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Registered Nurses' Intention To Use Electronic Documentation Systems: A Mixed Methods Study

Sarah Ibrahim, *The University of Western Ontario*

Supervisor: Donelle, Lorie, *The University of Western Ontario*
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Abstract

BACKGROUND: Home care in Ontario has become the fastest growing sector and cornerstone of the healthcare system. As a result of the increased shift to the home care sector in Ontario, there have been several health information technology (HIT) initiatives to improve the quality and delivery of health care services to patients. This is exemplified with the province-wide development and implementation of electronic documentation systems (EDS). Electronic documentation systems have the potential to ensure timely, up-to-date and comprehensive patient health and care-related information is available and accessible to healthcare providers such as registered nurses regardless of their physical location. Access to patient health and care-related information supports high-quality nursing care, decision-making, and care delivery processes. Despite the benefits of EDS (i.e., improved workflow, reduced diagnostic and laboratory tests and adverse drug events), low intention by registered nurses to use these systems is well documented. Existing evidence suggests that an expressed intention to use HIT such as EDS is a direct predictor and antecedent of behavioural usage. Despite the growing efforts to understand registered nurses' perceptions and overall intention to use EDS in practice, there is limited knowledge about registered nurses' intention to use EDS in the context of home care practice.

AIMS: The purpose of this study was to understand and examine factors that influence nurses' intention and overall perception of using EDS in their home care practice. The conceptual model framing this study was adapted from the Unified Theory of Acceptance and Use of Technology (UTAUT) to delineate the relationships among factors that influence registered nurses' intention to use EDS in home care practice.

METHOD: A sequential, explanatory mixed methods design, using a sample of nurses from Ontario who are currently practicing within the home care sector were recruited to address the study's objectives. Data were collected using both quantitative (online survey) and qualitative (semi-structured individual telephone interviews) methods. Quantitative data were analyzed with descriptive statistics and hierarchical multiple regression analysis and qualitative data were analyzed with content and inductive thematic analysis.

RESULTS: Individual, technological and organizational / environmental characteristics were found to influence nurses' intention, level of comfort and experience with EDS usage in home care practice. Additional factors found to influence home care nurses' experience with EDS usage included: the development and employment of workarounds, the influence of nurse-patient interaction amidst system usage, and the ability to provide input towards the system design.

CONCLUSION: Nurses play a significant role in the delivery of home health care services to Ontarians. The findings highlight the importance for: a) further exploration of the most appropriate model and / or adaptation of a model identifying a range of factors influencing nurses' intention to use EDS in different healthcare contexts; b) continued integration of nursing informatics competencies within nursing curricula; c) an organizational culture that supports the use of EDS in nurses' home practice (i.e., enlisting user champions and providing adequate training and IT support); and d) having representation of nurses in the EDS design and / or implementation processes through a user-centered design approach.

Keywords: home care, registered nurses, electronic documentation system, health information technology, behavioural intention, level of comfort and experience

Co-Authorship Statement

The thesis contains material, specifically Chapters 2, 3, 4 and 5, from manuscripts submitted to scholarly journals. The manuscripts were co-authored by Sarah Ibrahim, Dr. Lorie Donelle, Dr. Sandra Regan and Dr. Souraya Sidani.

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Chapter 1

Background and Problem of Statement

Introduction

The health care system over the past several decades has been challenged by significant changes with an aging population, increased complex and palliative care needs, and rise in usage of health care services and in turn, cost of care (Doran et al., 2012; Kitchen, Williams, Pong, & Wilson, 2011; Santi, Berg, & Stolee, 2013; Qu & Sun, 2015). The considerable changes have led to the increased reliance on the home care sector, which is considered to be the fastest growing sector in Ontario's healthcare system; with an estimated one million Ontarians receiving home care at any given time (Home and Community Care, 2015; Home Care Ontario, 2016; Kitchen et al., 2011). The growth in the home care sector can be attributed to: 1) the home being considered as the desirable place to receive health care and a cost-effective alternative to that of acute or long-term care facilities; 2) the need / importance of supporting the independence of individuals; and 3) the accessibility of technological advancements to support the delivery of efficient and high-quality health care and services (Barrett, 2011; Canadian Institute for Health Information [CIHI], 2011; Home Care Ontario, 2016; Kitchen et al., 2011).

Advancements in health information technology (HIT), that is, the application of information processing involving software and hardware for storing, sharing and retrieving health data for decision-making and communication, has significantly changed the health care system, nursing practice and delivery of care to Ontarians (Payne, 2016; Thompson & Brailer, 2004). In today's evolving healthcare system, it is imperative for healthcare providers (HCPs), specifically registered nurses, to adapt to the current and projected technological advancements that are being used to support the provision of high-quality home health care services, address the various and complex health care challenges, and deliver optimal quality nursing care (Payne, 2016; Ross-Kerr, 2003).

Provision of high-quality care is directly influenced by nurses' ability to access timely, comprehensive, and accurate health information (Payne, 2016). The transition from paper to electronic documentation systems (EDS) or clinical information systems facilitates the care delivery process within the home care sector through enhancements in

HCPs' workflow, productivity, documentation, and care team processes (i.e., communication among members of the interdisciplinary team and continuity of care). Electronic documentation systems also have the potential to address inefficiencies that result from paper-based charting (i.e., duplication of tests, medication errors, incomplete or illegible notes, and loss of patient health data) (Infoway, 2013; Saranto & Kiunnunen, 2008; Smith, Smith, Krugman, & Oman, 2011).

Despite the potential benefits of using EDS, empirical evidence indicates that the transition from paper-based documentation systems to EDS does create significant changes to nursing practice; low intention by nurses to use such systems in practice has also been noted (Kaya, 2011; Kim, Lee, & Yoo, 2016; Kipturgo, Kivuti-Bitok, Karani, & Muiva, 2014). The low intention to use HIT such as EDS is attributed to the interaction between humans and technology, which is affected by a number of factors including: human, technological, and organizational / environmental characteristics (Gagnon, Orruno, Assua, Abderjelil, & Emparanza, 2012; Taiwo & Downe, 2013).

Although initiatives are underway provincially and nationally (i.e., Infoway, 2016) for the continued transition from paper-based to EDS, there is a lack of research examining nurses' intention to use such systems to support safe and effective nursing care within the home care sector (Leblanc, Gagnon, & Sanderson, 2012). Theoretical and empirical evidence suggests that behavioural intention is a direct antecedent or determinant of actual behaviour usage (such as EDS usage); highlighting the importance of understanding the factors that influence this antecedent (Johnston & Warkentin, 2010; Sharma & Crossler, 2014; Venkatesh et al., 2012).

The potential benefits of using EDS within nurses' home care practice will not be fully realized if there is low intention to use them (Ifinedo, 2016). As such, it is critical to attain an understanding of the factors that influence nurses' intention to use EDS within the home care sector (Lee, Link, Yan, & Tsou, 2013; Montague, Asan, & Chiou, 2013). The purpose of this study was to understand and examine factors that influence nurses' intention and overall perception of using EDS in their home care practice. Such an understanding may assist and inform nurse and health systems managers, nurse

educators, software developers as well as decision and policy makers in developing effective strategies and interventions to enhance nurses' intention and support the successful use of EDS by nurses in their day-to-day home care practice (Hung et al., 2014; Li et al., 2013; Qu & Sun, 2015). This is particularly meaningful as nurses move into new roles that are enabled and supported by technology (While & Dewsbury, 2011).

Background

Home Care

Home care has evolved over the years and has become the fastest growing sector within the healthcare system in Ontario (Home Care Ontario, 2016; Kitchen et al., 2011). Home care was first established in Ontario in 1970 (Canadian Home Care Association, 2015). Publicly funded home care falls under the jurisdiction of the Ontario Ministry of Health and Long-Term Care and encompasses an array of services to persons of all ages that help with rehabilitative, acute, chronic and palliative care needs (Home Care Ontario, 2016; Home Care Ontario, n.d.). The home care sector includes the active involvement of regulated (e.g., nurses) and unregulated (e.g., personal support workers) nursing staff and HCPs, not-for-profit and for-profit organizations, family and friend caregivers, and volunteers (Canadian Home Care Association, 2015; Home Care Ontario, 2016). Home care has the potential to ensure the right care, at the right time, and the right place is provided to Ontarians (Canadian Home Care Association, 2015). Further, home care has the potential to foster and maintain an individuals' independence and dignity in their place of choice instead of less desirable living and care options (i.e., long-term care facilities) and to reduce healthcare costs (Sinha, 2012). For example, an expert group commissioned by the provincial government released a report entitled "Bringing Care Home" (2015), which estimated that in 2014, home care cost approximately $42 per day per person whereas the cost per day in long-term care facilities was $135 and in a hospital $450; accounting for a $93 and $408 cost difference per person per day respectively.

In Ontario, the provincial government established the Local Health Integration Network (LHINs), which are non-for-profit agencies funded by the Ministry of Health and Long-Term Care. There are 14 LHINs across the province of Ontario (Ministry of

Health and Long-Term Care, 2018). The LHINs are responsible for funding, planning, and coordinating efficient and accessible community and home health care services with health service provider organizations to collectively offer health care services to all individuals at the community level (Ministry of Health and Long-Term Care, 2018). With the increased reliance on the home care sector in Ontario coupled with the LHIN's strategic investment in eHealth initiatives (LHIN, 2016), it is essential to examine the innovative technological advancements that have the potential to create new possibilities in the delivery of home health care services to Ontarians (Barrett, 2011; Home Care Ontario, 2016; Kitchen et al., 2011).

Health Information Technology

Health information technology (HIT) is the application of information processing that involves both computer hardware and software for the purposes of storing, sharing, retrieving and using health information and knowledge for decision-making and communication (Lee, McCullough, & Town, 2013; Protti, 2015; Thompson & Brailer, 2004). Health information technology was introduced in the 1960s in hospitals and included ancillary information systems to support financial and billing services; later, HIT expanded to the management of pharmacy, laboratory and radiology services (Collen & Ball, 2015; Lee et al., 2013).

Over the last two decades, there has been increased implementation of HIT within the health care system to support the provision of care (Al-Khasawneh & Hijazi, 2016; Health Canada, 2015). Implemented HIT consists of a wide range of clinical and networking information systems such as EDS (i.e., electronic health records, picture archiving and communication system, nursing documentation, and medication administration), telemedicine, and the adaptation of online social media applications for health care use. Empirical evidence suggests that the integration and use of HIT for the delivery of health care services, particularly within the home care sector, has the potential to support patients and HCPs in planning and carrying out care (Canadian Home Care Association, 2015; Carretero, 2015; Bowles, Dykes, & Demiris, 2015; Home Care Ontario, 2016; Hsiao & Chen, 2016; Kuo, Liu, & Ma, 2013; Meier et al., 2013).

Specific to patients, the use of HIT supports aging in place, improves care delivery and access to preventative and treatment services, promotes independence, personalized care, and improved communication and collaboration with HCPs within the respective circle of care (Bowles et al., 2015; Canadian Home Care Association, 2015; Carretero, 2015; Meier et al., 2013). For HCPs, empirical evidence suggests that HIT has improved the efficiency of care delivery, documentation, workflow, and facilitates clinical team work and processes through enhanced collaboration and communication in real-time (Canadian Nurses Association, 2013; Hsiao & Chen, 2016; Kuo et al., 2013; Meier et al., 2013).

Clinical Documentation Systems

At the core of every health care encounter is clinical documentation (Jamal & Grant, 2014). Clinical documentation is a legal record of patients' health condition(s), needs, and are reflective of current care and services being delivered; which is required to be complete, precise and up-to-date (Jamal & Grant, 2014). High-quality clinical documentation serves the best interest of HCPs and patients (Jamal & Grant, 2014). Specific to front-line HCPs including nurses, having access to up-to-date and accurate patient health and care-related information allows them to make safe, efficient and effective patient care-related decisions based on the patients' care needs (Jamal & Grant, 2014). For patients, having a comprehensive treatment plan, timely results for tests and procedures, and medical diagnoses support disease management and preventative care; which improves patient health outcomes (Infoway, 2013; Jamal & Grant, 2014). As such, having access to patient health and care-related information through EDS is particularly important with the increased provision of care to individuals living with complex health care needs (i.e., multiple chronic co-morbid conditions and the aging population) and with care being delivered within the home care sector (Home Care Ontario, 2016). Several examples of clinical documentation systems being used within the home care sector in Ontario have been noted in the literature and are summarized in Table 1.

Table 1. Summary of Clinical Documentation Systems in Home Care

Clinical Documentation Systems	Overall Purpose
Client Health and Related Information System (CHRIS)	• Web-based patient management system for delivery of community and home health care services • Features: Clinical assessment and decision-support tools, eReferral, eNotifications, and Health Partner Gateway (HPG).
Clinical Connect	• Web-based portal specific to South West Ontario that collates patient health and care-related information from: CCAC; Regional Cancer Programs; Ontario Laboratories Information Systems (OLIS); and Southwestern Ontario Diagnostic Imaging Network (SWODIN).
interRAI Home Care (HC)	• Web-based system primarily for individuals living with a disability, are medically complex as well as have chronic and / or post-acute care needs. • Focuses on the assessment of an individuals' quality of life, level of function, needs, preferences, and strengths.
interRAI Contact Assessment (interRAI CA)	• Web portal system to support the home care intake process, specifically related to further assessments, provision of urgent home health care and specialized (i.e., rehabilitation) services to patients.

Client Health and Related Information System (CHRIS). CHRIS is a web-based patient management system that supports the delivery of community and home health care services for approximately 670, 000 individuals in Ontario (Health Shared Services Ontario, n.d.). The management system integrates digital health solutions across the province of Ontario to improve and streamline the delivery of home health care services. The features of CHRIS include: the integration of clinical assessment and decision-support tools (i.e., interRAI home care assessment tool); eReferral, which are electronic referrals from the acute care sector and / or emergency medical services to community and home care providers; and eNotifications, which are electronic notifications to community and home care providers of patient's hospital admission and discharge plans

(Health Shared Services Ontario, n.d.). The CHRIS also has a secure portal, Health Partner Gateway (HPG), that allows approved HCPs to access patient health information (i.e., clinical assessments and documents) as well as the ability, in real-time, "to receive, send and accept patient referrals and service orders" (Health Shared Services Ontario, n.d., p. 1).

Clinical Connect. Clinical Connect is a web-based portal that electronically collates patient health and care-related information from acute care settings, LHINs, Regional Cancer Care programs, Ontario Laboratories Information Systems (OLIS), and Southwestern Ontario Diagnostic Imaging Network (SWODIN) across South West Ontario (Clinical Connect, 2016). Through Clinical Connect, authorized HCPs can access, through desktop computers, mobile devices (i.e., iPhone, Android, Blackberry) and tablets (i.e., iPad), essential patient health and care-related information in real-time (Clinical Connect, 2016). The reported benefits of Clinical Connect include: the reduction of duplication of patient documentation, procedures and tests, and improvement in care transfer and coordination between HCPs and organizations in South Western Ontario (Clinical Connect, 2016).

interRAI Home Care (HC). interRAI HC is a web-based system that supports the assessment of quality of life, needs, strengths, preferences and level of function for individuals living with disabilities and that have complex care needs (Health Shared Services Ontario, n.d.).

interRAI Contact Assessment (interRAI CA). interRAI CA is a web-based system that records essential patient health-related information for the home care intake process (Health Shared Services Ontario, n.d.). The goal is to support HCPs' decision making regarding the need for additional and comprehensive assessments, urgency of home health care services, and need for specialized services (Health Shared Services Ontario, n.d.).

Electronic documentation systems (EDS), commonly referred to as electronic health record systems, electronic medical systems, computerized documentation, electronic clinical documentation or computer-based documentation, are secure, electronic information systems that are used by HCPs to systematically record, document,and access patient health and care-related information over time (HIMSS, 2011; Payne, 2016). The development and implementation of EDS such as the electronic health records (EHR) is a pan-Canadian initiative tasked by Canada Health Infoway Inc. (Infoway), a federally-funded, not-for-profit organization (Infoway, 2013). Infoway has supported agencies (i.e., eHealth Ontario) in the development of EDS, which can be accessed by HCPs providing care to patients regardless of their physical location (i.e., acute care, long-term care, community and home care) (Infoway, 2016; Office of the Auditor General of Canada, 2010). Information recorded into EDS include but are not limited to: patient demographics, diagnoses, past medical history, medications, immunizations, assessment data, laboratory and imaging results (i.e., x-ray, Computerized Tomography [CT] and Magnetic Resonance Imaging [MRI] scans), clinical interventions, care plans and patient outcomes (HIMSS, 2011; Infoway, 2013; Payne, 2016).

Traditionally such patient health and care-related information were stored in paper-based documentation systems. However, several limitations of the paper-based documentation systems were noted; affecting both patients and HCPs. The limitations included:

a) difficulty sharing medical information with members of the interdisciplinary team, particularly if patients were seeing more than one HCP and if care was being delivered by several HCPs within the home;

b) patients having to constantly recount their medical history with every HCP encounter, resulting in frustrations for the patients and inaccurate, up-to-date medical information;

c) difficulty maintaining confidentiality because of the various storage locations (i.e., patient's home and cabinets in acute and primary care settings) of

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medical information, increasing the risk of unauthorized access of such

information and the inability to track such activity; and

d) quality of care being compromised due to incomplete and / or illegible

handwriting / documentation, resulting in loss of important medical and health

information; ability for nurses to accurately interpret and access clinical

findings; increase in medical errors (i.e., with prescriptions); and duplication

of diagnostic tests (Home Care Ontario, 2016; Infoway, 2013; McDowell et

al., 2008).

The healthcare system is transitioning into EDS to mitigate the limitations of paper-based documentation systems. Benefits attributed to EDS implementation include:

a) improvements in legibility and completeness of documentation, which affects

nurses' ability to accurately interpret clinical findings, care plans and orders;

and promotes quicker retrieval of comprehensive and up-to-date clinical data;

b) reduction in laboratory and diagnostic tests (i.e., EHR and EMR systems have

alert notification features for ordering redundancy and of past test results) and

medical errors (i.e., availability of functions to alert HCPs of up-to-date and

comprehensive list of medications, potential prescribing errors, adverse drug

events from the interaction of other medications and patients' allergies);

c) improvement in patient outcomes through chronic disease management by

identifying individuals living with chronic diseases and at risk for poor health

outcomes through the predictive-modelling algorithms and preventative care

(i.e., improvements in immunizations, bone mineral density, and screening of

cervical, breast and colorectal cancer); and

d) support continuity of care, communication and collaboration among HCPs in

a timely manner and regardless of physical location (Dahrouge et al., 2012;

Home Care Ontario, 2016; Infoway, 2013; Kaczorowski et al., 2013; Nguyen

et al., 2014; Spencer & Lunsford, 2012; Tundia et al., 2012; Yee et al., 2012).

Although there are noted benefits of EDS primarily within acute care settings (with limited focus on the home care sector) (Carrington & Taise, 2013), the transition from paper-based to EDS include several limitations and barriers. Limitations and barriers

include: a) interrupted workflow and loss of productivity due to HCPs learning the system; b) initial time commitment required to enter data and convert paper-based documents / records to electronic documents; c) poorly designed EDS; and d) HCPs' anxiety, apprehension, resistance and low intention towards using such systems (Boonstra & Broekhuis, 2010; Creswell, Bates, & Sheikh, 2013; Infoway, 2013; Nguyen et al., 2014; Schenk, Mayer, Barney, Estill, Goss, & Shreffler-Grant, 2016; Stroetmann, Artmann, Dumortier, & Verhenneman, 2012; Sugarhood, Wherton, Procter, Hinder, & Greenhalgh, 2013; Payne, 2016; Yen & Bakken, 2012). The latter barrier, intention to use, is the focus of this research study.

Intention-Behaviour Relationship

Over the past decades, several theories have been proposed to explain human behaviour (Sommer, 2011). Clinical practice is considered to be a form of human behaviour that is related to the implementation of interventions or health care services and guided by the motivational predispositions of a person (Eccles et al., 2006; Godin & Conner, 2008). Intention, that is, an individual's subjective probability that he or she will engage in a given behaviour, is the immediate antecedent of actual behaviour (Fishbein & Ajzen, 2011; Fishbein & Ajzen, 1975; Fisher & Fisher, 1992; Gollwitzer, 1993). Research examining nurses' intention to use HIT in acute care practice found that intention predicted actual behavioural usage; accounting for 28.2%-58% of the variance in actual behavior of end-users such as nurses (Godin et al., 2008; Leblanc et al., 2012; Maillet et al., 2014; Sharifian, Askarian, Nematolani, & Farhadi, 2014; Wills, El-Gayer, & Bennett, 2008). Several factors influencing intention to use EDS have been examined, which provides valuable information on possible challenges or barriers that can be targeted with interventions to enhance use of HIT such as EDS by nurses in practice.

Registered Nurses' intention to using Health Information Technology

Nurses' low intention to use HIT, in general, has been cited as a factor leading to underutilization or unsuccessful implementation of HIT as intended in practice (Hsiao & Chen, 2016; Hung et al., 2014; Khalifa, 2013; Montague et al. 2013; van Houwelingen, Barakat, Best, Boot, Charness, & Kort, 2015; Yen & Bakken, 2012). However, it is

important to note that findings of nurses' low intention to use HIT particularly EDS have been predominantly examined within the acute care sector, with little to no focus on nurses' use of such systems within the home care sector. Acute and home care sectors differ in working environments, which may influence nurses' intention to use EDS differently. For example, home care nurses work independently and autonomously with limited direct and face-to-face interaction with colleagues (Lundy & Janes, 2014; Tourangeau et al., 2014). In comparison, nurses working in an acute care setting are in greater proximity with other HCPs and patient care resources. Moreover, the working environment of a home care nurse is unique: it comprises of several different locations (i.e., nurses' car and home; patients' home, and agency office), which may impact the availability of supplies and equipment. Whereas nurses working in an acute care setting have readily available human and material resources (Lundy & Janes, 2014; Torurangeu et al., 2014).

Underlying nurses' low intention of using HIT such as EDS is the complex inter-related technical and social issues within an organization; making the introduction and uptake of HIT a complex and dynamic process (Creswell et al., 2013; Yen & Bakken, 2012). Empirical evidence suggests factors that influence the use of HIT such as EDS to be categorized into the individual, technological and organizational / environmental dimensions (Asua, Orruno, Reviriego, & Gagnon, 2012; Chau & Hu, 2002; Gagnon et al., 2012). For the individual dimension, research suggests that factors related to nurses' age, professional experience, computer / technology knowledge, comfort working with computers and technology, and attitude towards the HIT influence nurses' use of HIT in their in day-to-day practice (Hsiao, & Chen, 2016; Juo, Liu, Ma, 2013; Li, Talaei-Khoei, Seale, Ray, & MacIntyre, 2013; Van Houwelingen et al., 2015; Wu, Li, & Fu, 2011).

For the technological dimension, empirical evidence suggests that the complexity of the HIT, compatibility and interoperability with existing technology systems as well as overall design (i.e., downtime and speed), influence nurses' intention to use HIT in practice (Gagnon et al., 2012; Hsiao & Chen, 2016; Hung et al., 2014; Li et al., 2013; Sugarhood et al., 2013). Specific to the organizational / environmental dimension, lack of

training and technology support were cited as shortfalls in intention to use HIT by nurses in practice (Li et al., 2013; Sugarhood et al., 2013).

Intention-Behaviour Models

The use of technology has been extensively explored since the inception of computer and information technology (Kijsanayotin, Pannurunothai, & Speedie, 2009). Several theories and models have been developed to explain how end-users make decisions to use technology (Ifinedo, 2016; Kijsanayotin et al., 2009). The theories and models originate from various disciplines such as sociology and psychology (Kijsanayotin et al., 2009; Venkatesh et al., 2003, 2012). The most dominant theories and models are: Innovation Diffusion Theory (IDT) (Rogers 1995), the Theory of Planned Behavior (TPB) (Fishbein & Ajzen 1975), the Technology Acceptance Model (TAM) (Davis 1989), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). Each theory (summarized in Table 2) are briefly discussed.

Table 2. Summary Table of Theoretical Frameworks and Models for End-Users'
Decisions related to Technology Usage

Theoretical Framework or Model	Reported Factors Influencing Intention to use Information Technology
Innovation Diffusion Theory (IDT) (Rogers, 1995)	5 characteristics of the innovation: • Trialability • Complexity • Relative Advantage • Compatibility • Observability
Theory of Planned Behaviour (TPB) (Ajzen, 1991)	Intention influences behavioural enactment. Intention is influenced by: • Attitude • Subjective Norm • Perceived Behavioural Control
Technology Acceptance Model (TAM) (Davis 1989, Davis et al. 1989, Davis 1993)	Intention to use a system is informed by attitude, which is influenced by: • Perceived usefulness (PU) • Perceived ease of use (PEOU)
Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003)	Intention to use information technology informed by four constructs: • Performance Expectancy • Effort Expectancy • Social Influence • Facilitating Conditions Moderators of the relationships among the four constructs, intention and actual behavioural usage: • Voluntariness of Use • Experience • Age • Gender

Innovation Diffusion Theory (IDT). The IDT proposes that adoption of technology is a
function of the individual and technological characteristics. Innovation Diffusion Theory
categorizes individuals on the basis of the rate / speed of adoption of the technology into:
innovators, early adopters, early majority, late majority and laggards (Rogers, 1995). The
five characteristics of the technology that affect its uptake are: 1) *trialability*, that is, the
ease of experimenting with a technology or innovation; 2) *complexity*, that is, the degree
to which an innovation is perceived to be easy to understand and use; 3) *relative
advantage*, referring to the degree to which an individual perceives the innovation as a

good idea and advantageous; 4) *compatibility*, which is the degree to which an individual perceives the innovation or technology as being compatible with current values, needs and previous experiences; and 5) *observability*, referring to the degree to which the results and benefits of the innovation are evident and visible to individuals (Rogers, 1995). Several limitations of IDT have been noted: 1) the theory is technology driven because of the pro-innovation bias, that is, all individuals of a social system should adopt innovations and quickly. A second limitation of the IDT is that it does not account for the influence of the social environment on an individuals' adoption of technology (Kole, 2000).

