Arab American University
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Upgrading features of electronic health record systems to capture the impact of pharmacists in Palestinian healthcare facilities: a mixed method

By

Hazem Mohammed Salem

Supervisor

Ramzi Shawahna

This thesis was submitted in partial fulfillment of the requirements for the Master's degree in
Health Informatics
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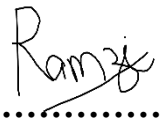
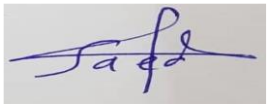
This Thesis was defended successfully on 29/07/2021 and approved by:

Committee Members	**Signature**
1. Supervisor: Dr. Ramzi Shawahna/	 **……**
2. External examiner Dr. Sa'ed Zyoud/	 **……**
3. Internal examiner Dr. Yousef Mimi/	 **……**

Declaration

This thesis was submitted in partial fulfillment of the requirement for Master's degree in Health Informatics.

I declare that the content of this thesis whole or any part of the same has not been submitted before in order to qualify for any other academic degree for any other university or institution. All the ethics transactions and guidelines have been followed duly while establishing the thesis.

Students Name: Hazem Mohammed Salem

Date: 12/10/2021

Sig: Hazem Mohammed Salem

Dedication

This thesis is dedicated to:

My beloved mother and my great father, for being my first teacher, who have always light my path and encouraged me to believe in myself in my long journey and the reason of what I became today.

My beloved wife, who always picked me up on time, encouraged and supported me from the beginning of my educational journey,

My beloved brothers and sisters,

To all my family, the blessing of life,

My friends who encourage and support me,

All people in my life who trust and believe in me,

I dedicate this research.

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Abstract

Background: Many healthcare systems around the world have transitioned from paper-based patient record systems to more modern electronic health record systems (EHRs). Pharmacists are one of the most trusted and accessible healthcare providers. Today, pharmacists are increasingly involved in providing direct patient care services. Currently, little is known on how the currently used systems can be upgraded to allow documenting pharmaceutical services/pharmacist interventions. Additionally, little is known on how these documented pharmaceutical services/interventions can be used to evaluate performance of pharmacists, benchmark services, and improve patient health outcomes. This study was conducted to report on the use of EHRs by pharmacists in hospitalized patient settings, collect the view of the pharmacists on the features that they desire to be upgraded in the current EHR to capture their role in hospitalized patient settings.

Methods: In phase 1, the databases: Medline/Pubmed, Cochrane, CINAHL/EBSCO, Embase, PsycINFO, and Scopus were systematically searched as late as April 10, 2021. Documents reporting on design/development of electronic health record systems to capture pharmaceutical services, use of electronic health record systems to improve/evaluate pharmaceutical care services/delivery, and/or measuring impact of pharmacists through EHRs were selected. In phase 2, in-depth semi-structured qualitative interviews were conducted with pharmacists, physicians, and IT/health informatics specialists.

Results: A total of 741 documents were identified from the database searches. Additional 5 relevant documents were added to the search results. Upon initial screening, 653 documents were excluded. When the documents were screened against the inclusion and exclusion criteria, 73 documents were excluded and 20 documents were included in the systematic scoping review. Of the selected documents, 4 (20%) reported on use of EHRs by pharmacists, 7 (35%) reported on

improvements to the pharmaceutical services brought by EHRs, 5 (25%) reported on using EHRs to capture impact of pharmacists, and 4 (20%) reported on the need to improve the design of EHRs. Semi-structured in-depth interviews were conducted with 17 participants. Of those, 9 (52.9%) were 40 years old and above, 9 (52.9%) were pharmacists, 15 (88.2%) were employed by a governmental hospital, and 10 (58.8%) had experience of 10 or more years. Qualitative analysis of the interviews allowed gaining insights into the importance of pharmacists as healthcare providers to hospitalized patients, perspectives of the participants on the EHR, and challenges and future outlooks.

Conclusion: Findings of this thesis indicated that pharmacists were important healthcare providers that were neglected when EHRs were designed. Currently used EHRs allow limited capture of the role of pharmacists in caring for patients in hospitalized patient settings. Upgrading EHRs taking into consideration of the interviewees in this study might allow capturing the impact of pharmacists in caring for patients in hospitalized patient settings. Future studies are still needed to investigate if upgrading EHRs can improve healthcare delivery and health outcomes of patients in hospitalized settings.

Keywords: Electronic health records, Health informatics, Pharmacist, Pharmaceutical services, Hospitals, Patient safety

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List of abbreviations

EHRs	Electronic health record systems
IT	Information technology
CDSSs	Clinical decision support systems
COREQ	COnsolidated Criteria for REporting Qualitative Research
CSV	Comma Separated Values
HIS	Health information system
OSF	Open Science Framework
PDF	Portable Document Format
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
RIS	Research Information Systems
UNRWA	United Nations Relief and Works Agency for Palestine Refugees

CHAPTER ONE

Introduction

1 Introduction

Globally, patient safety has been prioritized in almost all healthcare systems (Soresi et al., 2021). The advent of information technology (IT) and the recent advancements in the field have allowed fast leaps in transforming healthcare delivery in contemporary healthcare systems around the globe (Nugroho et al., 2021, Lazarova et al., 2021). As a result, many healthcare systems worldwide have transitioned from paper-based patient record systems to more modern electronic health record systems (EHRs), which are also known as computerized patient records (Baumann et al., 2018). The use of EHRs facilitated collecting patient health information like history, health complaints, vital signs, laboratory reports, reports of medical images, medications, and reports/notes of healthcare providers like physicians, nurses, and pharmacists (Shawahna, 2019b).

In addition to facilitating the collection of patient health information, EHRs might come with integrated clinical decision support systems (CDSSs). These CDSSs can improve healthcare delivery and safety through many features that the healthcare team could use. The features include the provision of indispensable medical and clinical information, alerts, warnings, reminders, among other features that could be helpful to healthcare providers (Jiang et al., 2019). These features have allowed personalizing healthcare delivery to patients and improved patient outcomes (Roshanov et al., 2013, Jiang et al., 2019). Additionally, transition from paper-based health records to EHRs was shown to significantly reduce documentation time, improved communication of patient's health information, reduced the incidence of medical errors and adverse events, improved adherence to guidelines, promoted safe practices, and improved patient outcomes and overall patient experience (Shawahna, 2019b). Therefore, decision makers in healthcare authorities, healthcare professionals, and professional groups have recommended and incentivized adopting and implementing of EHRs (Niazkhani et al., 2020, Palabindala et al., 2016, El Mahalli, 2015).

Pharmacists are one of the most trusted and accessible healthcare providers. In modern healthcare systems, the roles of pharmacists have expanded beyond merely dispensing medications to patients (Bondesson et al., 2012, Liekens and Foulon, 2019). Today, pharmacists are increasingly involved in providing direct patient care services. These services are often known as pharmaceutical care services. Pharmaceutical care can be defined as the responsible provision of therapy using medications that aim to achieve definite patient health outcomes and improvement of the quality of life of the patient (Liekens and Foulon, 2019). Through pharmaceutical care, pharmacists collaborate with other healthcare providers to design, implement, and monitor therapeutic regimens that are designed to achieve the definite patient health outcomes.

1.1 Background

Globally, EHRs and other accompanying systems like e-prescribing and CDSSs differ significantly by the IT companies and/or in-house developers who designed these systems (Shawahna, 2019b). These differences might limit the abilities of healthcare providers to order and/or document certain healthcare services. Additionally, differences in these electronic systems might limit the ability of healthcare providers to share patient health information between different hospitals/healthcare centers (Shawahna, 2019b, Davoody et al., 2019, Bhartiya et al., 2016).

In Palestine, the Ministry of Health has introduced an EHR system that is known as health information system (HIS) to all hospitals administered by the ministry. The EHR system used in the Palestinian governmental hospitals was developed by AviCenna Health Information Medical Systems (Shawahna, 2019b). On the other hand, private hospitals/healthcare centers and the hospitals/healthcare centers of the United Nations Relief and Works Agency for Palestine Refugees (UNRWA) use different forms of EHRs.

1.2 Problem statement

The majority of the hospitals/healthcare centers in Palestine use some sort of EHR, and these EHRs allow recording patient information, diagnosis, and laboratory tests. In other words, the current EHRs allow recording activities and services provided by physicians, probably nurses, and medical laboratory personnel. However, the roles of pharmacists were not sufficiently considered at the time of designing these systems. Therefore, the currently used systems do not capture and measure the impact of pharmacists in providing healthcare to hospitalized patients in Palestine. Currently, little is known about how the currently used systems can be upgraded to allow documenting pharmaceutical services/pharmacist interventions. Additionally, little is known on how these documented pharmaceutical services/interventions can be used to evaluate pharmacists' performance, benchmark services, and improve patient health outcomes.

1.3 Research hypothesis

Unlike quantitative studies, qualitative studies are not conducted to test the hypothesis. Rather, qualitative studies are conducted to generate hypotheses/theories. The two phases of this thesis attempted to answer the research questions.

1.4 Research questions

- Do pharmacist interventions improve health outcomes of hospitalized patients?
- Do EHRs allow measuring the impact of pharmacists in caring for hospitalized patients?
- What pharmaceutical services can be documented using EHRs and how they can be used in evaluating and benchmarking performance?
- How do pharmacists view their importance in hospitalized patient settings?
- What are the perspectives of the pharmacists on the EHR?

- What features do pharmacist desire to be upgraded in the current EHR?
- What are the challenges facing the pharmacists and what are their future outlooks?

1.5 Objectives

This thesis was conducted in two phases. Phase 1 was a systematic scoping review and phase 2 was a qualitative study.

Phase 1: The systematic scoping review was conducted to:

- Systematically search the literature to identify peer-reviewed articles reporting on the use of EHRs by pharmacists in hospitalized patient settings
- Summarize and qualitatively synthesize evidence on how EHRs impacted pharmaceutical services, how EHRs can be used to capture the impact of pharmacists in hospitalized patient settings, and how the design of EHRs can be improved to allow measuring the impact of pharmacists in hospitalized patient settings

Phase 2: The qualitative study was conducted to:

- Explore views and opinions of pharmacists and other stakeholders on how features of the current HER system can be upgraded to capture their role in hospitalized patient settings

1.6 Significance

Findings of this thesis might inform decision makers in healthcare and developers in IT companies on what features of the current EHRs might need to be upgraded to capture the impact of pharmacists in hospitalized patient settings. Capturing and measuring the impact of pharmacists in hospitalized patient settings might be useful in:

- Delineating expectations from the healthcare system

- Identifying deficiencies that need to be addressed
- Benchmark services/activities of hospital pharmacists
- Improving patient health outcomes
- Justifying allocation of scarce resources
- Promoting professional accountability
- Measure key performance indicators relevant to pharmaceutical services

CHAPTER TWO

Literature review

2 Literature review

2.1 The use of electronic health records by pharmacists

Hughes et al. (2011) described how an EHR was integrated and used by pharmacists while caring for patients and investigated the factors associated with using medications and laboratory reports from the EHR (Hughes et al., 2011). The participants were interviewed for their self-reported use of EHR. The pharmacists who practiced in a patient-centered care facility were reported more frequent use of the EHR to review information on medications and laboratory reports compared to the community pharmacists. The use of EHR was influenced by pharmacists, pharmacy, patients, physicians, EHR, and environment. The pharmacists who practiced in patient-centered care facilities reported that access to medical records and timeliness were barriers limited their practice. Understanding their roles, valid motives for using EHR, and fear of legal disciplinary actions limited the use of EHR by community pharmacists (Hughes et al., 2011).

Downard et al. (2007) published a report on pharmacists' use of EHRs and how these systems can be used to share health information (Downard et al., 2007). The authors reported that EHRs were excellent tools that can be used to advance patient care by pharmacists. The report also provided a descriptive account of how care can be integrated across practices in different environments, how the patients praised internet-based options, how health information can be shared, what information should be included, who will have access to information, and how patient's privacy can be ensured (Downard et al., 2007).

Scott et al. (2019) published a protocol for a scoping review that aimed to gain insights into how cross-organizational EHRs influenced the decisions of physicians and pharmacists (Scott et al., 2019). In UK's healthcare system, EHRs of patients are fragmented between different

healthcare centers and departments because of substandard information technology. The protocol proposed to adopt the notion of distributed cognition and sociotechnical systems thinking to guide the conceptual models. The databases: Embase, PubMed, Medline, HMIC, Health Business Elite, National Institute for Health, and Care Excellence Healthcare will be searched for relevant studies. Studies will be selected if they reported on how cross-organizational EHRs influenced decisions of physicians and pharmacists (Scott et al., 2019).

Vyas et al. (2019) used an EHR and simulations to train students on the pharmacist patient care process (Vyas et al., 2019). The study aimed to assess the impact of EHR and simulated encounters with physicians on knowledge and skills of students about implementing pharmacist-patient care process. Students who were enrolled in a therapeutics course reviewed cases with an EHR. The students made medication orders using the computerized provider order entry platform. A rubric was used by the faculty to grade the performance of the students and a pre-post attitude survey and knowledge tests were completed by the students. The students (n = 200) reviewed seven cases. Scores of the students were within the range of 67.7%-88.2% on the cases and 78.6%-91.1% on the medication orders. The quiz scores significantly improved from 15.3/20 to 17.3/20 (p-value <0.001). Attitude scores significantly improved from 23.2 to 31.0 (p-value<0.001). Training students on EHR and using simulations significantly improved students' understanding of the pharmacist patient care process (Vyas et al., 2019).

2.2 Electronic health records improve pharmaceutical services

Barra et al. (2018) evaluated the influence of an integrated EHR on medication orders reviewed by pharmacists in the emergency department of a trauma center (Barra et al., 2018). Medication orders reviewed by pharmacists before and after the implementation of the EHR were compared. The study collected the percentage of medication orders verified by a pharmacist, time

of order entry to pharmacist review, time of order entry to medication procurement, time of order entry to medication administration. During the study, 5,450 medications were ordered. Following the implementation of the integrated EHR, the percentage of medication orders reviewed increased from 51.8% before the implementation to 94% after the implementation (p-value < 0.001). The median time from order entry to pharmacist review decreased from 13 min before implementation to 4 min after implementation (p-value < 0.001). The median time from order entry to medication procurement increased from 9 min before implementation to 15 min after the implementation (p-value < 0.001). The median time from order entry to administration increased from 15 min before implementation to 23 min after implementation (p-value < 0.001). Implementation of the integrated electronic health record increased the percentage of medication reviews by a pharmacist before administration and decreased the time to pharmacist review. There was a marginal increase in the time to procurement and administration of the medication (Barra et al., 2018).

Finn et al. (2017) described the implementation of a new pharmacist-led oral chemotherapy program and evaluated interventions of pharmacists before and after implementing the program (Finn et al., 2017b). Documented pharmacist interventions relevant to oral chemotherapy medication orders were reviewed retrospectively before and after the EHR system (Epic Beacon). The study included 240 patients with 450 oral chemotherapy medication orders. Of those, 134 oral chemotherapy medications were ordered before the implementation of the program and 316 were ordered after the implementation of the program. The program increased pharmacist interventions by 660% (89 before the implementation vs. 681 after the implementation). Chemotherapy calendar coordination, focus on coordination of care, and assistance with treatment plans also increased after implementing the program. The program increased identification of chemotherapy order errors by more than 500% (41 before the implementation vs. 250 after the implementation). After

the implementation of the program, pharmacists could identify more significant, serious, or potentially lethal chemotherapy order errors. Implementation of Epic Beacon increased pharmacist review of chemotherapy medication orders, increased documentation of pharmacist interventions, improved identification and documentation of errors, decreased the need to clarify chemotherapy medication orders and increased the volume of chemotherapy medication orders (Finn et al., 2017b).

Hensler et al. (2018) to assess the impact of an automated EHR-based pharmacist-driven program on optimizing doses of valganciclovir for recipients of solid organ transplants in a major transplant center (Hensler et al., 2018). Demographic and clinical data were collected from 2 cohorts of liver, kidney, and pancreas-kidney recipients of transplant were collected before and after the implementation for 1 year after receiving the transplants. The 1-year incidence of cytomegalovirus infections decreased from 18.5% before the implementation to 12.2% after the implementation (p-value = 0.05). The 1-year incidence of breakthrough infections decreased from 61% before the implementation to 34% after the implementation (p-value = 0.03). The risk of developing cytomegalovirus infections was greater before implementing the dose optimization program (hazard ratio = 1.64, 95% CI of 1.06-2.60, p-value =0.03). The number of ganciclovir-resistant cytomegalovirus cases was reduced from 2 before the implementation to 0 after the implementation. The EHR-based program resulted in reducing cytomegalovirus infections among recipients of solid organ transplants (Hensler et al., 2018).

