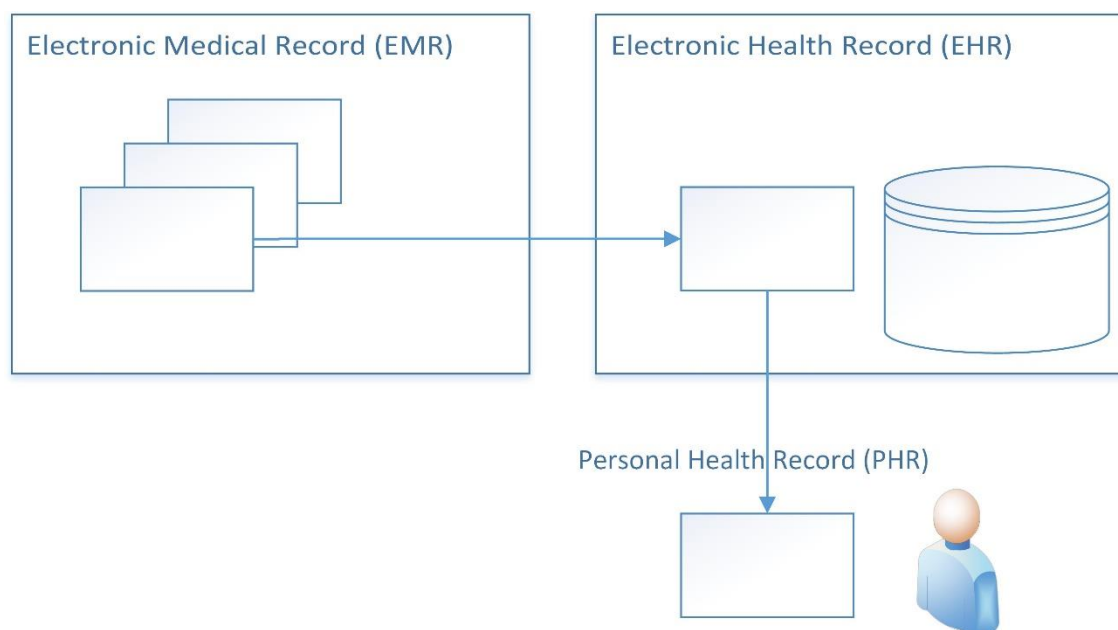
Figure 1: Relationship between Electronic health recording system (EHR), electronic medical record (EMR) and Personal health record (PHR)

By definition, EMR is: "a digital version of a paper chart that contains all of a patient's medical history from one practice and is mostly used by providers for diagnosis and treatment" (HealthIT.gov 2014). As shown in the figure, the data of EMR is generated and used in one provider while EHR can be used by more than one provider as any authorized parties can create and manage patients' data.

Compared to EMR and EHR, personal health record (PHR) serves the needs of individuals other than health care professionals. The personal health record is defined as "an electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment" (Markle Foundation 2003, cited in Tang et al. 2006, 122). An example of this is "my Kanta" Service, which is a nationally offered personal health record system for healthcare services, pharmacies, and citizens. With this service, Finnish citizens can get access to and manage the data related to their health record, consent information, living will, and organ donation testament. Electronic prescription and patient data repository can be used by the health care providers and the pharmacies as well (Terveysarkisto 2016).

2.2 Electronic health recording system

Electronic health recording system (EHRs) is considered as a documentation tool, which uses the acknowledged code or language for the purpose of better quality and more efficient and

continuing integrated health care (Hamilton 2011). There has been a trend to integrate patient portals with doctors' notes, pharmacy's supplies and billing information, and other health professionals' records (Top Mobile Trends 2014).

Compared to paper form documentation system, the EHRs have the advantage of allowing access to the information without the limitation of location and the number of users; they have more readable text and more incorporated data (Siegler & Adelman 2009). A study by Menanchemi and Collum (2011) focuses on the effects of EHRs on the organization and clinical outcomes. It was found out that EHRs are expected to benefit the organization by increasing the income, saving costs, improving the legal compliance, making research easier to conduct and increasing physicians' job satisfaction. As for the clinical outcomes, the EHRs had a positive influence by reducing the unnecessary tests, increasing compliance with care guidelines, and reducing medicine errors through the risk alert system. EHR's disadvantages were the financial burden of purchasing, developing, implementing and maintaining the systems; risks associated with data confidentiality and security; temporary distracting the workflow and temporarily decreased productivity; undesired outcomes due to the features of technology and lack of IT support staff (Menachemi & Collum 2011).

The main users of EHRs include nurses, physicians, patients, secretarial staff, pharmacists, and other healthcare professionals like laboratory staff. Being at the frontline of delivering care and coordinating other health professionals, nurses contribute a significant part of patients' data (Currell & Urquhart 2003). In this paper, EHR-systems are studied from the perspective of nurses.

2.3   Nurses

According to International Council of Nurses (ICN), a nurse is "a person who has completed a program of basic, generalized nursing education and is authorized by the appropriate regulatory authority to practice nursing in his/her country" (International Council of Nurses 1987). In Finland, a registered nurse must complete a bachelor degree which is offered by Universities of Applied Sciences. The National Supervisory Authority for Welfare and Health (Valvira) authorizes the qualified applicants' rights to practice the profession of a nurse. Even though the public health nurses, midwives, and paramedics also have the right to work as registered nurses (National Supervisory Authority for Welfare and Health 2015), in this thesis, they are not included in the study group.

One of the responsibilities of the nurses is documenting their work. In Finland, it is a legal obligation to record the relevant data concerning patient care. On top of that, the Finnish nurses are also required to use the information technology tools. National Finnish eHealth and eSocial Strategy 2020 sets strategic objectives for the development of information systems for

well-being and service renewal. These include empowering citizens to access and record their data, providing professionals with smart systems, improving utilization of resources by the help of IT, refining the information for knowledge management and harmonizing information exchange. These future directions require nurses to have a good command of informatics and eHealth tools. (Finnish Nurses Association eHealth expert working group 2015)

2.4 Electronic recording systems in nursing documentation

Nursing documentation has followed the trend of digitalization. The College of Registered Nurses of British Columbia (CRNBC) defines nursing documentation as "any written or electronically generated information about a client that describes the care or service provided to that client."(CRNBC 2013, 5) Nursing documentations are recorded by qualified nurses or other caregivers under the direction of a qualified nurse (Currell & Urquhart 2003).

Nursing documentation provides a communicative tool for nurses and other health care professionals about patients' health status, nursing intervention and outcomes of the care (CRNBC 2013). It is also believed to help the nurses to make evidence-based decisions thanks to the large pool of data. When it comes to the legal issues, documentation can be used as evidence to check if nurses' practices have met the professional standards (CRNBC 2013).