Theory of Planned Behaviour (TPB). The TPB originates from social cognitive theories and extends the Theory of Reasoned Action (TRA) (Ajzen, 1991; Fishbein & Ajzen, 1975). The TPB proposes that the enactment of a behaviour is determined by intention to perform the behaviour. Intention refers to the amount of effort the individual is willing to exert in a given behaviour (Ajzen, 1991). According to Ajzen (1991), intention is influenced by three factors: a) *attitude towards the behaviour*, that is, the individual's beliefs and corresponding positive or negative perspective of the potential outcomes of intending to and actually performing a behaviour; b) *subjective norm*, that is, the individuals' perception of social influence (i.e., colleagues and supervisors) that affect his / her behavioural intention and performance; and c) *perceived behavioural control*, that is, the individual's beliefs and perception of factors that facilitate or inhibit the ability to enact the behaviour. The TPB postulates that the combination of attitude, subjective norm, and perceived behavioural control lead to behavioural intention and in turn, the actual enactment of the behaviour (Ajzen, 1991). One of the main limitations of TPB is that the theory does not account for individual characteristics (i.e., demographic variables such as age and sex); making the assumption that all individuals experience the processes of the TPB similarly (Armitage & Conner, 2001).

Technology Acceptance Model (TAM). The TAM is based on principles adapted from Fishbein and Ajzen's (1975) attitude paradigm from psychology. The TAM posits that the acceptance of a technology by a user is determined by two factors: 1) *perceived usefulness (PU)*, that is, the degree to which an individual believes that using a particular

technology will enhance his / her job performance; and 2) *perceived ease of use (PEOU)*, that is, the degree to which an individual believes that using a particular technology is effort free (Davis, 1989, Davis et al. 1989, Davis 1993). The TAM proposes that intention to use and accept a technology is directly determined by one's attitude towards using the system, which is determined by PU and PEOU (Davis et al. 1989; Davis & Venkatesh 2004). Several limitations have been noted of the TAM. First, Burton-Jones and Hubona (2006) suggest that the influence from external factors such as level of education, age and system experience may have a direct influence on the usage of the technology. Second, the TAM lacks a diversity of proposed variables, resulting in adaptations to the model to meet the specific necessities of the HIT being examined; creating confusion among researchers (Baenbasat & Barki, 2007; Kim et al., 2016). Finally, the simplicity of the model cannot universally explain end-users decisions and behaviours across a variety of technologies and within diverse adoption contexts (Anja, Gewald, & Ulrich, 2014).

The Unified Theory of Acceptance and Use of Technology (UTAUT). The UTAUT model, as presented in Figure 1, was developed to consolidate the theories and empirical evidence on individual's intention, acceptance and adoption of information technology into a single unified theoretical model (Li et al., 2013). The UTAUT synthesized 32 constructs from eight theories and models that are widely used for examining factors that influence the adoption of technology, namely: TAM, TPB, a combined TPB / TAM, the Model of Personal Computer Utilization, IDT, and Social Cognitive Theory (SCT) (Maillet et al., 2014; Venkatesh et al., 2003).

The UTAUT model explains end-users' (e.g., nurses) intention to use a specific information technology with four constructs: a) performance expectancy; b) effort expectancy; c) social influence; and d) facilitating conditions (Venkatesh et al., 2003). *Performance expectancy* (consistent with the concept of perceived usefulness in the TAM) refers to the degree to which the end-user believes the technology will provide benefits in performing certain activities and result in performance gains (Venkatesh et al., 2003). *Effort expectancy* (consistent with the concept of perceived ease of use in the TAM) denotes the ease associated with the use of the technology. *Social influence*

(consistent with the construct of social norm in the TPB) and *facilitating conditions* refers to the impact important persons (i.e., supervisors and colleagues) have on the end-users' use of the technology and their perception of support within the organizational and technological infrastructure to use the respective technology (Venkatesh et al., 2003). It is postulated that performance expectancy, effort expectancy and social influence are direct determinants of behavioural intention and facilitating conditions is a direct determinant of actual behaviour performance (Venkatesh et al., 2003).

Within the UTAUT model, voluntariness of use, technological experience, age and gender moderate the relationships between the four key constructs and intention and actual behavioural usage (Venkatesh et al., 2003). The UTAUT model through its integrated and comprehensive approach to explain end-users' such as nurses' intention and usage of technology, has demonstrated a stronger explanatory power (i.e., accounts for 63.1% - 72.8% of the variance in usage intention and approximately 50% in actual technology use) in comparison to other models which explain only 27% - 40% of variance in acceptance to use HIT (Armitage & Conner, 2001; Kim et al., 2016; Samaradiwakara & Gunawardena, 2014; Sharifan et al., 2014; Venkatesh et al., 2003). As well, the UTAUT model has been used to identify and examine factors that influence nurses' intentions to use HIT such as EDS (i.e., Kim et al., 2016; Lee et al., 2013; Maillet et al., 2014; Phichitchaisopa & Naenna, 2013; Sharifan et al., 2014; Wills et al., 2008). Because of its comprehensiveness in accounting for the individual, technological, and organizational / environmental factors and its strong explanatory power, the UTAUT model was adapted for this study aimed to examine nurses' intention to use EDS and factors that influence the nurses' intention within home care.

Figure 1. Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).
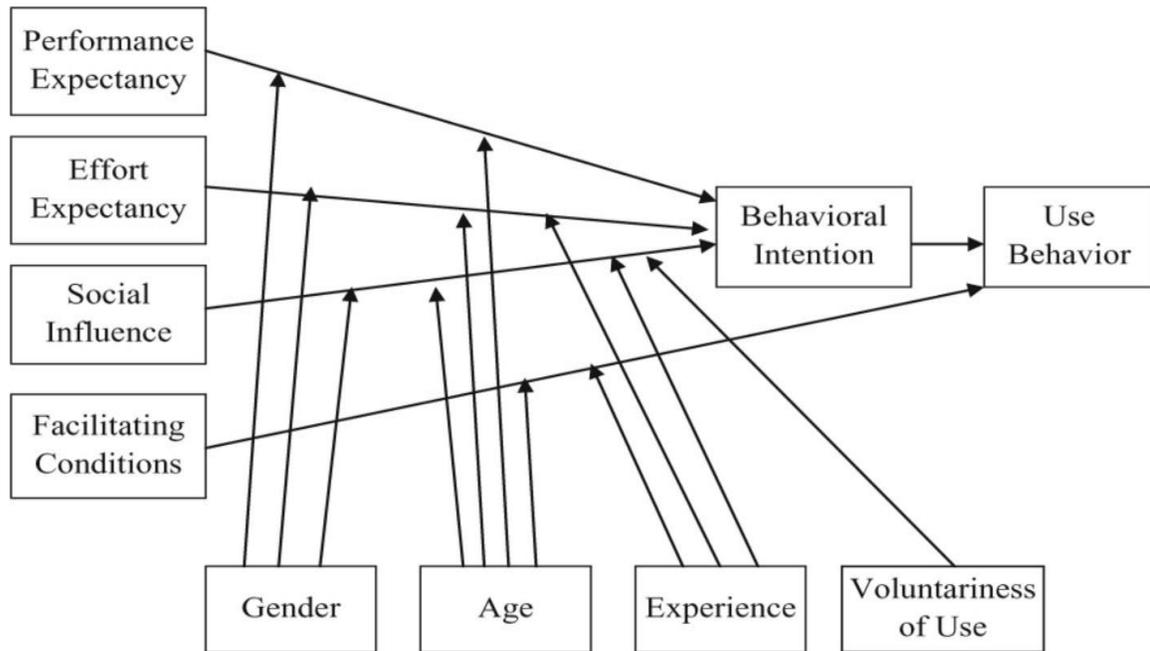
Limitations of Intention-Behaviour Relationship

Though behavioural intention is said to be an antecedent to actual behavioural performance or usage as proposed in several theories, a number of factors have been identified to potentially influence the intention-behaviour relationship (Fishbein & Ajzen, 2011; Kiriakidis, 2015). First is the stability of intention (Fishbein & Ajzen, 2011; Kiriakidis, 2015). Stability of intention refers to the change of intention to engage in a specific behaviour of interest following assessment (Fishbein & Ajzen, 2011; Kiriakidis, 2015). When intention changes following assessment, it often becomes a poor predictor of the behaviour of interest (Fishbein & Ajzen, 2011). Intention change may be attributed to: a) the passing of time in which unforeseeable events occur; and b) exposure to new information, which may potentially lead to an individual changing their intention towards a specific behaviour (Fishbein & Ajzen, 2011). For example, a nurse may express a low intention to use EDS prior to system usage in practice. However, a nurses' intention to use the EDS in practice may change following training and / or first-hand experience with the system. The change in intention to use EDS by the nurse may be from experiencing the positive influence of the EDS on their workflow, practice, ability to communicate

with allied HCPs, and access to up-to-date and comprehensive patient health and care-related information.

The second factor to potentially influence the intention-behaviour relationship is the intention-behaviour compatibility (Fishbein & Ajzen, 2011). Intention-behaviour compatibility is specific to the measure assessing intention and behaviour (Fishbein & Ajzen, 2011). If there is a lack of compatibility between the measures of intention and behaviour, it has the potential to demonstrate and be responsible for the weak correlation that has been noted within the literature (Fishbein & Ajzen, 2011). For example, some subjective measures used in practice to assess the intention and adoption of HIT are invalidated (Davis, 1989; Everson, Lee, & Friedman, 2014). Data obtained from invalidated measures lower researchers' confidence in accurately interpreting the results because of measurement error; measurement error can confound and / or attenuate the associations among the concepts of interest (Everson et al., 2014).

The third factor influencing the intention-behaviour relationship is literal inconsistency (Fishbein & Ajzen, 2011). Literal inconsistency refers to an individuals' failure to carry out the intention and in turn, enactment of actual behaviour. Though not empirically tested, it has been argued that literal inconsistency arises because individuals display favourable intention when the behaviour is perceived to be easy to perform, however individuals may change their mind when they perceive the behaviour as difficult to carry out (Campbell, 1963; Fishbein & Ajzen, 2011).

The intention-behaviour relationship is subject to the influence of factors, which may potentially undermine the relationship and utility of examining intention to predict actual behavioural performance / usage. However, contemporary theories specific to human social behaviour and empirical evidence have substantiated the predictive validity of the intention-behaviour correlations (i.e., 0.35 - 0.75; Armitage & Conner, 2001; Bamberg, Hunecke, & Blobaum, 2007; Ifinedo, 2016). The theories inform the identification and examination of factors that lead to the formation of an individuals' intention (Fishbein & Ajzen, 2011). Moreover, when examining the predictive accuracy

of such theories at the aggregate level rather than the individual level, intention is a good predictor of actual behavioural performance / usage (Fishbein & Ajzen, 2011).

Problem Statement

The implementation of EDS, one form of HIT, is a province-wide and pan-Canadian initiative that holds promise in making comprehensive, up-to-date, and timely patient health and care-related information available at the right place and the right time for all HCPs (Infoway, 2013; Nguyen et al., 2014). This is particularly important for nurses because they spend the most amount of time with patients, are the largest group of regulated HCPs and users of EDS (Delucia, Ott, & Palmieri, 2009; Stevenson et al., 2010; WHO, 2013). Further, the inability for nurses to directly communicate and access up-to-date and accurate information may compromise decision-making, delivery of high-quality nursing care and in turn, impact patient health outcomes (Home Care Ontario, 2016; Schenk et al., 2016). Despite the potential benefits of EDS, there have been reports of low intention to use such systems in practice by nurses (Hsiao & Chen, 2016; Hung et al., 2014; Khalifa, 2013; Montague et al. 2013; van Houwelingen et al., 2015; Yen & Bakken, 2012). Electronic documentation systems that are not used at all or to their fullest capacity cannot be reasonably expected to contribute to improving access to information and quality of care; rendering them of little value and negatively impacting organizations, patients and allied HCPs that require relevant, accessible and timely clinical information (Oye, Iahad, & Ab-Rahim, 2012; Wills et al., 2008). Despite the growing efforts to understand nurses' perceptions and overall intention to use EDS in practice, there is limited knowledge in the context of home care practice.

Study Purposes

The overall purpose of this study was twofold: 1) to examine factors that influence nurses' intention to use EDS within their home care practice. The factors selected were guided by empirical literature and a conceptual model that was adapted from the Unified Theory of Acceptance and Use of Technology (UTAUT); and 2) to explore nurses' perceptions of using EDS within their home care practice.

Research Questions

The research questions that were addressed in this study were:

Question 1: What are the relationships of nurses' personal and professional characteristics, and perceptions of the technological characteristics and organizational / environmental characteristics with their intention to use EDS within home care practice?

Question 2: How do nurses perceive the use of EDS within their home care practice?

Significance

Nurses play a significant role in the delivery of home health care services to Ontarians. To ensure high-quality nursing care is offered to patients and in turn, improve timely decision-making and patient health outcomes, nurses need access to up-to-date and accurate patients health and care-related information, which EDS hold promise in offering (Barrett, 2011; Infoway, 2013; Home Care Ontario, 2016; Kitchen et al., 2011; Nguyen et al., 2014; Schenk et al., 2016). Empirical evidence supports the benefits of EDS in practice; however, there is limited knowledge of factors that influence nurses' intentions to use such systems in their day-to-day home care practice.

This study was the first, to my knowledge, to explore and examine factors that influence nurses' intentions to use EDS within the home care sector in Ontario. Such an understanding is imperative with the expansion and integration of EDS across the province coupled with the increased reliance on the home care sector. The findings may provide useful information for nurse and health system managers, nurse educators, software developers, decision-makers, and policy makers on how to develop and introduce strategies and initiatives to support the successful integration and adoption of EDS as intended by nurses in their home care practice (Huong et al., 2014; Li et al., 2013; Qu & Sun, 2015).

Thesis Organization

The thesis was written in an integrated-article format as specified by the School of Postgraduate Studies at Western University. The goal of this thesis was addressed in a series of four papers (Chapters 2 to 5) that have been submitted for publication. The chapters are as follows:

Chapter 1: *Introduction*, includes the introduction, background of the problem, purpose of the research study, research questions, and significance of the study.

Chapter 2: is based on the manuscript entitled "Factors influencing registered nurses' intention to use health information technology in clinical practice: An integrative literature review."

Chapter 3: is based on the manuscript entitled "Predicting registered nurses' intention to use electronic documentation system in home care: Application of an Adapted Unified Theory of Acceptance and Use of Technology Model."

Chapter 4: is based on the manuscript entitled "A qualitative content analysis of nurses' comfort and employment of workarounds with electronic documentation systems in home care practice."

Chapter 5: is based on the manuscript entitled "Exploration of nurses' experience with using electronic documentation systems in home care."

Chapter 6: *Summary and Conclusions*, includes a summary of the research study, findings and implications.

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Chapter 2

Factors influencing registered nurses' intention to use health information technology in clinical practice: An integrative literature review

This chapter was adapted from a manuscript entitled "Factors influencing registered nurses' intention to use health information technology in clinical practice: An integrative literature review" by Sarah Ibrahim, Dr. Lorie Donelle, Dr. Souraya Sidani and Dr. Sandra Regan submitted and under review in the Canadian Journal of Nursing Leadership.

Abstract

BACKGROUND: There has been an increased and expanded implementation of health information technology (HIT) to support the provision of care, enhance patient safety, and reduce health care expenditure. The development and integration of HIT creates significant changes to nursing practice, which has been associated with nurses' low intention to use HIT; intention is a direct predictor of actual usage. Nurses' low intention to use HIT is particularly concerning as nurses constitute the largest group of regulated healthcare providers and are the largest user-group of HIT in practice; highlighting the importance of understanding the factors that influence nurses' intention to use HIT in practice.

AIMS: To explore and summarize current empirical literature on factors that influence nurses' intention to use HIT in practice.

METHODS: An integrative literature review was conducted. Electronic searches were performed using six scholarly databases to identify studies that examined factors influencing nurses' intention.

FINDINGS: Factors reported to influence nurses' intention to use HIT in practice reflected characteristics of nurses using the technology, the health information technology and the organizational environment.

CONCLUSION: The findings highlight the importance for nurse and health system managers as well as educators to foster an organizational culture that supports the use of HIT in nurses' day-to-day practice by: a) offering adequate education and training; b) including user champions to support HIT implementation; c) having an adequate representation of nurses during the design phase of the HIT and being receptive to their feedback; and d) having sufficient technological support in practice.

Keywords: Health Information Technology, behavioural intention, nurses, nursing, integrative review, and predictors

Background

Over the last two decades, there has been increased and expanded implementation of digital health services. Specifically, we are witnessing an increased use of health information technology (HIT) to support the provision of care, improve the quality and delivery of health care services, and enhance patient safety (Al-Khasawneh & Hijazi, 2016; Health Canada, 2015). The use and integration of HIT for the delivery of health care services have the potential to support patients and health care providers (HCPs) in planning and carrying out care (Bowles, Dykes, & Demiris, 2015; Canadian Home Care Association, 2015; Carretero, 2016; Home Care Ontario, 2016; Hsiao & Chen, 2016; Kuo, Liu, & Ma, 2013). Despite the potential benefits, the integration of HIT remains difficult and creates significant changes to nursing practice; resulting in nurses' low intention to use HIT (Creswell, Bates, & Sheikh, 2013; Hsiao & Chen, 2016; Hung, Tsai, & Chuang, 2014; Ifinedo, 2012). Low intention to use HIT is particularly concerning as nurses constitute the largest group of regulated HCPs and users of HIT as well as spend the most amount of time with patients than any other providers (Delucia, Ott, & Palmieri, 2008; Gagnon, Orruno, Asua, Abdeljelil, & Emparanza, 2012). Thus, nurses represent an important group to target for HIT implementation processes (Cho, Kim, Choi, & Staggers, 2016).

The low intention to use HIT is usually attributed to the interaction between humans and technology, which is affected by a number of factors associated with the human, technological, and organizational / environmental characteristics (Rouleau et al., 2017; Taiwo & Downe, 2013). Theoretical and empirical evidence suggests that behavioural intention to use HIT is a direct predictor or determinant of actual HIT usage; highlighting the importance of understanding the factors that influence this predictor (Ifinedo, 2012; Venkatesh, Morris, Davis, & Davis, 2003). Understanding these factors can guide the development of initiatives and strategies to address them with the goal of enhancing nurses' intention and actual HIT usage in practice. To date, several studies have been conducted examining the factors that influence nurses' intention to use HIT in their practice. However, it is unclear which factors or set of factors are most influential. Further, Strudwick (2015) conducted an integrative review of studies that investigated

factors predicting nurses' use of HIT. However, the studies included in the review were limited to research theoretically informed by the Technology Acceptance Model (TAM), extended technology acceptance model 2 (TAM2), Unified Theory of Acceptance and Use of Technology (UTAUT) models or a variation of these models. This requirement may have potentially led to the exclusion of studies that examined other factors that influence nurses' intention to use HIT using alternative models, theories (i.e., Theory of Planned Behaviour and Theory of Reasoned Action), or no models; potentially contributing to the lack of comprehensiveness and clarity about the factors or combination of factors influencing nurses' intention to use HIT.

Aims

The aim of this integrative literature review was to summarize the current literature on the factors that influence nurses' intention to use HIT in practice. The research questions guiding this review were: (1): What are the factors that influence nurses' intention to use HIT in practice; and (2) What factors have a direct or indirect (moderated or mediated) association with nurses' intention to use HIT in practice?

Design

An integrative literature review method was conducted. This review method was used as it allows for a more comprehensive understanding of the phenomenon of interest through the inclusion of diverse research methodologies (i.e., experimental and non-experimental studies) (Whittemore & Knafl, 2005). The integrative review process followed Whittemore and Knafl's (2005) five steps: 1) problem identification; 2) conducting a comprehensive literature search to identify all relevant literature; 3) evaluation of the overall quality of the studies; 4) data analysis, which includes ordering, coding, categorizing, synthesizing and summarizing the data from the primary sources; and 5) drawing conclusions and presenting findings.

Search Methods

The databases used to retrieve relevant publications were: Cumulative Index to Nursing and Allied Health Literature (CINAHL), PUBMED, SCOPUS, PsychINFO, Nursing Allied and Health Database (ProQuest), and Google Scholar. The following keywords were used in conjunction with Boolean operators to refine the literature search: "health information technology" OR "digital health" OR "technology" OR "eHealth" OR "computers" OR "telemedicine" OR "telehealth" OR "telehomecare" OR "electronic documentation systems" OR "hybrid documentation systems" AND "public health" AND "home care" AND "acute care" AND "long-term care" AND "community" AND "intention" OR "behavioural intention" AND "registered nurses" OR "nurses" OR "nursing".

Research articles were included in the review if the following selection criteria were met: a) the sample represented nurses; b) peer-reviewed articles reported on the association between factors and nurses' intention to use HIT in practice, that is the provision of direct patient care through activities and interventions with and / or on behalf of patients; c) study reports were written in English; and d) studies were published between 2008 and April 2018. The literature search was limited to the past 10 years to ensure information obtained on the technologies examined in the selected studies was relevant to what is currently being used in practice.

Quality Appraisal

Evaluation of primary sources in integrative literature reviews is complex and is to be conducted in a meaningful way (Whittemore & Knafl, 2005). In this integrative literature review, the quality of the research studies that met the selection criteria was assessed. Whittemore and Knafl (2005) suggest for primary sources of similar research designs, researchers can calculate quality scores and either include the scores into the design (i.e., inclusion / exclusion criteria) or the analysis. All studies that met the selection criteria used quantitative research methods and were assessed using a validated data evaluation tool, the Checklist for Assessing the Validity of Descriptive / Correlational Studies from the Joanna Briggs Institute (Pearson, 2014). The checklist

examined: a) adequacy of sampling strategies in minimizing self-selection bias; b) adequacy of sample size for the planned statistical analyses; c) delineation of inclusion criteria; d) linkage between the hypotheses and a theoretical framework; e) psychometric properties of the data collection instruments; f) sufficient description of comparative groups (if applicable); g) suitability of data analysis; h) statistical or clinical significance of the research findings; i) linkage(s) made between the findings and theoretical framework; and j) generalizability of findings. The reviewer scored each item as: yes, no, or unclear; with yes quantified as "1" and no and unclear criteria as "0". A final score was computed as the sum of the scores assigned to the criteria and studies received a score representing: low quality (0-3), average quality (4-6) and high-quality (7-10).

Data Abstraction

Data were extracted on the study characteristics and factors that influence nurses' intention to use HIT. The following information on the study characteristics was extracted: a) author's last name(s) and publication date; b) country in which the study was conducted; c) research design; d) health care sector; e) type of technology; and f) participant characteristics. Specific to the factors that influence nurses' intention to use HIT, data were extracted on: a) type of conceptual framework used (if applicable); b) factors identified to influence nurses' intention to use HIT in practice; and c) reported association of the factors with nurses' intention to use HIT as indicated in the study results.

Data analysis consisted of data reduction, data display, data comparison, and drawing conclusion and verification (Whittemore & Knafl, 2005). Specific to data reduction, an initial subgroup classification process was developed based on the study characteristics (i.e., sector, type of technology, and participant characteristics) and factors that influence nurses' intention to use HIT in practice (i.e., use of conceptual / theoretical framework, identified factors, and reported associations). Specific to data display, the extracted data from each article was converted into a chart to enhance the visualization of patterns within and across the data sources (Whittemore & Knafl, 2005). For data comparison, an iterative process of data examination was employed in which patterns and

associations were identified. For drawing conclusions and verification, the first author reviewed and cross-checked the extracted data to ensure consistency with the original articles and emergent patterns and all authors reviewed findings for analytical agreement.

Results

Search Outcomes

The literature search yielded 446 titles and abstracts. Of these, 57 were excluded because they were duplicates. Of the remaining 389 articles, 369 were excluded because they did not meet the selection criteria. For example, studies reporting on nurses' satisfaction, experience, level of comfort, attitude and technology readiness towards HIT usage in practice were excluded from the review. To ensure comprehensiveness of the literature search, a hand search of the reference lists in the selected articles was conducted; yielding an additional two articles for full review. A total of 22 studies were included in this review.

The majority of the studies (n=19, 86%) were rated as high-quality (Asua, Orruno, Reviriego, & Gagnon, 2012; Bennani & Oumlil, 2014; Chung, Ho, & Wen, 2016; Gagnon et al., 2012; Hung et al., 2014; Ifinedo, 2012; Ketikidis, Dimitrovski, Lazarus, & Bath, 2012; Kowitlawakul, 2011; Kummer, Schafer, & Todorova, 2013; Lau, 2011; Leblanc, Gagnon, & Sanderson, 2012; Lee, Lin, Yan, & Tsou, 2013; Lin et al., 2016; Kim et al., 2016; Phichitchaisopa & Naenna, 2013; Sharifian, Askarian, Nematolahi, & Farhadin, 2014; Shoham & Gonen, 2008; Song, Park, & Oh, 2015; Wu, Li, & Fu, 2011) and two (9%) scored as average quality (Wills, El-Gayer & Bennetti, 2008; Zhang, Cocosila, & Archer, 2010). Although only two out of the 22 studies were found to be of average quality, all studies were included in this review given the limited empirical research exploring and examining factors that influence nurses' intention to use HIT in practice (Galimany-Masclans, Garrido-Aguilar, Girbay-Garcia, Lluch-Canut, & Fabrellas-Padres, 2011; Lau, 2011). Furthermore, one paper (Strudwick, 2015) (5%) was an integrative literature review and was not scored.