Shay et al. (2018) measured the impact of a pharmacist-driven monitoring program of patients with bleeding disorders about completeness of bleeding log, documentation of the bleeding log in the EHR, and interventions of the pharmacists using an EHR tool (Shay et al., 2018). A pre-post intervention comparison in a single group was conducted. Before the

implementation, bleeding logs were scanned into the EHR and after the implementation the pharmacists completed the bleeding logs using a tool in the integrated EHR. For each record, the completeness of the bleeding logs was compared based on 10 clinical data elements. Before the implementation, 19/117 bleeding records were completed and documented into the EHR compared to 15/15 records were completed after the implementation (p-value < 0.001). Of the clinical data elements in all records, 706/1,170 were completed before the implementation compared to 120/150 were completed after the implementation (p-value < 0.001). After the implementation, 14 pharmacist interventions were recorded. Of those, the majority (8/15) was related to coordination of care. The integrated EHR tool improved the completeness and of bleeding logs and documentation of pharmacist interventions (Shay et al., 2018).

Grisso et al. (2004) described how pharmacokinetic services can be expanded via the EHR using computerized physician entry and computerized note capture tools (Grisso et al., 2004). EHR, computerized physician entry, and computerized note capture tools allowed staff pharmacists to expand their clinical roles by providing pharmacokinetic services to pediatric patients. The computerized documentation of the recommendations was well received by the staff healthcare providers. The system allowed access to information on dosing antibiotics and how the patient responded. Additionally, the system informed dosing of antibiotics in future hospitalizations (Grisso et al., 2004).

Monroe and Chin (2013) published a descriptive account of the efforts of Kaiser Permanente to promote specialty drug management, use of EHR system, Kaiser Permanente Specialty Pharmacy, and quality measurement of the provided services (Monroe and Chin, 2013). The integrated system used allowed pharmacists to coordinate provision of medications, monitoring laboratory reports, visits to the physicians, and other components of the therapy

provided to the patient. The system facilitated providing patient counseling, promoted adherence, and allowed pharmacist interventions to improve clinical outcomes and logistic issues. The system improved pharmacist and patient experience of care. The system might be adopted to improve clinical pharmacy services (Monroe and Chin, 2013).

Alex et al. (2016) to assess the impact of pharmacist in a team-based approach to medication management and discharge medication reconciliations on reducing medication errors in a tertiary care hospital using EHR and computerized physician order entry (Alex et al., 2016). A pharmacist participated in a team-based approach to medication management, medication reconciliations, and medication education upon patient discharge. Compared to the control in which collaboration with the pharmacist was not sought, collaboration with the pharmacist in the intervention group significantly increase the percentage of patients discharged without a medication error (93.8% vs. 40.2%, p-value < 0.001). In addition, the pharmacist's interventions reduced discharge medication errors associated with EHR and computerized physician order entry (Alex et al., 2016).

2.3 Use of electronic health records to capture impact of pharmacists

McNicol et al. (2019) implemented a documentation workflow that was standardized within an EHR to capture interventions of pharmacists in pediatric ambulatory care clinics and transitions-of-care service in central Ohio (McNicol et al., 2019). In the pediatric healthcare system where the study was conducted, clinical pharmacists were integrated within the healthcare team in seven pediatric clinics and transitions-of-care service to improve medication-related outcomes among pediatric patients. The documentation workflow was standardized within an EHR to collect the interventions made by the clinical pharmacists. A technician generated a weekly report of the intervention data, identified opportunities for reimbursement, documents, and bills through a

separate internet-based platform for medication therapy management. The novel documentation workflow was assessed and feedback was continuously collected from the clinical pharmacists and the technician. Clinical pharmacists received updates during the monthly staff meetings and changes to the workflow were implemented whenever needed. The clinical pharmacists made 5,210 documented interventions in different categories. Of those, 1,765 were related to medication education, 1,170 were related to medication reconciliations, and 795 were related to compliance assessments. The study concluded that the documentation workflow that was standardized within the EHR permitted consistent capturing of clinical pharmacist interventions in ambulatory care clinics and transitions-of-care service. Adequate training and uninterruptable feedback to the clinical pharmacists, help from the billing technician, and timely documentation of the interventions were key elements to the success of the new documentation workflow (McNicol et al., 2019).

Shawahna (2020) explored the views and opinions of stakeholders on the activities/services that could be used to measure quality of pharmaceutical care in Palestinian healthcare facilities (Shawahna, 2020c). Semi-structured interviews were conducted with the participants. The qualitative data were analyzed qualitatively. Activities/services were grouped into 6 themes: (1) providing collaborative, direct, and comprehensive care services to patients; (2) usual services/activities at the time of admission, during stay, at transition between wards/services/hospitals, and at discharge to home or community care; (3) identifying/resolving medication problems; (4) collaboration with other healthcare professionals; (5) professional development; and (6) performance/efficiency (Shawahna, 2020c).

Shawahna (2020) published a scoping review on quality indicators of pharmaceutical care for integrative healthcare (Shawahna, 2020b). The databases EMBASE, PubMed, MEDLINE,

COCHRANE, CINAHL/EBSCO, and SCOPUS were systematically searched and relevant studies were selected. A total of 31 studies were selected. Of the studies, 77.4% were related to provision of pharmaceutical services and 22.6% were related to provision of patient care. A total of 42 activities/services were identified as quality indicators that could be used to measure the impact of pharmacists. Activities/services included taking patient history, reconciliations, identifying/resolving drug problems, provision of collaborative care, care plans, improved performance, and continuing education (Shawahna, 2020b).

Shawahna (2020) developed a consensus-based core inventory of key performance indicators that can be used to measure impact of pharmaceutical care in healthcare facilities in Palestine (Shawahna, 2020a). A 3-round iterative Delphi technique was used to develop the consensus-based core inventory of key performance indicators. A core list of 8 key performance indicators was developed. The key performance indicators included number of resolved problems related to medications and complementary and alternative medicine, number of documented reconciliations, number of patients who received direct, comprehensive, and/or collaborative care, and number of patients for whom therapeutic plan were developed, and participation in multi-healthcare provider discussions/deliberations (Shawahna, 2020a).

Shawahna (2019) developed a consensus-based core set of key performance indicators that can be used in measuring the impact of pharmacists in caring for patients with epilepsy in primary healthcare (Shawahna, 2019a). The method used combined a comprehensive literature search, qualitative interviews, and a 3-round Delphi technique among panelists to develop the consensus-based core set of key performance indicators. A core list of 8 key performance indicators was developed. The indicators were from the areas of medication reconciliations and best possible medication history, pharmaceutical care, patient counseling/education, interprofessional patient

care, competence, and performance patient satisfaction/efficiency. Services relevant to identification of therapy problems and provision of direct care were rated higher than other services (p-value < 0.001). Adopting and implementing the key performance indicators might improve pharmaceutical care of patients with epilepsy in primary healthcare practice in Palestine (Shawahna, 2019a).

2.4 Need to improve the design of electronic health records

Shawahna (2019) explored benefits and features that need to be considered to plan, design, develop, implement, pilot, evaluate, maintain, upgrade, and use of EHRs with clinical decision support systems (Shawahna, 2019b). The method used combined a comprehensive literature search, qualitative interviews, and iterative Delphi rounds among panelists to develop the consensus-based items. Consensus was achieved on 110/122 items, of those, 16 were related to demography of the patients, 16 were related to medications, 16 were related to reviewing orders and alerts, 14 were related to the identity of the patient, 13 were related to assessing patient, 12 were related to alerts' quality, 11 were related to admitting and discharging patients, 9 were general features, and 3 were related to disease/diagnosis. Implementing the consensus-based items might improve developing efficient EHRs (Shawahna, 2019b).

Burgin et al. (2014) analyzed pharmacists' experiences with electronic patient records and electronic patient medication and administration records (Burgin et al., 2014). Semi-structured focus groups (n = 4) were held. thematic analysis and the Actor Network Theory were used to analyze the qualitative data. Three main themes emerged from the qualitative data. The pharmacists felt less visible to patients and experienced reduced relationship with the patients as they were not required to see the patients when they reviewed their prescriptions. Interprofessional relationships between the pharmacists, physicians, and nurses changed. Pharmacists also changed

what and how they documented information. Pharmacists need to be trained to keep the patient as the focus of care when implementing electronic patient records and electronic patient medication and administration records (Burgin et al., 2014).

Mercer et al. (2018) used a mixed method to investigate how physicians and pharmacists understand, make medication-related decisions, and communicate these orders and how this can impact designing EHRs (Mercer et al., 2018). Semi-structured interviews were conducted with physicians and pharmacists in team-based primary care clinics, independent-practice family physician clinics, and community pharmacies in Ontario, Nova Scotia, Alberta, and Quebec. Data were collected from healthcare professional (n = 34) in pharmacies (n = 19) and clinics (n = 9). The data were organized into 6 main themes. Physicians used their understanding of the patient to make decisions and Interprofessional Shared Decision-Making was not used. By design, current EHRs did not facilitate collaboration and direct communication between physicians and pharmacists. Professional and workplace boundaries internally and externally imposed between physicians and pharmacists. Colocation of physicians and pharmacists influenced their relationships. With regard to medication management, limited collaboration and communication existed between physicians and pharmacists. Pharmacists missed information regarding why medications were prescribed and physicians missed information relevant to adherence of the patient to taking the medications. Designs of EHRs can be improved to facilitate interprofessional collaboration and communication between the physician and pharmacist (Mercer et al., 2018).

Fuji et al. (2011) described views and practices of Nebraska pharmacists with regard to adopting and using EHRs and sharing health information (Fuji et al., 2011). A survey was mailed to all pharmacists practicing in Nebraska. Of the respondents, 12% used an EHR and 13%

indicated that they plan to adopt one in the future. At the time of the study, low uptake of EHRs was reported despite national focus on EHRs and sharing health information (Fuji et al., 2011).

CHAPTER THREE

Methods

3 Methods

This study was conducted in two phases. Phase 1 was a systematic scoping review and phase 2 was a qualitative study.

3.1 Phase 1: Systematic scoping review

This systematic scoping review was conducted and reported in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement for scoping reviews (PRISMA- ScR) (Tricco et al., 2018). Compliance with the PRISMA- ScR statement is shown in Appendix 1. To adhere with the international guidelines of conducting systematic reviews, this systematic scoping review was registered in Open Science Framework (OSF), Center for Open Science, Charlottesville, Virginia as Registration DOI: 10.17605/OSF.IO/X3EU5.

3.1.1 Search strategy

To identify relevant articles, the databases: Medline/PubMed, Cochrane, CINAHL/EBSCO, Embase, PsycINFO, and Scopus were searched. The search syntaxes were composed by combining the keywords: pharmacist, pharmaceutical care/services/activities and electronic health/patient record/system. The Boolean operators “OR” and “AND” were used to combine the keywords. The databases: Google Scholar and OpenGrey were searched to identify potential documents from the grey literature that might not be indexed in the searched databases. The databases were searched as late as April 10, 2021. A secondary manual search within the references of the retrieved articles was conducted as a back snowballing approach to identify potential articles that could be included (Greenhalgh and Peacock, 2005).

3.1.2 Selection of documents

The documents retrieved though the database searches were imported as Comma Separated Values (CSV) files that could be opened using Microsoft Excel (Microsoft Inc.) and Research Information Systems (RIS) documents that could be opened in EndNote (Clarivate Analytics, Philadelphia (Shawahna and Nairat, 2021, Shawahna, 2020b). The retrieved documents were screened and duplicates were removed. To ensure consistency, the process was repeated three time and the results of each process were compared. The titles and abstracts of the retrieved documents were screened against the inclusion criteria. Again, the process was repeated three times to ensure consistency and the results of each process were compared. The selected documents were eligible for a full-text review.

3.1.3 Inclusion and exclusion criteria

The documents identified in this study were eligible for a full-text review in case they reported on design/development of electronic health record systems to capture pharmaceutical services, use of electronic health record systems to improve/evaluate pharmaceutical care services/delivery, and/or measuring impact of pharmacists through electronic health record systems. Documents were excluded when they were reported in languages other than English and/or lacked data relevant to those mentioned in the inclusion criteria. Documents in the form of editorials and those in the form of letters to the editor were excluded.

3.1.4 Data extraction and synthesis

The full text of each selected document was viewed as Portable Document Format (PDF) using Adobe Acrobat Pro.v.11 (Adobe Inc., San Jose, California). Sticky notes, comments, and text

highlighting tools were used to mark the text reporting on pharmaceutical services that could be captured and measuring impact of pharmacists through electronic health record systems.

The data were collected into a data extraction form that was created for this study. The data collection form is provided in Appendix 2. The data extraction process was repeated three times to ensure consistency and reproducibility. Discrepancies were discussed and resolved by consensus. The collected data included: author(s), publication year, journal name, Number of citations, Type of access, objective(s) of the study, country from where the study originated, Settings, Sample, study design, method, and summary of the main outcomes and conclusions. As the data were heterogenous in nature, the data were analyzed qualitatively and presented as qualitative synthesis (Shawahna, 2020b, Shawahna and Nairat, 2021).

3.2 Phase 2: Qualitative interviews

The phase 2 was conducted using in-depth semi-structured qualitative interviews in an explorative design. To adhere with the international guidelines for conducting qualitative studies, this phase was conducted and reported in compliance with the COnsolidated Criteria for REporting Qualitative Research (COREQ) checklist (Tong et al., 2007). Compliance with the COREQ checklist is shown in Appendix 3. Semi-structured interviews were conducted with the interviewees with the help of an interview guide that was developed for this study. The interview guide in provided in Appendix 4.

The interview guide was informed by previous qualitative studies and modified by the researchers (Murphy et al., 2019, Hughes et al., 2011). The interview guide was pilot tested with 3 pharmacists to ensure generation of rich qualitative data.

3.2.1 Determination of the sample size

The sample size needed for this study was determined based on the thematic saturation point. Achieving conceptual thematic saturation was used as the recruitment endpoint (Lowe et al., 2018). In this study, conceptual thematic saturation was said to have been achieved when the qualitative data that emerged from the interviews were sufficient to saturate the themes, subthemes, and patterns. Informed by previous studies in which in-depth qualitative interviews were used to generate qualitative data from healthcare providers, approximately 8 hours of interview time would be needed to collect sufficient qualitative data to saturate the themes, subthemes, and patterns (Shawahna, 2020b, Shawahna and Abdelhaq, 2020, Shawahna et al., 2021). Assuming an average duration of each interview of about 40 min, a minimum of 14 interviews would be required to achieve conceptual thematic saturation.

3.2.2 Identification and recruitment of the interviewees

In this study, key contacts in the field were used to identify the potential interviewees. Purposive and snowball sampling approaches were combined to recruit the number of interviewees needed for this study (Shawahna, 2020b, Shawahna and Abdelhaq, 2020). This combination was motivated by the merits of these approaches to ensure achieving conceptual thematic saturation and recruitment of information-rich participants. The interviewees were invited and interviewed by the researcher who was a Master's student in the MSc Information Technology at Arab American University at the time of the study. The researcher explained the aims and design of the study to the potential interviewees and obtained their informed consent. The study participants were identified and recruited based on their experience in the field. In this study, the inclusion criteria were as follows: 1) having at least a Bachelor's degree in relevant field, 2) being employed by a hospital that uses electronic health information system or holding an administrative position

relevant to the use of the electronic health information system, 3) having a practical experience of more than 4 years, 4) providing consent to participate in a recorded semi-structured interview.

3.2.3 Collection of the qualitative data

The qualitative interviews were collected with the help of an interview guide that was informed by an extensive literature review. The literature review was comprehensively reported in Phase 1 of this thesis. The interview guide contained open-ended questions that allowed the participant to elaborate freely. Whenever needed, the researcher used appropriate prompts to motivate the interviewee to elaborate on a certain issue. The researcher was trained on conducting qualitative interviews by the research supervisor who had experience in conducting this type of interviews. Before the interviews, the interviewees were informed that this study was being conducted for the purpose of scientific research and the researchers had no interest in influencing the opinions of the interviewees. The interviews were recorded and their contents were transcribed verbatim. The interviews were not repeated as all interviews were recorded.