In order to make the nursing data exchangeable between the health care providers, a common structured nursing language has been developed. The Clinical Care Classification (CCC) system is most widely used in coding nursing actions into electronic health record. CCC system version 2.5 contains 176 Nursing Diagnoses, 201 Core Nursing Interventions and 528 Outcomes under the main 21 Care themes (Saba 2010). The CCC system benefits nurses by providing a standardized terminology framework to assess, document, and classify the essential part of the patient care (Saba 2010). In Finland, the project of implementing the common structured clinical language in EHRs started in 2003. Moreover, standardizing nursing data is also part of the project. Based on the CCC system, the Finnish Care Classification (FinCC) has been introduced to the nursing documentation. (Hämäläinen et al. 2007)

Commonly used recording systems for documenting the nursing care can be categorized into the methods of narrative charting, problem-oriented method, source-oriented method and focus charting (Ioanna, Stiliani, Vasiliki 2007).

	Description and components	Advantages	Disadvantages
Narrative charting	In chronological order	Reflecting sequence of time	Time-consuming, unable to reflect the nursing process
Problem-oriented	A Database, list of problems, care plan, progress notes	Easy to corporate among health care professionals and easy to follow the problem	Time-consuming and repetitive evaluation and interventions
Source-oriented	Organized based on source of data	Easy for recorders to locate their files	Chronological information is hard to locate
Focus charting (F-DAR)	Data, action, response	Reflecting well the nursing process	

Table 1: Types of recording systems

Narrative charting document is a document organized in a chronological order and is recorded in the sequence of time. This method is commonly used but is criticized for being a time-consuming and repetitive style for the documentation (Blair & Smith 2012).

According to Ioanna et al.(2007), problem-orientated nursing documentation method has been designed to solve the shortcomings of narrative documentation wich often fails to reflect the nursing process. It contains a database, a list of problems, care plan, and progress notes. The *Database* contains all the information about the patient, such as visits to the hospital, nursing evaluation, medical history, social and family elements. *List of problems* originates from a database, which functions as a reminder to keep the problems visible. The *care plan* is created by nurses based on nursing assessment, implementation, and evaluation. *Progress notes* are contributed by all the health care professionals involved in patient care (Ioanna et al. 2007).

The source oriented recording is organized by source providers. The nurses' written notes contain routine care, results of care, and other issues of the patients. It is easy for the recorder to locate their entries, but on the other hand, the files are scattered without being systematically organized (Yu 2006).

Focus charting method (F-DAR) consists of data (D), action (A), and response (R). Nurses make initial assessments and draft a nursing care plan based on those assessments. Then, they implement the care plan and evaluate the care eventually. This framework provides more organized nursing progress evidence for clinical decision making (Ioanna et al. 2007).

A significant amount of resources has been invested in electronic nursing information systems as they are believed to provide better information than traditional manual systems (Currell & Urquhart 2003). However, the findings of the effect of implementing EHR remains debateable. Müller-Staub, Needham, Odenbriet, and Lavin (2007) concluded that better documentation was not necessarily connected with better care. In contrast, Banner and Olney (2009) argued that a well-designed system can spare more of the care professionals' time for the patients by reducing the time spent on documentation.

3   Purpose of the study and research question

The purpose of this thesis is to describe the benefits and challenges of electronic health recording systems used by nurses.

The research question is "What are the benefits and challenges of using electronic health recording systems from nurses' perspective?"

4   Research method

In this thesis, a literature review was chosen as the research method to answer the research question. A literature review is a synopsis of current research related to a specific topic through the process of critical re-analysis and re-assessment of those findings (Parahoo 2006). In this context, the purpose of this thesis is to summarize the published research related to the benefits and challenges of nurses' using electronic health recording systems.

When carefully carried out, a literature review has clear objectives with the pre-defined eligibility criteria. It can be reproducible and explicit, and it should include maximum possible literature based on the pre-set criteria. It includes an assessment of the validity of the findings and a systematic presentation of the finding (Higgins JPT n.d. 2008, 6). In this study, the review protocol has followed the steps described by Aveyard: literature search, literature appraisal, data extraction, data analysis and result presentation (Aveyard 2010).

4.1 Literature search

This literature search was conducted through Laurea library's search interface: LAUREA FINNA, which is a collection of library's print and electronic materials, and EBSCOhost and ProQuest Central research databases. Keywords used in the searches were, "electronic health record," "electronic medical record," "nurses," "benefits and challenges" which were combined in different ways with the Boolean operator "and." The keywords were also searched using the common stem, such as "nurs" in order to include different variations of the words. The search was limited to the title and abstract. The preliminary search criteria had been set beforehand: 1) literature is published from 2007 to 2017; 2) literature is written in English only; 3) Full text is available and 4) articles are peer review. The data search was conducted in March 2017. The search process is illustrated in Table 2.

search engine	terms	electronic health records AND Nurse (title)AND benefits and challenges	electronic health record AND nurse (t)	total number of results
FINNA	Total hits	167	256	423
	1st screened	3	22	25
	2nd screened	1	4	5
EBSCOhost	Total hit	0	65	65
	1st select	0	18	18
	2nd select	0	1	1
ProQuest Central	Total hit	301	778	1079
	1st select	12	26	38
	2nd select	2	2	4
Total number of articles	Total hit	468	1099	1567
	1st select	15	66	81
	2nd select	3	7	10