Study Characteristics

A total of 22 studies were included in this review and published between 2008 and 2016. The majority of studies were conducted in an acute care setting (n=18, 82%), whereas two were conducted in the home care sector (n=2, 9%) and one in both acute and home care settings (n=1, 5%). The studies were conducted in the United States (n=3, 14%), Canada (n=3, 14%), and Taiwan (n=5, 23%); two were conducted in Spain (n=2, 9%) and one in each of China, Morocco, Israel, Iran, Macedonia, Australia, South Korea and Thailand (Table 3).

All studies used a theoretical framework, as shown in Table 3. The most commonly used theoretical frameworks were: The Unified Theory of Use and Acceptance Technology (UTAUT), Technology Acceptance Model (TAM), and extended Technology Acceptance Model 2 (TAM2). Similar constructs, representing a range of factors influencing behavioural intention to use HIT, were identified in the theoretical frameworks that guided the studies. The constructs included: *performance expectancy* (consistent with perceived usefulness), that is, the degree to which the end-user believes the technology will provide benefits in performing certain activities and result in performance gains; *effort expectancy* (consistent with perceived ease of use), which denotes the ease associated with the use of the technology; *social influence* (consistent with social norm), that is, the impact important persons (i.e., supervisors and colleagues) have on the end-users' use of the technology; and *facilitating conditions*, that is, the perceived level of support within the organizational and technological infrastructure to using the respective technology (Venkatesh et al., 2003).

The type of HIT investigated in the studies varied (Table 3) with the most frequent type being health information systems (i.e., sensor-based medication systems and nursing information system) and electronic documentation systems (EDS). Computers, personal digital assistants (PDAs) and web tools (i.e., Blogs, Podcasts, and Wiki pages) were investigated in older publications (i.e., 2008) and electronic documentation and health information systems in most recently published papers (i.e., 2016). The study sample

sizes ranged from 52 to 942 nurses with females constituting majority of research participants (Kim et al., 2016; Wu et al., 2011).

Table 3. Study Characteristics

Study	Country	Study Method	Type of HIT	Participants	Sample Size	Theoretical Framework
Asua et al., 2012	Spain	Study embedded within a Home Tele-monitoring Clinical Trial	Tele-monitoring System	Registered Nurses and Physicians working in a primary care setting	268	TAM and Chau and Hu's model of tele-medicine
Bennani & Oumlil, 2014	Morocco	Quantitative (research design not specified)	General HIT	Registered Nurses working in an acute care setting	200	Modified UTAUT
Chung et al., 2016	Taiwan	Cross-sectional	Patient Personal Health Records (PHRs)	Registered Nurses working in acute care sector	365	TAM and TPB
Gagnon et al., 2011	Spain	Study embedded within a randomized controlled open trial	Tele-monitoring system	Registered Nurses and Physicians working in a home care setting	n=72 RNs n=21 MDs	Chau and Hu's model of telemedicine acceptance and TAM
Hung et al., 2014	Taiwan	Quantitative (research design not specified)	Primary health information system (PHIS)	Registered Nurses working in an acute care setting	768	Theory of Reasoned Action
Ifinedo, 2016	Canada	Cross-sectional research design	Information Systems	Random sampling of Registered Nurses working in acute and home care settings	197	TAM
Ketikidis et al., 2012	Macedonia	Cross-sectional research design	HIT	Two-stage cluster sampling of registered nurses and	133	TAM

Study	Country	Study Method	Type of HIT	Participants	Sample Size	Theoretical Framework
				physicians working in a primary care setting		
Kim et al., 2016	South Korea	Quantitative (research design not specified)	EMR	Registered Nurses and Physicians working in an acute care setting	68% RNs; and 23% MDs Total: 942	UTAUT
Kowitta-Wakul, 2011	United States	Quantitative (research design not specified)	Remote ICU / electronic intensive care unit technology	Registered Nurses working in an acute care setting	117	TAM
Kummer et al., 2013	Australia	Scenario-based research design	Sensor-based Medication systems	Random selection of Registered Nurses working in an acute care setting	579	TAM 2
Lau, 2011	China	Quantitative (research design not specified)	Web Tools (i.e., Wiki, Blogs, Podcast)	Registered nurses working in an acute care setting	388	Decomposed Theory of Planned Behaviour (DTPB)
Leblanc et al., 2012	Canada	Exploratory Design	eHR	Registered Nurses working in an acute care setting	199	Theory of Planned Behaviour
Lee et al., 2013	Taiwan	Quantitative (research design not specified)	Information Technology	Registered Nurses working in an acute care setting	215	Adapted UTAUT
Lin et al., 2016	Taiwan	Quantitative (research design not identified)	Nursing Information System	Registered Nurses working in an acute care setting	245	TAM III and Behaviour Theory

Study	Country	Study Method	Type of HIT	Participants	Sample Size	Theoretical Framework
Phichitch-aisopa & Naenna, 2013	Thailand	Quantitative (research design not specified)	Health technology	Registered nurses, physicians and hospital staff members in an acute care setting	400	UTAUT
Sharifian et al., 2014	Iran	Descriptive analytical research design	Health information systems (HIS)	Random sampling of Registered nurses working in an acute care setting	303	UTAUT
Shoham & Gonen, 2008	Israel	Quantitative (research design not specified)	Computer	Random sampling of registered nurses working in an acute care setting	408	TPB
Song et al.,2015	United States	Quantitative (cross-sectional)	Bar Code Medication Administration	Registered Nurses working in acute care sector	163 nurses	TAM
Strudwick, 2015	No specific country	Integrative Review	Not Applicable	Registered Nurse	20 papers	Proposed a Modified TAM framework
Wills et al., 2008	United States	Quantitative (research design not specified)	EMR	Registered Nurses, Physician Assistants and Nurse Practitioners working in an acute care setting	52	UTAUT
Wu et al., 2011	Taiwan	Survey-type design	Mobile health care	Registered nurses and physicians working in	140	TAM and TPB frameworks

Study	Country	Study Method	Type of HIT	Participants	Sample Size	Theoretical Framework
				an acute care setting		
Zhang et al., 2010	Canada	Cross-sectional design	PDAs	Random sampling of registered nurses working in home care	84	TAM 2

Factors influencing nurses' intention to use HIT

The factors reported to influence nurses' intention to use HIT in practice reflected: 1) characteristics of nurses using the technology; 2) characteristics of the health information technology; and 3) characteristics of the organizational environment (Table 4).

Table 4. Summary of factors identified to directly and / or indirectly influence nurses' intention to use health information technology in practice

Study	Identified Factors that directly or indirectly influence nurses' intention to use Health information technology
Asua et al., 2012	Facilitating Conditions; Compatibility; Perceived Usefulness
Bennani & Oumlil, 2014	Social Influence; Trust
Chung et al., 2016	Perceived Usefulness; Computer self-efficacy, Subjective Norm; Attitude
Gagnon et al., 2011	Perceived Usefulness; Facilitating Conditions; Compatibility; Subjective Norm
Hung et al., 2014	Compatibility; Trust; Perceived Usefulness; Attitude; Social Influence
Ifinedo, 2016	Perceived Usefulness; Perceived Ease of Use; Attitude; Computer knowledge; Level of Education
Ketikidis et al., 2012	Perceived Ease of Use; Relevance; Subjective Norm
Kim et al., 2016	Performance Expectancy; Attitude
Kowittawakul, 2011	Years working in the hospital; Social Influence; Perceived Usefulness; Perceived Ease of Use; Attitude
Kummer et al., 2013	Perceived Usefulness; Image; Demonstrability; Personal Innovativeness; Subjective Norm; Professional Experience; Age
Lau, 2011	Attitude; Subjective Norm; Perceived Behavioural Control
Leblanc et al., 2012	Perceived Behavioural Control; Normative Beliefs; Attitude
Lee et al., 2013	Performance Expectancy; Effort Expectancy; Social Influence
Lin et al., 2016	Prior Experience
Phichitchaisopa & Naenna, 2013	Performance Expectancy; Effort Expectancy; Facilitating Conditions; Social Influence; Gender; Age
Sharifian et al., 2014	Performance Expectancy; Effort Expectancy; Social Influence; Facilitating Conditions
Shoham & Gonen, 2008	Attitudes; Self-efficacy; Innovativeness; Computer experience
Song et al., 2015	Age; Teamwork within hospital unit; Perceived Usefulness
Strudwick, 2015	Optimism; Innovativeness; Insecurity; Discomfort; Computer Self-efficacy; Work experience; Facilitating Conditions; Social Influence; Attitude; Perceived Ease of Use; and Perceived Usefulness
Wills et al., 2008	Performance Expectancy; Effort Expectancy; Social Influence; Facilitating Conditions
Wu et al., 2011	Attitude; Perceived Behavioural Control; Subjective Norm; Perceived Usefulness
Zhang et al., 2010	Subjective Norm; Perceived Usefulness; Image

1. Characteristics of nurses using technology

Demographic characteristics

A total of five studies (Ifinedo, 2012; Kummer et al., 2013; Lin et al., 2016; Phichitchaisopa & Naenna, 2013; Song et al., 2015) explored the influence of nurses' demographic characteristics on their intention to use HIT in practice. The findings indicated that age, level of education, professional experience and technology experience were significantly associated (directly or indirectly) with nurses' intention for HIT usage in practice.

Three studies (Kummer et al., 2013; Phichitchaisopa & Naenna, 2013; Song et al., 2015) examined age as a potential factor. The findings indicated that nurses' age was significantly associated with effort expectancy, social influence and intention; such that nurses over 40 years of age reported lower effort expectancy and higher social influence (Ifinedo, 2012). Kummer et al. (2013) found that age had a significant impact on social influence and personal innovativeness; such that social influence increased with age and personal innovativeness decreased with age. This finding indicated that overall, older nurses were more resistant to using HIT in practice. Song et al. (2015) on the other hand found that age had a significantly negative impact on nurses' intention to use HIT within the acute care sector. Overall, inconsistent findings were found regarding the influence of age on nurses' intention to use HIT in practice.

Four studies (Ifinedo, 2012; Kummer et al., 2013; Lin et al., 2016; Shoham & Gonen, 2008) explored level of education, professional experience and technology experience on nurses' intention to use HIT in practice (Table 4). None found a direct association between these factors and nurses' intention to use HIT in practice. One study found that nurses' level of education positively moderated the relationship of perceived usefulness and perceived ease of use with attitude and intention; the relationship was stronger for nurses with higher levels of education in acute and home care sectors (Ifinedo, 2012). Another study found that professional experience negatively moderated the influence of subjective norm on nurses' intention to use HIT in the acute care sector (Kummer et al., 2013). This suggests that with an increase in nurses' professional

experience, the influence of subjective norm on intention to use the HIT was weakened. One study reported that technology-related experience moderated the relationship between intention and actual behavioural usage; such that nurses with more experience had higher intention to use and actual usage of the HIT in practice (Leblanc et al., 2012). Further, compared to nurses with less experience, those with previous technology-related experience were found to have a more positive attitude towards using computers in practice (Shoham & Gonen, 2008). Overall, the results showed no direct association or influence of level of education, professional and technology-related experience on nurses' intention to use HIT in practice.

Traits of Nurses

Several studies (Bennani & Oumlil, 2014; Chung et al., 2016; Kummer et al., 2013; Lin et al., 2016; Shoham & Gonen, 2008; Strudwick, 2015; Wu et al., 2011) found nurses' individual traits to influence their intention to use HIT in practice. The first trait reported as influential was *personal innovativeness*, that is, an individual's "psychological state of willingness to take a risk by trying out an innovation" (Wu et al., 2011, p. 58). A total of four studies examined the influence of personal innovativeness. Personal innovativeness was found to have a positive, significant and direct influence on nurses: a) intention; b) perceived ease of use; c) perceived behavioural control (also referred to as facilitating conditions); and d) perceived usefulness within the acute care sector (Kummer et al., 2013; Shoham & Gonen, 2008; Strudwick, 2015; Wu et al., 2011).

The second trait reported as influencing nurses' intention to use HIT in practice was *trust*. Trust refers to a nurses' confidence in the quality and reliability of the HIT and in the organizational support. One study (Bennani & Oumlil, 2014) found that trust towards the quality and reliability of the HIT was a direct and statistically significant predictor of nurses' intention to use HIT; such that nurses with more trust had higher intention to use the respective HIT in their acute care practice.

The third trait reported as contributing to nurses' intention to use HIT was *self-efficacy*. Self-efficacy refers to the degree to which nurses feel capable of successfully performing the activity (Chung et al., 2016). In the two studies that examined the

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influence of self-efficacy, it was found to have a significant, positive and direct influence on nurses' intention to use computers and electronic health record system in the acute care sector (Chung et al., 2016; Shoham & Gonen, 2008).

An additional characteristic noted as influential to nurses' intention to use HIT in practice was *attitude*. Attitude refers to a nurse's favourable perception towards the HIT (Table 4) (Ajzen, 1991). All nine studies (Chung et al., 2016; Hung et al., 2014; Kim et al., 2016; Kowitlawakul, 2011; Lau, 2011; Leblanc et al., 2012; Shoham & Gonen, 2008) and the review (Strudwick, 2015) found nurses with positive and favourable attitudes towards the HIT to be more inclined to use it in their acute care and combined acute and home care practice.

2. Characteristics of Technology

A total of 15 studies (Asua et al., 2012; Chung et al., 2016; Gagnon et al., 2012; Kim et al., 2016; Ketikidis et al., 2012; Kowitlawakul, 2011; Kummer et al., 2013; Kuo et al., 2013; Lau, 2011; Leblanc et al., 2012; Lee et al., 2013; Phichitchaisopa & Naenna, 2013; Sharifian et al., 2014; Wills et al., 2008; Wu et al., 2011) and one review (Strudwick, 2015) reported on the characteristics of the HIT. Performance expectancy and effort expectancy were the identified factors in this category (Table 4). Performance expectancy and effort expectancy were found to have a direct and statistically significant influence on nurses' intention to use HIT in acute and home care practice. The relationship indicates that nurses' perceiving the HIT as easy to use and useful for their practice, were more inclined to use it in their acute and home care practice.

3. Characteristics of Organizational Environment

A total of 17 studies (Asua et al., 2012; Bennani & Oumlil, 2014; Chung et al., 2016; Hung et al., 2014; Gagnon et al., 2012; Ketikidis et al., 2012; Kim et al., 2016; Kowitlawakul, 2011; Kummer et al., 2013; Kuo et al., 2013; Lee et al., 2013; Phichitchaisopa & Naenna, 2013; Sharifian et al., 2014; Song et al., 2015; Wills et al., 2008; Wu et al., 2011; Zhang et al., 2010) and the one review (Strudwick, 2015) reported on the characteristics of the health care organization. Social influence and facilitating

conditions were the identified factors in this category (Table 4). Social influence and facilitating conditions were found to directly influence nurses' intention to use HIT in their practice. Nurses had higher intention to use the HIT in practice if colleagues were supportive of and encouraged HIT usage and if organizational (i.e., training and support) and technological (i.e., availability of equipment, resources and IT support) infrastructures were readily available.

Discussion

Behavioural intention to use HIT by nurses is a complex technical and social issue, making the introduction and uptake of HIT a non-linear and dynamic process that is affected by many factors (Creswell et al., 2013). Three categories of factors were found to influence nurses' intention to use HIT in practice. The first category was related to the characteristics of nurses using technology. Specific to the demographic characteristics of nurses, inconsistent findings were noted regarding the influence of nurses' age; therefore, there is less certainty about the direct association between age and nurses' intention to use HIT in practice. A potential explanation to this finding is that regardless of age, there has been an increase in both personal and professional technology usage coupled with the increased efforts within post-secondary institutions and healthcare organizations on technology-related educational and training efforts (Canadian Association of Schools of Nursing, 2013; Kaya, 2011). Perhaps more influential than their age, nurses are required to engage in training and update their technology-related knowledge and skills to be able to appropriately use the technology, which has become a standard part of day-to-day clinical nursing practice (Sharit & Czaja, 2017).

Only one study explored level of education and found that nurses with higher levels of education had higher intention to use HIT in their acute and home care practice. However, it is important to note that further exploration and examination of the influence of level of education on nurses' intention to use HIT is warranted as inferences cannot be made from one study. Similar findings were noted with nurses' professional experience. Only one study examined professional experience as a factor that may influence nurses' intention to use HIT in practice. The findings indicated a negative influence of subjective

norm on nurses' intention to use HIT that was moderated by professional experience. The relationship implies that nurses with more professional experience were more independent regarding the system usage and less influenced by colleagues, peers and management. A potential explanation to this finding may be that nurses with more professional experience have been exposed to and used various types of HIT in their practice; resulting in a better understanding of which systems are better fitting with their needs and workflow and in turn, resorting to their experience more than peers to influence their intention to use the respective HIT in practice.

Nurses' personal innovativeness and self-efficacy were the more commonly examined traits. Personal innovativeness was found to have a positive, direct and significant influence on nurses' intention, perception of ease of use and usefulness of the HIT as well as organizational support for HIT usage. This finding implies that nurses who are innovative and that are willing to try various types of HIT in practice tend to perceive it to be useful in their practice and have higher intention to use it. Self-efficacy was also found to have a direct and positive influence on nurses' intention to use HIT; implying that nurses who feel they are capable in successfully using the HIT, have higher intention to use it in practice.

Trust in the quality and reliability of the HIT was also found to have a direct influence on nurses' intention to use HIT in practice. However, it is important to note that this was examined in one study; highlighting the need for further examination and exploration of trust in the quality and reliability of the HIT as a factor as inferences cannot be made from one study. Nurses' attitude towards HIT was also found to be a strong and direct predictor of intention to use HIT by nurses in practice. The influence of attitude implies that nurses with a more favourable perception towards the respective HIT, have higher intention to use it in their practice.

The available evidence specific to the characteristics of technology showed that performance and effort expectancy had a direct, positive and significant influence on nurses' intention to use HIT in practice. The relationship of these two technological characteristics with intention implies that nurses who perceive the HIT to be beneficial

towards their performance, enhances their productivity, is easy to use and user-friendly, have higher intention to use the HIT in their respective practice. Similar findings were noted with the characteristics of the organizational environment. Social influence and facilitating conditions had a direct, positive and significant influence on nurses' intention to use HIT in practice. This finding implies that nurses who perceived that their colleagues, managers, and patients supported the adoption of the respective HIT, had higher intention to use the HIT in their practice. Further, if nurses believed the necessary organizational (i.e., education and training) and technological infrastructures were readily available to them to support the use of HIT, they demonstrated higher intention to use the HIT in their practice.

Overall, the factors found to influence nurses' intention to use HIT in practice as reported in the literature included: a) characteristics of nurses using the HIT, namely nurses' personal innovativeness, self-efficacy, and attitude; b) characteristics of the technology, namely performance expectancy and effort expectancy; and c) characteristics of the organizational environment, namely social influence and facilitating conditions. However, it is important to note that the evidence from this integrative literature review was derived predominantly from studies conducted in the acute care sector. A similar finding was noted and reported by Carrington and Tiase (2013). In their nursing informatics literature review, the latter researchers found that 42.5% of the studies took place in acute care, whereas only 3.7% occurred in community health sector specifically home care (Carrington & Tiase, 2013). In this review, a total of three studies focused on factors that influence nurses' intention to use HIT within the community healthcare sector, specifically home care. Further, none of the studies focused on other areas within the community healthcare sector such as public health, ambulatory care, health centres, schools, and other community-based settings. This finding is a significant limitation of existing empirical evidence in that nurses working conditions within the acute care sector differ from the community healthcare sector and may differentially impact nurses' intention to use HIT. For example, nurses working in the home care sector practice relatively independently and autonomously with limited direct interaction with colleagues (Tourangeau et al., 2014). In comparison, nurses working in acute care are surrounded by and work in collaboration with other HCPs to provide patient care. Moreover, the

working environment of a nurse in the community health sector comprises of different locations (i.e., patients' home, nurses' car, clinics, community centres, schools, and agency office), which may impact the availability of supplies, equipment and IT support (Tourangeau et al., 2014). In contrast, nurses working in the acute care sector have greater proximity to human and material resources (Lundy& Janes, 2014).

There has been a growth in the delivery of health care services within the community and home care sector. The growth is attributed, in part, to the cost-effectiveness of home health care services relative to patient care services within acute or long-term care facilities and the increased accessibility of technological advancements in-home care to support the delivery of efficient and high-quality health care and services (Barrett, 2011; Canadian Nurses Association, 2013; Kitchen, Williams, Pong, & Wilson, 2011). The lack of empirical evidence regarding factors that influence nurses, who are the most employed professionals in the community health sector, and their intention to use HIT coupled with the rapid growth of technological innovations and growing demand on the community health sector (both nationally and internationally), highlights the need for further research and knowledge generation in this area (Canadian Nurses Association, 2013; Home Care Ontario, 2016; Qu & Sun, 2015).

Implications

The findings of this review can inform and guide nurse and health system managers, educators and health informatics professionals in developing effective and proactive strategies that support and encourage the use of HIT by nurses in their day-to-day practice (Hung et al., 2014; Stevenson, Nilsson, Petersson, & Johansson, 2010). This can be done through several initiatives. First is providing adequate education and training to nurses. The training should accommodate nurses' knowledge and experience ranging from basic to more advanced training for those with more technology-related knowledge and / or experience prior to implementation of the HIT in practice (Stevenson et al., 2010). Educational and training initiatives may enhance nurses' technology-related literacy as well as modify prejudicial attitudes toward HIT (Kuo et al., 2013; Stevenson et al., 2010). Additionally, through the training initiatives, nurses would benefit from access

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to colleagues (i.e., nurse champions) who could champion the HIT implementation as they are more comfortable, innovative, have higher self-efficacy, trust towards the reliability and quality of the HIT and experience with technology (Stevenson et al., 2010). This extensive training would address the noted factors of individual (i.e., personal innovativeness, self-efficacy, and attitude) and organizational environment (i.e., social influence and facilitating conditions) characteristics that were found to have a direct influence on nurses' intention to use HIT in practice.

A second initiative is to have an adequate representation of nurses, who express an interest (i.e., nurses who are innovative and have high self-efficacy), in the design process of HIT. Such an opportunity may ensure the HIT aligns with nurses' clinical needs and workflow to support the goal of optimal delivery of patient health care services. The design of HIT is often led by non-nursing personnel (i.e., informatics, engineers and software developers) who have limited knowledge and understanding of the complexity of nursing practice and in turn, to design the respective HIT to fit with the practice of HCPs (While & Dewsbury, 2011). Nurses may have more of a positive attitude and in turn, higher intention to use HIT if they are actively involved in the design and implementation process of such technology in practice (Stevenson et al., 2010). Such an initiative would address two categories of factors that influence nurses' intention: individual (i.e., personal innovativeness, self-efficacy, and trust) and technological (i.e., performance expectancy and effort expectancy) characteristics.

Third, nurse and health system managers as well as nurse educators are encouraged to foster an organizational culture that is supportive of HIT usage by nurses. An organizational culture may be achieved by: a) software developers, health information providers and health system managers being open and receptive to nurses' feedback towards the development and maintenance of the respective HIT; b) the training initiatives afforded to nurses; c) the type of HIT to be used in practice; and d) the availability of IT support (Stevenson et al., 2010). An organizational culture that values nurses' voices and that integrates supportive and ongoing training as well as technical support have the potential to mitigate technology-related challenges that may arise during HIT usage by nurses in practice (Gagnon et al., 2012). Such a culture would address the

characteristics of the organizational environment that were found to influence nurses'
intention to use HIT in practice.

Limitations

One limitation of this review was the restriction that the selected papers were
published only in English. This may have led to the exclusion of papers published in
other languages. Thus, it is unknown if the findings from this review apply to nurses
working in non-English speaking countries and if similar factors would influence nurses'
intention to use HIT in practice because of the differences in cultural perspectives.

Conclusion

Health information technology continues to be widely integrated within healthcare
systems nationally and internationally. Nurses play a significant role in the delivery of
health care services, which has become enabled and supported by technology. Further,
nurses' intention to use HIT has significant implications for its successful utilization and
implementation within practice as they are the largest user groups. This review found that
characteristics of individual nurses, technology and the organizational environment
influenced nurses' intention to use HIT in practice. However, the evidence was derived
primarily from studies conducted within the acute care sector with little known in the
context of public health, community, long-term care and home care. Such findings
highlight the importance for further research to explore the set of factors influencing
nurses' intention to use HIT, which may differ depending on nurses' practice setting.
Examining and understanding factors that influence nurses' intention, which is a direct
predictor to actual HIT usage, may inform strategies and interventions to support nurses'
use of HIT in their daily practice.

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Chapter 3

Predicting registered nurses' intention to use electronic documentation systems in home care: Application of an Adapted Unified Theory of Acceptance and Use of Technology Model

This chapter was adapted from a manuscript entitled "Predicting registered nurses' intention to use electronic documentation systems in home care: Application of an Adapted Unified Theory of Acceptance and Use of Technology Model" by Sarah Ibrahim, Dr. Lorie Donelle, Dr. Sandra Regan and Dr. Souraya Sidani submitted and under review in the Canadian Journal of Nursing Leadership.

Abstract

BACKGROUND: The use of electronic documentation systems (EDS) has the potential to ensure timely, up-to-date, and comprehensive patient health and care-related information are available and accessible to nurses regardless of their physical location. Despite the noted benefits of EDS, low intention by nurses to use such systems is well documented, which could predict and influence behavioural usage. Further, limited knowledge exists about nurses' intention to use EDS in the context of home care.

AIMS: To examine factors that influence nurses' intention to use EDS in-home care practice. The conceptual model framing this study was adapted from the Unified Theory of Acceptance and Use of Technology.