3.2.4 Data analysis

The interpretive description method was used to qualitatively analyze the contents of the interviews (Thorne et al., 1997). One of the advantages of this method lied in allowing the identification of themes, subthemes, and patterns (Thorne et al., 2004). Additionally, this method allowed interpretative description of complex experiential issues as in this study (Thorne et al., 2004). The Qualitative Analysis Guide of Leuven was used to identify themes, subthemes, and patterns (Dierckx de Casterlé et al., 2012). Additionally, themes, subthemes, and patterns were refined through constant comparisons and iterations (Bowen, 2008). Contextualization of the data into themes, subthemes, and patterns was based on the relationship between the data points (Morse and Field, 1996).

3.3 Ethical considerations

All phases of this study were conducted in compliance with the international standards followed in medical and scientific research as outlined in the Declaration of Helsinki (World Medical Association, 2001). The protocol of this thesis was peer-reviewed and approved by the committee of the Faculty of Graduate Studies, Arab American University. The protocol of the systematic scoping review was registered in an open international registry and was conducted in adherence to the PRISMA- ScR. The qualitative phase of this thesis was conducted in adherence to the COREQ statement. All interviewees provided informed consent and the audio files of the recordings were protected with a password.

CHAPTER FOUR

Results

4 Results

4.1 Results of phase 1: scoping analysis

4.1.1 The selected documents

When duplicates were removed, a total of 741 documents were identified from the database searches. Additional 5 relevant documents were added to the search results. Upon initial screening, 653 documents were excluded. When the documents were screened against the inclusion and exclusion criteria, 73 documents were excluded and 20 documents were included in this systematic scoping review. The section process is shown in Figure 4-1.

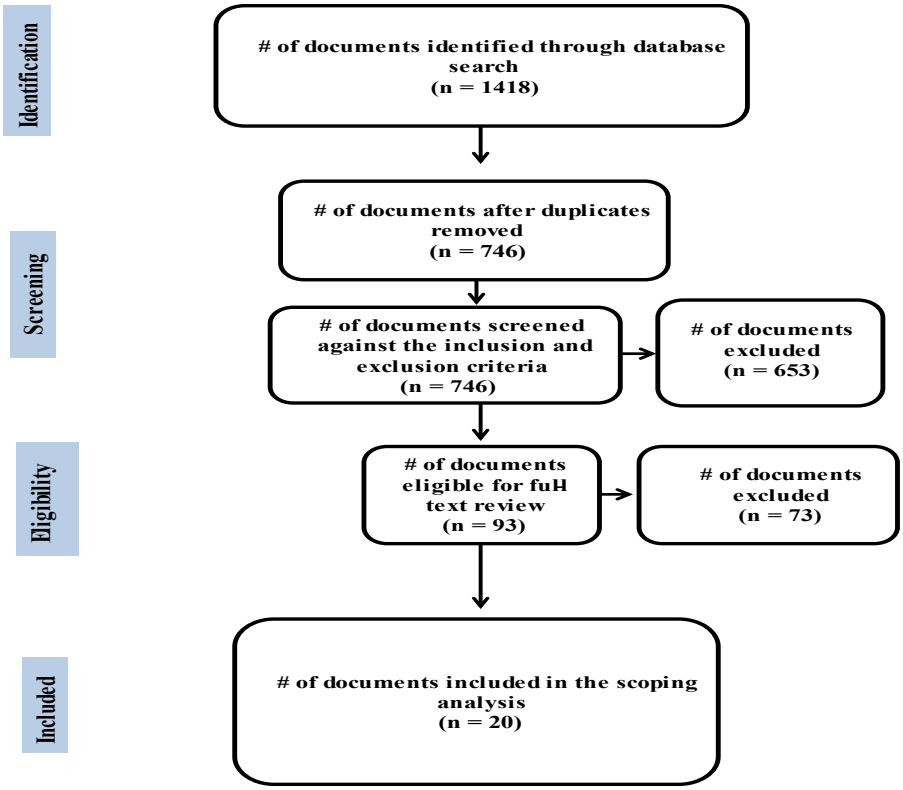

Figure 4-1: Flow diagram of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)

4.1.2 Characteristics of the selected documents

Of the selected documents, 7 (35%) reported on some intervention, 7 (35%) used qualitative methods, and 1 (5%) was a survey. Details of the study designs used in the selected documents are shown in Figure 4-2.

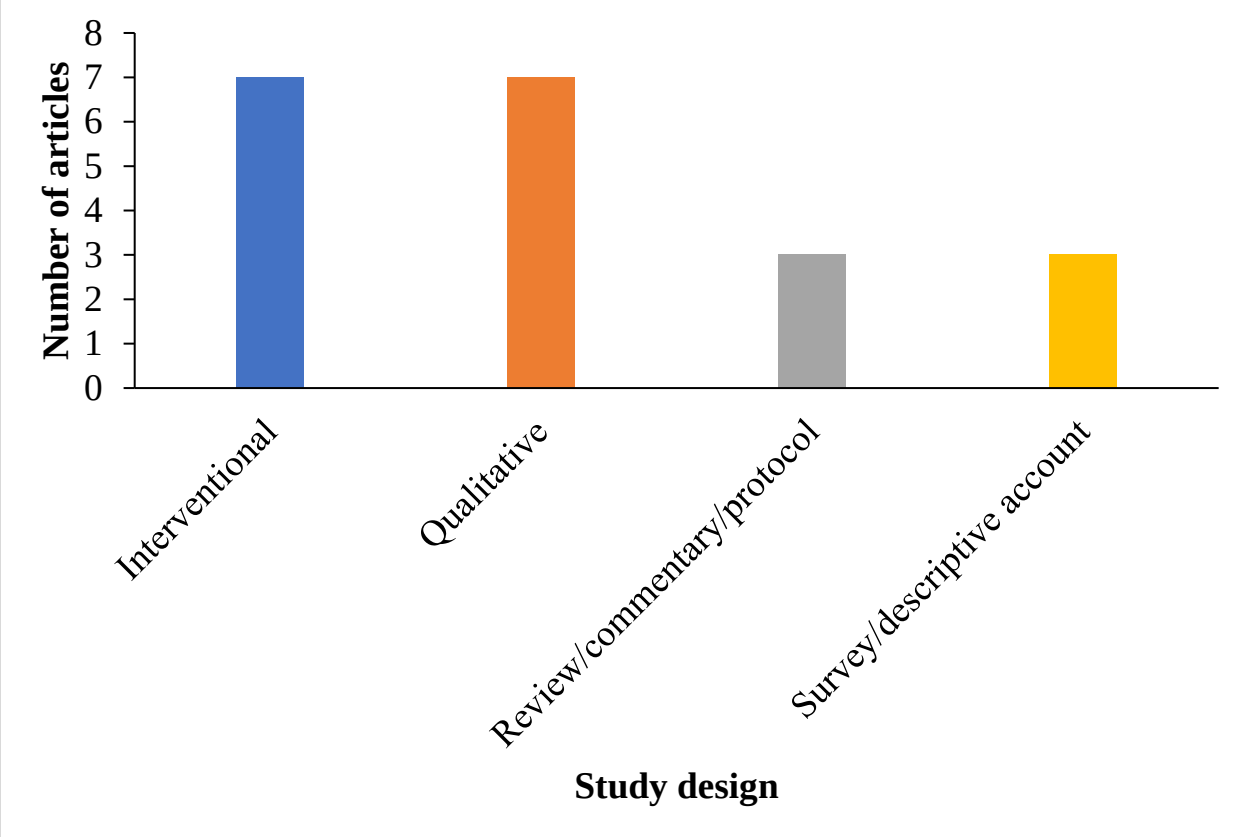

Figure 4-2: Study designs used in the selected documents

The selected documents were published between the years 2004 and 2020. Of the documents, 12 (60%) were published in the year 2018 and beyond. Years in which the documents were published are shown in Figure 4-3.

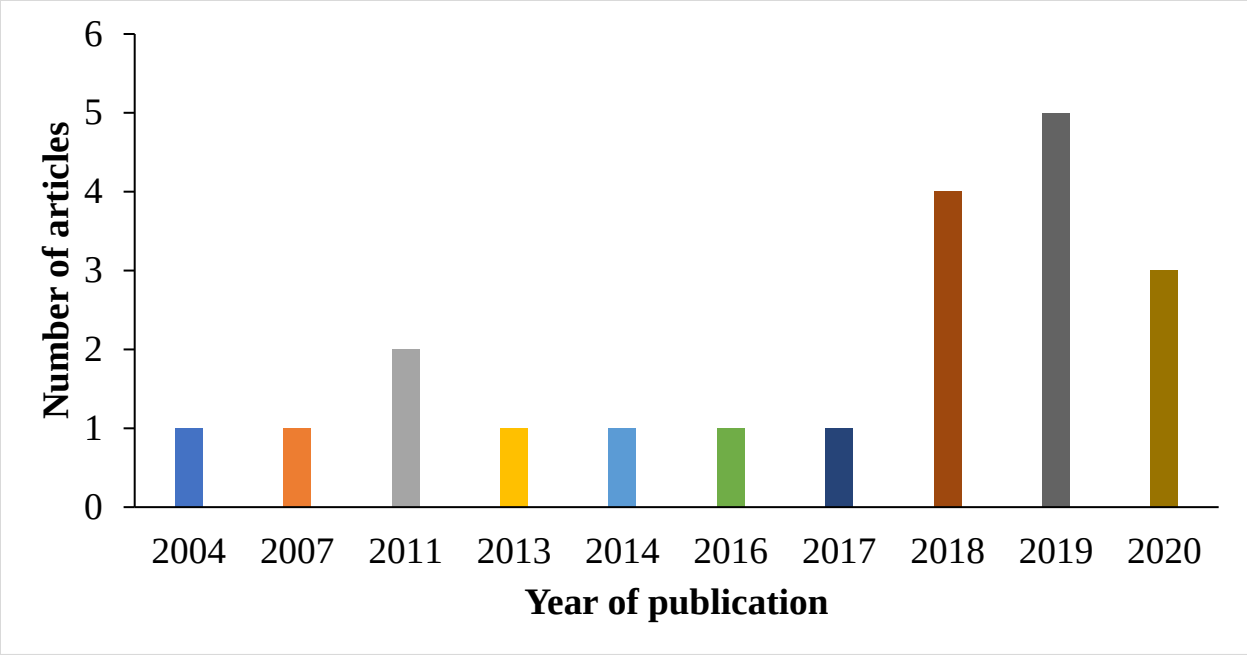

Figure 4-3: Years in which the selected articles were published

The documents were published in 16 different journals. Sources in which the selected articles were published are shown in Table 4-1.

Table 4-1: Journals in which the selected articles were published

#	Journal	n	%
1	Journal of the American Pharmacists Association	3	15.0
2	Evidence-based Complementary and Alternative Medicine	3	15.0
3	BMC Medical Informatics and Decision Making	1	5.0
4	BMJ Open	1	5.0
5	Epilepsy and Behavior	1	5.0
6	Hospital Pharmacy	1	5.0

#	Journal	n	%
7	JMIR Human Factors	1	5.0
8	Journal of managed care & specialty pharmacy	1	5.0
9	Journal of Managed Care Pharmacy	1	5.0
10	Journal of Oncology Pharmacy Practice	1	5.0
11	Journal of Pharmacy Practice	1	5.0
12	Perspectives in health information management	1	5.0
13	Pharmacy Education	1	5.0
14	Quality Management in Health Care	1	5.0
15	Research in Social and Administrative Pharmacy	1	5.0
16	Transplant Infectious Disease	1	5.0

More than half (55%) of the selected documents originated from the United States. Countries from where the selected documents originated are shown in Figure 4-4.

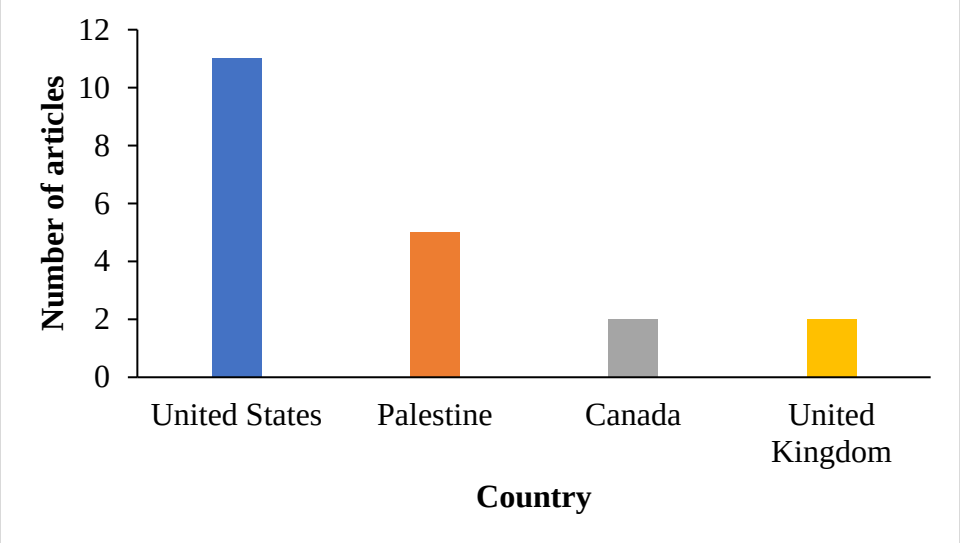

Figure 4-4: Countries from where the selected documents originated

Of the selected documents, 13 (65%) were accessible by subscription (Figure 4-5).

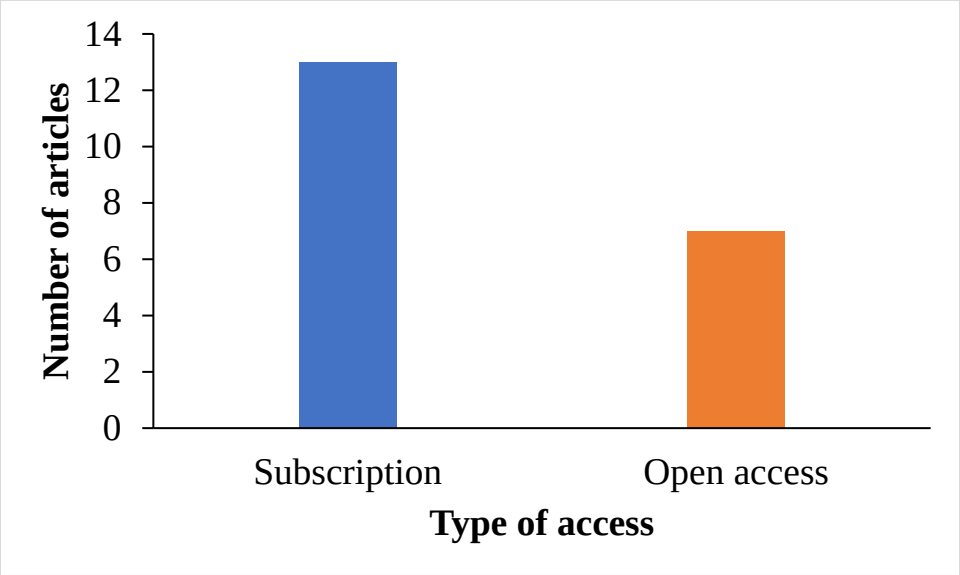

Figure 4-5: Type of access to the selected documents

The selected documents received a total of 117 citations. The number of citations received by each of the selected documents are shown in Figure 4-6.