Table 2: Data search process

A total of 1567 hits were yielded through the three databases. By the first screening, 1269 articles were discarded due to the irrelevance of the title. During the second screening, 217 irrelevant articles were excluded by reviewing both the title and abstract. After that, 81 articles remained for the next selection. 71 articles were further excluded due to the following exclusion criteria: duplicates (n=11), irrelevance to the research question (n=28), subjects mixed nurses with another group (n=18), unsuitable paper (n=9), the experience of nurses expecting of using EHRs (n= 5). In total, ten articles were included for the review. The literature selection process is illustrated in Figure 2.
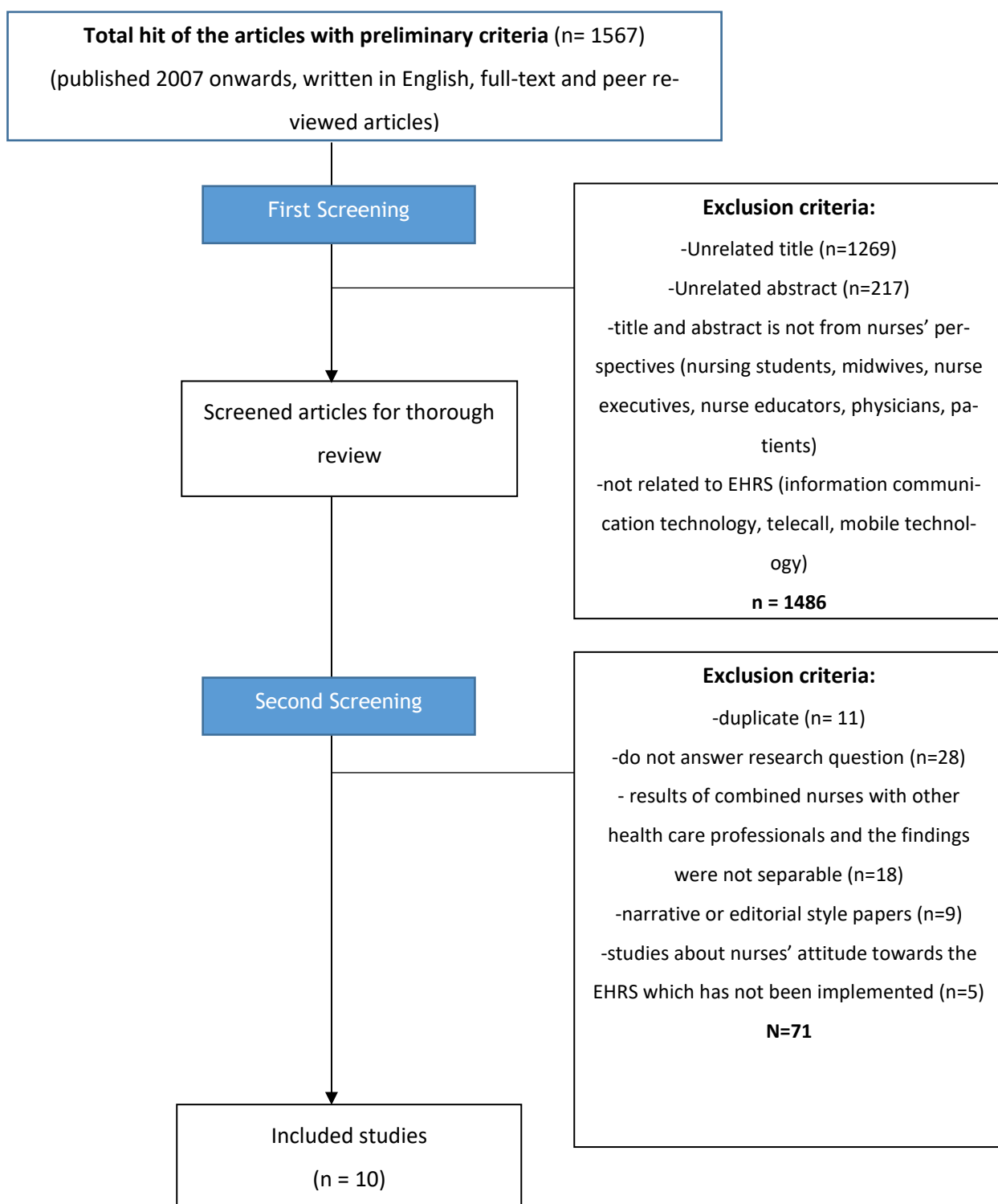
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┌─────────────────────────────────────────────────────────┐
│ Total hit of the articles with preliminary criteria (n= 1567) │
│ (published 2007 onwards, written in English, full-text and peer re- │
│ viewed articles)                                        │
└─────────────────────────────────────────────────────────┘
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First Screening

Exclusion criteria:

-Unrelated title (n=1269)

-Unrelated abstract (n=217)

-title and abstract is not from nurses' perspectives (nursing students, midwives, nurse executives, nurse educators, physicians, patients)

-not related to EHRS (information communication technology, telecall, mobile technology)

n = 1486

Screened articles for thorough review

Second Screening

Exclusion criteria:

-duplicate (n= 11)

-do not answer research question (n=28)

- results of combined nurses with other health care professionals and the findings were not separable (n=18)

-narrative or editorial style papers (n=9)

-studies about nurses' attitude towards the EHRS which has not been implemented (n=5)

N=71

Included studies

(n = 10)

Figure 2: Literature selection process

4.2   Literature appraisal

In critical appraisal phase the strengths and limitations, as well as the relevance of the litera-ture are examined using constructed guidelines (Aveyard 2010). Among all the included ten articles, one article is a qualitative study, one used both quantitative and qualitative study methods, and eight other articles used the quantitative cross-sectional method. The appraisal tools employed in this essay are CASP tool for qualitative study (Critical Appraisal Skills Programme 2017) and NIH quality assessment tool for cross-sectional studies (NIH Quality Assessment Tool 2004). The mixed method study was assessed by both guidelines.

CASP tool is an online checklist consisting of ten questions (Critical Appraisal Skills Programme 2017). The answers to the questions were recorded as "yes," "no" or "can't tell" NIH quality assessment tool contains fourteen criteria to help to determine the overall quality of the studies (NIH Quality Assessment Tool 2004). Neither of the assessment tools uses a scoring system. Assessment is based on the answers to those questions, and the articles are evaluated as Good, Fair, or Poor. After appraising each article, a total of eight articles were considered as Good while three were considered as Fair, as illustrated in Table 3.

Article	Type of study	Guideline	Quality rating	Comment
Beryl Juliet V.S, Sudha M. Perception, and Attitude of Staff Nurses towards Electronic Health Records.	Cross-section (questionnaire)	NIH	Fair	no mention of the time of the survey and or how the subjects were selected
Mahdi Habibi-Koolaee, Reza Safdari, Hamid Bouraghi Nurses Readiness and Elec-tronic Health Records	descriptive cross-section (questionnaire)	NIH	Good	
Nancy Staggers, Lauren Clark, et al. Nurses' Infor-mation Management and Use of Electronic Tools Dur-ing Acute Care Handoffs	qualitative (semi-structured inter-views, observations, and fieldnotes)	CASP	Good	
Mehmet Top & Ömer Gider. Nurses' Views on Electronic Medical Records (EMR)in Turkey: An Analysis According to Use, Quality and User Satisfaction	Cross-section (questionnaire)	NIH	Fair	Results nor compara-ble as the observations were done in different hospitals using differ-ent systems
LaDage, T; Prasun, M, Lin-ton, M J, et al.Nurse Anes-thetists' Perceptions of the	Mixed	CASP + NIH	Fair	small response rate

Electronic Anesthesia Information Management System				
Azza El.Mahalli Adoption and Barriers to Adoption of Electronic Health Records by Nurses in Three Governmental Hospitals in Eastern Province, Saudi Arabia	Cross-section (questionnaire)	NIH	Good	
Lacey Colligana, Henry W.W. Potts, et al.Cognitive workload changes for nurses transitioning from a legacy system with paper documentation to a commercial electronic health record	questionnaire	NIH	Good	
Laura S. Yontz, Jennifer L. Zinn et al.Perioperative Nurses' Attitudes Toward the Electronic Health Record	descriptive cross-section (questionnair)	NIH	Good	
Mehdi Kahouei, Hassan Baba Mohammad. et al.Nurses' Perceptions of Usefulness of Nursing Information System: a Module of Electronic Medical Record for Patient Care in Two University Hospitals of Iran	cross-section (questionnaire)	NIH	Good	
Fatma Ay, Sehrinaz Polat-The Belief and Opinions of Nurses on the Electronic Patient Record System	Cross-section (questionnaire)	NIH	Good	

Table 3: Summary of data appraisal

4.3   Data extraction

In this step, the findings of the included articles are summarized to be manageable in size, to answer the research question (Aveyard 2010). A data collection form is also encouraged to use (Higgins JPT n.d.).

In this thesis, the ten included articles were firstly thoroughly read through by the author. A summary of each paper's findings, study methods, the level of evidence is presented in Appendices 1.

4.4   Data analysis

The selected data was analyzed by the qualitative content analysis method which is "a research technique for making replicable and valid inferences from texts to the contexts of their use" (Krippendorff 2004, 18). This method aims at developing a systematic conceptual map based on categorized phenomenon. It can be utilized for either qualitative or quantitative data (Elo & Kyngäs 2008, 107).