METHOD: A cross-sectional design was used. Nurses (N = 217) currently practicing within the home care sector in Ontario participated in the study. An online survey using adapted and psychometrically sound instruments was administered. Data were analyzed with descriptive statistics and hierarchical multiple regression.

FINDINGS: Performance expectancy, attitude, social influence and facilitating conditions had significant, positive and direct effects on nurses' behavioural intention to use EDS. Effort expectancy and nurses' individual characteristics (i.e., age, level of education and technology experience) were not found to have a direct and / or moderating influence on nurses' intention to use EDS in-home care practice.

CONCLUSION: The findings highlight the importance for: a) further exploration of the most appropriate model and / or adaptation of a model identifying a range of factors influencing nurses' intention to use EDS in different healthcare contexts; and b) for nurse managers, educators and health informatics professionals to foster a supportive environment EDS usage by including nurses in the EDS design and implementation processes, enlisting user champions, and providing adequate training, education and information technology support.

Keywords: Electronic documentation system, Nurses, Behavioural Intention, Home care, Health information technology, and Unified Theory of Acceptance and Use of Technology (UTAUT)

Background

The increasing need for health promotion and illness prevention coupled with the aging population, shortage of health human resources, rise in usage of health care services and cost of care as well as technological advancements, have led to the utilization of health information technology (HIT) such as electronic documentation systems (EDS) in healthcare practice (Christodoulakis, Asgarian, & Easterbrook, 2017; Doran et al., 2012; Naylor, Kudlow, Li, & Yuen, 2011; Santi, Berg, & Stolee, 2013; Qu & Sun, 2015). Nurses spend more time with patients than other healthcare professionals (HCPs) and in today's evolving healthcare system, it is imperative that nurses use HIT that may improve the efficiency and quality of patient care delivery (Delucia, Ott, & Palmieri, 2009). Quality of care is influenced by a nurses' ability to have access to timely, complete, accurate and up-to-date patient health and care-related information to make safe, efficient and effective decisions related to patient care; which EDS hold promise in offering (Jamal & Grant, 2014). Electronic documentation systems also have the potential to address inefficiencies that are characteristic of paper-based charting such as duplication of tests, medication errors, incomplete or illegible notes, and loss of patient health data (Deloitte, 2010; Infoway, 2013; Lapointe et al., 2012; Smith, Smith, Krugman, & Oman, 2011).

Despite the potential benefits of EDS, low intention to use such systems has been noted among nurses (Dowding, Turley, & Garrido, 2012; Kaya, 2011; Kim, Lee, & Yoo, 2016; Kipturgo, Kivuti-Bitok, Karani, & Muiva, 2014; Plantier et al., 2017). Theoretical and empirical evidence suggests that behavioural intention is a direct determinant of behavioural usage (Ajzen & Fishbein, 2005; Ifinedo, 2012; Venkatesh et al., 2003; 2012). Evidence suggests that underlying nurses' low intention to use EDS is a complex inter-play of technical and social issues situated within health care organizations (Creswell et al., 2013; Yen & Bakken, 2012). The factors that influence nurses' use of EDS can be categorized along the technological (e.g., ease of use and functionality), organizational / environmental (e.g., training and information technology support) and individual (e.g., age, attitude and experience) dimensions (Bennani & Oumlil, 2014; Hung et al., 2014;

Ifinedo, 2016; Sharifian et al., 2014; Strudwick, McGillis-Hall, Nagle, & Trbovich, 2018).

Nurses' low intention to use EDS has predominantly been reported within the context of the acute care sector, with little to no focus on the home care sector. Yet within national (i.e., Canada) and international (i.e., United States and Europe) healthcare systems, home care is the fastest growing healthcare sector (Home Care Ontario, 2016; Institute of Medicine, 2003; Kitchen et al., 2011). The increase in home care services coupled with the accessibility of technological advancements are perceived to be a cost-effective alternative to acute and / or long-term care and addresses the preference of individuals to receive health care in their home (Barrett, 2011; Home Care Ontario, 2016; Kitchen et al., 2011). Further, acute and home care sectors differ in working environments (i.e., geography and locations), which may influence nurses' intention to use EDS in practice differently (Tourangeau et al., 2014).

As nurses represent the largest group of regulated HCPs and are the largest user groups of EDS, their perception and intention to use such systems in practice may have implications for system implementation and patient care; potentially influencing the achievement of the EDS benefits in practice (Cho, Kim, Choi, & Staggers, 2016; Stevenson et al., 2010; Strudwick et al., 2018; World Health Organization, 2013). Thus, it is important to determine the factors that may influence nurses' intention to use EDS in-home care practice.

Since the inception of computer and information technology, the exploration of how end-users make decisions to use technology has been extensively explored and has been guided by theories and conceptual frameworks (Kijsanayotin et al., 2009; Ifinedo, 2016). Guided by a conceptual framework, the purpose of this study was to examine the factors that influence nurses' intention to use EDS in the home care sector. The research question guiding this investigation was: What are the relationships among the individual, technological, and organizational / environmental characteristics and nurses' intention to use EDS within the home care sector?

Conceptual Framework

The Unified Theory of Acceptance and Use of Technology (UTAUT) model was adapted to investigate the factors that influence nurses' intention to use EDS in the home care sector. The UTAUT model explains individuals' intention to use a specific information technology, with four predictors: a) performance expectancy; b) effort expectancy; c) social influence; and d) facilitating conditions (Venkatesh et al., 2003). The model also proposes that age, gender, experience and voluntariness of use moderate the relationships between the four predictors and intention (Venkatesh et al., 2003). The following presents the theoretical and operational definitions of behavioural intention and the predictors of technology use within the individual, technological and organizational / environmental dimensions.

Behavioural intention was defined as the amount of effort an individual is willing to exert to achieve a behavioural goal (Ajzen, 1991). In this study, behavioural intention was the outcome variable and operationalized as nurses' self-reported intention to use EDS to support the delivery of home care practice.

Individual dimension encompassed nurses' attitude and personal characteristics. Attitude refers to an individual's beliefs and corresponding positive and / or negative perspectives of the potential outcomes of performing a specific behaviour (Ajzen, 1991). Attitude was operationalized as nurses' favourable perception of using EDS to support the delivery of health care in home care practice. Nurses' personal (i.e., age and level of education) and professional (i.e., technology experience) characteristics were also explored as potential moderators.

The technological dimension encompassed the variables: a) *performance expectancy* (also referred to as perceived usefulness), denoting the degree to which the end-user (i.e., the nurse) believes the technology will provide benefits in performing certain activities and result in performance gains; and b) *effort expectancy* (also referred to as perceived ease of use), denoting the ease associated with the use of the technology (Venkatesh et al., 2003). Performance and effort expectancy were operationalized as

nurses' self-reported evaluation of the usefulness and ease of using EDS, respectively, in-home care practice.

Organizational / environmental dimension encompassed the variables: a) *social influence* (referred to as social norm), reflecting an individuals' beliefs and perception of social influence (i.e., colleagues and supervisors) on the adoption and performance of the identified behaviour; and b) *facilitating conditions* (referred to as perceived behavioural control and compatibility), denoting the degree to which nurses believed the organizational (i.e., training) and technological infrastructure (i.e., IT support and availability of resources) exist to support technology usage (Ajzen, 1991; Venkatesh et al., 2003). Social influence was operationalized as nurses' self-reported perception of the extent to which they believe other persons (e.g., other nurses, HCPs and patients) supported and approved EDS usage in their home care practice. Facilitating conditions was operationalized as nurses' self-reported perception of the extent to which they believed that organizational and technological infrastructures existed to support their EDS usage in home care practice.

In this study, two adaptations to the UTAUT model were made as presented in Figure 2. First was the inclusion of attitude as a fifth predictor of behavioural intention. The inclusion of attitude as a fifth predictor was informed by the research literature, specifically the integrative literature review (Chapter 2) that explored and examined the factors that influence nurses' intention to use HIT such as EDS in their clinical practice. The findings from the integrative literature review (Chapter 2) noted that attitude was a statistically significant, direct, and positive influence on nurses' intention to use HIT such as EDS in their clinical practice. As such, because of the limited literature that explores and examines the influence of attitude on nurses' intention to use EDS in their home care practice, attitude was included as a fifth predictor. The second modification was the removal of gender and voluntariness of EDS use as moderators of the relationships of the proposed factors with nurses' intention to use EDS. The rationale for this decision was: a) the predominantly female-oriented nursing profession; and b) the use of EDS within the workplace often is not an option for nurses, but rather a standard part of nursing practice (MacWilliams, Schmidt, & Bleich, 2013; Sharit & Czaja, 2017).

The proposed hypotheses were: a) performance expectancy, effort expectancy, attitude, social influence and facilitating conditions have a positive, direct relationship with nurses' intention to use EDS within their home care practice; and b) age, level of education and technology experience moderate the relationship between the independent variables (i.e. the five factors) and dependent variable (i.e., intention); such that the relationship is stronger for younger nurses and nurses with higher levels of education and more technology experience. The hypotheses were tested in a sample of nurses working in the home care sector.

Figure 2. Adapted Unified Theory of Acceptance Model (UTAUT)
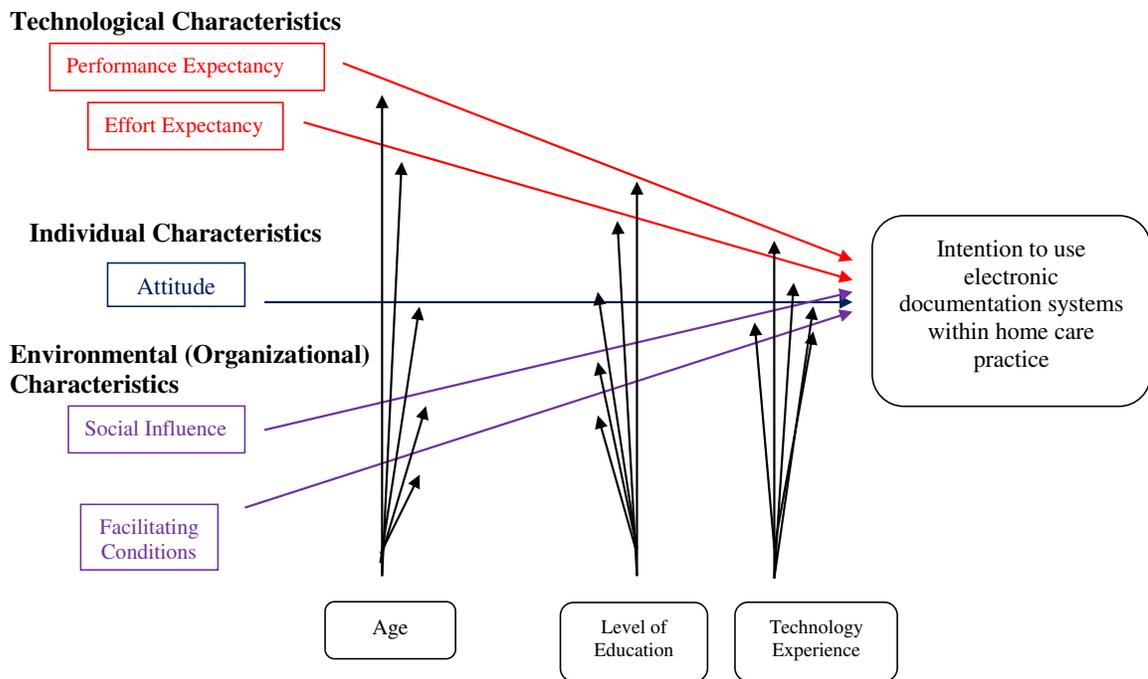
Methods

Design

A cross-sectional survey design was used (Hall, 2008). An online survey was constructed and administered using the Tailored Design Method (TDM) (Dillman, Smyth, & Leah, 2014). The research protocol was approved by the Research Ethics Board at Western University (REB approval #: 109426).

Sample

The target population consisted of registered nurses working in the home care sector in the province of Ontario, Canada. Nurses were eligible if they were, at the time of participation: a) registered with the College of Nurses of Ontario (CNO); b) employed part time or full time; c) practicing within a home care setting; and d) providing direct patient care, that is, face-to-face and hands-on contact for assessing, monitoring, and treating patients or coordinating patient care, that is, assessing patient needs, planning, and implementing appropriate health care services (College of Nurses of Ontario, 2014). Nurses in managerial positions, self-employed or concurrently working in both acute and home care sectors were excluded from the study.

The College of Nurses of Ontario (CNO) was contacted to obtain a list of nurses who reported providing direct or coordinating patient care in the home care sector in Ontario, and that consented to have their names released for research purposes. Upon receipt of the list from the CNO, a systematic sampling method was employed. A systematic sampling method is a type of probability sampling in which every nth case from the list provided from the CNO are randomly selected (Loiselle, Profetto-McGrath, Polit, & Beck, 2007). Systematic sampling can be applied in a way that is still considered to be random if the periodic interval, n, is determined beforehand and the starting point is random. To determine the size of the width of the nth interval, which is considered to be the "standard distance between the selected elements" (Loiselle et al., 2007, p. 260), the size of the population was divided by the desired sample size. Calculation for the sample size was conducted using Soper's (2016) a priori-sample size calculator for multiple

regression analysis. The sample size calculation was based on a p-level of 0.05, 20 predictors (which included the five independent variables: effort expectancy, performance expectancy, attitude, social influence, facilitating conditions; and the moderating variables, that is, age, level of education and technology experience, on each of the five independent variables), a medium effect size of R= 0.15 and a power of 0.80 (Cohen, 1988). The sample size required for this study was 156 nurses. In this study, with the size of the population of nurses working in the home care sector and providing direct or coordinating care was 3163 and the desired sample size of 156 home care nurses, the sampling interval was 20. The advantage of using a systematic random sampling method is the high degree of the selected sample's representativeness of the population in comparison to a clustered selection of participants that can be attained in simple random sampling.

Participant Recruitment

Upon receipt of the list (from the CNO) of nurses currently working in the home care sector and that met the inclusion criteria for this study, the researchers assigned a code number to each potential participant. Based on previous publications (Fan & Yan, 2010), a conservative response rate of 10% was assumed for this study and with a calculated sample size of 156, a total of 1560 nurses were randomly selected from the CNO list of possible participants. The TDM of survey administration proposed by Dillman (2014) was utilized to enhance participant response rates (Dillman, 2014). The TDM provides specific type and timing for initial and follow-up contact with participants, which is presented below. Although there is no guarantee of a high response rate with any participant recruitment techniques and procedures, the TDM attempts to make it possible to achieve a participant response rate of 60%-70% or higher (Monroe & Adams, 2012).

The study package, which contained a letter of information along with instructions to access the online survey followed Dillman's (2014) recommendations: 1) completed package sent out, avoiding official (i.e., provincial holidays, Good Friday) and summer holidays; 2) a reminder letter of information along with instructions to access the online

survey sent out after one week; and 3) a third and final reminder with a postcard which included instructions to access the online survey three weeks later. As per Dillman et al.'s (2014) recommendations for online surveys, participants were contacted at three points in time over a span of four weeks in the Fall of 2017.

Based on Dillman's (2014) recommendations, the following elements were utilized and integrated in the design of the letter of information: 1) presentation on an official university letterhead with the full correct date; 2) introduction to the research project and its importance, voluntary participation was highlighted, appreciation for taking part in the research study, reassurance of confidentiality and contact information of the researcher, researcher's supervisors and of the REB at Western University; and 3) researcher's name, contact information.

Dillman et al.'s (2014) method also guided the preparation of the mailed packages and online surveys. The elements guiding the online survey included: 1) the use of an organized package with a creative and interesting title to capture the attention of potential participants; 2) the inclusion of the name and address of the specific research organization, that is, Arthur Labatt Family School of Nursing, Western University; 3) the presentation of simple, relevant and easy questions first and ordered in a logical and sequential manner (i.e., begin with demographic questions such as age, sex, and level of education followed by questions specific to EDS); 4) maintaining a consistent layout throughout the online survey (i.e., avoiding differences in visual appearance and spacing of the questions, font size and colour); 5) the provision of definitions (specifically of EDS) and instructions on how to complete the online survey (i.e., select a response through the drop down list offered for each question); 6) the use of graphical language (i.e., arrows) to guide the participants through the survey; 7) the use of drop down boxes, which was primarily presented in section two of the survey to make the answering process simple and easy; and 8) thanking the participants for completing the online survey, and asking them if they would like a copy of the research findings. A $5 gift card was offered to participants, upon completion of the online survey, as a token of appreciation for their participation in the study. An English only online survey was made available to participants through the Qualtrics survey software (Qualtrics, 2018).

Qualtrics enables persons to complete online surveys in a secure and autonomous manner (Qualtrics, 2018). Completion of the online survey, which took approximately 15 minutes, implied the participant's voluntary and informed consent.

Instrumentation

Demographic and Professional Characteristics

Standard questions were used to assess nurses' demographic and professional characteristics. Data collected on nurse participants' demographic characteristics included their: age, sex, and highest level of nursing education. Data collected on participants' professional characteristics included their: 1) position (whether the participants were in the role of care coordinator or direct patient care provider); 2) employment status (i.e., casual, part-time or full-time); 3) years working within the healthcare system; 4) years working within the home care sector; 5) current use of information technology hardware and / or software applications; 6) frequency of information technology hardware and / or software application usage; 7) years using information technology hardware and / or software applications in practice; 8) current use of EDS in-home care practice; 9) frequency of EDS usage; 10) years using EDS; and 11) nurses' level of comfort with EDS usage in home care practice.

Main Study Variables

The main study variables were performance expectancy, effort expectancy, attitude, social influence, facilitating conditions and behavioural intention. Three instruments were used to measure these variables.

The Perceived Usefulness and Perceived Ease of Use Scale (Davis, 1989) which comprised of 12 items forming two subscales, one measuring performance expectancy and the other measuring effort expectancy was used. The scale was anchored on a seven-point Likert-scale with response options ranging from 0 "strongly disagree" to 7 "strongly agree." Higher scores reflected nurses' perception and belief that the EDS usage in home care practice would benefit their work performance, be easy to use and free from effort respectively. The items demonstrated good internal reliability in previous

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studies (Cronbach's alpha coefficient: 0.70 - 0.91) (Hung et al., 2014; Ifinedo, 2016; Kuo et al., 2013; Lee et al., 2013; Lin et al., 2016) and in this study (Cronbach's alpha coefficient ≥ 0.70) (Table 5).

The Nurses' Computer Inventory (NCATT) scale measures nurses' attitude towards using computers in practice (Jayasuriya, & Caputi, 1996). For this study, the questions were adapted to measure nurses' attitude toward EDS usage, specifically whether the system (instead of computers) usage was perceived to be a good idea, would make work interesting and easier, improve patient care, save time, and maintain confidentiality within nurses' home care practice. The NCATT comprised of 22 questions anchored on a five-point Likert scale ranging from 1(strongly disagree) to 5 (strongly agree). The total score was computed after reverse coding negatively worded items. Higher scores represented favourable attitude towards nurses' EDS usage in home care practice. The NCATT scale demonstrated good internal consistency reliability in previous studies (Cronbach's alpha coefficient: 0.70 - 0.95) (Jayasuriy & Caputi, 1996; Wilson, 2008) and in the current study (Cronbach's alpha coefficient ≥ 0.70) (Table 5).

The UTAUT scale was used to measure social influence, facilitating conditions and behavioural intention (Venkatesh et al., 2003). The social influence subscale consisted of four items rated on a seven-point Likert scale, ranging from strongly disagree to strongly agree. Higher subscale scores reflected nurses' positive perception of important persons' views regarding the EDS usage in practice. The facilitating conditions subscale also consisted of four items with a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Higher subscale scores reflected a positive perception by nurses that organizational and technological infrastructures exist for the use of EDS in practice. Behavioural intention was measured with three items, using a seven-point Likert scale. A high subscale score reflected increased behavioural intention of nurses to use EDS in practice. The subscales measuring social influence, facilitating conditions and behavioural intention demonstrated acceptable reliability in previous studies (Cronbach's alpha coefficient: ≥ 0.70) (Bennani & Oumlil, 2014; Hung et al., 2014; Lee et al., 2013; Lin et al., 2016; Maillet et al., 2014) and in this study (Cronbach's alpha coefficient ≥ 0.70) (Table 5).

Table 5. Reliability and Content Validity Index of Scales

Scale/Subscale	n	Items	Scale Range	Cronbach's α	CVI
Performance Expectancy Subscale Perceived Usefulness and Perceived Ease of Use Scale (Davis et al., 1989)	217	6	1-7	.957	.971
Effort Expectancy Subscale Perceived Usefulness and Perceived Ease of Use Scale (Davis et al., 1989)	217	6	1-7	.941	.94
Nurses' Computer Attitude Inventory Scale (NCATT) (Jayasuriya & Caputi, 1996)	217	22	1-5	.918	.97
Social Influence Subscale UTAUT Scale (Venkatesh et al., 2003)	217	4	1-7	.758	.96
Facilitating Conditions Subscale UTAUT Scale (Venkatesh et al., 2003)	217	4	1-7	.70	1.00
Behavioural Intention Subscale UTAUT Scale (Venkatesh et al., 2003)	217	3	1-7	.882	1.00

Note. UTAUT = Unified Theory of Acceptance and Use of Technology

Pilot Study of Instrument

The wording of the items for the standardized data collection instruments was adapted to fit with the focus of the study. Specifically, the terms "systems" and "computers" were replaced with "electronic documentation systems." The content validity of the adapted measures was examined with six home care nurses. Nurses participating in the pilot test completed a content validation tool (Appendix C). They were asked to carefully read each item, complete the adapted measures, rate the relevance of the items' content to their practice in home care, and comment on the following: a) sequence of questions; b) wording of questions; c) comprehension of the instructions and questions (i.e., if questions were easy to understand and not ambiguous); and d) ease of use.

The ratings were performed using a four-point scale that ranged from 1 "*not relevant*" to 4 "*highly relevant*" (Lynn, 1986). The content validity index (CVI) was calculated for each individual item and on the overall instrument (Lynn, 1986). The CVI for each item was computed as the percentage of nurses who rated the item as either "*quite relevant*" or "*highly relevant.*" The content validity index was ≥ 0.80 for all measures; indicating the items captured the aspects of the concept under investigation in the study (Table 5).

Data Analysis

Descriptive statistics and hierarchical multiple regression analysis were conducted using the Statistical Package for Social Sciences Version 23.0 (SPSS 23.0) (IBM Corporation, 2015). Pre-analysis data screening was conducted on raw data prior to data analyses. Missing data analysis was conducted and revealed less than 5% of missing data. Cases with missing values were included by imputing the mean score for each participant.

The majority of statistical tests rely upon assumptions about the variables used in the statistical analysis. There are several assumptions for multiple regression analysis that were accounted for in this research study: linearity, homoscedasticity, normality and collinearity (Celik, 2011; Drapper & Smith, 1998; Gujarati, 2003). Assumptions that are not met may result in incorrect inferences such as Type I or Type II errors as well as over or under estimation of regression coefficient estimates (Osborne & Waters, 2002; Williams, Gomez, & Kurkiewicz, 2013). All assumptions of regression analyses were met. The independent variables were added to the regression model in three sequential blocks. The first block included the five independent variables: attitude, performance expectancy, effort expectancy, social influence and facilitating conditions. The second block contained the moderator variables: age, level of education and technology experience. The third block included the interaction terms among each of age, level of education and technology experience and each of the five independent variables. The standardized regression coefficients (β) and the adjusted R^2 were examined and reported.

Results

Demographic and Professional Characteristics of Participants

A total of 217 participants completed the online survey. The majority of participants were female (94.5%) with an average age of 47.4 years (SD: 10.82, range 25-70). Most nurses held a baccalaureate degree (59%) and reported being in the role of care coordinator (55.8%) or direct patient care provider (44.2%). The majority (72.4%) of participants reported working full-time and had worked within the healthcare system and home care sector for an average of 22.1 and 12.7 years respectively (Table 6). The participants' characteristics were comparable to the target population (i.e., average age of nurses was 45 years, majority being female and working full time) as reported by the College of Nurses of Ontario (2016).

Table 6. Personal and Professional Characteristics

	Mean	SD
Age	47.43	10.82
Years working in healthcare system	22.10	11.54
Years working in home care sector	12.74	8.23
	N	%
Gender		
Male	11	5.1
Female	205	94.5
Prefer Not to Answer	1	0.5
Level of Education		
Diploma/Certificate	77	35.5
Bachelor's Degree	128	59
Master's Degree	12	5.5
Employment Status		
Full Time	157	72.4
Part Time	42	19.4
Causal	18	8.3
Employer		
Service Provider Organization	81	37.3
Local Health Integration	133	61.3
Other	3	1.4
Position		
Care Coordinator	121	55.7
Nurse providing direct patient care	96	44.2

Note. SD = Standard deviation

For nurses' professional characteristics, almost all (96.8%) reported having experience using hardware and / or software applications for an average of 8.66 years. Most (85.7%) nurses reported using EDS in their home care practice for an average of 7.48 years. Of the nurses who reported using EDS in their home care practice; the majority (77%) reported using the system on a daily basis and most (62.2%) reported being very comfortable in using the system within their practice (Table 7).

Table 7. Technology-related Characteristics

	N	*%*
Experience using hardware and/or Software Applications		
Yes	210	96.8
No	7	3.2
Experience using EDS		
Yes	186	85.7
No	31	14.3
Frequency of using EDS		
Less than once a month	9	4.1
Every Week	10	4.6
Daily	167	77
Comfort using EDS		
Not comfortable at all	10	4.6
A little comfortable	12	5.5
Quite comfortable	60	27.6
Very comfortable	135	62.2
	Mean	SD
Years using hardware and / or software applications	8.66	5.91
Years using EDS	7.84	4.96

Note. SD = Standard deviation; EDS= Electronic Documentation System

The descriptive findings for the main study variables are presented in Table 8. On average, nurses had moderately high scores for performance expectancy and effort expectancy; indicating that nurses working in the home care sector believed that the use of the EDS would benefit their work performance, be free from effort and easy to use. Nurses had a favourable attitude towards EDS usage in home care practice. Further, nurses had a positive perception of the social influence of important persons (such as colleagues and managers) on their EDS usage. They also had a positive perception of the facilitating conditions, specifically the existing organizational (i.e., training and education) and technological (i.e., IT support) infrastructures in supporting their EDS

usage in home care practice. Overall, nurses reported high behavioural intention to use EDS in their home care practice.