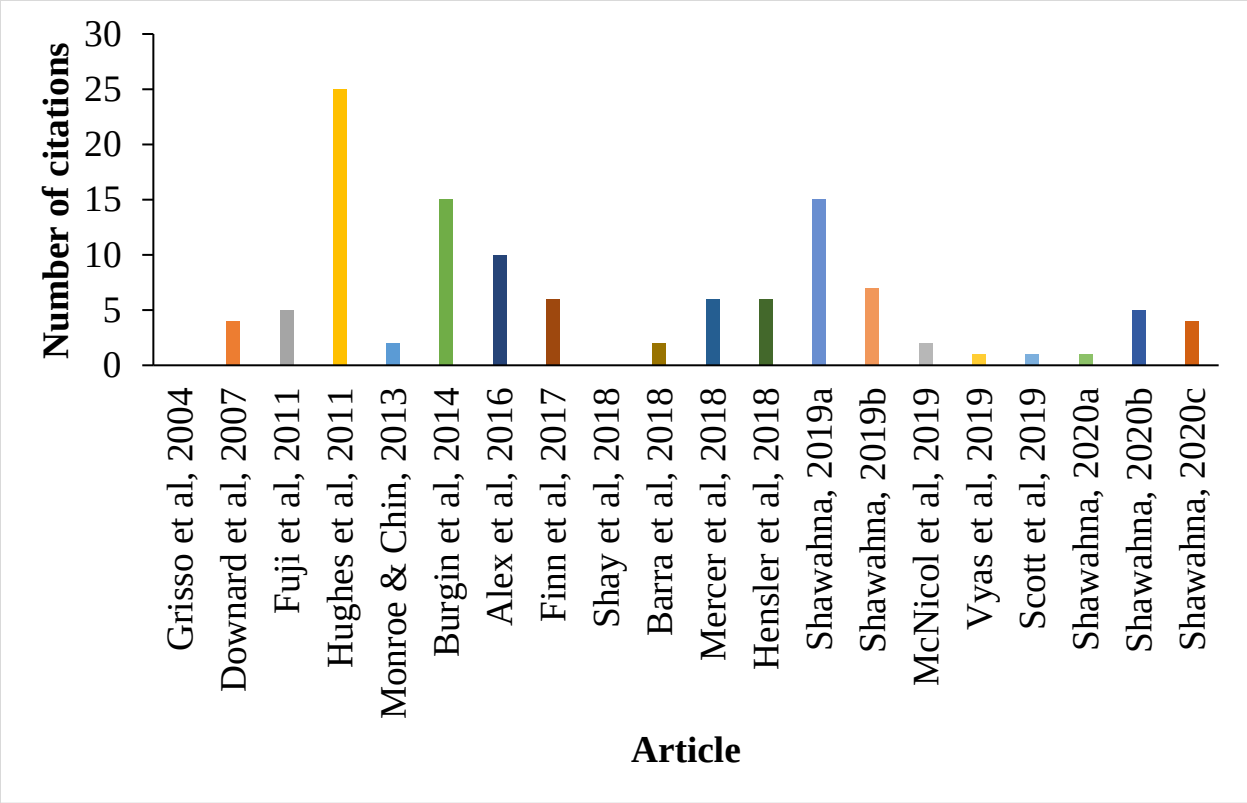

Figure 4-6: Number of citations received by each of the selected documents

4.1.3 Content analysis of the selected documents

Of the selected documents, 4 (20%) reported on use of EHRs by pharmacists, 7 (35%) reported on improvements to the pharmaceutical services brought by EHRs, 5 (25%) reported on using EHRs to capture impact of pharmacists, and 4 (20%) reported on the need to improve the design of EHRs as shown in Table 4-2.

1 **Table 4-2:** Summary of the selected documents

#		Objective	Settings	Sample	Design	Methods	Main findings
The use of electronic health records by pharmacists							
1	Hughes et al., 2011	A description of how an EHR was integrated and used by pharmacists while they cared for patients and investigated the factors associated with using medications and laboratory reports from the EHR	Primary care networks, long-term care settings, community independent and chain pharmacies, and grocery store pharmacies in Edmonton, Canada	Pharmacists (n = 16), pharmacy technicians (n = 3), and pharmacy interns (n = 2)	Qualitative	The participants were interviewed for their self-reported use of EHR	• The pharmacists who practiced in a patient-centered care facility were reported more frequent use of the EHR to review information on medications and laboratory reports compared to community pharmacists • The use of EHR was influenced by pharmacists, pharmacy, patients, physicians, EHR, and environment • The pharmacists who practiced in patient-centered care facilities reported that access to the medical records and timeliness were barriers limited their practice • Understanding of their roles, valid motives for using EHR, and fear of legal disciplinary actions limited the use of EHR by community pharmacists • EHRs were excellent tools that can be used to advance patient care by pharmacists
2	Downard et al., 2007	To report on pharmacists' use of EHRs and how these systems can be used to share health information	N/A	N/A	Descriptive account	A descriptive account of how EHRs can be used to share health information	• The report also provided a descriptive account of how care can be integrated across practices in different environments, how the patients praised internet-based options, how health information can be shared, what information should be included, who will have access to information, and how patient's privacy can be ensured

#		Objective	Settings	Sample	Design	Methods	Main findings
3	Scott et al., 2019	To gain insights into how cross-organizational EHRs influenced decisions of physicians and pharmacists	UK healthcare system	The databases: Embase, PubMed, Medline, HMIC, Health Business Elite, National Institute for Health, and Care Excellence Healthcare	Scoping review protocol	The protocol proposed to adopt the notion of distributed cognition and sociotechnical systems thinking to guide the conceptual models. The databases will be searched for relevant studies.	• Studies will be selected if they reported on how cross-organizational EHRs influenced decisions of physicians and pharmacists
4	Vyas et al., 2019	To assess the impact of EHR and simulated encounters with physicians on knowledge and skills of students with regard to implementing pharmacist-patient care process	Educational training	Students enrolled in a therapeutics course (n = 200)	Interventional	Students who were enrolled in a therapeutics course reviewed cases with an EHR. The students made medication orders using the computerized provider order entry platform. A rubric was used by the faculty to grade the performance of the students and a pre-post attitude survey and knowledge tests were completed by the students	• Cases scores were within the range of 67.7%-88.2% • Medication orders scores were within the range of 78.6%-91.1% • Training improved quiz scores from 15.3/20 to 17.3/20 • Training improved attitude scores from 23.2 to 31.0 • Training students on EHR and using simulations significantly improved students' understanding of the pharmacist patient care process.

#		Objective	Settings	Sample	Design	Methods	Main findings
5	Barra et al., 2018	Evaluation of the influence of an integrated electronic EHR on medication orders reviewed by pharmacists	Emergency department of a trauma center	Medication orders (n = 5,450)	Interventional	Medication orders reviewed by pharmacists before and after the implementation of the EHR were compared. The study collected percentage of medication orders verified by a pharmacist, time of order entry to pharmacist review, time of order entry to medication procurement, time of order entry to medication administration	• Medication orders reviewed increased from 51.8% before the implementation to 94% after the implementation (p-value < 0.001) • The median time from order entry to pharmacist review decreased from 13 min before implementation to 4 min after implementation (p-value < 0.001) • The median time from order entry to medication procurement increased from 9 min before implementation to 15 min after the implementation (p-value < 0.001) • The median time from order entry to administration increased from 15 min before implementation to 23 min after implementation (p-value < 0.001) • Implementation of the integrated electronic health record increased the percentage of medication reviews by a pharmacist before administration and decreased the time to pharmacist review • There was a marginal increase in the time to procurement and administration of the medication

#		Objective	Settings	Sample	Design	Methods	Main findings
6	Finn et al., 2017	Description of implementation of a new pharmacist-led oral chemotherapy program and evaluated interventions of pharmacists before and after implementing the program	Medical University of South Carolina Hollings Cancer Center	Cancer patients (n = 240) who received oral chemotherapy medication orders (n = 450)	Interventional	Documented pharmacist interventions relevant to oral chemotherapy medication orders were reviewed retrospectively before and after of the EHR system (Epic Beacon)	• The program increased pharmacist interventions by 660% (89 before the implementation vs. 681 after the implementation) • Chemotherapy calendar coordination, focus on coordination of care, and assistance with treatment plans also increased after the implementation of the program • The program increased identification of chemotherapy order errors by more than 500% (41 before the implementation vs. 250 after the implementation) • After the implementation of the program, pharmacists could identify more significant, serious, or potentially lethal chemotherapy order errors • Implementation of Epic Beacon increased pharmacist review of chemotherapy medication orders, increased documentation of pharmacist interventions, improved identification and documentation of errors, decreased the need to clarify chemotherapy medication orders, and increased the volume of chemotherapy medication orders

#		Objective	Settings	Sample	Design	Methods	Main findings
7	Hensler et al., 2018	To assess the impact of an automated EHR-based pharmacist-driven program on optimizing doses of valganciclovir for recipients of solid organ transplants	A large transplant center	Recipients of solid organ transplants (before the implementation = 303 and after the implementation = 263)	Interventional	Demographic and clinical data were collected from 2 cohorts of liver, kidney, and pancreas-kidney recipients of transplant were collected before and after the implementation for 1 year after receiving the transplants	• The 1-year incidence of cytomegalovirus infections decreased from 18.5% before the implementation to 12.2% after the implementation (p-value = 0.05) • The 1-year incidence of breakthrough infections decreased from 61% before the implementation to 34% after the implementation (p-value = 0.03) • The risk of developing cytomegalovirus infections was greater before the implementation of the dose optimization program (hazard ratio = 1.64, 95% CI of 1.06-2.60, p-value =0.03) • The number of ganciclovir-resistant cytomegalovirus cases was reduced from 2 before the implementation to 0 after the implementation • The EHR-based program resulted in reducing cytomegalovirus infections among recipients of solid organ transplants
8	Shay et al., 2018	Measurement of the impact of a pharmacist-driven monitoring program of patients with bleeding disorders with regard to completeness of bleeding log, documentation of the bleeding log in the electronic health record (EHR), and interventions of the	Hemophilia treatment centers and specialty pharmacies	Bleeding records (before implementation = 117 and after implementation = 150)	Interventional	Prior to the implementation, bleeding logs were scanned into the EHR and after the implementation the pharmacists completed the bleeding logs using a tool in the integrated EHR. For each record, completeness of the bleeding logs was compared based on	• 19/117 bleeding records were completed before the implementation compared to 15/15 records were completed after the implementation (p-value < 0.001) • 706/1,170 were completed before the implementation compared to 120/150 were completed after the implementation (p-value < 0.001) • After the implementation, 14 pharmacist interventions were recorded • The integrated EHR tool improved completeness and of bleeding logs and documentation of pharmacist interventions

#		Objective	Settings	Sample	Design	Methods	Main findings
		pharmacists using an EHR tool				10 clinical data elements	
9	Grisso et al., 2004	Description of how pharmacokinetic services can be expanded via the EHR using computerized physician entry and computerized note capture tools	Vanderbilt University Medical Center	Staff pharmacists	Descriptive account	A descriptive account of how pharmacokinetic services can be expanded via the EHR using computerized physician entry and computerized note capture tools	• EHR, computerized physician entry, and computerized note capture tools allowed staff pharmacists to expand their clinical roles by providing pharmacokinetic services to pediatric patients • The computerized documentation of the recommendations was well received by the staff healthcare providers • The system allowed access to information on dosing antibiotics and how the patient responded • The system informed dosing of antibiotics in future hospitalizations

#		Objective	Settings	Sample	Design	Methods	Main findings
10	Monroe and Chin, 2013	To describe the efforts of Kaiser Permanente to promote specialty drug management, use of EHR system, Kaiser Permanente Specialty Pharmacy, and quality measurement of the provided services	Kaiser Permanente	N/A	Commentary	A descriptive account of the efforts of Kaiser Permanente	• The integrated system used allowed pharmacists to coordinate provision of medications, monitoring laboratory reports, visits to the physicians, and other components of the therapy provided to the patient • The system facilitated providing patient counseling, promoted adherence, and allowed pharmacist interventions to improve clinical outcomes and logistic issues • The system improved pharmacist and patient experience of care • The system might be adopted to improve clinical pharmacy services
11	Alex et al., 2016	To assess the impact of pharmacist in a team-based approach to medication management and discharge medication reconciliations on reducing medication errors in a tertiary care hospital using EHR and computerized physician order entry	An academic tertiary care hospital	Discharge patients (n = 279)	Interventional	A pharmacist participated in a team-based approach to medication management, medication reconciliations, and conducted medication education upon patient discharge	• Compared to the control in which collaboration with the pharmacist was not sought, collaboration with the pharmacist in the intervention group significantly increase the percentage of patients discharged without a medication error (93.8% vs. 40.2%, p-value < 0.001) • Interventions of the pharmacist reduced discharge medication errors associated with EHR and computerized physician order entry

#		Objective	Settings	Sample	Design	Methods	Main findings
12	McNicol et al., 2019	A standardized documentation workflow was integrated with an EHR to collect interventions of clinical pharmacists	Pediatric ambulatory care clinics and a transitions-of-care programs in central Ohio	Clinical pharmacists (n = 7) and a billing technician (n = 1)	Interventional	The documentation workflow was standardized within an EHR to collect the interventions made by the clinical pharmacists. A technician generated a weekly report of the intervention data, identified opportunities for reimbursement, documents, and bills through a separate internet-based platform for medication therapy management. The novel documentation workflow was assessed and feedback was continuously collected from the clinical pharmacists and the technician. Clinical pharmacists received updates during the monthly staff meetings and changes to the	• 5,210 documented interventions were made by the clinical pharmacists • 1,765 were related to medication education • 1,170 were related to medication reconciliations • 795 were related to compliance assessments • Adequate training and uninterruptable feedback to the clinical pharmacists, help from the billing technician, and timely documentation of the interventions were key elements to the success of the new documentation workflow

#	Objective	Settings	Sample	Design	Methods	Main findings
					workflow were implemented whenever needed.	

#		Objective	Settings	Sample	Design	Methods	Main findings
13	Shawahna, 2020	Exploring views and opinions of stakeholders on the activities/services that could be used to measure quality of pharmaceutical care in Palestinian healthcare facilities	Healthcare facilities in Palestine	Complementary and alternative medicine practitioners (n = 9), pharmacists (n = 8), physicians (n = 2), nurses (n = 2), and risk/quality assurance manager (n = 1)	Qualitative, interviews	Semi-structured interviews were conducted with the participants. The qualitative data were analyzed qualitatively	• Activities/services were grouped into 6 themes • Providing collaborative, direct, and comprehensive care services to patients • Usual services/activities at the time of admission, during stay, at transition between wards/services/hospitals, and at discharge to home or community care • Identifying/resolving medication problems • Collaboration with other healthcare professionals • Professional development • Performance/efficiency
14	Shawahna, 2020	To conduct a scoping review on quality indicators of pharmaceutical care for integrative healthcare	Healthcare systems	EMBASE, PubMed, MEDLINE, COCHRANE, CINAHL/EBSCO, and SCOPUS	Scoping review	The databases were systematically searched and relevant studies were selected	• 31 studies were selected • 77.4% of the studies were related to provision of pharmaceutical services and 22.6% were related to provision of patient care • 42 activities/services were identified as quality indicators that could be used to measure the impact of pharmacists Activities/services included taking patient history, reconciliations, identifying/resolving drug problems, provision of collaborative care, care plans, improved performance, and continuing education
15	Shawahna, 2020	Development of a consensus-based core inventory of key performance indicators that can be used to measure	Healthcare facilities in Palestine	Panelists (n = 50)	Qualitative, Delphi technique	A 3-round iterative Delphi technique was used to develop the consensus-based core inventory of key	• A core list of 8 key performance indicators was developed • The key performance indicators included number of resolved problems related to medications and complementary and alternative medicine, number of

#		Objective	Settings	Sample	Design	Methods	Main findings
		impact of pharmaceutical care in healthcare facilities in Palestine				performance indicators	documented reconciliations, number of patients who received direct, comprehensive, and/or collaborative care, and number of patients for whom therapeutic plan were developed, and participation in multi-healthcare provider discussions/deliberations
16	Shawahna, 2019	Development of a consensus-based core set of key performance indicators that can be used in measuring the impact of pharmacists in caring for patients with epilepsy in primary healthcare	Primary healthcare practice in Palestine	Panelists (n = 40)	Qualitative, Delphi technique	The method used combined a comprehensive literature search, qualitative interviews, and a 3-round Delphi technique among panelists to develop the consensus-based core set of key performance indicators	• A core list of 8 key performance indicators was developed • The indicators were from the areas of medication reconciliations and best possible medication history, pharmaceutical care, patient counseling/education, interprofessional patient care, competence, and performance patient satisfaction/efficiency • Services relevant to identification of therapy problems and provision of direct care were rated higher than other services (p-value < 0.001) • Adopting and implementing the key performance indicators might improve pharmaceutical care of patients with epilepsy in primary healthcare practice in Palestine
		Need to improve the design of electronic health records					

#		Objective	Settings	Sample	Design	Methods	Main findings
#	Shawahna, 2019	Exploring benefits and features that need to be considered to plan, design, develop, implement, pilot, evaluate, maintain, upgrade, and use of EHRs with clinical decision support systems	Palestinian healthcare system	Physicians (n = 32), pharmacists (n = 11), nurses (n = 14), IT/programmers (n = 19)	Mixed method, qualitative	The method used combined a comprehensive literature search, qualitative interviews, and iterative Delphi rounds among panelists to develop the consensus-based core set of key performance indicators	• Consensus was achieved on 110/122 items • 16 were related to demography of the patients, 16 were related to medications, 16 were related to reviewing orders and alerts, 14 were related to the identity of the patient, 13 were related to assessing patient, 12 were related to alerts' quality, 11 were related to admitting and discharging patients, 9 were general features, and 3 were related to disease/diagnosis • Implementing the consensus-based items might improve developing efficient EHRs
18	Burgin et al., 2014	Analysis of experiences of pharmacists with electronic patient records and electronic patient medication and administration records	Hospital pharmacists	Four semi-structured focus groups (4-6 participants in each)	Qualitative	Semi-structured focus groups (n = 4) were held. thematic analysis and the Actor Network Theory were used to analyze the qualitative data	• The pharmacists felt less visible to patients and experienced reduced relationship with the patients as they were not required to see the patients when they reviewed their prescriptions • Interprofessional relationships between the pharmacists, physicians, and nurses changed • Pharmacists also changed what and how they documented information • Pharmacists need to be trained to keep the patient as the focus of care when implementing electronic patient records and electronic patient medication and administration records

#		Objective	Settings	Sample	Design	Methods	Main findings
19	Mercer et al., 2018	To investigate how physicians and pharmacists understand and communicate medication information of their patients and how this can impact designing EHRs	Team-based primary care clinics, independent-practice family physician clinics, and community pharmacies in Ontario, Nova Scotia, Alberta, and Quebec	Healthcare professional (n = 34) in pharmacies (n = 19) and clinics (n = 9)	Mixed method, qualitative	Semi-structured interviews were conducted with physicians and pharmacists	• Interprofessional Shared Decision-Making was not used • By design, current EHRs did not facilitate collaboration and direct communication between physicians and pharmacists • Professional and workplace boundaries internally and externally imposed between physicians and pharmacists • Colocation of physicians and pharmacists influenced their relationships • Pharmacists missed information regarding why medications were prescribed and physicians missed information relevant to adherence of the patient to taking the medications • Designs of EHRs can be improved to facilitate interprofessional collaboration and communication between the physician and pharmacist
20	Fuji et al., 2011	Description of views and practices of Nebraska pharmacists with regard to adopting and using EHRs and sharing health information	Nebraska, US	Pharmacists in Nebraska (n = 1,953)	Observational, survey	A survey was mailed to all pharmacists practicing in Nebraska	• 12% of the respondents used an EHR and 13% indicated that they plan to adopt one in the future • At the time of the study, low uptake of EHRs was reported despite national focus on EHRs and sharing health information

1

4.1.4 Pharmaceutical services/activities that could be provided by pharmacists to patients

A total of 52 services/activities that could be provided by pharmacists to patients in hospitalized settings were identified. These services/activities are shown in Table 4-3.