The inductive content analysis process follows three steps of preparation, organizing and reporting (Elo & Kyngäs 2008, 109). During the preparation phase, the unit of analysis is identified. The data is required to be comprehensively understood before one starts the next organizing phase. This phase includes open coding, creating categories and abstraction (Elo & Kyngäs 2008, 109).

The results were coded with number and color. Articles were organized in the sequence of the number from one to ten and each articles' main findings were listed and further numbered with sub-headings, e.g., 1.1, 1.2, 1.3. For example, the article "Nurse Anesthetists' perceptions of the Electronic Anesthesia Information Management System" is numbered 10. The Findings are displayed: 10.1- the better capture of billing charges; 10.2- hardware and software issues; 10.3- improve documentation; 10.4- time monitoring the patient is taken away by documenting with EHRs; 10.5- easy access to vital patient information. Then these codes were coloured with Green and Red, representing benefits and challenges respectively. All the coded data was regrouped into eight sub-categories. Finally, the findings that represent the benefits of using EHR was coded green, while the red color symbolized the challenges. The whole process of inductive content analysis is demonstrated in figure 3.
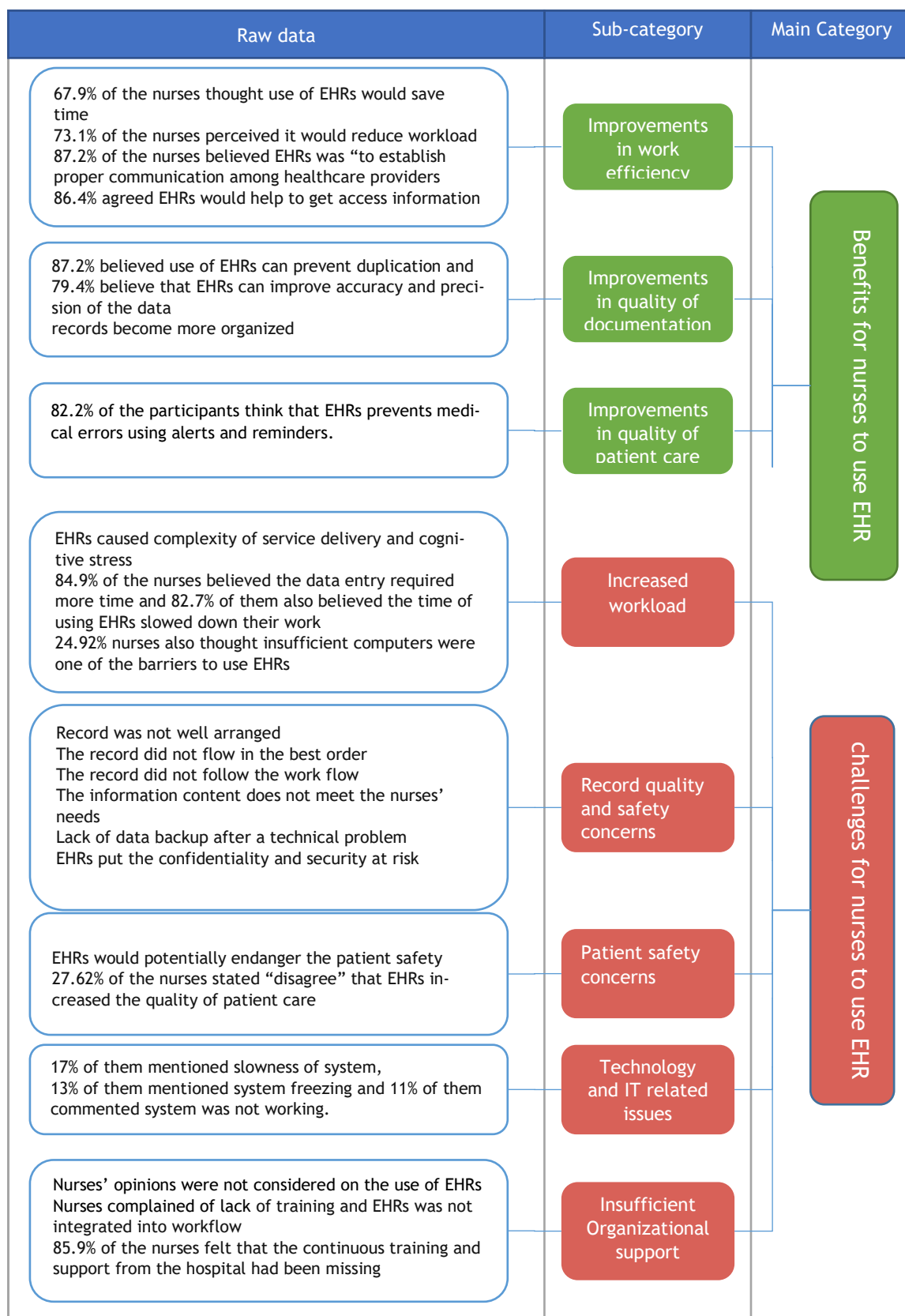
Figure 3: Inductive content analysis process

5   Findings

Eight sub-categories (figure 4) were identified throughout the inductive content analysis to answer the research question: What are the benefits and challenges of using electronic health recording systems from nurses' perspective?
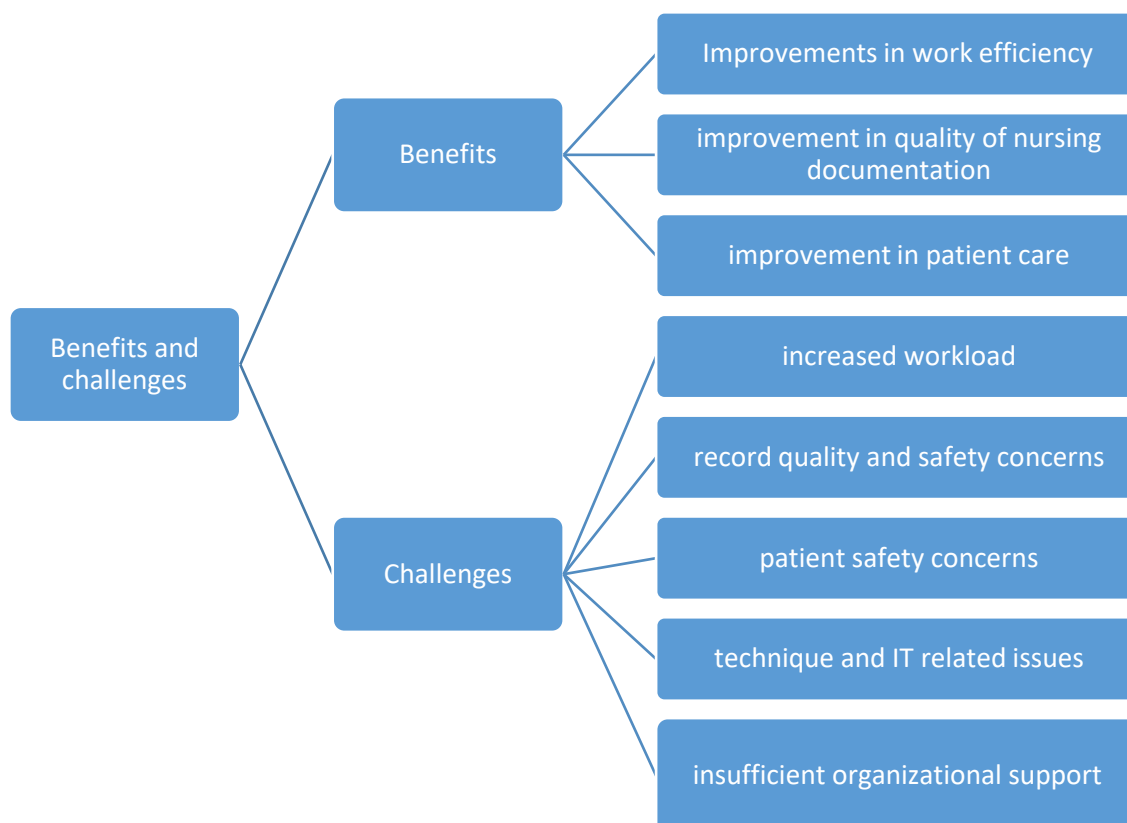