Table 8. Main Study Variables

	Mean	*SD*
Performance Expectancy (scored out of 7)	5.569	1.469
Effort Expectancy (scored out of 7)	5.569	1.15
Attitude (total score of 110)	81.65	12.82
Social Influence (scored out of 7)	5.89	1.44
Facilitating Conditions (scored out of 7)	5.51	1.07
Behavioural Intention (scored out of 7)	6.41	0.79

Note. SD = standard deviation

Hypothesized Relationships

The results of the hierarchical multiple regression analysis are presented in Table 9. The hypothesized independent variables, that is, performance expectancy, effort expectancy, attitude, social influence and facilitating conditions were included in the first block. All these variables except effort expectancy had statistically significant, direct, positive but small relationships with behavioural intention. Performance expectancy, effort expectancy, attitude, social influence and facilitating conditions explained 47.6% $(F(5, 211)=40.266, p=.000)$ of the variance in nurses' intention to use EDS in the home care sector.

The hypothesized moderating variables of age, level of education and technology experience were entered into the second block of the hierarchical regression model, in addition to the hypothesized independent variables (Table 9). Age, level of education and technology experience showed no statistically significant associations with behavioural

intention; the regression coefficients were close to zero and there was no change in the adjusted R^2. In addition to the independent variables and moderators, the interaction terms were entered into the regression model in the third block. The interaction terms represented the moderating effects of age, level of education and technology experience on the relationship between the independent variables and the dependent variable of nurses' intention to use EDS. Only technology experience moderated the relationship between social influence and behavioural intention (F(21, 195)=11.606, p=.000); accounting for an additional 3% of variance in nurses' intention to use EDS in the home care sector (Table 9). Furthermore, the coefficients for the interaction term of technology experience and effort expectancy and nurses' attitude to EDS were not calculated and excluded from the regression model. A potential explanation for this finding is that the variables had minimal variance.

Table 9. Summary of Hierarchical Regression Analysis for Variables predicting Behavioural Intention to use Electronic Documentation Systems in the home care sector

Variable	B(SE)	β	t-test	Adjusted R^2
Block 1				.476
Performance Expectancy (PE)	.143 (.037)	.266	3.821*	
Effort Expectancy (EE)	-0.11(.048)	-.016	-.225	
Attitude	.013(.005)	.211	2.850*	
Social Influence (SI)	.082(.034)	.149	2.395*	
Facilitating Conditions (FC)	.216(.049)	.292	4.415*	
Block 2				.471
Age	.002(.004)	.026	.457	
Level of Education (LOE)	.012(.074)	.009	.166	
Technology Experience	-.218(.309)	-.037	-.706	
Block 3				.508
Age by PE	-.001(.003)	-.056	-1.55	
Age by EE	-.003(.005)	-.300	-.730	
Age by Attitude	.000(.000)	-1.97	-.352	
Age by SI	.003(.003)	.376	.948	
Age by FC	.004(.005)	.385	.763	
LOE by PE	-.113(.069)	-.613	-1.622	
LOE by EE	-.040(.093)	-.196	-.425	
LOE by Attitude	.009(.008)	.629	1.112	
LOE by SI	.053(.062)	.302	.852	
LOE by FC	.003(.093)	.015	.034	
Technology Experience by PE	.246(.376)	.473	.654	
Technology Experience by EE	-	-	-	
Technology Experience by Attitude	-	-	-	
Technology Experience by SI	-1.613(.465)	2.901	-3.466*	
Technology Experience by FC	-.663(.566)	-.881	-1.172	

Note. * p<0.001. PE= Performance Expectancy; EE= Effort Expectancy; SI= Social Influence; FC= Facilitating Conditions; LOE= Level of Education

Discussion

This study was the first, to our knowledge, to examine factors that influence nurses' intention to use EDS in the home care sector in Ontario. The nurses' individual characteristics, age and level of education, did not have a significant direct and / or moderating effect on nurses' intention to use EDS in their home care practice, whereas, technology experience was found to minimally moderate the relationship between social influence and behavioural intention. These findings, along with available empirical evidence specific to the home care sector suggest that the influence of these nurses' individual characteristics on intention to use HIT, including EDS, is inconclusive. Several

studies did not find nurses' personal (i.e., age and level of education) and professional (i.e., previous nursing experience and technology experience) characteristics to be associated with nurses' intention to use a home telemonitoring system, an electronic health record system, information system and EDS in acute and home care settings (Gagnon et al., 2012; Ifinedo, 2016; Leblanc et al., 2012; Msiska et al., 2016). Whereas in several studies, it was found that older nurses were more resistant, less comfortable and less likely to use HIT in their respective acute care practice (Kummer et al., 2013; Singh & Senthil, 2015; Song, Park, & Oh, 2015).

There are several possible explanations of the statistically nonsignificant associations of nurses' individual characteristics with their intention to use EDS in-home care practice. First, in general, there has been a widespread increase in personal and professional technology usage (Kaya, 2011). Increasingly, nurses are expected and required to use technology in their day-to-day practice and to engage in training as well as update their technology-related knowledge and skills to appropriately use the technology in practice. Second, there have been increased efforts to develop and integrate technology literacy, competencies, knowledge and skills within entry-level nursing education programs in post-secondary institutions (CASN, 2013). The increased educational efforts (i.e., incorporation of nursing informatics in curricula within entry-level nursing programs and integration of EDS in simulation laboratory exercises) coupled with the majority of healthcare organizations providing nurses with EDS training and an overwhelming majority of nurses (96.8%) in this study having technology experience, may have contributed to the nonsignificant direct and / or moderating effect of education on nurses' intention (Borycki et al., 2011; CASN, 2013; Mannino & Cornell, 2014).

Finally, specific to technology experience, the nonsignificant finding may reflect the observation that the majority of nurses (96.8%) reported to having previous experience with using technology and / or are currently (85.7%) using EDS in their home care practice. This resulted in limited variance in this variable, which may have attenuated the direct and moderating influence of technology experience on the dependent variable. If the study had been conducted when EDS was first implemented,

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for those that reported using the EDS in their home care practice, it is possible that technology experience may have influenced nurses' intention to use such systems. Over time and with the increased exposure to and use of EDS, the influence of technology experience may have worn off (Strudwick et al., 2018).

The results of this study provided partial support for the hypothesized relationships in the adapted UTAUT model. Performance expectancy, effort expectancy, attitude, social influence and facilitating conditions had significant, positive, and direct associations with nurses' intention to use EDS in the home care sector; explaining 47.6% of the variance of behavioural intention. This finding is consistent with empirical evidence in the context of acute care (e.g., Phichitchaisopa & Naenna, 2012).

Performance expectancy had a positive but small influence on nurses' intention to use EDS in their home care practice. This finding suggests that nurses tended to focus more on the system being useful in their practice (i.e., fit with workflow, enhanced communication and care delivery, and provided a more organized and focused means of documentation) rather than it being easy to use (effort expectancy). The study finding is in alignment with the literature that also found performance expectancy (also referred to as perceived usefulness) to influence nurses' level of comfort, experience, acceptance, intention and adoption of HIT such as EDS in acute and home care practice (Asua et al., 2012; Chung, Ho, & Wen, 2016; Gagnon et al., 2012; Ifinedo, 2016; Maillet et al., 2014; Phichitchaisopa & Naenna, 2013; Sharifian et al., 2014; van Howelingen et al., 2015; Zhang et al., 2010).

Nurses who participated in this study had favourable and positive attitudes toward use of EDS in their home care practice. More specifically, nurses had a positive perception of the potential of EDS to make clinical practice easier, improve patient care, save time and maintain patient confidentiality. Nurses' positive attitude towards the EDS usage has been confirmed in numerous studies within the acute care sector (Chung et al., 2016; Galimany-Masclans et al., 2011; Hung et al., 2014; Kim et al., 2016; Kowitlawakul, 2011; Lau, 2011; Shoham & Gonen, 2008) and both acute and home care sectors (Ifinedo, 2016).

Nurses' positive and favourable attitude towards use of EDS in the home care sector may be reflective of their increased personal usage of technology as well as professional technology usage in clinical practice over time (Kipturgo et al., 2014). Most nurses participating in this study reported long-term use of EDS with an average of 7.8 years. Personal technology use is also widespread and emerging evidence suggests that skill development through personal technology use are transferable within multiple contexts (i.e., workplace) (Mom, Oshri, & Volberda, 2012). In addition, the nurses' positive attitudes may reflect their knowledge and skills using EDS through experience with the technology.

Participating nurses reported that their colleagues (social influence) positively influenced their intention to use EDS in their home care practice. If nurses perceived their colleagues (i.e., nurses, managers, and allied HCPs), patients and their families to be supportive and approved of EDS usage, they had higher intention to use the system in their home care practice. This finding is consistent with studies examining the association of social influence on nurses' intention to use HIT such as EDS within the acute care sector (Bennani & Oumlil, 2014; Chung et al., 2016; Hung et al., 2014; Ketikidis et al., 2012; Kowitlawkul, 2011; Kummer et al., 2013; Lau, 2011; Lee et al., 2013; Phichitchaisopa & Naenna, 2013; Sharifan et al., 2014; Wills et al., 2008; Wu et al., 2011) and home care sector (Gagnon et al., 2012; Zhang et al., 2010). However, it is important to note that in this study, social influence was found to have the weakest effect compared to other factors. A potential explanation for this finding is that although nurses work in hierarchical organizations and within interprofessional teams, they work more independently and with limited direct and face-to-face interaction with colleagues within the home care sector (Lundy & Janes, 2014; Tourangeau et al., 2014). As a result, this social influence might not be as substantial in comparison to nurses working in the acute care sector who are surrounded by and work in direct collaboration with allied HCPs.

Nurses had a favourable and positive perception of the facilitating conditions, specifically organizational training, education and IT support, which influenced their intention to use EDS in their home care practice. Nurses who perceived having the organizational (i.e., training and manuals) and technological (i.e., readily available IT

staff and support) infrastructures available to support them, had higher intention to use the EDS in their home care practice. Furthermore, relative to performance expectancy, effort expectancy, attitude and social influence, facilitating conditions appeared to have the largest effect (represented by a large regression coefficient) on nurses' intention to use EDS in their home care practice. A potential explanation to this finding is that irrespective of nurses' attitude and the usefulness of the technology, nurses who believed barriers were removed by nurse educators as well as nurse and health system managers and had access to training, education and IT support were more likely to perceive the EDS as useful in their position and in turn, have higher intention (Strudwick, 2015). This finding is also consistent with other studies examining intention and adoption of various types of HIT (i.e., telemonitoring, web-based tools, hospital information systems, EDS and mobile solutions) in acute and home care practice by nurses, who are comparable in terms of personal and professional experience to those in this study (Asua et al., 2012; Gagnon et al., 2012; Lau, 2011; Leblanc et al., 2012; Phichitchaisopa & Naenna, 2013; Sharifian et al., 2014; Wills et al., 2008; Wu et al., 2011).

Implications

The findings from this study have implications for theory, practice, and research. For theory, more than 50% of variance in nurses' intention to use EDS in this study was not accounted for in the adapted UTAUT model. A potential explanation to this finding is that the UTAUT model, similar to other models developed to explain how end-users make decisions to use technology, originate from disciplines such as business, sociology and psychology and not specifically within the context of nursing care (Kijsanayotin et al., 2009; Venkatesh et al., 2003, 2012). As a result, not all factors (i.e., nurses' level of comfort, nurse-patient interactions, nurses' personal innovativeness and self-efficacy, employment setting and organizational culture) that may potentially influence nurses' intention to use EDS in-home care practice and relevant to nursing practice were captured in the UTAUT model (Im et al. 2011; Van de Vijver & Leung 1997). This limitation highlights the need for more research to determine the most appropriate and / or adaptation of the model accounting for nurses' intention and actual use of EDS in various health care environments.

Specific to practice, the findings regarding the influence of performance expectancy on nurses' intention highlight the importance for such systems to be designed in a way that fits with nurses' preferences, workflow and needs. Nurses' contribution to the design and refinement of EDS can be accomplished through the following means: a) software developers shadowing nurses in practice to understand the complexity of nursing practice and the requirements for nursing documentation; and b) having an adequate representation of nurses during the design, procurement, pilot-testing and / or implementation processes of EDS in-home care practice (Strudwick et al., 2018).

The finding related to the influence of nurses' attitude and social influence on intention to use EDS in-home care practice highlights the importance for nurse and health system managers as well as nurse educators to foster a working environment and organizational culture that supports and encourages EDS usage in nurses' home care practice. Fostering a working environment and organizational culture that is supportive of EDS usage may be achieved in two ways. The first is affording nurses with the opportunity to practice using the system prior to full integration of the system in home care practice. This practice opportunity may result in a positive early experience for nurses as there is less stress on mastering the skills and knowledge required to use the EDS right away, are convinced of its usefulness, and comfortable with its integration of it in their home care practice (van Houwelingen et al., 2015). The second focuses on encouraging peer support by enlisting EDS champions to share information and tips as well as assist other home care nurses with system usage in practice (Yuan et al., 2015).

The finding related to the influence of facilitating conditions on nurses' intention to use EDS in-home care practice highlights the importance for nurse managers, educators, and health informatics professionals to ensure nurses are afforded with the organizational and technological infrastructures (Gagnon et al., 2012). Home care nurses practice in patient-controlled environments that are not necessarily conducive for the delivery of health care services because of the limited availability of resources, equipment and face-to-face interaction with other personnel including IT staff (CNA, 2013; Lundy & James, 2014; Tourangeau et al., 2014). As such, making IT support available around the clock and easily accessible coupled with the provision of sufficient training and education

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prior, during and ongoing with EDS usage for home care nurses is imperative to address challenges in the performance of the system (Furlong, 2015; Strudwick et al., 2018; Zadvinskis et al., 2018).

Specific to research, future research is needed to investigate: a) nurses' intention to use EDS in the home care sector with a national sample of nurses to determine if similar factors found in this study also influence their intention to use EDS in-home care practice within different regions of the country having different support systems; b) explore additional factors (i.e., personal innovativeness and self-efficacy) not captured in this study that may influence nurses' intention to use EDS in-home care practice; and c) determine the extent to which intention to use EDS predicts nurses' actual usage in home care practice.

Limitations

The study had some noted limitations. First, the inclusion criteria were limited to persons that were able to read and write in English. Second, the perception and experiences of the nurses who participated in this study may differ from home care nurses that did not consent to have their names released for research purposes. However, the participant's characteristics were comparable to the CNO population. Finally, social desirability might be a limitation as it is associated with nurses' self-reported intention to use EDS in-home care practice and is not a direct measure.

Conclusion

This study sought to identify factors that influence nurses' intention to use EDS in their home care practice. Performance expectancy, attitude, social influence and facilitating conditions were found to be significantly associated with nurses' intention to use EDS in their home care practice. Whereas effort expectancy and nurses' demographic (age and level of education) and professional characteristics (technology experience) were not found to significantly influence their intention to use EDS in practice. Identifying the factors that influence nurses' intention to use EDS in the home care sector is imperative because they are the largest users of such systems and play an important

role in the delivery of home health care services. Further the findings may inform and guide interventions to appropriately address the factors and promote the successful integration and adoption of EDS by nurses in their home care practice (Li et al., 2013; Qu & Sun, 2015).

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Chapter 4

A qualitative content analysis of nurses' comfort and employment of workarounds with electronic documentation systems in home care practice

This chapter was adapted from a manuscript entitled "A qualitative content analysis of nurses' comfort and employment of workarounds with electronic documentation systems in home care practice" by Sarah Ibrahim, Dr. Lorie Donelle, Dr. Sandra Regan and Dr. Souraya Sidani submitted and under review in the Canadian Journal of Nursing Research.

Abstract

Background: Electronic documentation systems (EDS) have the potential to assist healthcare providers such as nurses with timely access to patient health and care-related information, which may guide their practice and patient-related decision making. Nurses are the largest users of EDS; however, limited evidence exists exploring nurses' comfort with EDS usage and the types of workarounds developed within the context of home care.

Aim: To explore home care nurses' comfort with EDS usage and to identify the types of workarounds developed and the respective reasons.

Methods: A cross-sectional survey design was employed to collect relevant quantitative and qualitative data. A total of 217 home care nurses participated in the study. Quantitative data related to nurses' comfort with EDS usage were analyzed using descriptive statistics. A total of 186 and 53 qualitative comments were analyzed specific to nurses' comfort and development of EDS workarounds respectively. Qualitative data were analyzed using inductive content analysis.

Findings: Nurses reported moderate-to-high levels of comfort with EDS usage. Individual, technological and organizational / environmental characteristics influenced nurses' comfort. Individual and technological characteristics contributed to nurses' discomfort. Further, workarounds developed and employed by home care nurses stemmed from the technological characteristics of the EDS.

Conclusion: Findings highlight the need for: a) health system managers, health informatics professionals, and nurse educators to assess nurses' level of comfort with EDS usage and in turn, inform training initiatives accordingly; and b) having representation of nurses in the EDS design and implementation processes through a user-centred design approach. Such an approach may ensure the systems are designed to fit with the complexity of nursing practice and that is user-friendly; potentially enhancing nurses' level of comfort and mitigating the development and employment of workarounds during system usage.

Keywords: home care, nurses, health information technology, electronic documentation systems, workarounds, level of comfort, and qualitative content analysis

Background

Worldwide, there has been an increased integration and usage of electronic documentation systems (EDS) within healthcare organizations (Stone, 2014). The potential to enhance access to preventative and treatment services, workflow, documentation, patient health outcomes, collaboration and communication in real-time among healthcare providers (HCPs) and patients, and productivity have been the motives for using such systems in practice (Bowles, Dykes, & Demiris, 2015; Canadian Home Care Association, 2015; Carretero, 2016; Hsiao & Chen, 2016). Despite the noted benefits of EDS, there have been reports of nurses' negative experience, low intention, satisfaction and discomfort with EDS usage in multiple health care sectors (Hsiao & Chen, 2016; Stevenson, Nilsson, Petersson, & Johansson, 2010; Strudwick et al., 2018; Topaz et al., 2016). Further, although nurses are required to use EDS in practice, it has been reported that workarounds have been constructed to address the unfavourable experiences (i.e., poor and non-friendly system design and limited functionality) with the system and to accommodate their practice (Rathert, Porter, Mittler, & Fleig-Palmer, 2017; Ser, Robertson, & Sheikh, 2014). Workarounds involve the implementation, by end-users, of temporary practices or behaviours to overcome limitations of a technological system (Cresswell et al., 2012).

Nurses are the largest user-groups of EDS, spend the most amount of time with patients, and are the largest group of regulated HCPs (Delucia, Ott, & Palmieri, 2009; Stevenson et al., 2010; WHO, 2013). It therefore is important to understand nurses' level of comfort with EDS usage and nurse-developed workarounds (Cho, Kim, Choi, & Staggers, 2016; Raddaha, 2018) because such systems that are not used as intended or to their fullest capacity, cannot be reasonably expected to contribute to improving access to information and providing high-quality care (Wills et al., 2008). However, to date, limited empirical evidence exists that describes nurses' level of comfort with EDS usage and the workarounds developed by nurses within the home care sector. The home care sector is an area of practice that warrants further research and focus because it is the fastest growing sector in healthcare systems both nationally and internationally (i.e., Europe and the United States) coupled with the projections that two-thirds of Canadian

nurses will be working in the community and home care sector by 2020 (Canadian Nurses Association, 2013; Institute of Medicine, 2003; Kitchen, Williams, Pong, & Wilson, 2011). To address this knowledge gap, we explored home care nurses' experiences with EDS usage. The specific aims were to describe nurses' level of comfort with EDS usage in the home care sector and identify the types of workarounds and the respective reasons for nurses' development and employment of the workarounds.

Methods

Design

A cross-sectional survey design with closed and open ended-questions was employed. The Tailored Design Method (TDM) was followed to enhance response rate (Dillman, Smyth, & Leah, 2014). Participants were mailed a package twice within a four-week interval, that included a letter of information and instructions to access the online survey. The survey was made available through a secure link using the Qualtrics survey software (Qualtrics, 2018). A final reminder postcard was sent four weeks later. Completion of the online survey implied participant's voluntary, implicit and informed consent. To promote participation in the study and as a token of appreciation for those having taken part in the study, a $5 gift card was offered to participants upon completion of the online survey (Dillman et al., 2014). The study protocol was approved by the university Research Ethics Board (REB approval #: 109426).

Sample

The target population consisted of registered nurses employed within the home care sector in the province of Ontario, Canada. The eligibility criteria required that participants were: a) registered with the College of Nurses of Ontario (CNO); b) employed full time or part time; c) practicing within the home care sector; and d) providing direct patient care or coordinating patient care. Nurses were excluded if they were in managerial positions, self-employed and / or working in both acute and home care sectors concurrently. The CNO was contacted to obtain a list of nurses working in the home care sector that met the eligibility criteria and consented to have their name and

contact information released for research purposes. A systematic sampling method was employed following receipt of the list (Chapter 3).

Data Collection and Analysis

Data were collected with an online survey. The following section describes the collection and analysis procedures for both the quantitative and qualitative data.

Quantitative Data

Closed-ended questions were used to collect quantitative data on nurse participants' demographic and professional characteristics, current use of hardware and / or software applications, and EDS usage in home care practice. Participant's demographic characteristics were assessed with standard questions about age, sex, and level of education. Information collected on participant's professional characteristics included: nurses' position, employment status, years working within the healthcare system and home care sector, self-reported current use of hardware and / or software applications and EDS, frequency and years of EDS usage, level of comfort with EDS usage in home care practice, and if workarounds were developed and the respective reasons.

Descriptive statistics were conducted using the Statistical Package for Social Sciences Version 23.0 (SPSS 23.0) (IBM Corporation, 2015) to analyze the data on nurses' level of comfort and use of different types of workarounds. Descriptive statistics included frequency distribution and measures of central tendency and dispersion.

Qualitative Data

Open-ended questions were used to gain an in-depth understanding of nurses' level of comfort and their respective reasons for developing and employing workarounds with EDS usage in home care practice. Two open-ended questions were asked of participants. The first question was related to nurses' perspective on level of comfort with EDS usage: "could you explain why you feel comfortable or uncomfortable using EDS in your home care practice". The second question was related to nurses' development and employment

of workarounds: "describe any workaround approaches you have developed when using EDS in your home care practice and why?". Several iterations of the open-ended questions were made to ensure the questions were designed to elicit participant's perspectives on their level of comfort and employed workarounds with EDS usage. Six home care nurses validated the content and relevance of the questions.

Inductive content analysis was conducted using the NVivo Software (Version 11) (NVivo, 2012). The analysis allowed for categories to emerge directly from the data and without any "theory-based categorization matrix" (Elo et al., 2014, p. 2). The first step consisted of the first author independently reading each open-ended response, making notes while reading and identifying key phrases and words to freely generate categories (i.e., open coding) (Vaismoradi, Turunen, & Bondas, 2013). The second step, creating categories, entailed the iterative development, organization and reduction of the number of categories by grouping codes based on similarities (i.e., EDS not working, EDS crashing, slow EDS, and EDS downtime) and into broader categories (i.e., technical shortcomings) (Vaismoradi et al., 2013). Data saturation was considered when there was replication in categories; confirming completeness and comprehensives of the data and in turn, facilitating abstraction (Elo et al., 2014). The third step, abstraction, involved the organization of the broader categories into salient categories and the respective descriptions (Elo et al., 2014; Polit & Beck 2004).

In this study, trustworthiness of the qualitative content analysis was maintained through: credibility, dependability, conformability, and transferability (Elo et al., 2014). Specific to *credibility*, reflexivity and peer-debriefing were employed (Anney, 2014). This allowed for reflection of the researcher's background, thoughts, feelings, perceptions, and potential biases throughout the process through journaling and receipt of scholarly guidance and feedback during data analysis (Anney, 2014; Guba, 1981). For *dependability*, two strategies were employed: a) code-to-code procedures, that is, coding the data and waiting two weeks to re-code the same data then comparing the findings; and b) maintenance of audit trail, that is, the transparent description of the steps taken from the beginning of the research project to the research findings (Anney, 2014; Lincoln & Guba, 1985). *Confirmability* on the other hand entailed reflexivity through journaling

and audit trail strategies (Bowen, 2009). Finally, for *transferability*, a thick description strategy was employed. The thick description strategy allowed for a clear explanation and description of the research processes (i.e., data collection and analysis procedures) for replication purposes (Anney, 2014).

Results

Demographic and Professional Characteristics of Participants

A total of 217 participants completed the online survey. The majority (94.5%) of nurses were female, with an average age of 47.43 years. Most (59%) nurses had a baccalaureate degree; 72.4% of the nurses reported working full-time in the role of a care coordinator (55.8%) or direct patient care provider (44.2%). Nurses reported working within the healthcare system and home care sector for an average of 22.10 and 12.74 years respectively. Almost all nurses (96.8%) had experience with hardware and / or software applications in practice for an average of 8.66 years. Further, most nurses (85.7%) reported EDS usage in their home care practice for an average of 7.48 years; of these, 167 (77%) indicated using the EDS on a daily basis.