Table 4-3: Activities/services that could be provided by pharmacists to patients in hospitalized settings

#	Activity/service
1	Extemporaneous compounding medications by calculating, weighing, measuring, and mixing different ingredients
2	Preparing medication orders
3	Dispensing medications as prescribed by a healthcare provider authorized to prescribe medications
4	Review medication orders for completeness, accuracy, and suitability for the patient
5	Provide information/educate/counsel patients about medications, their side effects, correct dosage, and proper storage
6	Maintain records such as pharmacy files, patient profiles, charge system files, inventories, registries of poisons, narcotics or controlled medications
7	Plan, implement, and/or maintain procedures for mixing, packaging, and/or labelling medications according to the policy and legal requirements, to ensure quality, security and proper disposal
8	Assess the identity, strength, or purity of medications
9	Work with other health care providers to plan, monitor, review, and/or evaluate the quality and/or effectiveness of medications
10	Order and purchase pharmaceutical supplies, medical supplies, and/or medications and maintaining stock, storage, and handling medications properly
11	Analyze prescribing trends to monitor patient compliance and to prevent excessive usage or harmful interactions of medications
12	Advise patients on the selection of medication brands, medical equipment, and/or healthcare supplies
13	Providing collaborative, direct, and comprehensive patient care services
14	Provision of common services and activities at the time of admission, during stay, at transition between wards/services/hospitals, and at discharge to home or community care
15	Perform duties efficiently
16	Take best possible medications histories
17	Conduct best possible medications history reviews
18	Conduct medication reconciliations at admission
19	Conduct medication reconciliations at transition (between wards/services/hospitals) of care

#	**Activity/service**
20	Conduct medication reconciliations at discharge
21	Develop/prepare/implement/complete therapeutic care plans
22	Initiate/participate in interprofessional discussions
23	Making suggestions to other healthcare providers including physicians
24	Attending meetings
25	Conducting patient education sessions
26	Formal answering inquiries
27	Identifying/resolving contraindications related to medications
28	Identifying/resolving allergies to medications
29	Identifying/resolving drug-drug interactions
30	Identifying/resolving drug-food interactions
31	Identifying/resolving inappropriate medication doses to the patient's renal function
32	Identifying/resolving medication underdoses
33	Identifying/resolving medication overdoses
34	Titrating medication doses to produce a desirable therapeutic effect
35	Identifying/resolving adverse drug reactions
36	Identifying/resolving duplicate medications
37	Identifying/resolving ineffective medications
38	Identifying/resolving ambiguous medication orders
39	Identifying/resolving misspelled medication orders
40	Identifying/resolving illegibly written medication orders
41	Identifying/resolving missing medications (that should have been prescribed)
42	Identifying/resolving missing medication doses
43	Identifying/resolving missing medication frequencies of administration
44	Identifying/resolving missing medication routes of administration
45	Identifying/resolving missing medication durations of therapy
46	Identifying/resolving missing recommendations to take medications in relation to meal
47	Identifying/resolving medication-related problems for high alert medications
48	Initiate/implement/complete documented assessments of response to a therapeutic plan involving medications
49	Receiving no/minimal complaints on the services of pharmacists
50	Committing no/minimal errors related to medications
51	Attending continuing educational/training
52	Delivering educational/training

4.2 Results of phase 2: qualitative interviews

4.2.1 Characteristics of the study participants

Semi-structured in-depth interviews were conducted with 17 participants. Of those, 9 (52.9%) were 40 years old and above, 9 (52.9%) were pharmacists, 15 (88.2%) were employed by a governmental hospital, and 10 (58.8%) had experience of 10 or more years. The median age of the participants was 42 (36-44) years and the median length of experience was 10 (8-15) years. The median duration of the interviews was 33 (27-33) min. The characteristics of the participants are shown in Table 4-4. The geographical distribution of hospitals from where the participants were recruited is shown in Figure 4-7.

Table 4-4: Characteristics of the study participants (*n = 17*)

Characteristic	**n**	**%**
Age (years)		
< 40	8	47.1
≥ 40	9	52.9
Academic degrees		
BSc Pharmacy	2	11.8
MSc Clinical pharmacy	5	29.4
Pharm.D	2	11.8
MD, Consultant in oncology	1	5.9
MD, Consultant in neurology	2	11.8
MSc Health Informatics	3	17.6
MSc Health administration	1	5.9

MD, Orthopedics resident	1	5.9
Place of work		
Governmental hospital	15	88.2
Ministry of health	2	11.8
Length of experience (years)		
< 10	7	41.2
≥ 10	10	58.8

BSc: Bachelor of Science, MD: Doctor of Medicine, MSc: Master of science, Pharm.D: Doctor of Pharmacy

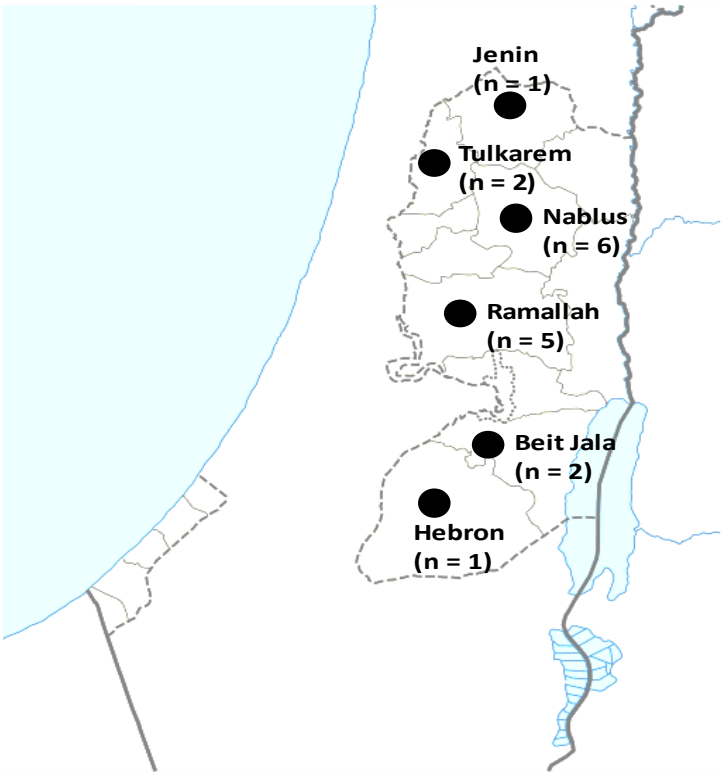

Figure 4-7: Geographical distribution of the places from where the participants were recruited (the map was adopted and modified from Wikimedia Commons that is sharable under a Creative Commons license. The map can be accessed from: http://commons.wikimedia.org/wiki)

4.2.2 Content analysis of the interviews

The qualitative data collected in this study were analyzed for their contents. The qualitative data were organized into 3 main themes. Theme 1 contained 4 subthemes and subtheme 4 contained 9 patterns. Theme 2 contained 10 subthemes and subtheme 10 contained 6 patterns. Theme 3 contained 5 subthemes. The main themes and subthemes are shown in Figure 4-8.

Thematic analysis	**Healthcare delivery**	Expert in medications
		Source of information
		Provider of services
	Improving electronic health record system	Dispensing medications
		Planning procurements of medications
		Reducing medication errors
		Informing hiring decisions
		Access to patient information
		Tracking shortages of medication
		Adherence to guidelines
		Sharing patient information
	Challenges/future outlooks	Organization
		Relationships
		Continuing education/training
		Technical support
		Motivation

Figure 4-8: Main themes and subthemes

4.2.2.1 Importance of pharmacists as healthcare providers to hospitalized patients

4.2.2.1.1 An important member of healthcare delivery team

In this study, the participants stressed on the importance of pharmacists as healthcare providers who partner with other providers in the healthcare team and provide important healthcare services to hospitalized patients. One of the participants shared:

"Pharmacists are part of the healthcare delivery team. Pharmacists have many responsibilities and duties to accomplish in collaboration with the other healthcare team members. Our overall duty is to achieve the best patient outcomes with the least costs."

The participants pointed to the pharmacists as the experts in medications within the healthcare team. One of the interviewees stated:

"The pharmacist is expert in medications. We [pharmacists] have no competitors in this field! We always inform the patients not to hesitate in consulting us [pharmacists] when they have concerns about medications or any complications. We can provide them with alternatives that contain the same active ingredients. We can also provide them with cheaper alternatives with the same efficacy. They just need to ask us [pharmacists] and we would be ready to help".

4.2.2.1.2 An expert in medications

The participants pointed to the pharmacists as the experts in medications within the healthcare team. One of the interviewees stated:

"The pharmacist is expert in medications. We [pharmacists] have no competitors in this field! We always inform the patients not to hesitate in consulting us [pharmacists] when they have concerns about medications or any complications. We can provide them with alternatives that contain the same active ingredients. We can also provide them with cheaper alternatives with the same efficacy. They just need to ask us [pharmacists] and we would be ready to help".

4.2.2.1.3 Source of information to patients, healthcare providers, and decision makers

Pharmacists often answer questions and provide information relevant to medications to the patients and other healthcare providers. In this regard, one of the participants shared:

"Pharmacists educate patients about their medications, potential side effects, and how to manage them in case they occurred. Pharmacists educate the patients how to use their medication. For example, we educate asthma patients how to use their inhalers, what medications they should avoid, and when they should take their medications. Because the patients cannot remember everything, we provide the patients with written information."

The participant continued:

"...we provide information with care. We ensure the patients to know everything about their disease and medications. We educate patients about the consequences of their disease. The patients should be adequately informed of the advantages of adhering to their therapeutic plans."

"Patients take different medications. Pharmacists educate patients whether to take their medications with food or without food and whether they [patients] can crush tablets or not. Those [patients] who inject insulin, we educate them on how many units they should inject, how, and where to inject them. We deal with different patients and different medications."

"Even if it takes time, the patients have to know on the nature of the medication they should be taking and why they have to take it. The patients should be aware of their health conditions regardless of the nature of their disease. At the end of the day, we are providing healthcare services that should have impact on the health of the patients."

Another participant continued:

"...there is no doubt that physicians rely on the pharmacists as a reference with regard to all information about medications in all wards and services. They [physicians] always consult us when they need to calculate doses, screen for drug interactions, and the best ways to ensure safe administration of medications."

4.2.2.1.4 Provider of healthcare services

The participants stated that pharmacists are important healthcare providers whose responsibility is to provide pharmaceutical care services to hospitalized patients.

4.2.2.1.4.1 Designing therapeutic plans

"Deciding on the best medication, optimal dosage form, and optimal dose could be tricky for some patients. In many occasions, we cannot complete all orders in time. It would be great if the system would be helpful in exposing these tricky cases so we can follow up with them and decide on the optimal medication, dosage form, and dose."

"the patient would be encouraged to take part in designing their therapeutic plan. The patient can inform healthcare providers of his concerns and preferences even after being discharged from the hospital. This would allow us to take the concerns and preferences of the patient into consideration and improve services."

"Wrong and late diagnosis are one of the major issues in healthcare. These issues can lead to many problems in healthcare delivery for the physicians, pharmacists, and even nurses. Probably, the main reason behind wrong or late diagnosis is the increasing burden on the physician. With the availability of many medications, why not sharing the burden with the pharmacists. The physician would focus on diagnosis and the pharmacist would focus on deciding on the best therapy."

"Assignment of clinical pharmacists with clear job description would have significant outcomes with regard to reducing medication errors. I think the time has come for clinical pharmacists to be hired for all wards and to participate in the rounds with the physicians. This way, the physician would focus on the diagnosis and the pharmacist would help in deciding on which medications to

prescribe, why not! Pharmacists know better about how medications work and interact with each other and with food supplements. Pharmacists know better about dose calculations."

"in my opinion, the clinical pharmacist has to be responsible for designing the therapeutic plan of the patient because they [clinical pharmacists] are experts in medications and their actions. The therapeutic plan has to be individualized to meet the needs of the patient."

"clinical pharmacists are experts in medications with extensive knowledge of clinical, medical, and biological sciences. They know which medications are more suitable for the patients based on their diagnosis to achieve therapeutic goals and improve patient outcomes."

4.2.2.1.4.2 Dispensing medications

Dispensing medications is one of the traditional roles of pharmacists. One of the participants stated:

"Dispensing medications goes beyond providing the patient with the prescribed medications. Pharmacists have to check which medications the patient was using before being admitted to the hospital, whether these medications should be continued or not, and continuously checking the medications the patient have to take while being admitted to the hospital, and finally checking the discharge medications. Every time, the pharmacist would ensure that the medications are suitable to the health conditions of the patient, absence of drug interactions and allergy. The pharmacist would also ensure adherence of the patient to the therapeutic plan with regard to medications and food supplements. This might also include preparing the medications to be dispensed or recommending changing the medication in case needed."

Another participant shared:

"Pharmacists provide many services to hospitalized patients. We [pharmacists] are present in the hospital pharmacy and we dispense medications to the patients. Clinical pharmacists also attend ward rounds with the physicians. They also see patients in the day care services. Our presence is always felt when medications need to be prepared and when dose calculations are needed. We often teach patients how to use their medications and we provide them with all information relevant to their medications. We are always read for help."

4.2.2.1.4.3 Dose calculation

The participants pointed to the role of pharmacist in calculating doses of medications in different wards and services, notably, pediatrics and oncology. One of the participants shared:

"Dose calculation is one of the most important duties of the pharmacists. The dose should be calculated accurately. This would help the patient and the hospital save costs. In oncology ward for example, drugs are too expensive and doses have to calculated accurately. Therefore, we collaborate with the physicians to make sure the dose was calculated accurately for chemotherapy and biological therapy. A computerized system to calculate doses for all wards would be great."

4.2.2.1.4.4 Assessing effectiveness of the medications

The participants stated that pharmacists could assess the effectiveness of the medications and how the patient was responding to therapy. In this regard, one of the participants shared:

"One of the duties of the pharmacists is to ensure the medications are working. We have to assess whether the patient is receiving the benefits of the medications or not and whether side effects are being experienced. For example, when a cancer patient receives a new therapy, we have to assess if the patient received the benefits of the therapy and compare the outcomes with previous therapies. In case the patient did not benefit from the new therapy, we have to figure out why. In

case the feature of the system would allow collecting and linking the patient information and outcomes, this might allow predicting progress after a certain time period and how much the patient has benefited from the therapy."