Figure 4: Eight sub-categories of the benefits and challenges

5.1   Benefits of using EHRs for nurses

5.1.1   Improvements in work efficiency

Three out of the selected ten articles agreed that the EHRs had a positive impact on nurses' work efficiency (Juliet & Sudha 2013, Habibi-Koolaee et al. 2015, Top & Gider 2012). The study by Juliet and Sudha (2013) concluded that 95.5% nurses hold a positive attitude towards EHRs. 67.9% of them thought the use of EHRs would save time and 73.1% of them perceived it would reduce the workload of nursing staff.

The study by Juliet and Sudha aimed at describing nurses' attitude and perception on EHRs in India. A total of 134 staff nurses in Sri Ramakrishna Hospital in India answered the questionnaire. The questionnaire collected the demographic data and the prepared questions. The tool to assess the participants' attitude was a modified Stronge and Brodt Attitude scale, by which nurses answer the questions with *most favorable, favorable* and *unfavorable* (Juliet & Sudha 2013). However, as mentioned in data appraisal section, the credibility of this quantitative research is *fair*. The reason is that the authors did not state in the study how they selected the target group and what kind of EHRs the hospital was using. Also, there was no mention of ethical consideration.

The study by Habibi-Koolaee et al. (2015) showed that 87.2% of the nurses believed the most beneficial part of EHRs was "to establish proper communication among healthcare providers." 86.4% agreed EHRs would help to get access information faster. 74.8% also thought EHRs would improve their workflow. This study aimed at assessing nurses' readiness for using EHRs. The participants were 284 randomly chosen nurses from Tehran University of Medical Sciences hospital in Iran. 85.9% of nurses completed the questionnaire. The questionnaire asked not only the demographic information but also nurses' computer skills, knowledge, and attitude. They found that nurses' high or low computer skills had no connection with the attitude towards EHRs use. However, a p-value of < 0.05 indicated that the finding that knowledge and attitude are negatively correlated is statistically significant (Habibi-Koolaee et al. 2015).

The study by Top and Gider (2012) gave support to the idea that EHRs could help nurses to get the information in time (31.5% of the participate agreed *most of the time*, 29.5% agreed *about half of the time*). 30.78% of nurses agreed, and 31.28% slightly agreed that EHRs accelerated the time to acquire patients' test results. This study was conducted at outpatient wards in three different hospitals, with one in public university hospital, one in Turkish Ministry of Health hospital and one in private hospital in Kocaeli (Top & Gider 2012). However, as the authors claimed, the university hospital has a more advanced EMR system than the other two has. Therefore, the results can not be generalized for the whole target group.

A pilot study conducted by LaDage, Prasun, Linton, Kaiser and Laskowski (2015), held neutral opinions regarding whether EHRs improve work efficiency (51.1%) or not. About half of the participates believed the system would neither impact their work (54.5%) nor change their work (47.8%). The aim of this study was to explore the nurse anesthetists' perception towards electronic anesthesia information management system. Likert Scale questionnaire, which is an attitude assessment scale from strongly agree to disagree, was used for data collecting. Also, three prepared questions were added. However, the result cannot apply to the whole target group of 1,359 registered members, due to the small response rate (6%) (LaDage et al. 2015).

5.1.2 Improvements in quality of nursing documentation

Two studies agree that the quality of the nursing documentation can be enhanced by EHRs (Top & Gider 2012, Habibi-Koolaee et al. 2015). According to Top & Gider (2012), nurses believed EHRs helped the tests and investigations, and that the treatments become more organized (29.78% agree plus 33.61% slightly agree).

In the study by Habibi-Koolaee et al. (2015), 87.2% of participates believed that the use of EHRs could prevent duplication. 79.4% believe that EHRs can improve accuracy and precision of the data compared to paper-based records.

5.1.3 Improvements in patient care

According to Kahouei et al. (2014), whether the quality of patient care had been enhanced throughout EHRs or not remain undetermined. The results which reflected the process of patient care were shown in *promoting patient care, planning of diet and nursing diagnosis*. 43.7% nurses somewhat agreed, and 6.3% nurses completely agreed that the use of EHRs helped to promote patient care quality. 27.2% nurses somewhat agree, and 15.2% complete agreed that EHRs contributed to planning patients' diet. As for EHRs' achieving to nursing diagnosis, the respond was neutral, with 49.4% completely disagreed. In this study, 316 nurses who were working in two teaching hospitals in urban Iran participated this survey. A computer-based information system called NIS was introduced to the two hospitals in 2010. The study was conducted after one year of implementation. The response rate was 71.6% with 316 participated nurses of the 441 targeting nurses.

In the previously mentioned study by Habibi-Koolaee et al. (2015), the quality of care was improved by reducing medical errors with EHRs. 82.2% of the nurses believed EHRs "to prevent medical errors using alerts and reminders." Regarding the same issue, the respondents in the study by (LaDage, T., Prasun, M., Linton, M J, Kaiser, A., & Laskowski 2015) were not sure if EHRs prevented medical errors (40.7%). Similarly, in the study by Ay & Polat (2014), the nurses thought EHRs neither improved quality of care nor saved extra time for patient care. 27.62% of the nurses disagree that EHRs increased the quality of patient care. 13.31% of them "slightly agreed." 31.28% disagreed EHRs "increased the time spared for patient care."

5.2 Challenges of using EHRs for nurses

5.2.1 Increased nurses' workload

On the contrary to the opinion of EHRs increasing work efficiency, four out of selected ten articles concluded that EHRs in fact increased nurses' workload. (Yontz et al. 2015; Habibi-Koolaee et al. 2015; Colligan et al. 2015; Top & Gider 2012)

The study by Yontz, Zinn and Schumacher (2015) focused on perioperative nurses' opinions towards the use of EHRs. The data was gathered through questionnaire and open-ended question to the barriers of using EHRs. The response rate was low (20.2%) with a target group of 396 perioperative nurses from a non-profit integrated tertiary health network in the southeastern United States. (Yontz et al. 2015.) The results show that despite the favorable attitude towards EHRs, the location of the computer and the limited number of computers raised nurses' concerns. They found it frustrating to get the information from a computer at the workstation while they were dealing with patients. The waiting time for using computer increased when too many people used the same computer, or when there were not enough computers or the work space was limited. In the study of Top & Gider (2012), 24.92% of the nurses mentioned that an insufficient number of computers was one of the barriers to using EHRs.