Participants' comfort with EDS usage

A total of 186 (86%) nurses answered the open-ended questions related to their level of comfort with EDS usage. Nurses indicated being very comfortable (n=135, 62.2%), quite comfortable (n=60, 27.6%), a little comfortable (n=12, 5.5%) and not at all comfortable (n=10, 4.6%) with EDS usage. The categories and respective subcategories of the reasons underlying nurses' level of comfort and / or discomfort are presented in Table 10. A total of 11 subcategories emerged from the content analysis; each subcategory explained the reasons underlying nurses' level of comfort with EDS usage. The subcategories were mapped into three categories: 1) nurses' individual characteristics; 2) technological characteristics; and 3) organizational / environmental characteristics (Table 10).

Table 10. Factors affecting nurses' comfort and discomfort using Electronic Documentation Systems (EDS) in home care sector (n=186)

Factors related to nurses' comfort using Electronic Documentation Systems	Factors related to nurses' discomfort using Electronic Documentation Systems
Nurses' Individual Characteristics • Technology-related knowledge, skills and experience • Educational training related to technology • Frequency of technology and/or EDS usage	**Nurses' Individual Characteristics** • Lack of experience • Infrequency usage • Age • Concerns related to patient data security • EDS usage during patient-interactions
Technological Characteristics Improvement in Workflow • Documentation legible, organized and focused • Access to timely, accurate, and up-to-date patient health and care-related information Enhances communication and care delivery • Allow others to access and share patient health and care-related information • Enhances communication among HCPs EDS Design • User-Friendly • Easy to use	**Technological Characteristics** Disruption of workflow and loss of productivity Technical Shortcomings • Network/Connectivity-related issues to access EDS in-home care sector; and inability to access EDS during home visits EDS Software & Hardware Design • Design • Speed • Frequent Updates • Small hardware size • Battery life
Organizational / Environmental Characteristics • Training • IT Support	

Category 1: Nurses' Individual Characteristics

This category reflected the influence of nurses' individual characteristics on their level of comfort with EDS usage in their home care practice. A total of five subcategories illustrated the underlying reasons for nurses' comfort with EDS usage: technology-related knowledge, skills and experience; educational training related to technology; frequency of technology and / or EDS usage; perception of safety and confidentiality of patient health and care-related data; and the influence of nurse-patient interactions amidst EDS usage.

Participating nurses who reported having technology-related knowledge, skills, and experience coupled with the educational background, frequent usage with general technology and / or EDS and who trusted the system, were reportedly more comfortable with EDS usage in practice. These nurses explained that they were able to apply and transfer their knowledge, skills and experiences towards proficiently learning and using the EDS in their home care practice. Nurse participants expressed:

> "I started using a PC and Internet at home 25 years ago. Worked in a hospital unit that was paperless for 5 years and have used electronic documentation in-home care for greater than nine years. I am generally comfortable with technology and learn quickly. I have welcomed E-Documentation since first introduced to it in 2005." (Participant 7)

> "My diploma education 30 years ago included a basic computer course and each of my positions has built on that knowledge with advancing technology." (participant 126)

Some nurses on the other hand reported having limited technology-related experience and exposure to EDS in practice. Further, some participating nurses also indicated that they were cognizant with using the system amidst patient interactions and had reservations regarding the safety and security of patient data on such systems. For example, a nurse commented: "sometimes I also gauge whether a patient might be uncomfortable and therefore will do assessments by hand and enter it later" (Participant 159). They explained that their limited experiences with technology, perception that patients did not appreciate the use of EDS in addition to concerns with data security

contributed to their discomfort with EDS usage in practice. For example, a nurse noted: "am always concerned about security of client information and data" (Participant 89). A few nurses also commented on the influence of age on their technology-related skills, which in turn influenced their level of comfort with EDS usage. Nurses expressed:

> "Not as proficient with electronic devices due to age, learning curve." (Participant 144)

> "Spent most of my career with paper documentation so now that is all computer, typing skills are slower compared to younger nurses." (Participant 186)

Category 2: Technological Characteristics

This category described the influence of the technological characteristics on nurses' level of comfort with EDS usage in their home care practice. Three subcategories that illustrated nurses' reported comfort with EDS usage in practice were: enhanced workflow; enriched communication; and EDS design. Whereas the three subcategories for nurses' reported discomfort with EDS usage in practice were: disruption to nurses' workflow and loss of productivity; technical shortcomings; and EDS software and hardware design.

Enhanced Workflow

Nurses reported that EDS usage enhanced their workflow and performance because of: a) access to legible, organized, accurate and up-to-date patient health and care-related information; and b) the convenience, portability and efficiency of the EDS (i.e., less time spent documenting and documentation completed at the point of care). For example, participating nurses commented:

> "Efficient, clean, legible (for myself and those accessing my data), excellent method of information sharing when database is shared among service providers." (Participant 85)

> "Saves time, work can be done in the visit with electronics instead of in the evening on home computer during family time." (Participant 109)

"It's convenient to use as I'm able to work remotely from home and still access it. There are issues that come up at times when connectivity is less than optimal, and sometimes the system "crashes" however overall, it makes working easier as far as I'm concerned." (Participant 46)

Enriched Communication

Nurses commented that the EDS usage enriched their communication with colleagues. Nurses and other members of the interdisciplinary team, regardless of their physical location, were able to access and share up-to-date patient health and care-related information. Further, nurses were able to communicate to other nurses and HCPs the results of various assessments performed and care provided through the EDS. Participating nurses expressed:

"There is easy direct communication with providers, senior managers, clients / families." (Participant 128)

"… feel that it provides a means to better communication within the various disciplines." (Participant 162)

"Allows other staff to use and access chart at the same time." (Participant 11)

EDS Design

Some participating nurses indicated that the EDS was designed in a user-friendly manner and was easy to use in their home care practice; further contributing to their comfort with using the system in practice. For example, a nurse made the following comment: "ease of use, ease of finding information, easily read information, ease of documentation." (Participant 45)

Disruption to nurses' workflow and loss of productivity

A few nurses commented that EDS usage disrupted their workflow and loss of productivity; resulting in their discomfort with the system usage in practice. The disruption to workflow and loss of productivity were said to be influenced by: a) the amount of time required to learn how to use the system; b) the data entry inefficiencies due to increased and repetitive documentation demands; c) delays in service provider

agencies updating pertinent patient health and care-related information required during home care visits; and d) inaccurate data entry due to human error. Nurses also indicated that there were challenges in simultaneously documenting and engaging patients in conversations, taking away from the quality of patient care delivery. Further, nurses commented on the increased reliance on technology to complete their work, the lack of "workstations" (i.e., desks and tables) available during home care visits; and patients and caregivers not having access to the system and in turn, their information. Nurse participants expressed:

> "It is difficult to record in the blackberry and chart at the same time and be able to make eye contact with client during this time." (Participant 32)

> "What poses a challenge is when we go into an unclean environment and cannot sit down or there is no dedicated space to put the laptop." (Participant 159)

Technical shortcomings

Technical shortcomings, specifically the poor network and system connectivity impacted nurses' discomfort with the EDS largely. These shortcomings influenced nurses' ability to access the EDS in a timely manner resulting in limited access to patient's medical records at the point of care. Nurses noted:

> "Sometimes the connection doesn't work even with an air card and so it [data entry] must be done by hand and inputted later which adds more time to our day." (Participant 159)

> "There are issues that come up at times when connectivity is less than optimal, and sometimes the system crashes." (Participant 46)

> "Sometimes due to internet issues, it is not feasible to only use electronic documentation." (Participant 58)

EDS software and hardware design

The EDS software was also noted to influence nurses' discomfort. This was related to the software being slow or inaccessible at the point of care at times, requiring constant upgrades (at times unscheduled and during shifts) and the overall design not being user-

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friendly. For example, the available patient assessment templates in the system were reported to be poorly aligned with homecare nurses' workflow and geared more towards the work practices of the home care coordinators. Additionally, nurses reported having to navigate through the entire EDS to access the necessary information and / or tools needed for documenting the results of assessment or delivery of care and treatments. Nurse participants expressed:

> "Scrolling through data in a linear fashion that includes non-practice information can be overwhelming." (Participant 37)

> "Not always user-friendly a lot of tabs to navigate through to get the information you want." (Participant 55)

Issues with the hardware (i.e., phone) for using EDS were associated with nurses having to access the system on a small screen; making it difficult for them to read and enter data. This was further accompanied with the need to frequently charge the devices because of the low battery life. The need to frequently charge the devices was not always feasible and / or readily available when nurses were travelling between visits and / or during patient home care visits. For example, a nurse participant expressed:

> "…However, there are many shortcomings: very awkward to complete whole assessments on such a small device." (Participant 6)

Category 3: Organizational / environmental characteristics

This category described the reported influence of the organizational / environmental characteristics on nurses' comfort with EDS usage in their home care practice. Two subcategories illustrated the reasons for nurses' comfort: training and IT support. Nurses indicated receiving sufficient training (and ongoing when system upgrades were made) from their respective provider agency. The training reportedly helped nurses learn how to proficiently operate the EDS; contributing to their overall level of comfort in using the system. For example, participating nurses commented:

"Excellent staff education and training with regular updates to ensure understanding and proficiency to use electronic documentation systems." (Participant 117)

"The prior teaching / training that is given prior to the role out of the system helps to make it more comfortable to work with." (Participant 176)

The readily available IT support was also reported to contribute to nurses' comfort with the system usage in practice. Nurses had access to the necessary IT support in a timely manner when encountering technical challenges (i.e., poor connection and system failure) in their home care practice and regardless of their location (i.e., patient's home and agency office). For example, participating nurses expressed:

"We have access to IT support in office and when working remotely in the community." (Participant 75)

"There is excellent IT and information management." (Participant 173)

"I have good IT support to troubleshoot technology problems." (Participant 105)

Participants' development of workarounds

A total of 53 participants answered the open-ended question regarding EDS workarounds they developed and employed when using the system in their home care practice. Just over 40% of nurses reported having developed and employed EDS workarounds. Three categories emerged regarding the challenges that occurred, and the respective EDS workarounds implemented. The categories were: 1) technical issues; 2) EDS usability challenges; and 3) EDS data entry challenges (Table 11).

Table 11. Reported workarounds for Electronic Documentation System usage by nurses in the home care sector (n=53)

Identified Issue	Workaround
Technical • Connectivity issues • EDS crashing or slowing down, and unscheduled downtime	• Use paper documentation • Fax Documents
Usability • Design of EDS	• Use / Apply shortcuts to navigate through EDS • Develop and customize templates to fit with nurse's position, workflow, tasks and assessments • Revert to Narrative Charting
Data Entry	• Write on paper then transfer to EDS • Avoid charting at point of care (because of ergonomics and focus on patient interaction) • Develop an established data entry approach and order: • One HCP entering data at a single point in time • Completing tasks then documenting • Enter data in a manner to capture patient needs • Enter data in a way to ensure data is not omitted

Category 1: Technical Issues

Technical issues emerged as a reason for the development and employment of EDS workarounds by nurses when using the system in their home care practice. The noted technical issues resulted from poor and / or lack of connectivity, unscheduled system downtime, and the EDS slowing down and / or not working. In these situations, the workaround most nurses reported using was paper documentation at the point of care and transferring the notes to the EDS when access to the Internet or system became available. Nurse participants expressed:

"There are times where internet access is limited, and this prevents real-time documentation. For those times, I utilize a paper copy of the documentation and enter the information as soon as I return to the office. This is one of the challenges of working in a rural area. My iPhone has internet access that can be tethered to my computer but at times there are dead spots for it as well." (Participant 23)

"I carry a notebook to all home visits in the event the electronic system is unavailable." (Participant 28)

"Connectivity issues when outside of the hospital or patient home, therefore paper notes are taken and input when connectivity improves." (Participant 29)

"When the system is down, I use paper cheat sheets to gather information to enter at a later date." (Participant 30)

Category 2: EDS Usability Challenges

The EDS usability challenges of the EDS were reported to be influenced by the misalignment of the EDS design with nurses' workflow, tasks, and preferences. To overcome the usability challenges, several workarounds were developed by nurses to make documentation practice more efficient. The workarounds included: a) developing shortcuts (i.e., skip drop down options) to navigate through the system; b) customizing templates within the existing EDS to support the nurse's role (i.e., nurse providing direct patient care), workflow, tasks and assessments; and c) documenting notes through narrative charting. Nurse participants expressed:

"… I now create PDFs of the files I need and save them on my laptop for reference during the visit." (Participant 18)

"I've developed my own word template to use, which can be pasted into the documentation system. Our documentation is more set up for care coordination than direct nursing service." (Participant 31)

"Shortcuts to skip drop downs, saves time, decrease clicking, and copy and pasting notes to decrease time and duplication." (Participant 34)

Category 3: EDS data entry challenges

The EDS data entry challenges were related to the timing and location of documentation. To overcome these challenges, the following workarounds were employed by nurses: a) writing on paper at the point of care and transferring the information to the EDS at a later point in time; b) not charting at the point of care because of ergonomic-related challenges (i.e., not having a workstation and / or a spot to place the laptop within the home care sector) and to focus on patient-interactions; and c) having developed a data entry approach and order.

To address these data entry challenges, some nurses reported that only one HCP could enter data at a single point in time in the EDS. As a result, the providers came up with a plan regarding the data entry order by each respective provider. Further, some nurses reported to first completing tasks (e.g., assessments) then documenting into the system as well as entering data in a specific way to capture the patients' care needs and ensure data were not omitted. Participating nurses noted:

> "It is difficult to document when doing a face to face interview, so I take notes in a word document before documenting directly on client's chart. I have my own template to complete the note and reminds me of questions to ask." (Participant 43)

> "When documenting in the home with client, I use the notes part to document conversation. I do not concern myself with data entry when I am in conversation with client." (Participant 48)

> "In hospital coordination ergonomics with holding laptop while with patient is not practical and therefore documentation is often done when back in the office space." (Participant 29)

> "I know which questions will trigger higher scores so that I can justify the care the patient requires. The tool isn't supposed to replace clinical judgement but there are many flaws that don't capture the patients or situations complexity." (Participant 7)

> "Only one person can document at a time. As a team, we developed a process of who would document first." (Participant 42)

Discussion

The purpose of this study was to explore home care nurses' level of comfort with EDS usage and identify the types and reasons for developing and employing workarounds. Findings from the study suggest that home care nurses reported moderate-to-high levels of comfort with EDS usage in practice. Comfort with EDS usage was influenced by nurses' individual, technological and organizational / environmental characteristics. The findings are in alignment with the factors (i.e., performance and effort expectancy, social influence and facilitating conditions) influencing nurses' intention and overall experience with using EDS in their home care practice, as presented in Chapter 3 and 5. Further, less than half of home care nurses reported to having developed and employed workarounds with EDS usage to address the technological challenges.

Reasons for Comfort / Discomfort

Limited empirical evidence exists examining nurses' level of comfort with EDS usage. However, the study findings are congruent with the literature examining nurses' perceptions, reported concerns, satisfaction, barriers and facilitators with EDS usage in practice (e.g., Black Book Market Research, 2014; Saleem et al., 2015; Strudwick et al., 2018; Topaz et al., 2016). For example, Strudwick et al. (2018) found the navigation, functionality, system performance, response time and impact of the EDS on workload to negatively influence nurses' perception of the system usage in the acute care sector. Further, a study conducted by Topaz et al. (2016) noted that the identified issues related to the technological and organizational / environmental characteristics contributed to nurses' low satisfaction with the EDS in practice. Some of the challenges to nurses' use of EDS in practice as identified by Topaz et al. (2016) were: a) the EDS not capturing nursing knowledge and practice (i.e., insufficient incorporation of nursing clinical decision support tools) and being geared more towards billing or regulatory reporting needs; b) lack of EDS interoperability with other systems, resulting in patient health and care-related information not being shared across acute and home care sectors and provinces; and c) the lack of training offered to nurses to support EDS usage in practice.

The factors found to influence nurses' level of comfort with EDS usage in home care practice have two implications. First, prior to training nurses on EDS usage in home care practice, leadership such as nurse and health system managers and educators might consider conducting preliminary assessments of nurses' level of comfort with general usage of health information technology (HIT) and EDS. Through such an assessment, management and educators may attain an understanding of how to design and implement strategies and initiatives that address nurses' comfort or discomfort with EDS usage and incorporate this in the training sessions. For example, in this study, nurses' lack of experience, infrequent EDS usage and concerns regarding data security contributed to their discomfort. By identifying and understanding nurses experience with EDS, additional education and training time for nurses with limited technology experience may be warranted. A blended learning approach may also be utilized for EDS training sessions for home care nurses. A blended learning approach integrates various learning modalities (i.e., traditional instructor-led lectures, hard-copy information, video and audio recordings, demonstrations, and hands-on practice) (Bredfeldt, Awad, Joseph, & Snyder, 2013; Edwards et al., 2012). This approach has the potential to meet the various learning needs and styles of home care nurses and in turn, increase their level of comfort with the EDS prior to and during system implementation. For example, as part of the training afforded to nurses in some home care organizations in the Netherlands, nurses were given hands-on practice with a home telehealth technology a few months prior to full implementation with the aim of promoting their comfort with the technology (van Houwelingen et al., 2015). Ongoing training post-implementation of the EDS has also been found to be beneficial for nurses (Bredfeldt et al., 2013). Nurses and particularly those with limited EDS experience, may be overwhelmed during initial training of EDS and focus mainly on attaining basic proficiency rather than mastery (Bredfeldt et al., 2013). Ongoing training provides opportunities for home care nurses to master the skills with the system and learn of any changes to the EDS design and / or feature(s); thereby enhancing nurses' comfort (Bredfeldt et al., 2013).

Second, to address nurses' reported discomfort with the design of the EDS, it would be important for health system managers and software developers to adopt a user-centred design approach in which formative usability, system implementation and

summative usability assessments are performed prior, during and post-implementation of the system (Saleem et al., 2015). Evidence suggests that the user-centred design approach is being implemented with HIT in general (i.e., telemedicine, medical devices, mobile and computer applications) for both patients and HCP end-users, however, limited evidence exists specific to EDS (Rivera et al., 2018; Saleem et al., 2015; Smaradottir & Fensli, 2016). The uniqueness of this design approach is the systematic integration of nurses' perspective and feedback on the features and functionality of the EDS (Hagedorn, Krishnamurty, & Grosse, 2016). This in turn, may lead to a system that meets the end-user's needs and preferences and fits with their workflow; potentially contributing to the achievement of the anticipated benefits of the system. However, it is important to note that such an approach may not be feasible with large propriety systems where there is little flexibility to make adjustments to the EDS (Evans, 2016). This highlights the importance for policy makers to collaborate with leadership, EDS vendors and to have adequate representation of HCPs when designing such systems as well as more rigorous data quality governance and management (Bronnert et al., 2012).

Reasons for Workarounds

Workarounds may improve workflow and efficiency through less time spent documenting and navigating the EDS. However, workarounds may negatively influence effectiveness of care delivery, lead to unavailable information, and undermine the way in which the system is designed (Debono et al., 2013; Flanagan et al., 2013). As noted in this study, just over 40% of nurses using EDS in the home care sector reported to developing and employing workarounds. The presence of workarounds is an indication that the system is not supportive of the needs and practice of end-users (Debono et al., 2013).

The primary consequence to the workarounds as reported by study participants and corroborated in the literature are primarily related to the technological characteristics. For example, a survey of 13,630 nurses practicing in the United States in 2014 found that 67% of nurses reported using workarounds to address the technological limitations of the EDS (Black Book Market Research LLC., 2014). The shortcomings of the technological

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characteristics as found in this study and supported by empirical evidence, were related to the EDS having poor interoperability, usability (i.e., not easy to use, user-friendly and intuitive) and slow speed as well as limited functionality and discrepancy with nurses' needs and clinical workflow (Cifuentes et al., 2015; Menon et al., 2016; Patterson, 2018; Rathert et al., 2017; Ser et al., 2014; Strudwick et al., 2018; Topaz et al., 2016). Whereas the workarounds generated from organizational / environmental characteristics were found to be associated with insufficient training afforded to nurses to support EDS usage in this study and the literature (Ser et al., 2014; Topaz et al., 2016). A potential explanation to these findings is that: a) EDS are often designed by software developers, who have little knowledge and understanding of the complexity of nursing practice; and b) there is an underlying assumption that nurses are comfortable with technology because of the general increase in personal usage and in turn, require less training (Kaya, 2011; Stevenson et al., 2010).

Accordingly, there is a need to ensure collaboration across disciplines, health system managers, health informatics professionals, and HCPs such as nurses throughout the EDS design and implementation processes (Moen, 2003; Stevenson et al., 2010). More specifically, having sufficient representation of home care nurses (Strudwick et al., 2018) throughout the EDS design and implementation process is essential for effective uptake and usage of EDS. The lack of nursing representation, in general, in the design and development of EDS is particularly noteworthy given that they are the largest user group of such systems in practice (Raddaha, 2018; Stevenson et al., 2010).

Multi-professional collaboration is recommended and can be accomplished through two means. First, the implementation of a user-centred design approach in which health system managers, health informatics professionals, and software developers focus on the needs of nurses as the end-users when designing the EDS. Second, having software developers shadow nurses to understand the complexity of nurse's roles and in turn, inform the design of such systems that are intuitive, user-friendly and fitting with their workflow and needs (Saleem et al., 2015; Stevenson et al., 2010). Furthermore, the findings from this study highlight the importance for nursing leaders to become more actively involved in organizational and national efforts toward designing EDS (Samuels,

McGrath, Fetzer, Mittal, & Bourgoine, 2015) and providing sufficient education and training that fits with nursing practice particularly as such systems continue to evolve to play a significant role in healthcare.

Limitations

One limitation of this study is that there are different EDS being used in the home care sector, varying by home care agency in which nurses are employed. As such, there may be differences in the EDS and some of the findings may not be applicable or generalizable to all systems used in the home care sector.

Conclusion

This study sought to understand nurses' level of comfort with EDS usage and the types and reasons of workarounds employed by nurses within the context of home care. Nurses' level of comfort with EDS usage were related to individual, technological and organizational / environmental characteristics. The technological characteristics contributed to the identified development and employment of workarounds by nurses using EDS in their home care practice. The findings highlight the importance of a user-centred design approach to develop EDS; illustrated by having representation of nurses in the design and implementation processes of EDS to ensure systems are designed to fit with the complexity of nursing practice, are intuitive, and user-friendly. Such an approach may also increase nurses' comfort and avoid the development of workarounds. The findings also highlight the importance for leadership and organizations to conduct preliminary assessments of nurses' level of comfort with EDS usage prior to training and implementation. Through such assessments, appropriate education and strategies may be placed prior to training and full implementation of EDS in nurses' home care practice.

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Chapter 5

Exploration of nurses' experience with using electronic documentation systems in home care

An adapted version of this manuscript entitled "Exploration of nurses' experience with using electronic documentation systems in home care" by Sarah Ibrahim, Dr. Lorie Donelle, Dr. Sandra Regan and Dr. Souraya Sidani has been submitted and is under review in the Global Qualitative Nursing Research Journal.

Abstract

BACKGROUND: Electronic documentation systems (EDS) have become integral aspects of healthcare systems both nationally and internationally. Despite the growing efforts to understand registered nurses' experience with EDS usage in practice, limited knowledge exists in the context of home care.

AIMS: To explore registered nurses' experience with EDS usage in home care practice.

METHOD: A descriptive qualitative study was used. Registered nurses (N = 13) practicing in the home care sector in Ontario took part in one-on-one, semi-structured, telephone interviews. Simultaneous data collection and analysis was conducted. Data were analyzed using inductive thematic analysis.

FINDINGS: Nurses' individual, technological, and organizational / environmental characteristics were perceived to influence nurses' experience with EDS usage. Nurses also devised workarounds to overcome and address the technological characteristics of the system.

CONCLUSION: Findings highlight the importance of: a) having a role for nurses in the EDS design and implementation processes; and b) leadership (i.e., nurse educators and nurse and health system managers) fostering a supportive environment and employing the necessary technical support for nurses using EDS in their home care practice.

Keywords: Registered nurses, home care, health information technology, electronic documentation systems, and experience.

Background

Electronic documentation systems (EDS) have become integral and transformational for healthcare systems both nationally and internationally (Stone, 2014). Empirical evidence has shown that EDS have the potential to improve access and accuracy of patient health and care-related information, continuity of care and efficiency of care delivery; streamline workflow; and enhance real-time communication, collaboration and decision-making among care providers (Bowles et al., 2015; Canadian Home Care Association, 2015; Carretero, 2015; Cherry, Ford, & Peterson, 2011; Hsiao & Chen, 2016; Infoway, 2013; Jamal & Grant, 2014).

While there are noted benefits of EDS, differences in technology experience, attitude, and perceptions of EDS are influential determinants of nurses' satisfaction, intention and actual system usage in practice (Denomme, Terry, Brown, Thind, & Stewart, 2011; Kim, Le, & Yoo, 2016; Kipturgo, Kivuti-Bitok, Karani, & Muiva, 2014). Several studies have examined nurses' implementation of EDS and factors influencing nurses' satisfaction, intention and actual EDS usage in practice within acute care hospitals (Kim et al., 2016; Leblanc et al., 2012; Maillet et al., 2014; Zhang & Zhang, 2016). However, there is limited research exploring nurses' perceptions and experiences with EDS usage in the context of home care (Abu Raddaha, Obeidat, Al Awaisi, & Hayudini, 2017). Understanding home care nurses' perspectives is important because the home care sector is the fastest growing worldwide and in Canada, coupled with the projections that by 2020, two-thirds of Canadian nurses will be practicing within the community and home care sector (Canadian Nurses Association, 2013; Home Care Ontario, 2016; Institute of Medicine, 2003; Kitchen, Williams, Pong, & Wilson, 2011). The home care sector also differs from other workplace settings (i.e., acute care), which may influence and shape nurses' experience with EDS usage differently (Tourangeau et al., 2014). Additionally, nurses represent the largest group of regulated healthcare professionals (HCPs), spend the most time with patients in comparison to other providers, and are the largest user groups of EDS in practice (Cho, Kim, Choi, & Staggers, 2016; Delucia, Ott, & Palmieri, 2009; Stevenson et al., 2010; World Health Organization, 2013).