4.2.2.1.4.5 Screening for drug interactions

One of the roles of pharmacists was to screen for drug related problems, one of the participants shared:

"The pharmacists have to check for drug interactions. The system might provide additional helping tools to check for drug interactions. This can reduce the consequences of these drug interactions. This can also help improving adherence by informing the patient when and how to take the medications."

Another participant continued:

"It is important to assess medications for possibility of interactions. This would save the patient costs and would impact the quality of the services provided. There is no excuse for changing the medications of the patient because of interactions or adverse reactions that we did not account for."

4.2.2.1.4.6 Ordering laboratory tests

The participants also pointed to the roles of pharmacists that were ever expanding beyond the traditional role of dispensing medications. One of the participants shared:

"It is a good if patients would come periodically for laboratory tests to make sure they are adherent to taking their medications and to assess whether a medication need to be changed or discontinued. We often call and follow up with some patients who receive expensive biological

therapies. If the system would allow an outreach and appointment functions, the outcomes would be great."

4.2.2.1.4.7 Medication reconciliation

Medication reconciliation was an important service that can be provided by pharmacists. One of the participants shared:

"our role is to perform a medication reconciliation and inform the patients about the medications that they need to continue taking and which medications to discontinue. Some patients continue to take unnecessary medications for years."

4.2.2.1.4.8 Procuring medications/supplies

The participants stated that the roles of pharmacists in decisions relevant to procurement of medications and other supplies were indispensable. The participants shared:

"The pharmacy manager decides on the quantities of the medications that need to be procured to the pharmacy store and those needed by the hospital. We [pharmacists] have to ensure that we do not run deficient with medications by entering into the electronic system the medication orders we need."

Another participant added:

"Pharmacists can help decide on the best medical supplies and medications from the quality and pricing perspectives …. presence of pharmacists in administrative and decision-making positions is a cornerstone in the hospital. I mean, we [pharmacists] are always involved in decisions related to saving costs of disposables, medical equipment, supply bids, and securing the best prices from the offering companies. We [pharmacists] are also present when new employees are hired.

Moreover, a considerable proportion of the hospital's budget is spent on medications and other medical supplies. Therefore, our presence near the decision-making process is felt."

4.2.2.1.4.9 Storage of medications

Pharmacists are experts in medications and are knowledgably of how medications should be stored. One of the participants shared:

"The pharmacist who decides on how medications should be stored, where, at which temperature, and when they should be dispensed. Although this seems be an easy task for the pharmacist, the system can be helpful in organizing storage of medications."

4.2.2.2 Perspectives of the participants on the electronic health record system

The participants stated that the electronic health record system can be designed to improve pharmaceutical services.

4.2.2.2.1 Dispensing medications

One of the participants shared that the system can be used to make dispensing medications more efficient:

"Dispensing medications can be easier using electronic systems. The system can have features to help in reducing medication errors and drug-drug interactions. This could be an important addition to the traditional medication dispensing process."

Another participant shared:

"the system helps organize appointments without any interruptions or conflicts. This way, the physician would not have overlapping appointments and the pharmacist would not have shortage of medications because the system has organized the appointments and informed the pharmacists

of the medications needed. It would be great if the system would have a feature of sending daily alerts of how many patients we would see that day and how many medications we need to prepare."

4.2.2.2.2 Planning future procurements of medications

The participant stated that the system can be used in planning future procurement of medications.

"In many occasions, we become short in medications as we are unaware of exhausting the storage of these medications. On other occasions, medications almost expire before being used and we have to give them to other hospitals. We are planning to procure medications based on the statistics of bed occupancies. The system would be helpful in predicting the amount of medications we need."

4.2.2.2.3 Reducing medication errors

The participants stated that the electronic system can reduce the incidence of medication errors. In this regard, one of the participants shared:

"*Presence of an electronic system with complete information for all healthcare providers might reduce errors."*

Another participant shared:

"…the system would allow detecting and tracking medication errors. Alerts can then be sent, remedies can be sought, and lessons can be learnt."

4.2.2.2.4 Informing hiring decisions

The participants stated that the system could reveal personnel needs and inform future hiring decisions. One of the participants shared:

"The system would allow gathering information on the pharmacist/physician and pharmacist/patient ratios. Decision makers would be able to have information whether these ratios are adequate to provide optimal healthcare services and avoid errors."

Another participant added:

"….the system would allow deciding on the number of pharmacists needed to meet current and future needs."

"we would analyze trends of cases being admitted to the hospital to forecast our future needs. This would help us improve the services provided to the patients."

4.2.2.2.5 Access to patient information

The pharmacists who participated in this study expressed willingness to have more access to patient information. In this regard, one of the participants shared:

"All patient information relevant to medical history and laboratory tests would be in the system and we [pharmacists] can have access to from the pharmacy. We can review the patient information any time we need to."

Another participant shared:

"….all laboratory and medical imaging reports are in one place. The physician and pharmacist can have access to these reports even when they [physicians and pharmacists] are outside the hospital premises."

"…. the system would allow collecting information on how many times the patient was admitted to the hospital and how many times the patient consulted the pharmacist. We would know if the diagnosis was correct … We would also know whether the patient returned back for the same

health concerns or not or whether the patient returned as a result of complications relevant to medications. This information can be known in a matter of a click!"

Another participant added:

"all healthcare providers should contribute to the patient records. This would enable us to have complete records with all information on the patient. The pharmacists can oversee adherence to the therapeutic plan and can screen for the incidence of complications related to the medications."

4.2.2.2.6 Tracking shortages of medications

The participants stated that the electronic system would allow tracking medications in the store and would allow predicting shortages of medications. One of the participants shared:

"the system allows access the medications available in the hospital. It [the electronic system] can provide us with information on the drugs available on the store, therefore, we can ensure surveillance of the stock."

4.2.2.2.7 Ensuring adherence to protocols/guidelines

The participates stated that the electronic system can help tracking and ensuring adherence to protocols/guidelines while delivering healthcare services. One of the participants shared:

"through technological advancements, one can assess how adherent physicians and pharmacists to the protocols and guidelines followed while treating patients. We can also assess how adherent the patient was to the treatment. Electronic records can allow us know where the problem was in the therapeutic continuum."

4.2.2.2.8 Improving secured sharing of patient information

The participants pointed to the improved communication and sharing of patient information. One of the participants shared:

"Communicating patient information to other hospitals and physicians in the community would be carried out easily. This would ensure patient privacy as the information would be sent to the right person compared to a paper-based health record."

Another participant added:

"the electronic system is more secure that the paper-based records because it [electronic system] allows access of the authorized personnel to the information. One would need authorization to access patient information. This would allow maintain patient privacy."

4.2.2.2.9 Go paperless

One of the participants shared in this regard:

"….why would the patient always carry a proof of his insurance? Why would the patient carry receipts of payments? Any issues in the registration or payments would be easily clarified through the system."

4.2.2.2.10 Desired features to be added to the upgraded system

The participants expressed desires for features to be added to the current system, these desired features are listed below.

4.2.2.2.10.1E-prescribing

One of the participants shared:

“with advancement of healthcare delivery, the world is increasingly using e-prescribing systems. Writing and sending an e-prescription is much easier than sending a paper-based medication order through the nursing staff to the pharmacy. E-prescribing ensures accuracy of the prescription and saves preparation and dispensing time.”

Another participant added:

“a system through which physicians can send orders from spelling errors or illegible writing can promote effective communication between healthcare providers and reduce medical errors.”

4.2.2.2.10.2Clinical decision support system

One of the participants shared:

“the clinical decision support system would be a major addition to any healthcare facility. On daily basis, healthcare providers are dealing with different cases and many medications. The clinical decision support system would allow timely access to essential information. This is very important.”

Another participant shared:

“The clinical decision support system would help designing therapeutic plan for the patient concerned through diagnosis information and laboratory reports. This would save healthcare providers time and efforts that could be used to take care of other duties.”

4.2.2.2.10.3Library of therapeutic plans

One of the participants shared:

“Designing therapeutic plans on evidence-based clinical information that would automatically be included in the system. These therapeutic plans would be compliant with the international

guidelines and designed by a multi-healthcare professional team would take into consideration all health issues of the patient."

Another participant shared:

".....all medication information relevant to why and when the medication should be used supported with detailed evidence-based information."

Another participant added:

"As the profession keeps on advancing, we should keep up with advancements. With the availability of electronic systems and other supportive systems, we can keep advancing our knowledge and practice."

Another participant added:

"I wish the system would allow access to comprehensive databases that would serve as reference for the pharmacists with all information needed. I think subscription to such databases would be very helpful in reducing drug related problems."

4.2.2.2.10.4Documenting pharmacist intervention

The participants stated that the system should allow documenting the interventions made by the pharmacists. One of the participants shared:

"The system should document the interventions made by the pharmacist. This documentation should be comprehensive to account for all interventions relevant to consultations, counseling, dispensing and other pharmaceutical services."

Another participant shared:

"every pharmaceutical care service should carry a unique code that would allow collecting and analyzing services provided to the patients by each provider. This might be use to evaluate providers and services."

4.2.2.2.10.5Evaluating pharmacist performance

The participants shared that the system should allow evaluation of pharmacists. One of the participants shared:

"the current criteria used to evaluate pharmacists are not clear. Therefore, pharmacists are not motivated to continue advancing their career and services."

Another participant shared:

"....recognition is very important for the advancement of any profession. In this country, the pharmacist is not well recognized. The system should allow evaluating the services provided by different healthcare providers. Pharmacists would be evaluated based on the number of interventions they made."

Other participants shared:

"number of prescriptions dispensed, number of drug interactions resolved, number of medication orders modified, number of medications suggested, and adherence of the pharmacist to the protocols and guidelines could be used in evaluating their performance."

"the time spent in dispensing medications, designing therapeutic plan, and preparing medications."

"the costs saved from avoiding drug interactions, unnecessary medications"

"number of decisions made"

4.2.2.2.10.6Reporting medication errors

The participants stated that they wanted the system to allow filing a medication error report. One of the participants shared:

"the system should allow filing and analyzing medication error reports. The reports could later be anonymized, summarized, and lessons could be learnt."

4.2.2.3 Challenges and future outlooks

4.2.2.3.1 Job description and organization

The participants were not satisfied with the current organization of hospital/clinical pharmacy practice. One of the participants shared:

"….the job description of the pharmacist is not clear in the work place. The potentials of the pharmacists are underutilized."

"Pharmacist-assistants often replace pharmacists in the healthcare team."

Another participant shared:

"Hopefully, there would be another organization of pharmacy within the hospital. For example, a central pharmacy store, ward pharmacies, discharge pharmacy, and a pharmacy for disposables with designated pharmacists."

Another participant added:

"There should be at least one pharmacist in each ward to take care of the patients from the time they were admitted to the hospital. The pharmacist would take the medication history of the patient, participate in designing the therapeutic plan, prepare and dispense medications, conduct

medication reconciliations, and verify the discharge medications. The system should collect all services provided by each provider."

4.2.2.3.2 Relationship with other healthcare providers

Some of the participants expressed concerns with regard to their relationship with the physician. One participant shared:

"…to be honest with you, physicians consider me a competitor and they [physicians] always try to limit my interventions during the ward rounds and when I try to recommend a medication."

4.2.2.3.3 Lack of continuing education and training

The participants expressed concerns with regard to the availability of continuing education and training. One of the participants shared:

"lack of continuing education for the pharmacists in their work places, access to up-to-date information on the medications, workshops, conferences, and seminars holds pharmacists back from advancing in their career."

Another participant suggested:

"….organizing periodic national or international meetings and conferences for the pharmacists would be helpful in advancing the career."

4.2.2.3.4 Lack of technical support

The participants expressed concerns over lack of technical support and training on how to use the system. One of the participants shared:

"…technical support is essential. The pharmacists need to know how to use the system effectively. Currently, not many pharmacists know how to use the system. There are a lot of features that we do not know about."

Another participant added:

"absence of adequate technical support makes dealing with the system more difficult and reduces the quality of the services provided."

4.2.2.3.5 Lack of motivation

Some of the participants expressed concerns with regard to lack motivation among the pharmacists themselves:

"the pharmacists themselves need to expand their roles through provision of pharmaceutical care services that extend beyond merely dispensing medications. Pharmacists should educate patients and other healthcare providers about medications.

5 Discussion

6 Summary of the main findings

In this thesis, a systematic scoping review was conducted to identify documents reporting on design/development of electronic health record systems to capture pharmaceutical services, use of electronic health record systems to improve/evaluate pharmaceutical care services/delivery, and/or measuring impact of pharmacists through electronic health record systems. The documents analyzed reported use of EHRs by pharmacists in hospitalized patient settings, improvement of pharmaceutical services, use of EHRs in capturing the impact of pharmacists in hospitalized patient settings, and how the design of EHRs can be improved to allow measuring the impact of pharmacists in hospitalized patient settings.

The majority of the majority of the documents included were either interventional or qualitative studies. Interventional studies are powerful in testing the newly designed EHRs and/or other added features (Finn et al., 2017a, Hensler et al., 2018, Vyas et al., 2019, Barra et al., 2018, Shay et al., 2018, Alex et al., 2016, McNicol et al., 2019). On the other hand, qualitative studies are often used to explore views and opinions of healthcare providers with regard to performance of the current systems and how they could be improved (Hughes et al., 2011, Shawahna, 2019a, Shawahna, 2019b, Shawahna, 2020a, Shawahna, 2020c, Burgin et al., 2014, Mercer et al., 2018). The majority of the documents included in this study were published recently. This could be explained by the recent largescale adoption of EHRs in different healthcare systems around the world (Fuji et al., 2011, Shawahna, 2019b). the majority of the documents originated from English speaking countries (United States, Canada, and United Kingdom). This could be explained at least in part by the research methodology used in this study in which documents in language other than

English were exclude. Additionally, the healthcare systems in these countries incentivized uptake of EHRs (Fuji et al., 2011). Although the majority of the documents selected in this study were accessible by subscription a considerable number of documents were also published as open access. This probably reflected the recent growth of open access journals. Of the documents included, that of Hughes et al. (2011) received the largest number of citations.

Content analysis of the documents selected showed an increasing trend in usage of EHRs by pharmacists. Hughes et al. (2011) reported higher use of EHRs by pharmacists who practiced in patient-centered facilities compared to those who practiced in community settings (Hughes et al., 2011). The documents included reported that EHRs were excellent tools for pharmacists to review medication use, laboratory findings, and share patient health information with other healthcare providers (Downard et al., 2007, Hughes et al., 2011, Scott et al., 2019, Vyas et al., 2019). The documents included showed that EHRs improved delivery and efficiency of pharmaceutical services. Following implementing EHRs, the number of pharmacist interventions, medication order reviews, number of medication errors identified, number of completed bleeding records, and number of optimized antiviral and antibiotic doses were increased (Barra et al., 2018, Finn et al., 2017a, Hensler et al., 2018, Shay et al., 2018, Grisso et al., 2004, Monroe and Chin, 2013, Alex et al., 2016). The EHRs also allowed expanding pharmaceutical services (Grisso et al., 2004). The documents also showed that EHRs allowed documenting pharmacist interventions and informed benchmarking decisions (McNicol et al., 2019, Shawahna, 2019a, Shawahna, 2020a, Shawahna, 2020b, Shawahna, 2020c). Dissatisfaction with current features of EHRs were also reported (Shawahna, 2019b, Burgin et al., 2014, Fuji et al., 2011, Mercer et al., 2018).

The services/activities collected in this study represent the wide range of pharmaceutical services/activities that could be offered by pharmacists across the healthcare continuum in

hospitalized patient settings. These services/activities were previously proposed to be used in evaluating performance of pharmacists and informing benchmarking efforts (Shawahna, 2019a, Shawahna, 2020a, Shawahna, 2020b, Shawahna, 2020c).

The interviewees in the qualitative phase of this thesis stressed on the importance of their presence as healthcare providers to patients in hospitalized settings. In modern healthcare delivery, the role of pharmacists in providing direct healthcare services has been expanding (Shawahna, 2020a, Shawahna et al., 2020, Shawahna, 2020c, Shawahna, 2020b, Shawahna et al., 2019, Bach et al., 2018, Anderson and Marrs, 2018, Sakeena et al., 2019). Pharmacists are experts in medications who could serve as a source of information to the rest of the healthcare team members. Additionally, pharmacists can provide healthcare services to hospitalized patients. In this study, the services highlighted by the participants included designing therapeutic plans, dispensing medications, calculation of doses, evaluating patient response to medications, screening for drug related problems, reviewing laboratory findings, performing medication reconciliations, and making decisions to procure medications, supplies, and storage of medications. These roles were consistent with those expected from inclusion of pharmacists as members of the healthcare delivery teams in hospitalized patient settings (Sakeena et al., 2019, Bach et al., 2018, LeBlanc et al., 2008, Schnipper et al., 2006, Shawahna, 2019a, Shawahna, 2020a, Shawahna, 2020b, Shawahna, 2020c).