The study of Yontz et al. (2015) also pointed out that the extra workload had been increased by using EHRs. For instance, 84.9 % of the nurses believed that the data entry required more time and 82.7 % of them also believed that the slowly responding computers slowed down their work.

The study by Habibi-Koolaee et al. (2015) assessed both benefits and challenges of EHRs. The biggest challenge in that study mentioned by nurses was that EHRs caused *complexity of service delivery* (40.8% of the nurses mentioned). However, no further information was provided how did the EHRs make the service delivery more complex.

The additional workload added on nurses also reflect on the cognitive side. A study by Lacey, Henry, Chelsea, and Robert focuses on how the cognitive workload changed for nurses when they shifted documentation from paper-based system to a commercial electronic health record system. The participants were pediatric nurses from the US who worked in either an intensive care unit or an inpatient ward. In 2011, the commercial EHRs replaced the old paper-based system. The data was collected on the first, fifth, and tenth shifts after the implementation. The result revealed that in the first shifts of using EHRs, the nurses' cognitive workload increased. However, with the pre-training, halved care responsibilities and technical

support, the nurses experienced no extra workload. After about ten shifts, the increased cognitive workload due to the EHRs disappeared. This study also pointed out considerable variation among the nurses' adoption towards the new EHRs and the fast adoption was connected with a positive attitude towards the computer. (Colligan et al. 2015)

5.2.2   Record quality and safety concerns

Four studies considered the negative effects on quality and security of the data (Habibi-Koolaee et al. 2015, Yontz et al. 2015, Top & Gider 2012, Mahalli 2015). The nurses in the study by Yontz et al. (2015) commented the records were not well arranged, did not flow in the suitable order or did not follow their workflow. The nurses in Top & Gider (2012) pointed out that the most challenges barriers for the nurses to use EHRs were that the content of the system did not satisfy nurses' work needs. When asked about "how often does the information content meet your needs?" 20% of participants responded *Never* and 17.5% answered *Seldom*. However, the study did not specify what kinds of needs were. Also, regarding the clearance of the information and accuracy of the system, 20%, and 35% nurses responded *Never/Almost never* respectively.

Lack of customized functions of the system had been criticized by the nurses. According to Mahalli (2015), one of the barriers for nurses in governmental hospitals in Eastern Province of Saudi Arabia to use EHRs was "lack of customizability of the system according to users' needs" (81.1% agreed).

Nurses had identified the data security as a potential barrier to use EHRs. (Habibi-Koolaee et al. 2015) In their study, 76.4% of the nurses expressed their concern about the backup data. They worried the data would be eliminated from the system if some hard drive or software crashed. Up to 81.4% of them considered the data security and confidentiality was at potential risks in EHRs. This result is supported by another study conducted by Mahalli (2015). In his study, even higher percentage of nurses (88.6%) shared the worries of data loss if computer crashes or power fails. 72.4% nurses regarded confidentiality and security of data a potential barrier in EHRs.

One study by Nancy Staggers, Lauren Clark, Jacquelyn W. Blaz, and Seraphine Kpasandoy investigated how the nurses have used EHRs during their handoffs. This study used the mixed method to collect data, including semi-structured interviews, observations, and field notes. 26 nurses, who were working in five medical and surgical units in a tertiary care facility and a cancer hospital in the Western USA were interviewed. The EHRs had been implemented in the hospitals for nine months. The results showed that the nurses prefer paper-formed handoff report to the electronic form. The reasons included that the paper-form report allowed the

nurses to customize their report as they could easily write down, highlight or remove the information based on own use. Compared to the electronic report printout, the information provided by EHRs was either uncompleted or unusable. They also defend to use the paper form report as the handwriting note-taking could enhance their memory while typing the information on the keyboard did not offer the similar cognitive advantages. (Staggers et al. 2012)

5.2.3 Patient safety concerns

Some nurses raised the issue of patient safety caused by using EHRs. In Yontz et al. (2015), the nurses answered to open-ended question "what are the barriers to using EHRs?" 7% of the respondents mentioned EHRs would potentially endanger the patient safety. The reasons included that nurses physically were unable to be near with patient as the computers were always at the workstation and mentally the attention could not be focused as it was easy to be distracted by charting on EHRs. Some nurses also worried that the documenting took far too much time so that the time left for patient lessened.

5.2.4 Technology and IT related issues

Nurses had faced several computer related technical problems when they used EHRs (Yontz et al. 2015, Mahalli 2015). For instance, in the study of Yontz et al. (2015), computer related issues frustrated nurses most and 17 % of them mentioned slowness of system, 13 % of them mentioned system freezing and 11 % of them said that the system was not working.

In the Mahalli (2015) research, the stability of the system was mentioned when the nurses were asked about the barriers to using EHRs in their work. Up to 83.8 % of them complained about the system had the occasional disconnecting problem. In the mixed method study by LaDage et al. (2015), 33.53 % of the nurses thought "there are hardware and design issues with the computers."

5.2.5 Insufficient organizational support

One of the challenges mentioned by nurses was a lack of the support from their working place (Yontz et al. 2015, Habibi-Koolaee et al. 2015, Top & Gider 2012, Ay & Polat 2014). In the study by Yontz et al. (2015), nurses held relatively positive attitude on the matter of organizational support. 65.3 % agreed that they could get the support whenever it was needed. 71.7 % thought hospital offered enough training and continuous support for the nurses to use EHRs. Still, "lack of support when computer hardware or software malfunctioned" and "not enough practice time before going live" were mentioned by nurses as challenges to use EHRs.

In Habibi-Koolaee et al. (2015) research, 85.9 % of the nurses felt that the continuous training and support from the hospital had been missing. Similarly, in Top & Gider (2012), half of the participates said they had not received any training for EHRs use, and more than half (59 %) of the nurses believed the system was not integrated well into their workflow.

Nurses also complained that as the end-user of the system, their opinions had often been ignored. According to Ay & Polat (2014), 83.19 % of the nurses claimed they were not asked about the system they were using, even though 75.54 % expressed the willingness of offering their opinions.

6   Discussion

The purpose of this thesis was to describe the benefits and challenges of using EHRs for nurses. The results have demonstrated that EHRs can benefit nurses' work by improving work efficiency, quality of nursing documentation, and quality of patient care. The challenges for nurses when using EHRs in their work include lack of support from the workplace and the technology and IT related issues. Nurses also pointed out that EHRs may decrease their work efficiency, quality of the documentation and the quality of care. However, it is neither the purpose of this thesis nor is there the possibility to make the conclusion whether benefits overweigh the challenges or vice versa.