In Ontario, there are different electronic clinical documentation systems being used within the home care sector, including: Clinical Connect, Clinical Health and Related Information System (CHRIS) and interRAI (Clinical Connect, 2016; Ontario Association of Community Care Access Centres, 2013). As such, understanding nurses' experience with EDS usage in practice is imperative because such systems cannot contribute to improving access to patient health and care-related information and support the quality of care delivery if they are not used as intended; rendering them of little value (Oye, Iahad, & Ab-Rahim, 2012). Therefore, the research question guiding the study was: What are registered nurses' experiences with EDS usage in the home care sector?

Methods

Design

A qualitative descriptive study (Sandelowski, 2000) was conducted as part of a larger investigation of home care nurses' intention to use EDS, which has been reported separately (Chapter 3). A qualitative descriptive design was employed because it allows for a comprehensive understanding of specific experiences directly from those experiencing the phenomenon under investigation (Bradshaw, Atikinson, & Doody, 2017). The Institutional Research Ethics Board approved the research protocol (REB approval #: 109426).

Sample

Registered nurses working in the home care sector were the target population for this study. Nurses were eligible to participate in the study if they were: a) registered with the College of Nurses of Ontario (CNO); b) employed part time or full-time in-home care settings; c) coordinating or providing direct patient care; and d) had participated in the online survey and agreed to take part in the qualitative interviews. Registered nurses were excluded if they reported being in managerial positions, self-employed or concurrently working in both acute and home care sectors. A convenience sampling method was employed (Etikan, Musa, & Alkassim, 2016). According to empirical research, a minimum approximated sample size of 12 participants is recommended for qualitative

interviews studies (Guest, Bunce, & Johnson, 2006). The final sample was determined based on the evidence of data saturation (Saunders et al., 2018).

Recruitment of Participants

Nurses who took part in the quantitative phase of the larger study (online survey) were asked to provide their contact information if they were interested in taking part in a one-on-one, telephone semi-structured interview to discuss their perceptions of using EDS in home care practice. A convenience sampling method was employed (also referred to as a volunteer sample), which is a type of non-probability or non-random sampling technique that involves drawing on a sample representing the target population that are willing to participate and easily accessible (Etikan et al., 2016; Sekaran & Bougie, 2010). Although there are advantages of using a convenience sampling method (i.e., offers a breadth of information, easy access to participants and affordability) (Gray, Grove, & Sutherland, 2016; Polit & Beck, 2012; Rebar, Gersch, Macnee, & McCabe, 2011) one of the main disadvantages is the limited ability for the researcher to control for biases (i.e., under or over-representation of a particular group within the sample) (Gray et al., 2016; Mackey & Gass, 2005; Polit & Beck, 2012).

A total of 80 nurses, from the quantitative phase, had expressed an interest; however only 58 nurses had provided their contact information. The researcher contacted all potential participants by email to further explain the details of the qualitative study and to provide them with a letter of information. Some participants did not respond following several attempts of contact. Written consent for the interview and audio-recording of the interview was obtained from all participants.

Data Collection

The data collection procedures in qualitative descriptive research often involve semi-structured interviews (Stanley, 2015). The use of interviews enables researchers to explore, in depth, the phenomenon of interest with participants; supporting the emergence of themes and contributing to the richness of the data (Doody & Noonan, 2013). As such, one-on-one, telephone, semi-structured interviews were conducted. A telephone

interview was selected because of the following benefits: a) reducing cost associated with travelling and in turn, increasing convenience in participants partaking in the study; b) mitigating the physical distance between participants and the researcher; c) allowing for the participation of nurses located in different geographic areas of the province; and d) reducing the power between the researcher and participants. This is because the absence of face-to-face interactions may reduce response bias (i.e., social desirability) as the participant and researcher are less affected by one another's presence, maintains a level of anonymity and privacy as well as decreases social pressure, which may increase participants' overall level of comfort and yield for a more relaxed and opened interview (Farooq, 2015; Holt, 2010; Mikecz, 2012; Trier-Bieniek, 2012; Vogl, 2013).

The interviews were 30 to 60 minutes in duration. A semi-structured interview guide was used to allow participants to freely express their thoughts and experiences with EDS usage in their home care practice (Sandelowski, 2000). Further, the semi-structured interview guide also afforded the researchers with direction about the various aspects to be explored (Bradshaw et al., 2017). The semi-structured interviews were audio-recorded and transcribed verbatim. The semi-structured questions evolved to generate greater inquiry into themes (i.e., training, workarounds, and ways in which nurses provided feedback about the EDS design) that emerged from the interviews. A sample of the interview questions are presented in Table 12. Participants were offered a $20 gift card as a token of appreciation for taking part in the interviews.

Table 12. Sample of Semi-Structured Questions

1. Describe your initial experience with using electronic documentation systems in your home care practice.
2. What would facilitate and/or hinder your intention to use electronic documentation systems in your home care practice?
3. Did electronic documentation systems change/influence the way you communicate, collaborate and make patient-related decision making? How?
4. How or in what way do patients influence your intention to use electronic documentation systems during your patient-interactions?
5. Have you developed any workarounds when using electronic documentation systems? And if so, why?
6. How do you think nurses' personal characteristics, such as one's age, level of education, and technology experience influence intention to use electronic documentation systems in home care practice?

Data Analysis

Data analysis in qualitative descriptive research designs are derived directly from the data (Lambert & Lambert, 2012). As such, simultaneous data collection and analysis were conducted to accommodate the emergence of codes and themes (patterns) from the data (Vaismoraid et al., 2013). Identifiable information (i.e., participant name, name of employment agency or coworkers) were removed from participant transcripts to ensure audio-recordings could not be traced or associated to any participant. An inductive thematic analysis was conducted.

The six phases of thematic analysis as outlined by Braun and Clarke (2006) were applied to identify, analyze, describe and report the data. The six phases were: 1) *familiarizing with the data* through: transcribing the data, examination of the data line by line and repeated reading of the data (both hard and electronic copies) in an active way (i.e., noting some initial thoughts and ideas); 2) *generating initial codes*, that is, code for as many potential patterns / themes and collate the data relevant for all the codes; 3) *searching for themes*, sort the codes into potential themes and collate the data within each respective theme; 4) *reviewing themes*, which involved the refinement of the themes (i.e., some potential themes may not be real themes as there was insufficient data to support them; and combining or breaking down themes) in relation with the text data and the coded extracts, lending to a solid understanding of what the themes were, how they fit

together and explained the phenomenon of interest; 5) *defining and naming themes*, which involved defining and refining the themes (i.e., determining sub themes was necessary for some of the themes and asking oneself why) and determine which aspects of the text data provided the narrative for the respective themes; and 6) *producing the report*, involved the final data analysis and write-up which summarized the themes, supporting narrative from the text data as examples to represent the respective themes, and relating the data analysis to empirical evidence and the research question. NVivo (Version 11) (NVivo, 2012) was used to facilitate the analysis.

The transcripts were independently reviewed and coded by the first author. All transcripts were read and reviewed by the second author. To ensure trustworthiness, the following strategies were employed: reflexivity, interview and step-wise techniques, peer-debriefing, investigator triangulation, code-to-code procedures and thick description (Anney, 2014). For example, the researchers reflected upon their backgrounds, biases and potential influence towards the data analysis. The first author has quantitative research experience and is coming from a lens that is influenced by the Unified Theory of Use and Acceptance Model (UTAUT). The second author has extensive clinical and research experience with health and nursing informatics among HCPs and patients. This process better prepared the researchers in acknowledging their positionality and in turn, creating transparency in relation to the data analysis processes (Krefting, 1991). Coding and analysis were discussed between the first and second author. Further, any discrepancies regarding the data and emergent themes were resolved through consensus between the authors. The overall emerging themes were discussed and approved by all authors.

Findings

Sample Characteristics
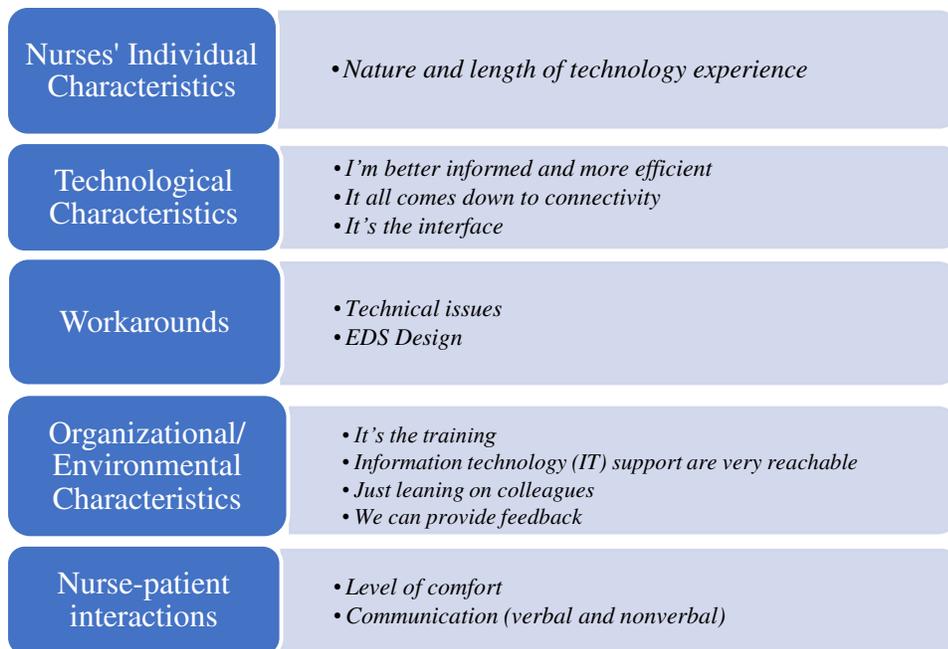
A total of 13 nurses were interviewed. The majority of participants were female (92.3%) with an average age of 53.15 years (range 34-65). Most nurses reported being in the role of care coordinator (n=10, 77%) and three (23%) were direct patient care providers. Ten (77%) of the nurses reported working full-time. All participating nurses reported using EDS in their home care practice.

Themes and Subthemes

A total of five themes emerged from the analysis of the data; each theme reflected an aspect of home care nurses' experience with EDS usage. The themes reflected factors that influenced nurses' EDS usage and strategies to overcome and address the technological characteristics of the system. The factors were: 1) individual characteristics; 2) technological characteristics; 3) workarounds; 4) organizational / environmental characteristics; and 5) nurse-patient interaction (Figure 3).

Figure 3. Themes and Subthemes of nurses' experiences with EDS usage in home care practice

Nurses' Individual Characteristics	• *Nature and length of technology experience*
Technological Characteristics	• *I'm better informed and more efficient* • *It all comes down to connectivity* • *It's the interface*
Workarounds	• *Technical issues* • *EDS Design*
Organizational/ Environmental Characteristics	• *It's the training* • *Information technology (IT) support are very reachable* • *Just leaning on colleagues* • *We can provide feedback*
Nurse-patient interactions	• *Level of comfort* • *Communication (verbal and nonverbal)*

Theme 1: Individual Characteristics

This theme described the influence of registered nurses' individual characteristics on their overall experience with EDS usage in their home care practice. The theme that illustrated nurses' individual characteristic was the nature and length of technology experience. This theme is consistent with the content analysis from the quantitative phase, in which it was found that nurses with more technology experience reported being more comfortable with using the EDS in their respective home care practice (Chapter 4).

Nature and length of technology experience. Nurses reported that having technology-related experience, knowledge and skills contributed to their positive and favourable experience with EDS usage. More specifically, having the personal (for younger nurses) and / or professional (for more experienced nurses) experience reportedly allowed nurses to understand, navigate, and proficiently use the EDS in their home care practice. Participating nurses explained that with personal and / or professional experience, they were able to apply and assimilate their knowledge and skills attained from general technology usage, similar systems and various clinical settings towards EDS usage; supporting workplace digital usage. For example, a nurse stated:

> "I've used electronic documentation systems since the 90s. Just software things. You know, how do you use that, just comfort with software." (Participant 9)

For those participating nurses who reported to having limited technology experience, they expressed having a more negative experience with EDS usage. Nurses explained that this negative experience was related to the lack of comfort and in turn, high levels of anxiety and stress associated with having to learn and master EDS usage in a home care setting. Regarding the influence of technology experience, participating nurses made the following comments:

> "I think I would have to say when I look at the younger staff who have no issues with using anything electronic, I had always considered myself to be fairly comfortable, but I certainly can see that I'm not as comfortable as they are, when they were raised with, as babies, using these things practically." (Participant 13)

> "I do know one person who was in orientation at the time I was. When she was just struggling during the orientation and about a month after, she actually resigned because she just said, "oh my God, I can't, I just can't, every time I think I'm doing something, I'm in the wrong place and putting a note in and then it's gone because I didn't save it properly," And so, she decided that just wasn't for her and she actually went back to the hospital." (Participant 6)

Theme 2: Technological Characteristics

This theme described the influence of the technological characteristics on registered nurses' overall experience with EDS usage in their home care practice. The three subthemes were: I'm better informed and more efficient; it all comes down to connectivity; and it's the interface. The findings related to the influence of the technological characteristics is also consistent to the quantitative findings. More specifically, it was found that performance expectancy, effort expectancy, and technical-related issues (i.e., connectivity) influenced nurses' level of comfort and / or intention to use EDS in their home care practice (Chapters 3 and 4).

I'm better informed and more efficient. The majority of nurses reported that EDS usage positively influenced their work performance and enhanced their communication, collaboration and patient-related decision-making experience. More specifically, EDS usage was said to have enhanced nurses' performance, communication and collaboration by: a) having legible, organized, and comprehensive documentation; b) improved and timely access to accurate, complete and up-to-date patient health and care-related information regardless of physical location; c) being better informed at the point of care resulting from real-time access to patient health and care-related information, procedure and test results, interventions, referrals and orders; and d) the convenience, portability (i.e., EDS usage in various settings such as hospital, patient's home, nurse's car, agency office, and parking lot) and efficiency of the system (i.e., documenting at the point of care, less time spent documenting by hand and transferring notes). Participating nurses expressed:

> "I'm better informed, number one. I'm also, I'm more efficient in a way. I get my job done quicker than I used to in the old days when I would write notes. Then I would go back to the office and then transcribe my notes, even though they were very point form, it still was kind of doing double duty. Now, I write my notes right up in client's homes. My assessment is pretty close to being complete before I leave a client's home." (Participant 12)

> "We have multiple people accessing the same file at the same time- it's just communicating with people like if I'm out on a home visit or out in the community and do a documentation, the office staff can read my

documentation and know what I'm planning, what I'm doing. And so, it facilitates that communication with the rest of the team." (Participant 10)

"We're more accessible to each other, because we're in community and we're on our own, the ability now to reach each other via email. Also, the ability to pull up and see what we're doing versus relying on having to go to somebody and have them answer the phone and be able to tell us what we need to know in terms of orders…so I think that has really made a big difference." (Participant 13)

It all comes down to connectivity. The majority of nurses indicated experiencing technical issues with EDS usage in their home care practice. The technical issues were reportedly related to poor or lack of Internet connectivity, unscheduled EDS downtime, and the EDS slowing down or not working. The resultant technical issues were often experienced by nurses in rural and remote areas and less often in the agency offices. The technical issues were said to negatively influence nurses' experience with EDS usage in their home care practice because the technical issues hindered their ability to work, access patient health and care-related information, communicate with allied HCPs, and document at the point of care; compromising care delivery and patient-related decision making. Nurses noted:

"The other negative to it... that the system goes down and then you're blind really…That impacts the work and it impacts the patients because you can't help them, can't service them and then we try and revert to what's called a downtime system and that takes even longer because they are all separate papers that you have to fill out and now you're faxing things to people, specifically, because we have to get the service in the homes. And it's just chaos." (Participant 9)

"If the connectivity went down and I was actually physically in the office, it would still be a problem. But yeah, you can't do anything. So, we can't even—so we had an issue like this a few weeks ago actually where our internal server had gone down, and people didn't even want to answer the phones. So, because you can't access client files, you don't want to pick up a phone call because there's nothing you can do about the information that the person is going to say to you anyways. You can't open the file, you can't book an appointment, you can't do any of that stuff. So, it would be definitely the fact that it all—if the web, if the internet goes down, web access goes down then you are kind of stuck." (Participant 11)

It's the interface. Nurses reported both positive and negative experiences with EDS usage in their home care practice based on the overall system design. For those that expressed having a positive experience, this was related to the system: a) being user-friendly, easy to navigate, intuitive, and free of complications; b) being able to interface with other systems; and c) fitting with nurses' workflow and needs. Nurse participants expressed:

> "We can access the region files a little bit easier because everything is interfaced in the one program." (Participant 1)

> "…once you're used to it and you just work through, you know, from left to right, through those tabs, as you're entering information. It's designed in very logical and sequential manner." (Participant 6)

The nurses' negative experience with EDS usage was reportedly related to the overall system design, specifically: a) not being designed in a user-friendly manner (i.e., too many tabs to navigate through) and not fitting with nurses' workflow and needs; b) not capturing or reflecting nurses' professional judgement; and c) not interfacing with other systems. Nurses expressed:

> "There are real challenges with the interface. So, how it communicates with our partners etc. It takes a lot of practice and even after five years of using the system, I still at times struggle with how to get the right message out to our service providers, our partners, or whoever." (Participant 3)

> "So, based on how you answer the assessment questions, it creates an algorithm and it creates a score and so, now the home care agency have decided if you're in the low score or the medium score, you go on a wait list for services. If you're in the high, you can get maybe two hours of personal support and if you're in the very high, you can maybe get seven, right. The thing is, is that if you don't have cognitive issues, you score very low, but your ADL needs are really high, but you still don't get the service. So, you're always having to fight with the supervisors to get service because even though the score is low, I mean for example, we had a paraplegic who was basically bedridden and needed all kinds of physical care and didn't score high enough to even get service and we said, this is insane. But and that's where it goes bad, is when they rely on numbers instead of the nurses' professional assessment for giving service." (Participant 9)

Theme 3: Workarounds

This theme described the workarounds developed by nurses when using the EDS in their home care practice. Workarounds are temporary behaviours and / or practices by end-users to overcome technology-related limitations (Creswell et al., 2013). The reported workarounds resulted from nurses' negative experiences with the technical issues (i.e., poor connectivity, unscheduled EDS downtime, slow function of EDS and the system being compromised) and shortcomings in the system design. The reported workarounds are consistent with the findings from the quantitative phase in which it was found that technical and usability (i.e., design) issues contributed to the development and employment of workardounds by nurses while using EDS in their respective home care practice (Chapter 4). To address the technical issues, the workarounds nurses developed included: a) downloading all patient-related documents to have a backup hard copy of the information; b) writing notes on paper and / or in a Word document at the point of care and transferring information to the EDS at a later point in time; c) developing a cheat sheet of all key questions from the assessment tools; d) using "downtime forms" developed by the agency; e) using the "offline" option in the EDS when working in remote areas; and f) using phones to coordinate and deliver care when the system was compromised. Nurses described the workarounds they developed as follows:

> "If I can't open [the system] in the home or it freezes in the home, I have made my own workaround for, I made a laminated sheet to remind me and then I can take some notes." (Participant 10)

> "I'll open different documents and then I don't lose them because they're already there, I don't lose them when I lose my connectivity so no big deal. Also, I write my notes in Word so I can still—so, I've uploaded the template that I need into a Word document and I do everything in Word and then I transfer it into our documentation system that all can access it. But I just find, because if I lose the documentation system right in the middle of something, I lose everything, and I can't get it back. Whereas, I don't lose a Word document." (Participant 12)

The workaround developed to address shortcomings of the EDS design were related to data entry. More specifically, nurses reported having to enter data in a specific way to generate a certain score that was reflective of the patients' needs and care required. This shortcoming was said to be "quite frustrating" as some nurses indicated that their professional judgement was being replaced by the algorithm embedded within the EDS. For example, a nurse stated:

> "You really have to be thoughtful in how you score people and that… Like what are the triggers or what are the identifiers that trigger the system to influence the outcome… Because certain things about the program, if you are mentally capable but physically heavy care, you do not score the same as someone who is suffering from dementia but mobile." (Participant 4)

Theme 4: Organizational / Environmental characteristics

This theme described the influence of the organizational / environmental characteristics on nurses' overall experience with EDS usage in their home care practice. The four subthemes were: it's the training; information technology (IT) support is very reachable; just leaning on colleagues; and we can provide feedback. The findings related to the organizational / environmental characteristics are consistent with the quantitative phase in which it was found that social influence (i.e., peer support) and facilitating conditions (i.e., EDS training and readily available IT support) directly and positively influenced nurses' intention and level of comfort with using the EDS in their home care practice (Chapter 3 and 4).

It's the training. Nurses reported receiving training during orientation and on an ongoing basis when upgrades were made to the EDS. Training ranged from three hours to two weeks and was delivered by an interdisciplinary team (i.e., nurses, physical and occupational therapists, social workers, IT personnel and education specialists). Training was delivered through different mediums: webinars, e-mail, and classroom, and in both passive (i.e., lecture) and interactive (i.e., hands-on practice) means. The training was reportedly geared towards nurses learning how to operate the system, understand the features (i.e., tabs, sections, templates and shortcuts), documentation, ordering and referral procedures.

Nurses had various opinions about the training and its influence on their experience. Overall, participating nurses were satisfied with the training received and expressed that it positively influenced their EDS usage experience. This finding was prominent among nurses who had a longer training period (i.e., two weeks), that was interactive and delivered through different mediums. Through such training, nurses reported that their learning needs were met and that they had adequate time to attain mastery of using the system, which was reflected in the following manner:

> "There's weeks of orientation for new people including classroom as well as pulling up a chair beside someone and actually working through with someone else looking over your shoulder. And when there are major computer upgrades within the training environment, often each person has a computer, so that you actually work through the steps while the trainer is saying, you know, click on this tab, and you do the same in yours just to make sure that you're comfortable with it seeing the same thing." (Participant 6)

Some nurses on the other hand reported being dissatisfied with the training received; negatively influencing their EDS usage experience. This was noted by nurses who had a short training period (i.e., three hours) that was passive, with limited time to attain proficiency and mastery of the necessary knowledge and skills to competently use the system in their home care practice. Nurse participants indicated:

> "It was provided like very quickly. The rollout was let's get everybody trained as fast as we can. Because we were all at different levels of computer usage, it should've been, I felt, individualized to the person's ability to use a computer, never mind use this documentation system." (Participant 13)

> "…Could be a little bit more because it was overwhelming trying to know where to go for certain things." (Participant 1)

IT support is very reachable. All nurses reported having a positive experience with the availability of IT support while using EDS in their home care practice. The positive experiences were associated with: a) nurses receiving adequate IT support, regardless of their physical location (i.e., agency office and patient's home) and time of the day; b) having issues resolved within a timely manner (i.e., 30-60 minutes); and c) having access to organizational resources (i.e., documents, summary notes, and cheat sheets) made

available through the respective organization's Intranet. Such experiences were captured by the following nurses:

> "IT support is really good, for sure, yeah, I mean any time we have any issues they're on it all the time and let us know a lot through emails if some functions of the system are down or anything so communication's really good." (Participant 1)

> "IT support are very reachable. And they are there 24 hours if I would be working after hours and have a major issue, they're there. So, they are excellent and then they can, they just get onto my screen and they just do whatever they need to do. I don't have to verbally do stuff with them, so they just jump onto my screen and look after that, so they are very good." (Participant 8)

> "We can go to our intranet and find those documents to walk me through the a, b, c, d. So, they set that up very, very easily. Like this morning I hadn't done an assisted living application in a year, I had no idea how to process that, so they walked me through the software… So, it's been very good you know, the how to set the A-Z for every process, so every new user, I could get how do I do a referral to a pathologist, so they can go in and get that workflow sheet for any process because we do so many processes. They've been very good about where I find the information to walk me through the software." (Participant 10)

Just leaning on colleagues. Nurses indicated that they received a significant amount of support from their colleagues to help them use the EDS, navigate data entry approaches, and come up with shortcuts. Some nurses also reported having champions in their agency to offer assistance and support when a need was expressed. The champions were nurses who were comfortable and well experienced with technology and EDS usage. Through such a collaborative and supportive approach, nurses had a positive and favourable experience with system usage in their home care practice. For example, nurses expressed:

> "The problem that most often comes up is how do I do a certain task that I don't do very often and that's when we lean on each other or someone else who's done it more recently." (Participant 3)

> "My colleagues are really helpful. I'm on the older end of the spectrum and I find that my younger colleagues are really, really helpful." (Participant 12)

We can provide feedback. The majority of nurses indicated that they had the opportunity to provide feedback towards the EDS design. Further, some nurses reported having their feedback incorporated into the system upgrades. The feedback provided by nurses for the design of the EDS were associated with: a) features (i.e., including back arrows and templates); and b) layout (i.e., presentation of information, categories and labels) to make it more user-friendly. Nurses stated:

> "They've certainly made improvements over the time, absolutely. Some of the things I've asked for, well I'm still waiting for that little curly cue to go backwards… I think they're listening to us and making improvements." (Participant 12)

> "We get an opportunity when we do our education or as things come up, we do have an opportunity to say I don't think this works as well or we are able to make suggestions or enhancements or changes to the program. That goes forward to a provincial committee and its sort of determined if it's something that affects the whole province, all the users provincially, they might change it. If it's just for us, not likely it would be changed. But you do have an opportunity to bring forward any ideas or suggestions you might have to make improvements or changes." (Participant 4)

Theme 5: Nurse-patient interactions

The majority of nurses indicated that their interaction with patients amidst EDS usage influenced their experience. The influence was associated with both patients and nurses' level of comfort with EDS usage during the interactions. Some nurses commented that patients felt they were not receiving the necessary attention, did not have the nurses' undivided attention, were not being heard as the nurses' attention was geared more towards the EDS, and the interaction was impersonal. For example, a nurse expressed, "I think people feel if you're not making eye contact, you're not listening to their story" (Participant 4). Some nurses commented that they had to find a balance with maintaining eye contact, not focusing all of their attention towards the system, and being mindful of their body positioning with the laptop and EDS usage during sensitive conversations with patients. Nurse participants expressed:

"Yeah, you are not making eye contact. I mean I do, do some of the assessment by clicking, I don't, you know, type at all during a home visit. I'll do check screens, but not—like I don't do big notes. That part is a little tricky because they always say you shouldn't have the laptop between yourself and the patient when you are doing the interviewing because then it makes them feel like you're not really listening to them if you're typing at the same time." (Participant 10)

"Well, I used to work in the community and I found it very impersonal when I would go to a home and I would have to sit my laptop up and ask all these questions and type it in when I'm sitting beside the person, instead of making eye to eye contact because my way of nursing has always been you assess the person while you're talking to them and you pick up queues with regards to pain or you pick up queues if their emotional state is different or anything like that, but when you're so focused on this computer program and a generic questionnaire that some things don't even relate to them, I find that it really hinders how you develop a relationship with your patients." (Participant 9)

Discussion

In this study nurses' experiences with EDS usage in their home care practice were related to nurses' individual, technological and organizational / environmental characteristics as well as nurse-patient interactions. The findings are consistent with that of the quantitative phase in which it was found that nurses' individual (i.e., technology-related experience), technological (i.e., performance and effort expectancy as well as technical shortcomings), and organizational / environmental (i.e., social influence and facilitating conditions) characteristics influenced nurses' intention and / or level of comfort with using EDS in their respective home care practice (Chapters 3 and 4). Nurses also devised workarounds to address the shortcomings from the technological characteristics.