In this study, the participants expressed willingness to upgrade the system to make the job of the pharmacist easier, especially, with regard to dispensing medications, planning future procurements of medications, reducing medication errors, accessing patient health information, tracking shortages of medications, ensuring adherence to guidelines and protocols, improving sharing of patient health information, and reducing paper-based work. These perspectives were

consistent with the basis on which EHRs were introduced into different healthcare systems (Downard et al., 2007, Barra et al., 2018). The participants expressed their willingness to upgrade the system with additional features that include e-prescribing, CDSSs, comprehensive information database, abilities to document pharmacist interventions, and reporting medication errors. Many systems around the world were upgraded to include such features that were shown to improve interventions of pharmacists and patient health outcomes (Shawahna, 2019b).

In the qualitative phase of this thesis, several challenges that pharmacists face while practicing in hospitalized patient settings. These challenges might have limited contribution of the pharmacists to improving patient health outcomes. Probably, these findings might be a call for decision makers in healthcare authorities to improve pharmacy practice in hospitalized patient settings.

7 Appraisal of the methods used in this study

7.1.1 Strengths

The two phases of this thesis have a number of strengths that should be considered when interpreting the findings. First, phase 1 was the first systematic scoping review that was conducted to summarize the literature reporting on design/development of electronic health record systems to capture pharmaceutical services, use of electronic health record systems to improve/evaluate pharmaceutical care services/delivery, and/or measuring impact of pharmacists through electronic health record systems. Second, a systematic search was adopted to the major databases used to index relevant documents. Systematic search strategies are more robust than random searches. Third, the scoping analysis used in this study was not limited to the bibliometric characteristics of the documents. Rather, the selected documents were analyzed for their contents. Fourth,

participants in the qualitative phase included experts with extensive experience in hospitalized patient settings or in dealing with EHRs. This should have added richness to the qualitative data generated from this phase. Fourth, the interviewees were diversified in terms of sociodemographic characteristics, length of experience, and geographical location of their work place. This should have added width to the qualitative data collected in this phase. Fifth, rigorous methods were used to analyze the qualitative data. This should have strengthened the findings of this phase.

7.1.2 Limitations

First, the quality of the selected documents was not appraised using appropriate tools. Although quality appraisal of the documents is not mandatory in systematic scoping reviews, quality of the selected documents could also be interesting. Second, the documents selected in this study were only those reported in English. Filtering the results might have led to excluding interesting findings that might have been reported in other languages. Third, phase 2 of this thesis was purely qualitative in nature. It could have been more interesting should this phase include quantitative data on the pharmaceutical services provided in hospitalized patient settings. Fourth, the interviewees were from the governmental sector. It could have been more interesting if participants from private healthcare sector were included. Fifth, the number of the participants was relatively limited. Finally, patients were not interviewed in this study. As patients are increasingly involved in their healthcare decisions, inclusion of patients could have permitted exposing their views and opinions.

8 Conclusion

Findings of this thesis indicated that pharmacists were important healthcare providers that were neglected when EHRs were designed. Currently used EHRs allow limited capture of the role

of pharmacists in caring for patients in hospitalized patient settings. Upgrading EHRs taking into consideration of the interviewees in this study might allow capturing the impact of pharmacists in caring for patients in hospitalized patient settings. Future studies are still needed to investigate if upgrading EHRs can improve healthcare delivery and health outcomes of patients in hospitalized settings.

9 Recommendations

The necessity of adopting an official policy by the Ministry of Health to regulate the workflow in its facilities. The existence of legal cover for all operations within the system for pharmacists and other service providers. Increasing the number of pharmacists in all facilities of the Ministry of Health. Integrating pharmacists in all their workplaces with the aim of developing the pharmaceutical reality and keeping pace with technological and scientific development

10 Future work

Conduct a study on a large scale to examine the unlimited roles of pharmacist in the presence of HIS and use the outcome by the stakeholders to adopt more pharmacist in the MOH and more upgrading tolls for HIS.

References

ALEX, S., ADENEW, A. B., ARUNDEL, C., MARON, D. D. & KERNS, J. C. 2016. Medication errors despite using electronic health records: The value of a clinical pharmacist service in reducing discharge-related medication errors. *Quality Management in Health Care,* 25**,** 32-37.

ANDERSON, S. L. & MARRS, J. C. 2018. A Review of the Role of the Pharmacist in Heart Failure Transition of Care. *Advances in Therapy,* 35**,** 311-323.

BACH, Q. N., PEASAH, S. K. & BARBER, E. 2018. Review of the Role of the Pharmacist in Reducing Hospital Readmissions. *Journal of Pharmacy Practice,* 32**,** 617-624.

BARRA, M. E., CULBRETH, S. E., SYLVESTER, K. W. & ROCCHIO, M. A. 2018. Utilization of an Integrated Electronic Health Record in the Emergency Department to Increase Prospective Medication Order Review by Pharmacists. *Journal of Pharmacy Practice,* 31**,** 636-641.

BAUMANN, L. A., BAKER, J. & ELSHAUG, A. G. 2018. The impact of electronic health record systems on clinical documentation times: A systematic review. *Health Policy,* 122**,** 827-836.

BHARTIYA, S., MEHROTRA, D. & GIRDHAR, A. 2016. Issues in Achieving Complete Interoperability while Sharing Electronic Health Records. *Procedia Computer Science,* 78**,** 192-198.

BONDESSON, Å., HOLMDAHL, L., MIDLÖV, P., HÖGLUND, P., ANDERSSON, E. & ERIKSSON, T. 2012. Acceptance and importance of clinical pharmacists' LIMM-based recommendations. *International Journal of Clinical Pharmacy,* 34**,** 272-276.

BOWEN, G. A. 2008. Naturalistic inquiry and the saturation concept: a research note. *Qualitative Research,* 8**,** 137-152.

BURGIN, A., O'ROURKE, R. & TULLY, M. P. 2014. Learning to work with electronic patient records and prescription charts: Experiences and perceptions of hospital pharmacists. *Research in Social and Administrative Pharmacy,* 10**,** 741-755.

DAVOODY, N., KOCH, S., KRAKAU, I. & HÄGGLUND, M. 2019. Accessing and sharing health information for post-discharge stroke care through a national health information exchange platform - a case study. *BMC Medical Informatics and Decision Making,* 19**,** 95.

DIERCKX DE CASTERLÉ, B., GASTMANS, C., BRYON, E. & DENIER, Y. 2012. QUAGOL: a guide for qualitative data analysis. *Int J Nurs Stud,* 49**,** 360-71.

DOWNARD, S., GALT, K. A. & REEL, A. B. 2007. Pharmacists' use of electronic health records: Silent leaders no more. *Journal of the American Pharmacists Association,* 47**,** 680-692.

EL MAHALLI, A. 2015. Adoption and Barriers to Adoption of Electronic Health Records by Nurses in Three Governmental Hospitals in Eastern Province, Saudi Arabia. *Perspect Health Inf Manag,* 12**,** 1f.

FINN, A., BONDARENKA, C., EDWARDS, K., HARTWELL, R., LETTON, C. & PEREZ, A. 2017a. Evaluation of electronic health record implementation on pharmacist interventions related to oral chemotherapy management. *Journal of Oncology Pharmacy Practice,* 23**,** 563-574.

FINN, A., BONDARENKA, C., EDWARDS, K., HARTWELL, R., LETTON, C. & PEREZ, A. 2017b. Evaluation of electronic health record implementation on pharmacist interventions related to oral chemotherapy management. *J Oncol Pharm Pract,* 23**,** 563-574.

FUJI, K. T., GAIT, K. A., SIRACUSE, M. V. & CHRISTOFFERSEN, J. S. 2011. Electronic health record adoption and use by Nebraska pharmacists. *Perspectives in health information management / AHIMA, American Health Information Management Association,* 8.

GREENHALGH, T. & PEACOCK, R. 2005. Effectiveness and efficiency of search methods in systematic reviews of complex evidence: audit of primary sources. *BMJ,* 331**,** 1064.

GRISSO, A. G., WRIGHT, L. & ROSENBLOOM, S. T. 2004. Expansion of Pharmacokinetic Services Through the Electronic Health Record Using CPOE and Computerized Note Capture Tools. *Hospital Pharmacy,* 39**,** 184-187+192.

HENSLER, D., RICHARDSON, C. L., BROWN, J., TSENG, C., DECAMP, P. J., YANG, A., PAWLOWSKI, A., HO, B. & ISON, M. G. 2018. Impact of electronic health record-based, pharmacist-driven valganciclovir dose optimization in solid organ transplant recipients. *Transplant Infectious Disease,* 20.

HUGHES, C. A., GUIRGUIS, L. M., WONG, T., NG, K., ING, L. & FISHER, K. 2011. Influence of pharmacy practice on community pharmacists' integration of medication and lab value information from electronic health records. *Journal of the American Pharmacists Association,* 51**,** 591-598.

JIANG, X., WELLS, A., BRUFSKY, A. & NEAPOLITAN, R. 2019. A clinical decision support system learned from data to personalize treatment recommendations towards preventing breast cancer metastasis. *PLoS One,* 14**,** e0213292.

LAZAROVA, E., MORA, S., RUBARTELLI, P., COSOLITO VITALE, A., PARETO, L., MAGGI, N., RUGGIERO, C. & GIACOMINI, M. 2021. Integrating an Electronic Health Record System into a Regional Health Information System: An HL7 FHIR Architecture. *Stud Health Technol Inform,* 281**,** 1087-1088.

LEBLANC, J. M., SEOANE-VAZQUEZ, E. C., ARBO, T. C. & DASTA, J. F. 2008. International critical care hospital pharmacist activities. *Intensive Care Medicine,* 34**,** 538-542.

LIEKENS, S. & FOULON, V. 2019. Pharmaceutical Care and the Role of the Patient. *In:* ALVES DA COSTA, F., VAN MIL, J. W. F. & ALVAREZ-RISCO, A. (eds.) *The Pharmacist Guide to Implementing Pharmaceutical Care.* Cham: Springer International Publishing.

LOWE, A., NORRIS, A. C., FARRIS, A. J. & BABBAGE, D. R. 2018. Quantifying Thematic Saturation in Qualitative Data Analysis. *Field Methods,* 30**,** 191-207.

MCNICOL, M., KUHN, C. & SEBASTIAN, S. 2019. Standardized documentation workflow within an electronic health record to track pharmacists' interventions in pediatric ambulatory care clinics. *Journal of the American Pharmacists Association,* 59**,** 410-415.

MERCER, K., BURNS, C., GUIRGUIS, L., CHIN, J., DOGBA, M. J., DOLOVICH, L., GUÉNETTE, L., JENKINS, L., LÉGARÉ, F., MCKINNON, A., MCMURRAY, J., WAKED, K. & GRINDROD, K. A. 2018. Physician and pharmacist medication decision-making in the time of electronic health records: Mixed-methods study. *JMIR Human Factors,* 5.

MONROE, C. D. & CHIN, K. Y. 2013. Specialty pharmaceuticals care management in an integrated health care delivery system with electronic health records. *Journal of Managed Care Pharmacy,* 19**,** 334-344.

MORSE, J. M. & FIELD, P. A. 1996. Principles of data analysis. *In:* MORSE, J. M. & FIELD, P. A. (eds.) *Nursing Research: The Application of Qualitative Approaches.* Boston, MA: Springer US.

MURPHY, D. R., GIARDINA, T. D., SATTERLY, T., SITTIG, D. F. & SINGH, H. 2019. An Exploration of Barriers, Facilitators, and Suggestions for Improving Electronic Health Record Inbox-Related Usability: A Qualitative Analysis. *JAMA Network Open,* 2**,** e1912638-e1912638.

NIAZKHANI, Z., TONI, E., CHESHMEKABOODI, M., GEORGIOU, A. & PIRNEJAD, H. 2020. Barriers to patient, provider, and caregiver adoption and use of electronic personal health records in chronic care: a systematic review. *BMC Med Inform Decis Mak,* 20**,** 153.

NUGROHO, H. S. W., NOTOBROTO, H. B. & ROSYANTI, L. 2021. Acceptance Model of a Mandatory Health Information System in Indonesia. *Healthc Inform Res,* 27**,** 127-136.

PALABINDALA, V., PAMARTHY, A. & JONNALAGADDA, N. R. 2016. Adoption of electronic health records and barriers. *J Community Hosp Intern Med Perspect,* 6**,** 32643.

ROSHANOV, P. S., FERNANDES, N., WILCZYNSKI, J. M., HEMENS, B. J., YOU, J. J., HANDLER, S. M., NIEUWLAAT, R., SOUZA, N. M., BEYENE, J., VAN SPALL, H. G., GARG, A. X. & HAYNES, R. B. 2013. Features of effective computerised clinical decision support systems: meta-regression of 162 randomised trials. *BMJ,* 346**,** f657.

SAKEENA, M. H. F., BENNETT, A. A. & MCLACHLAN, A. J. 2019. The Need to Strengthen the Role of the Pharmacist in Sri Lanka: Perspectives. *Pharmacy,* 7.

SCHNIPPER, J. L., KIRWIN, J. L., COTUGNO, M. C., WAHLSTROM, S. A., BROWN, B. A., TARVIN, E., KACHALIA, A., HORNG, M., ROY, C. L., MCKEAN, S. C. & BATES, D. W. 2006. Role of Pharmacist Counseling in Preventing Adverse Drug Events After Hospitalization. *Archives of Internal Medicine,* 166**,** 565-571.

SCOTT, P., NAKKAS, H. & RODERICK, P. 2019. Protocol for a scoping review to understand how interorganisational electronic health records affect hospital physician and pharmacist decisions. *BMJ Open,* 9.

SHAWAHNA, R. 2019a. Development of key performance indicators to capture in measuring the impact of pharmacists in caring for patients with epilepsy in primary healthcare: A Delphi consensual study. *Epilepsy Behav,* 98**,** 129-138.

SHAWAHNA, R. 2019b. Merits, features, and desiderata to be considered when developing electronic health records with embedded clinical decision support systems in Palestinian hospitals: a consensus study. *BMC Med Inform Decis Mak,* 19**,** 216.

SHAWAHNA, R. 2020a. Development of Key Performance Indicators for Capturing Impact of Pharmaceutical Care in Palestinian Integrative Healthcare Facilities: A Delphi Consensus Study. *Evid Based Complement Alternat Med,* 2020**,** 7527543.

SHAWAHNA, R. 2020b. Quality Indicators of Pharmaceutical Care for Integrative Healthcare: A Scoping Review of Indicators Developed Using the Delphi Technique. *Evid Based Complement Alternat Med,* 2020**,** 9131850.

SHAWAHNA, R. 2020c. Quality Indicators of Pharmaceutical Care in Palestinian Integrative Healthcare Facilities: Findings of a Qualitative Study among Stakeholders. *Evid Based Complement Alternat Med,* 2020**,** 4520769.

SHAWAHNA, R., ABBAS, A. & GHANEM, A. 2019. Medication transcription errors in hospitalized patient settings: a consensual study in the Palestinian nursing practice. *BMC Health Serv Res,* 19**,** 644.

SHAWAHNA, R., ABDELFATTAH, B., SHAFEI, M. & RUZZEH, S. 2020. Therapeutic monitoring of antiepileptic drugs: Recommendations to improve care of patients with epilepsy in the Palestinian practice. *Epilepsy Behav,* 111**,** 107215.

SHAWAHNA, R. & ABDELHAQ, I. 2020. Exploring perceived benefits, motives, barriers, and recommendations for prescribing yoga exercises as a nonpharmacological intervention for patients with epilepsy: A qualitative study from Palestine. *Epilepsy Behav,* 106**,** 107041.

SHAWAHNA, R., BATTA, A., ASA'AD, M., JOMAAH, M. & ABDELHAQ, I. 2021. Exercise as a complementary medicine intervention in type 2 diabetes mellitus: A systematic review with narrative and qualitative synthesis of evidence. *Diabetes Metab Syndr,* 15**,** 273-286.

SHAWAHNA, R. & NAIRAT, Q. 2021. Research productivity in the field of physical exercise and epilepsy: A bibliometric analysis of the scholarly literature with qualitative synthesis. *Epilepsy Behav,* 121**,** 108058.