One of the controversial issues is the EHRs' impact on work efficiency. Some considered EHRs made their job more efficient as it improved communication, workflow and facilitated a quicker information access. EHRs were also thought to add extra cognitive workload and to make service delivery more complex. There could be several reasons that cause the different opinions: How long the system has been in use, to which extent the system has integrated into the workflows, how user-friendly the system is and how functional it is. Insufficient training can cause problems with the otherwise functional system. It may be difficult to verify whether EHRs can improve communication or not, but at least it has changed the way of communication. Tanttu (2017) states in the National Nursing Documentation Project presentation that the anecdotal oral nursing reports have shifted more and more to silent reporting after implementation of the structured electronic nursing documentation systems.

The study by Menachemi & Collum (2011) also mentioned that EHRs disturb the workflows and can lead to a potentially decreased efficiency. The reason lies in the necessary time the users require to learn the new system. The study focusing on the cognitive workload (Colligan et al. 2015) shows that in the first shifts of using EHRs, the nurses' cognitive workload increased. It was suggested that with sufficient training, reduced care responsibilities and with technical support, this cognitive stress could be balanced.

An earlier literature review by Kelley et al. (2011) examined the literature on effects of electronic nursing documentation on the quality of patient care, and the authors were inconclusive whether using EHRs improves patient care or not. One of their findings was that the time required for electronic documentation varies depending on many factors, including patients' condition. Their results were in line with one of the reviewed article by Kahouei et al. (2014), where 43.7% nurses somewhat agreed, and 6.3% nurses completely agreed that use of EHRs promotes patient care. The article by Juliet and Sudha (2013) however claimed the use of EHRs did save time, but their findings were based on a self-reported survey instead of direct observation or RCT. How exactly did the EHRs save time was not mentioned.

One of the benefits referred to by the nurses was that EHRs could prevent medical errors, thanks to the alerts and reminder functions (Habibi-Koolaee et al. 2015). As it was an attitude assessment, therefore, no further explanation was provided how EHR prevents medical errors. As mentioned earlier, the drug interaction alarming function is one of the features of decision support systems which have been integrated into electronic health recording systems. For example, The EHRs in Finland contains the alarming about laboratory results and the drug interaction. It also enables the users to get access to the guidelines and other useful resources, such as "Terveysportti" medical database portal (Hämäläinen et al. 2007).

The study by Menachemi & Collum (2011) suggested that the potential benefit to patient care with EHRs may be associated with the increased compliance with the guidelines. The computer reminders facilitated health care providers to follow up the evidence-based guidelines, and it was shown a positive link with pressure ulcer prevention, risk of deep vein thrombosis and pulmonary embolism reduction.

This thesis focused on the nurses as the end users of the EHRs. Apparently, the benefits are shared with others than health care providers as well. For instance, EHRs makes it possible for patients to get access to their medical records. As mentioned earlier, this type of personal health record system also provides more convenience to the patients, such as e-prescriptions. Moreover, the society also benefits from the use of the EHRs. The large pool of data can improve the ability to conduct research, and combined with other databases it can help in predicting outbreaks of epidemics.

When it comes to the challenges of using EHRs for nurses, there is a close link to the barriers for the organization to implement EHRs. For instance, the study by Colligan, Potts, Finn and Sinkin (2015) concluded that nurses' cognitive workload increased significantly in the first shifts of using new EHRs and it disappeared after ten work shifts. On the other hand, the result can be interpreted as a temporarily reduced productivity for the organization.

Moreover, many nurses had identified the lack of the support from the organizations as one of the significant challenges of using EHRs. For instance, the study by Habibi-Koolaee et al. (2015) mentioned the lack of continuous training. The study by Top & Gider (2012), referred to the absence of sufficient training before using the new system. These difficulties might be explained by the challenges of organizations facing when adopting the system. Developing and maintaining the systems adds the financial burden for the organization and the financial pressure may also limit the number of IT support staff they can hire (Menachemi & Collum 2011).

One of the challenges the nurses mentioned was that the nurses were physically tied to the computer when they wanted to document with the EHRs. This made them worry about the safety of the patient as they were taken away from patients' bedside. The workload also potentially increased when they had to fight for their turn to use the limited number of computers (Yontz et al. 2015). However, this result may not be applied to the other wards or the other countries and regions. Thanks to the new design of portable electronic devices, such as portable computers and tablets, it is possible for nurses to get access to the patients' information as well as to the patients simultaneously (Andersen et al. 2009).

The decisions of buying systems are made on hospital management level or hospital district or country level. This raises questions: who designed the system? Is the system user-friendly to nurses? Is the system design from the data retrieval point of view or the nurses' workflow perspective? Perhaps the different design of EHRs explained the various reactions from the nurses. Some of them mentioned that the EHRs improved document's accuracy, prevented duplication, and organized the recording better (Top & Gider 2012, Habibi-Koolaee et al. 2015). Others suggested that the record not is well arranged and didn't reflect their needs and workflows (Yontz et al. 2015). Furthermore, as described before, some nurses wish to have a say on this matter. Therefore, for the further research, it is valuable to collect nurses' feedback and could there arise some design principles for EHRs that could be transferred to the designing, maintaining and developing the systems.

7   Trustworthiness

The trustworthiness in qualitative research is assessed by four criteria: credibility (how much the quality of the articles are), transferability (how much results can be applicable), confirmability (to what degree the results can be confirmed) and dependability (how reliable the results are) (statistics solutions n.d.). To ensure the credibility, prior to thesis process, the author had read the articles and books thoroughly about electronic health recording systems and formed a clear defined research question. After studying different methodologies, a literature review was chosen to answer the research question. A total number of 1567 articles was

produced with the minimum criteria (Peer-reviewed, full-text articles published in English and year 2007 onwards). The selected ten articles were evaluated by the critical appraisal tools for credibility. During the process, the author thoroughly studied and noted strengths and limitations of each included article.

For transferability, some of the findings showed similar results although the studies were conducted in different countries. For instance, in the developing countries, the respondent nurses tended to complain more about the hardware facilities, while in the developed countries, the nurses focused more on the software issues.

For the confirmability, the raw data was extracted directly from the survey results. The results were synthesized into eight sub-categories and two main categories. For dependability, the whole process of data collecting was done in a consistent manner and was documented in detail in Paragraph 5.1. To decrease the possible biases, the author presented the thesis during thesis meetings, where the authors had the chances to discuss with the teachers, other students, and thesis opponents.

8   Ethical consideration

The ethical issues in the systematic review have not been considered as important as in other studies, as systematic review deals with secondary data instead of the data directly from participants. According to Vergnes, Marchal-Sixou, Nabet, Maret, Hamel (2010), the ignorance of ethical consideration in the systematic review could lower the overall quality of the research, as the original studies may have conflicts of interest or invalid informed consent or other unethical issues.

In this thesis, each included article has been reviewed through the critical appraisal tools. Failure to provide ethical information and consideration would affect the quality of the article. Among the selected ten articles, eight of them mentioned they had obtained permission by a committee and informed consent from participants. Six of the articles declare no potential conflicts of interest or reported the source of the funding. A few of the studies also mentioned that the data kept confidentiality and had informed participants' rights involving in the research.

According to the guideline for preparing and publishing systematic reviews (Wager & Wiffen 2011), the first thing to consider is the authorship. In this case, the thesis is completed by one author, with the help of thesis teacher, language support teacher as well as the opponent. Secondly, duplicates have been avoided. From the extracted data, there were no

duplicated articles identified. In Theseus.fi, there is no same topic thesis published previously, although one master thesis studied the impact of EHRs on nurses' routines. The research question makes it different from this thesis. Thirdly, the plagiarism has been avoided. The author has strictly followed Laurea's reference guidelines and consulted a language teacher for referencing check. At last, there are no potential conflicts of interest in this thesis and no sources of funding. In addition, as the research method used in this thesis is a literature review, therefore, research permission or participants' informed consent is not required.

9   Limitations and recommendation

As always, this thesis has its constraints and places to further improvements. There were possibly methodological limitations in gathering and screening of an inclusive sample of articles. Search was performed using library access provided by Laurea. This limits the search to the journals that the library has a subscription to or to those journal articles that were retrievable through EBSCOhost and ProQuest databases. Refining the search for a sufficient number of search results required fine tuning of the search statements with trial and error. There was a trade-off between finding a large amount of possibly related articles and a smaller number of more specific articles, but with a larger probability of omitting relevant articles. Because one of the selection criteria was articles written in English, this could eliminate possible relevant articles which are published in other languages.

This thesis was written by a single author thus it was not feasible to discuss the findings or have different perspectives to the study. There could be bias present in how the articles were selected and how the search statements were formulated. This is hard to remove without doing research in a team. There were also time constraints how one person can read through the materials which force limits to the number of articles being retried and read.

Among the entire ten selected articles, only two were mixed method studies, and the rest used cross-sectional quantitative methods. Only two studies used observational methods to analyze use of EHR. Instead, most of the research were based on self-reported questionnaire data. Self-reported findings and not easily verifiable from the material itself and require further qualitative studies to identify the root causes of the challenges. For example, some of the reported problems might be addressed by proper training, which after the identified set of challenges with EHR could be different. Moreover, related to the questionnaires, the questions were often prepared by the authors beforehand. For that reason, the nurses only responded to those predefined issues which were identified by the questionnaire makers. Therefore, the problems associated with the topic may not be covered comprehensively.

Although the appraisal tool has been used to verify each article's credibility, again due to the limited academic experiences, and no scoring system applied in those tools, how rightness to use the tool to assess those data is also under question.

Moreover, the nurse was defined as "a person who has completed a program of basic, generalized nursing education and is authorized by the appropriate regulatory authority to practice nursing in his/her country." (International Council of Nurses 1987) Hence, the nurses from different countries in the included articles are likely to have different nursing education backgrounds, different responsibilities in using the EHRs, and different practice code. Furthermore, the studies did not mention if the nurses are registered nurses or practical nurses as in Finland their responsibilities of documenting are not the same. For the future study, it is recommended to study these two groups separately as they have different reporting needs.

For the further study, it would be interesting to compare the results based on different countries. Depending on the results of the reviewed articles, it is shown that the nurses in the developing countries (Iran, India, and Turkey, Saudi Arabia) complain more about the computer related issues, such as crashes of hardware and software and availability of the computers. In three other studies conducted in the developed country (USA), the nurses considered more how and to what extent the system had integrated into their workflow. The different considerations may be explained by the difference between nations' infrastructure, IT skills, nursing education, funding support and legal systems.

As described earlier, the nurses complained that the EHRs could not fulfill their work needs. For the further studies, researchers could focus on the specific requirements and opinions of using EHRs from the nurses in different settings. For example, is there differences between the outpatient ward or inpatient ward or in developed countries or developing countries. The nurses' opinions could further provide valuable information in innovating and developing new usable systems in the future. Another recommendation would be to compare the other end-users' experiences as this thesis only focused on nurses. How the other health care professionals use the EHRs and how is the data shared between different healthcare professionals? It would be interesting to know does EHRs change the way nurses communicate with doctors, pharmacists, and other end users.

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Figures

Tables

Appendices

Appendix 1: Data extraction chart

Author/date	Tittle	Aim of study	Research method/ Level of evidence	Main findings
1. Beryl Juliet V.S, Sudha M.	Perception and Attitude of Staff Nurses towards Electronic Health Records.	to assess the views of nurses towards EHRS	Questionnaire Fair	benefits in patient care -save time -reduce workload of nursing personnel
2. Mahdi Habibi-Koolaee, Reza Safdari, Hamid Bouraghi	Nurses Readi-ness and Elec-tronic Health Records	to assess nurses' readiness for EHRS implemen-tation	questionnaire GOOD	87.2% of nurses' positive at-titude towards EHRS is to promote communication; The complexity of service delivery was seen as most negative (40.8%)
3. Nancy Staggers, Lauren Clark, Jacquelyn W. Blaz, and Seraphine Kapsandoy	Nurses' Infor-mation Management and Use of Electronic Tools During Acute Care Handoffs	to study the use of EHRS during nursing handoffs	qualitative (semi-structured inter-views, observa-tions, and field-notes)	Two-thirds of the nurses prefer personal paper forms
4. Mehdi Kahouei, Hassan Baba Mohammad. et al.	Nurses' Percep-tions of Useful-ness of Nursing Infor-mation System: a Module of Electronic Medi-cal Record for Patient Care in Two University Hospitals of Iran	to assess nurses' view about use-fulness of EHRS	descriptive study	Nursing information system has potential to improve pa-tient care in hospital setting.

5. Lacey Colligana, Henry W.W. Potts, et al.	Cognitive workload changes for nursestransitioning from a legacy system with paperdocumentation to a commercial EHR	to assess the pediactric nurses' cognitive impact when shifting from paper documentation system to EHRS	questionnaire	The most increased cognitive workload appears during early phases of transition.
6. Laura S. Yontz, Jennifer L. Zinn et al.	Perioperative Nurses' Attitudes Toward the Electronic Health Record	to assess the perioperative nurses' attitudes toward the use of EHRS	descriptive survey	EHRS is beneficial, no extra workload is caused.
7. Azza El.Mahalli	Adoption and Barriers to Adoption of Electronic Health Records by Nurses in Three Governmental Hospitals in Eastern Province, Saudi Arabia	to assess the adoption and barriers to use EHRS by nurses	cross-sectional, questionnaire	the most mentioned barrier was "loss of access to medical records if computer crashes"
8. LaDage, T; Prasun, M , Linton, M J, et al.	Nurse Anesthetists' Perceptions of the Electronic Anesthesia Information Management System	to examine nurse anesthesias' view of EHRS	mixed method study	The benefits of AIMS can improve completion of record and make it easy to get access
9. Fatma Ay, Sehrinaz Polat	The Belief and Opinions of Nurses on the Electronic Patient Record System	to evaluate the use of EHRS	Questionnaire	insufficient number of computers is biggest problem. The system needs to be improved.
10. Mehmet Top & Ömer Gider	Nurses' Views on Electronic Medical Records (EMR) in Turkey: An Analysis According to Use, Quality and User Satisfaction	to examine nurses' views on EHRS	Questionnaire	59% of nurses think EMR systems fail to integrated into their workflow.