SHAY, B., KENNERLY-SHAH, J., NEIDECKER, M., BEATTY, S., WITKOFF, L., BROWN, N. & KRAUT, E. 2018. Effect of a Pharmacist-Driven Monitoring Program and

Electronic Health Record on Bleeding Log Completeness and Documentation. *Journal of managed care & specialty pharmacy,* 24**,** 1034-1039.

SORESI, J., MURRAY, K., MARSHALL, T. & PREEN, D. B. 2021. An evaluation of an electronic audit and feedback system for patient safety in a tertiary hospital setting: A study protocol. *Health Informatics J,* 27**,** 14604582211009919.

THORNE, S., KIRKHAM, S. R. & MACDONALD-EMES, J. 1997. Interpretive description: a noncategorical qualitative alternative for developing nursing knowledge. *Res Nurs Health,* 20**,** 169-77.

THORNE, S., KIRKHAM, S. R. & O'FLYNN-MAGEE, K. 2004. The Analytic Challenge in Interpretive Description. *International Journal of Qualitative Methods,* 3**,** 1-11.

TONG, A., SAINSBURY, P. & CRAIG, J. 2007. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care,* 19**,** 349-357.

TRICCO, A. C., LILLIE, E., ZARIN, W., O'BRIEN, K. K., COLQUHOUN, H., LEVAC, D., MOHER, D., PETERS, M. D. J., HORSLEY, T., WEEKS, L., HEMPEL, S., AKL, E. A., CHANG, C., MCGOWAN, J., STEWART, L., HARTLING, L., ALDCROFT, A., WILSON, M. G., GARRITTY, C., LEWIN, S., GODFREY, C. M., MACDONALD, M. T., LANGLOIS, E. V., SOARES-WEISER, K., MORIARTY, J., CLIFFORD, T., TUNCALP, O. & STRAUS, S. E. 2018. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med,* 169**,** 467-473.

VYAS, D., CHEN, M. A. Y., BOYCE, E. G., GALAL, S. M., ROGAN, E. L. & MAKER, J. 2019. Training students on the pharmacist patient care process using an electronic health record and simulations. *Pharmacy Education,* 19**,** 374-380.

WORLD MEDICAL ASSOCIATION 2001. World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. *Bulletin of the World Health Organization,* 79**,** 373-374.

Appendix 1: Compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement for scoping reviews (PRISMA- ScR)

Section	Item #	PRISMA-ScR checklist item
Title		
Title	1	Identify the report as a scoping review.
Abstract		
Structured summary	2	Provide a structured summary including, as applicable: background, objectives, eligibility criteria, sources of evidence, charting methods, results and conclusions that relate to the review question(s) and objective(s).
Introduction		
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review question(s)/objective(s) lend themselves to a scoping review approach.
Objectives	4	Provide an explicit statement of the question(s) and objective(s) being addressed with reference to their key elements (e.g., population or participants, concepts and context), or other relevant key elements used to conceptualize the review question(s) and/or objective(s)).
Methods		
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., web address), and, if available, provide registration information including registration number.
Eligibility criteria	6	Specify the characteristics of the sources of evidence (e.g., years considered, language, publication status) used as criteria for eligibility, and provide a rationale.
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with authors to identify additional sources) in the search, as well as the date the most recent search was executed.
Search	8	Present the full electronic search strategy for at least one database, including any limits used, such that it could be repeated.
Selection of sources of evidence	9	State the process for selecting sources of evidence (i.e., screening, eligibility) included in the scoping review.
Data charting process	10	Describe the methods of charting data from the included sources of evidence (e.g., piloted forms; forms that have been tested by the team before their use, whether data charting was done independently, in duplicate) and any processes for obtaining and confirming data from investigators.

Section	Item #	PRISMA-ScR checklist item
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.
Critical appraisal of individual sources of evidence	12	***If done,*** provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).
Summary measures	13	*Not applicable for scoping reviews.*
Synthesis of results	14	Describe the methods of handling and summarizing the data that were charted.
Risk of bias across studies	15	*Not applicable for scoping reviews.*
Additional analyses	16	*Not applicable for scoping reviews.*
Results		
Selection of sources of evidence	17	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.
Characteristics of sources of evidence	18	For each source of evidence, present characteristics for which data were charted and provide the citations.
Critical appraisal within sources of evidence	19	***If done***, present data on critical appraisal of included sources of evidence (see item 12).
Results of individual sources of evidence	20	For each included source of evidence, present the relevant data that were charted that relate to the review question(s) and objective(s).
Synthesis of results	21	Summarize and/or present the charting results as they relate to the review question(s) and objective(s).
Risk of bias across studies	22	*Not applicable for scoping reviews.*
Additional analyses	23	*Not applicable for scoping reviews.*
Discussion		
Summary of evidence	24	Summarize the main results (including an overview of concepts, themes, and types of evidence available), explain how they relate to the review question(s) and objectives, and consider the relevance to key groups.
Limitations	25	Discuss the limitations of the scoping review process.
Conclusions	26	Provide a general interpretation of the results with respect to the review question(s) and objective(s), as well as potential implications and/or next steps.
Funding		
Funding	27	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.

Appendix 2: Data extraction form

#	Authors	Title	Year	Journal	Number of citations	Country of the corresponding author	Type of access	Objective	Settings	Sample	Design	Methods	Main findings
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Appendix 3: Compliance with the COnsolidated Criteria for REporting Qualitative Research (COREQ) checklist

#	Topic	Guide Questions/Description
	Domain 1: Research team and reflexivity	
	Personal characteristics	
1	Interviewer/facilitator	Which author/s conducted the interview or focus group?
2	Credentials	What were the researcher's credentials? E.g. PhD, MD
3	Occupation	What was their occupation at the time of the study?
4	Gender	Was the researcher male or female?
5	Experience and training	What experience or training did the researcher have?
	Relationship with participants	
6	Relationship established	Was a relationship established prior to study commencement?
7	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research
8	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic
	Domain 2: Study design	
	Theoretical framework	
9	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis
	Participant selection	
10	Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball
11	Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email
12	Sample size	How many participants were in the study?
13	Non-participation	How many people refused to participate or dropped out? Reasons?
	Setting	
14	Setting of data collection	Where was the data collected? e.g. home, clinic, workplace
15	Presence of non-participants	Was anyone else present besides the participants and researchers?
16	Description of sample	What are the important characteristics of the sample? e.g. demographic data, date
17	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?
18	Repeat interviews	Were repeat interviews carried out? If yes, how many?

#	Topic	Guide Questions/Description
19	Audio/visual recording	Did the research use audio or visual recording to collect the data?
20	Field notes	Were field notes made during and/or after the interview or focus group?
21	Duration	What was the duration of the interviews or focus group?
22	Data saturation	Was data saturation discussed?
23	Transcripts returned	Were transcripts returned to participants for comment and/or correction?
	Domain 3: analysis and findings	
24	Number of data coders	How many data coders coded the data?
25	Description of the coding tree	Did authors provide a description of the coding tree?
26	Derivation of themes	Were themes identified in advance or derived from the data?
27	Software	What software, if applicable, was used to manage the data?
28	Participant checking	Did participants provide feedback on the findings?
	Reporting	
29	Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number
30	Data and findings consistent	Was there consistency between the data presented and the findings?
31	Clarity of major themes	Were major themes clearly presented in the findings?
32	Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?

Appendix 4: The interview guide

Sociodemographic and practice details of the participant
Age (years)
Academic degrees
Place of work
Length of experience (years)
Interview questions
How do you see the importance of pharmacists as healthcare service providers for hospitalized patients?
How do other members of the healthcare provision team (physicians, nurses, ..etc.) see the pharmacist as a member?
What services are captured for pharmacists within the healthcare provision team?
How can we improve capturing pharmacist's interventions using the HER system?
What are the obstacles and challenges facing capturing pharmacist's interventions using the current HER system?
What services/activities can be used as key performance indicators for pharmaceutical services in hospitalized patient settings?

Arab American University
Faculty of Graduate Studies

الجامعة العربية الأمريكية
كلية الدراسات العليا

2021-4-15

حضرة د. عبد الله القواسمي المحترم

رئيس وحدة التعليم الصحي والبحث العلمي / وزارة الصحة الفلسطينية

تسهيل مهمة بحثية

تحية طيبة وبعد،

تهديكم كلية الدراسات العليا في الجامعة العربية الامريكية اطيب التحيات، وبالإشارة الى الموضوع أعلاه، تشهد كلية الدراسات العليا في الجامعة أن الطالب **حازم محمد حسن سالم** والذي يحمل الرقم الجامعي 201820261 وهو طالب ماجستير في الجامعة العربية الامريكية تخصص المعلوماتية الصحية، ويعمل على رسالة بعنوان **Upgrading features of electronic health record systems to capture the impact of pharmacists in Palestinian healthcare facilities: a mixed method" تحت اشراف د. رمزي شواهنة.** نأمل من حضرتكم الايعاز لمن يلزم لمساعدته في الحصول على المعلومات اللازمة للدراسة، علما" ان المعلومات ستستخدم لغاية البحث فقط وسيتم التعامل معها بغاية السرية، وقد أعطيت هذه الرسالة بناء" على طلبه.

وتفضلوا بقبول فائق الاحترام

د. أشرف الميمي

عميد كلية الدراسات العليا

كلية الدراسات العليا
FACULTY OF GRADUATE STUDIES

Jenin Tel: +970-4-2418888 Ext.:1471,1472 Fax: +970-4-2510810 P.O. Box:240
Ramallah Tel: +970-2-2941999 Fax: +970-2-2941979 Abu Qash - Near Alrehan
E-mail: FGS@aaup.edu ; PGS@aaup.edu Website: www.aaup.edu

State of Palestine
Ministry of Health
General Directorate of Education in
Health and Scientific Research

دولة فلسطين
وزارة الصحة
الإدارة العامة للتعليم الصحي
والبحث العلمي

Ref.: .....
Date:.....

الرقم: ٢٠٢١/٦٤٠/١٦٢
التاريخ: ٢٠٢١/٤/٢٤

الأخ مدير عام الادارة العامة للمستشفيات المحترم،،،

الأخ مدير مجمع فلسطين الطبي المحترم،،،

تحية واحترام،،،

الموضـــوع: تسهيل مهمة بحث

يرجى التكرم بتسهيل مهمة الطالب: حازم محمد حسن سالم، ماجستير معلوماتية صحية- الجامعة العربية الامريكية، لعمل بحث التخرج بعنوان:

" Upgrading features of electronic health record systems to capture the impact of pharmacists in Palestinian healthcare facilities: a mixed method."

حيث سيقوم الطالب بجمع معلومات من خلال عمل مقابلات مع كوادر صحية (بعد أخذ موافقتهم)، مع العلم أن مشرف الدراسة: د. رمزي شواهنة.

وذلك في: المستشفى الوطني-نابلس-، مستشفى ثابت ثابت -طولكرم-، مستشفى خليل سلمان جنين، مجمع رام الله الطبي وقسم الحاسوب داخل مجمع رام الله الطبي

على ان يتم الالتزام بجميع تعليمات واجراءات الوقاية والسلامة الصادرة عن وزارة الصحة بخصوص جائحة كورونا، وتحت طائلة المسؤولية.

على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التعهد بعدم النشر.

الباحث يستطيع تقديم طلب بعد انتهاء بحثه للمنافسة على جائزة فلسطين للبحث العلمي

بامكان الباحث تقديم طلب للمشاركة ببحثه في المؤتمر الفلسطيني الدولي للبحث العلمي

مع الاحترام،،،

د. عبد الله القواسمي
مدير التعليم الصحي والبحث العلمي

نسخة: مشرف الدراسة المحترم/ جامعة القدس

P.O. Box: 14
Telfax: 09-2333901
Healtheducation.dep@gmail.com
ص.ب. 14
تلفاكس: 09-2333901

تحسين ميزات أنظمة السجلات الصحية الإلكترونية لقياس تأثير الصيادلة في مرافق الرعاية الصحية الفلسطينية: طريقة مختلطة

حازم محمد سالم

الملخص

خلفية الدراسة: إتجهت العديد من أنظمة الرعاية الصحية في مختلف أنحاء العالم لإستبدال أنظمة السجلات الصحية للمرضى الورقية بأنظمة سجلات صحية الإلكترونية أكثر حداثة. يعد الصيادلة من مقدمي الرعاية الصحية في مختلف الأنظمة الصحية حول العالم، و يشارك الصيادلة بشكل متزايد في تقديم خدمات رعاية مباشرة للمرضى. حاليًا، لا يُعرف الكثير عن كيفية تحسين أنظمة السجلات الصحية المستخدمة حاليًا للسماح بتوثيق الخدمات الصيدلانية المقدمة للمرضى أو تدخلات الصيدلاني، بالإضافة إلى ذلك، لا يُعرف الكثير عن كيفية إستخدام تلك الخدمات أو التدخلات الصيدلانية الموثقة في تقييم أداء الصيادلة والخدمات المعيارية وتحسين النتائج الصحية للمرضى. أجريت هذه الدراسة لتحليل إستخدام السجلات الصحية الإلكترونية من قبل الصيادلة في المستشفيات، وجمع وجهات نظر الصيادلة حول الميزات التي يرغبون في تحسينها في السجلات الصحية الإلكترونية الحالية لتوثيق دورهم في العناية بالمرضى في المستشفيات.

الطريقة: في المرحلة الأولى، تم إجراء بحث منهجي في قواعد البيانات التالية: Medline/Pubmed و Cochrane و CINAHL/EBSCO و Embase و PsycINFO و Scopus حتى 10 أبريل 2021 عن الوثائق/الدراسات التي أجريت حول تصميم/تطوير أنظمة السجلات الصحية الإلكترونية لتوثيق خدمات الرعاية الصيدلانية، وإستخدام أنظمة السجلات الصحية الإلكترونية لتحسين/تقييم خدمات الرعاية الصيدلانية،

و/أو قياس تأثير الصيادلة من خلال السجلات الصحية الإلكترونية. في المرحلة الثانية، أجريت مقابلات مع الصيادلة والأطباء ومتخصصي تكنولوجيا المعلومات/المعلوماتية الصحية.

النتائج: خلصت نتائج البحث المهجي في قواعد البيانات لما مجموعه 741 وثيقة/دراسة. تمت إضافة 5 مستندات إضافية ذات صلة إلى نتائج البحث. عند الفحص الأولي، تم إستبعاد 653 وثيقة/دراسة. عندما تم فحص الوثائق/الدراسات ضمن المعايير المتبعة في الدراسة، تم إستبعاد 73 وثيقة/دراسة وتم تضمين 20 وثيقة/دراسة في الدراسة المراجعة المنهجية. من بين الوثائق/الدراسات المختارة، 4 (20٪) تحدثت عن إستخدام السجلات الصحية الإلكترونية من قبل الصيادلة، و 7 (35٪) تحدثت عن تحسينات في الخدمات الصيدلانية التي تقدمها السجلات الصحية الإلكترونية، و 5 (25٪) تحدثت عن إستخدام السجلات الصحية الإلكترونية لتوثيق تأثير الصيادلة، و 4 (20٪) عن الحاجة إلى تحسين تصميم السجلات الصحية الإلكترونية. أجريت مقابلات معمقة مع 17 مشاركًا. من بين هؤلاء، 9 (52.9٪) كانوا صيادلة، و 15 (88.2٪) يعملون في مستشفيات حكومية، و 10 (58.8٪) لديهم خبرة 10 سنوات أو أكثر في المجال. كشف التحليل النوعي للمقابلات عن أهمية الصيادلة كمقدمي رعاية صحية للمرضى في المستشفيات، ووجهات نظر المشاركين حول السجلات الصحية الإلكترونية، والتحديات والتوقعات المستقبلية.

الخلاصة: أشارت نتائج هذه الأطروحة إلى أن الصيادلة من مقدمي الرعاية الصحية المهمين الذين تم إهمالهم عندما تم تصميم السجلات الصحية الإلكترونية. تسمح السجلات الصحية الإلكترونية المستخدمة حاليًا بتوثيق محدود لدور الصيادلة في رعاية المرضى في المستشفيات. قد يسمح تحسين السجلات الصحية الإلكترونية بعد الأخذ في عين الإعتبار آراء المشاركين الذين تمت مقابلتهم في هذه الدراسة بتوثيق تأثير الصيادلة في

رعاية المرضى في المستشفيات. لا تزال هناك حاجة لدراسات مستقبلية للتحقق مما إذا كان تحسين السجلات الصحية الإلكترونية يمكن أن تحسن تقديم الرعاية الصحية والنتائج الصحية للمرضى في المستشفيات.