Nurses' individual characteristics

The nature and length of nurses' technology experience reportedly influenced their experience with EDS usage in home care practice. Nurses with more personal (often younger nurses) and / or professional (often experienced nurses) technology experience reported having a more favourable EDS usage experience in practice. Although there is

limited empirical evidence exploring the influence of nurses' individual characteristics such as technology experience on nurses' intention, experience and actual EDS usage, this finding is in alignment with the existing literature. For example, van Howelingen et al. (2015), Aldosari, Al-Mansour, Aldosari and Alanazi (2018), Dharmarajan and Gangadharan (2013) as well as Tubaishat (2017) found that nurses with more technology experience (in comparison to those with less) were more comfortable, accepting of and had a more positive perception of the perceived ease of use and usefulness of the HIT in practice. Leblanc et al. (2012) also found that technology experience moderated the relationship between nurses' intention and actual usage of HIT in practice; such that those with more experience had higher intention to use the HIT in practice.

A potential explanation for this finding is that historically, nursing programs did not include nursing informatics in the curricula because EDS were not as well integrated in practice. Within schools of nursing, there was a lack of health informatics education and awareness of the technology-related skills and knowledge nurses were required to attain (Borycki, Joe, Armstrong, Bellwood, & Campbell, 2011). As such, some nurses (often those that were older) were less likely to attain adequate nursing education related to HIT and EDS; possibly contributing to job stress and anxiety, and influencing practice competence (Valencia & Raingruber, 2010). Although inconsistencies with the integration of nursing informatics in nursing curricula have been noted in the literature (Hunter, McGonigle, & Hebda, 2013), today, educational institutions have recognized the importance for nursing informatics competencies and the need for increased learning opportunities for nursing students within nursing education (i.e., courses and simulation laboratory exercises) and clinical practice (CASN, 2013). Further, in general, younger nurses, who are often referred to as digital generation nurses, have grown up with more access and exposure towards technology (Singh & Senthil, 2015). Such exposure may potentially influence younger nurses' overall level of comfort, technology-related literacy, skills and knowledge in comparison to older nurses who did not grow up within a technology-driven environment.

Technological Characteristics

Mixed findings were reported regarding the overall influence of the technological characteristics on nurses' experience with EDS usage. Nurses reporting a positive experience with EDS usage, indicating that the system influenced their performance, communication, collaboration and timely access to patient health and care-related information. This finding is in alignment with other studies examining nurses' attitude, acceptance, willingness, intention and actual HIT usage in acute and home care sectors (Chung, Ho, & Wen, 2016; Ifinedo, 2016; Kim et al., 2016; Kummer et al., 2013; Sharifian et al., 2014; van Howelingen et al., 2015; Vitari & Ologeanu-Taddei, 2018). For example, van Howelingen et al. (2015) and Vitari and Ologeanu-Taddei (2018) found that perceived usefulness (also referred to as performance expectancy) and perceived ease of use (also referred to as effort expectancy) of the technology were strong predictors of nurses' willingness and intention to use a home telehealth system and electronic health records in practice respectively. Further, Chung et al. (2016) found that perceived usefulness positively and significantly affected nurses' intention to use patient personal health records in practice.

Nurses who did not have a favourable experience with EDS usage related it to the technical issues, the EDS design and lack of training afforded to them by their provider agency. The findings are in alignment with empirical evidence about nurses' perception, satisfaction, concerns, barriers, and facilitators of HIT and EDS usage in practice (Black Book Market Research, 2014; Saleem et al., 2015; Singh & Muthuswamy, 2013; Sockolow, Liao, Chittams, & Bowles, 2012; Stevenson et al., 2010; Strudwick et al., 2018; Topaz et al., 2016; Wright, 2014). For example, nurses working in community-based healthcare settings in Philadelphia were unable to fully utilize the EDS as intended because of the poor system usability and navigation (Sockolow et al., 2012). Further, Strudwick et al. (2018), Topaz (2016), and Zhang et al. (2016) reported that the EDS functionality, usability, interoperability, and navigation were reported as barriers; negatively influencing nurses' work practice, satisfaction, patient care delivery, perception and EDS usage. Additionally, Singh and Muthuswamy (2013) and Wright

(2014) noted that nurses attributed barriers to EDS usage in practice to insufficient training on the information technology system.

Workarounds

Some nurses reported employing workarounds with EDS usage in their home care practice. The workarounds resulted from the technical issues and EDS design. The reported workarounds in this study are in alignment with those reported in the literature. For example, Blijileven, Koelemeijer, Wezels and Jaspers (2017), found that nurses resorted to writing down information on paper when the EDS was inoperable and having to copy and paste data because of challenges with standardized data entry templates. Similarly, Cifuentes et al. (2015) found that HCPs developed workarounds (such as the use of multiple systems) related to system challenges (such as the inability to track and document pertinent patient health information as well as support communication and coordination among HCPs, and interoperability with other systems). The use of workarounds may improve workflow and efficiency for nurses but is often an indication that the system design is not supportive to end-user's practice (Debono et al., 2013). A potential explanation to the development of workarounds by nurses is that such systems are often designed by software developers and non-nursing personnel who have a limited understanding of nursing practice (Stevenson et al., 2010).

Organizational / Environmental Characteristics

Organizational / environmental infrastructure, training, information technology (IT) support, availability of organizational resources, peer social support, and the ability to provide input towards the EDS design were reported to influence nurses' experience with EDS usage in their home care practice. These findings are in alignment with those of other studies examining nurses' attitude, intention, acceptance and HIT usage in practice (Bennani & Oumlil, 2014; Chung et al., 2016; Kim et al., 2016; Kummer et al., 2013; Leblanc et al., 2012; Sharifian et al., 2014; Song et al., 2015; Strudwick, 2015; Zhang et al., 2010). For example, peer-support through provider champions was preferred by clinicians (i.e., nurses and allied HCPs) 78% of the time in a not-for-profit integrated health delivery system (Dastagir et al., 2012). Additionally, Sharifian et al. (2014) found

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that social influence and facilitating conditions had a statistically significant and positive influence on nurses' utilization of hospital information systems. This finding was further corroborated by van Howelingen et al., (2015) where social influence was found to be a significant predictor of nurses' motivation to use a home telehealth system in practice.

Nurse-patient interactions

The majority of nurses expressed being mindful of patient's needs (i.e., emotional state) and importance of communication amidst EDS usage in their practice. A few researchers have considered the potential influence of the interaction between HCPs (i.e., nurses, nurse practitioners and physicians) and patients with EDS usage and noted similar findings to this study. Rose, Richter and Kapustin (2014) conducted a qualitative phenomenological study and reported that maintaining eye contact during interactions was important to patients as it provided a sense of personal connection, being cared for and not ignored. Ajamai and Bagheri-Tadi (2013) on the other hand found that physicians and nurses were unintentionally spending more time interacting with the EDS than with patients during visits. The clinicians saw and understood the value of the face-to-face interaction with patients and decided to write down notes during interactions and transferring the information into the EDS at a later point in time. Though such an approach increased documentation time for clinicians, it was reported to be offset by the enhanced quality of care and increased time spent with patients. Similar challenges were noted by Duffy, Kharasch and Du (2010); they found that nurses were distracted with the EDS during patient interactions; with more than 60% of their time with patients being spent on the system. Further, there were reports of extended periods of silence, reduced eye contact and "time out" episodes in which nurses had to manage the system during interactions (Duffy et al., 2010).

Implications

The findings from this study have several practice, policy, and research implications. Specific to *practice*, it is important for the EDS design to appropriately fit with nursing practice. This is because home care nurses practice in demanding and complex environments and are the largest user-groups of EDS (Cho et al., 2016); highlighting the importance for such systems to facilitate their work rather than add to it (Nimako, Azumah, Donkor, & Adu-Brobbey, 2012). Designing EDS that fit nursing practice can be achieved by: a) having software developers understand (through shadowing, observing and engaging in dialogue) the complexity of the role, needs and workflow of nurses; and b) having a role for home care nurses at the decision-making table during the design, procurement and implementation of EDS in practice (Hagedorn, Krishnamurty, & Grosse, 2016; Moen, 2003; Saleem et al., 2015; Stevenson et al., 2010; Strudwick et al., 2018). Additionally, it is imperative for nurse educators and nurse and health system managers to foster a supportive environment and organizational culture that leverages peer and IT support to using the EDS as intended and designed as well as help address technical challenges that may arise from system usage in practice (Gagnon et al., 2012). This is particularly important for nurses working in the home care sector because of the differences in working environment (which are not conducive and designed for delivery of health care services) and the availability of resources in comparison to nurses employed in the acute care sector (Lundy & Janes, 2014; Tourangeau et al., 2014).

Specific to *policy*, it is important for nurse and health system managers and educators to develop best practice guidelines for the provision of adequate education and training to nurses prior to EDS implementation as well as ongoing when system updates are made. Basic computer training sessions for nurses that express a lack of technology experience could also be offered (Tubaishat, 2017). Through such sessions, nurses may attain the necessary technology-related skills and understanding that can be applied and transferred to EDS usage in practice; enhancing their perception and overall experience with such systems. The focus of the training should also extend beyond nurses simply learning how to use the system and focus on EDS usage during patient interactions (Rose,

Richter, & Kapustin, 2014). The training may focus on: a) nurses' verbal and nonverbal communication (i.e., maintaining eye contact) during documentation; b) positioning of the laptop or tablet between the nurse and patient to eliminate a barrier between them; and c) interspacing documentation and patient assessments and conversations (Rose et al., 2014; Zhang et al., 2016).

Specific to *practice*, nurses should foster a collaborative documentation approach with patients during system usage (Rose et al., 2014; Zhang et al., 2016). More specifically, nurses may: a) explain and show (through screen sharing) patients the EDS and way in which it tracks the patient's progress based on the data and information entered; and b) collaboratively read the information entered and presented into the EDS with the patient as a means of educating patients (through sharing visual information, test results and / or images) and reducing extended periods of silence (Rose et al., 2014; White & Danis, 2013; Zhang et al., 2016). Such approaches have been reported to improve quality of care and enhance patient engagement in decision making and care delivery (White & Danis, 2013; Zhang et al., 2016). Additionally, it is imperative to continue to integrate informatics competencies within nursing programs (i.e., through courses and simulation exercises) to enhance the technology-related knowledge and skills of future nurses and in turn, position them to be successful users of such systems in practice (Tubaishat, 2017).

Specific to *research*, seeing as this was the first study, to our knowledge, that explored nurses' experience to EDS usage in the context of home care in Ontario, further research in this area is warranted. Future research may include: conducting focus groups with nurses to further explore and understand their experiences, satisfaction, level of comfort, facilitators and barriers that influence their EDS usage in home care practice. Additionally, observational studies may be designed to observe how EDS usage influence nurse-patient interactions in home care practice. As well, longitudinal research studies may be designed to explore how nurses' experience, intention and satisfaction with EDS usage may change over time.

Limitations

The study had two limitations. First, the experiences of the nurses that participated in this study may differ from those who did not consent to take part in the research study. However, the study sample was comparable to the CNO population. Second, despite reaching data saturation through the repetition of similar themes and topics during analysis, it is possible that not all of the information related to nurses' experience with EDS usage was communicated during the interviews that would further allow for a better understanding of nurses' experience with EDS usage.

Conclusion

Electronic documentation systems remain a permanent fixture within national and international healthcare systems to improve timely access to up-to-date and accurate patient health and care-related information, patient-related decision making and patient health outcomes. This study was the first study, to our knowledge, that sought to understand nurses' experiences with EDS usage within the context of home care. Nurses' experience with EDS usage in their home care practice was found to be influenced by nurses' individual characteristics (i.e., nature and length of technology experience); technological characteristics (i.e., system design) that influenced nurses' work and performance, communication, collaboration and patient-related decision making; employment of workarounds; organizational / environmental characteristics (i.e., training, peer / social support, IT support, availability of organizational resources); and nurse-patient interactions. Understanding nurses' experience with EDS usage may inform leadership (such as nurse and health system managers and nurse educators) and software developers of strategies that can be employed to foster a positive experience and in turn, position nurses to be successful users of such systems (Tubaishat, 2017) particularly as they continue to become supported by technology in practice (Li et al., 2013; Qu & Sun, 2015).

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Chapter 6

Conclusion and Recommendations

Background and Study Purpose

The integration and adoption of health information technology (HIT) is revolutionizing the health care system and the way in which healthcare providers (HCPs) access and interact with health data (Rojas & Seckman, 2014). This is exemplified with the increased implementation and adoption of electronic documentation systems (EDS) in healthcare systems worldwide (Stone, 2014) and across healthcare sectors such as home care in Canada (Infoway, 2013). The goal of the implementation of such systems is to enhance documentation, timely access to patient health and care information, communication and collaboration among HCPs, patient safety and delivery of quality of care (Dowding, Turley, & Garrido, 2012; Infoway, 2013; Nguyen et al., 2014; Plantier et al., 2017). Although there are noted benefits of such systems, empirical evidence suggests that the implementation of EDS in practice does not necessarily translate to the achievement of the intended benefits (Gephart, Carrington, & Finley, 2015). The realization of the EDS benefits entail the usage of the system as intended and designed coupled with high level of acceptance by HCPs (Holden & Karsh, 2010). There have been reports of low intention and usage of HIT and EDS by nurses in practice (Hsiao & Chen, 2016; Hung et al., 2014; van Houwelingen et al., 2015).

Nurses represent the largest group of regulated HCPs in Canada (Canadian Nurses Association, n.d.) and user groups of EDS in practice (Cho et al., 2016). As such, their perception, intention and usage of the system in practice may influence the anticipated benefits (Strudwick et al., 2018). Despite the growing efforts to understand nurses' perceptions, intention and actual EDS usage in practice, there is limited knowledge in the context of home care, which is the fastest growing sector in Ontario. The purpose of this study was twofold: a) to examine factors that influence nurses' intention to use EDS within their home care practice; and 2) to explore nurses' perceptions with EDS usage in their home care practice.

In this chapter, a summary of the main study findings is presented, followed by a discussion of the implications of the findings to research, practice, education, policy, and research. The chapter will conclude with an overview of the strengths and limitations of the study.

Methods

A two-phase sequential (quantitative $\rightarrow$ qualitative), explanatory mixed methods design was employed. Health and social sciences researchers in recent years have been using mixed methods research designs, which is an approach to inquiry for collecting, integrating, analyzing, and drawing inferences using a combination of quantitative and qualitative data in one research study to attain a comprehensive understanding of human experience and behaviour (Creswell, 2014; Tashakkori & Teddlie, 2003). The reasons for combining quantitative and qualitative data is based on the assumption that quantitative and qualitative methods together are: complementary in understanding a phenomena of interest; allowing for robust analysis; allowing researchers to simultaneously address confirmatory and exploratory research questions; and the convergence of both quantitative and qualitative research mitigates the limitations of each approach (Azorin & Cameron, 2010; Creswell, 2014; Ivankova, Creswell, & Stick, 2006; Polit & Beck, 2012). Furthermore, the three main objectives of using mixed methods are: 1) to obtain a convergence of research findings; 2) to minimize alternative plausible explanations and conclusions based on the data; and 3) to elucidate the various aspects of the phenomenon of interest (Jeanty & Hibel, 2011; Johnson & Onwuegbuzie, 2004).

The philosophical underpinning of mixed methods is pragmatism (Creswell, 2014; Jeanty & Hibel, 2011). Pragmatism supports the use and integration of both quantitative and qualitative research methods within a research study and rejects the distinctions that are drawn between positivist / empiricist approach (philosophical underpinning for quantitative methods) and the constructivist / phenomenological approach (philosophical underpinning for qualitative methods) (Jeanty & Hibel, 2011; Polit & Beck, 2012). Through this philosophical underpinning, it is believed that the research questions are more important and should drive the inquiry instead of the research methods and the

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underlying paradigm (Jeanty & Hibel, 2011; Polit & Beck, 2012). The fundamental principle with mixed methods research and the pragmatic paradigm is that research methods ought to be mixed in a way that offers the best opportunity to answer the research questions and complement the strengths and non-overlapping limitations of quantitative and qualitative research methods (Johnson & Onwuegbuzie, 2004; Johnson & Turner, 2003).

There are a number of strengths of employing a sequential, explanatory mixed methods research design. First, the two-phase structure of the design is straightforward for a single researcher to implement because the phases are conducted separately and only one type of data is collected and analyzed at a single point in time (Camerino, Castaner, & Anguera, 2012; Creswell, 2014; Polit & Beck, 2012). Finally, it may provide a more complete and comprehensive understanding of the phenomenon of interest than either quantitative or qualitative research approaches alone can offer (Creswell & Clark, 2011). Combining quantitative and qualitative methods involves both deductive and inductive reasoning as well as objective and subjective data; allowing the researcher to develop an inclusive, meaningful and comprehensive understanding of the phenomenon of interest as experienced / reported by the participants. Further, it increases the overall confidence on the findings when the results converge despite the biases inherent in each method of data collection and analysis (Azorin & Cameron, 2010; Niglas, 2004; Onwuegbuzie & Leech, 2005; Tashakkori & Teddlie, 2003).

Despite the strengths of employing mixed methods research, there are some noteworthy limitations. First, the explanatory mixed methods research design is time-intensive for implementing both quantitative and qualitative phases sequentially; that is, qualitative data collection cannot commence prior to gathering and analyzing the quantitative data (Camerino et al., 2012; Harwell, 2011; Polit & Beck, 2012). Second, this research design is resource intensive because of the requirements for collecting and analyzing, separately, the quantitative (i.e., administration of survey, conducting descriptive statistics and regression analysis) and qualitative (i.e., conducting semi-structured interviews, transcribing interviews, and thematically analyzing data) data (Camerino et al., 2012; Harwell, 2011). Finally, the explanatory mixed methods research

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design can be quite costly because of the different resources (i.e., software packages for analyzing quantitative and qualitative data, and the administration of survey and conducting interviews) needed to appropriately conduct the phases (Onwuegbuzie & Johnson, 2004).

The quantitative phase (phase 1), was informed by an adapted Unified Theory of Acceptance and Use of Technology (UTAUT) model to investigate the factors influencing nurses' intention to use EDS in-home care practice. A self-administered online survey using adapted and psychometrically sound instruments was employed for data collection. Descriptive statistics and hierarchical multiple regression analysis were used to analyze the quantitative data. Further, the qualitative responses to open-ended questions included in the online surveys were analyzed using inductive content analysis. Phase 2 complemented the quantitative data to attain a more comprehensive understanding of the factors contributing to nurses' EDS usage in home care. Qualitative data were collected through one-on-one, semi-structured telephone interviews. Inductive thematic analysis was employed and followed the six phases outlined by Braun and Clarke (2006).

Summary of Results

A total of 217 nurses completed the online survey and 13 nurses participated in the one-on-one, semi-structured telephone interviews. The majority of participants were female, held a baccalaureate degree, and reported being in the role of care coordinator (55.8%) or direct patient care provider (44.2%). The majority of participants reported working full-time and had worked within the home care sector for an average of 12.74 years. The participants' personal and professional characteristics were comparable to the target population as reported by the CNO (2016).

Nurses' overall perception of EDS within home care practice

All participating nurses reported having professional technology experience and most (85.7%) nurses used EDS in their home care practice. Nurses had a moderately strong belief and favourable attitude that EDS usage would be beneficial towards their

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work performance, be easy to use and improve patient outcomes. A potential explanation to nurses' favourable attitude towards EDS usage in their home care practice is nurses' first-hand experience of the system benefits; which may include improved work performance, ability to access comprehensive and timely patient health and care-related information, and communication with allied HCPs in real-time (Chung et al., 2016; Hung et al., 2014). Further, nurses who participated in this study indicated that having the support from peers and managers in addition to a supportive organization and well-established technological infrastructure (i.e., education, training and availability of IT support) positively influenced their intention to use EDS in their home care practice.

Factors influencing Nurses' intention to Use EDS – Integration of quantitative and qualitative findings

The quantitative and qualitative findings showed that nurses' individual, technological and organizational / environmental characteristics influenced nurses' intention, level of comfort and experience with EDS usage in home care practice.

Nurses' individual characteristics

The contribution of nurses' demographic and professional characteristics, specifically age, level of education and technology experience, was not consistently identified in the quantitative and qualitative findings. The direct and indirect (i.e. moderating the influence of performance expectancy, effort expectancy, attitude, social influence and facilitating conditions) relationships of age, level of education and technology experience with intention to use EDS were not found to be statistically significant. This resulted in the rejection of the research hypotheses that age, level of education and technology experience would moderate the relationship between the independent variables and intention, such that the relationship would be stronger for nurses who had higher levels of education, more technology experience and that were younger in age. In contrast, participating nurses in the qualitative phase of the study felt that the nature and length of professional technology experience influenced their level of comfort and experience with EDS usage in practice. More specifically, participants in the

qualitative phase indicated that nurses with more professional technology experience reported a more favourable and positive experience with EDS usage in practice.

Although limited research exists exploring the influence of age and professional technology experience on nurses' intention, experience and actual EDS usage, inconsistent findings have been noted. For example, three studies found that older nurses were more resistant, less comfortable and less likely to use HIT in their respective acute care practice (Kummer et al., 2013; Singh & Senthil, 2015; Song, Park, & Oh, 2015). Whereas Gagnon et al. (2012), Leblanc et al. (2012) and Ifinedo (2016) reported that demographic (i.e., age) and professional (i.e., level of education and nursing experience) characteristics did not influence nurses' intention to use a home telemonitoring system, electronic health record system and information systems respectively in acute and home care settings. Further, Leblanc et al. (2012) and Msiska et al. (2017) did not find previous professional experience with computerized systems and computer experience to be associated with providers' EDS usage in acute care practice. Differences in research design, data collection instruments and procedures, context (i.e., acute care versus home care) and country in which the studies were conducted could account for the inconsistent findings.

A potential explanation of the nonsignificant associations between nurses' demographic and professional characteristics and intention to use EDS in practice found in this study is the increase in both personal and professional technology usage among nurses regardless of age (Kaya, 2011). Nurses are required to use technology and EDS as it has become a standard part of practice in all healthcare sectors (RNAO, n.d., Sharit & Czaia, 2017). The general increase in personal and professional technology experience among nurses coupled with the majority (96.8%) in this study reporting to having previous and / or current professional technology and EDS experience in practice may have limited the variance in this variable and attenuated the direct and / or indirect relationships with nurses' intention to use EDS in their home care practice.

Nurses' attitude towards EDS was found to have a statistically significant, positive and direct influence on nurses' intention to use EDS. This finding resulted in the acceptance of the hypothesis that attitude would have a positive and direct relationship with nurses' intention to use the EDS in their respective home care practice. This finding implies that nurses with a favourable and positive perception of EDS (i.e., its usage would improve clinical practice and patient care, save time and being a good idea to use) indicated intention to use the EDS in home care practice. This finding is in alignment with the results of numerous studies that examined nurses' perception, intention and acceptance of information technology and systems, patient health records, software applications, and telemedicine technology in both acute and home care sectors (Chung et al., 2016; Hung et al., 2014; Ifinedo, 2016; Kim et al., 2016; Kowitlawakul, 2011; Lau, 2011). Nurses personal and professional experience with technology has the potential to contribute to nurses' increased knowledge, enhanced skills, attitude, understanding and experience of the benefits of technology adoption.

Technological characteristics and nurses' intention to use EDS

The contribution of the technological characteristics, specifically performance expectancy and effort expectancy, was not consistently identified in the study's quantitative and qualitative findings. For performance expectancy, a direct and statistically significant relationship was found with nurses' intention to use EDS in-home care practice. This finding resulted in the acceptance of the hypothesis that performance expectancy would have a positive and direct relationship with nurses' intention to use the EDS in their respective home care practice. The relationship implies that nurses who perceived that the EDS would be beneficial to their performance and enhanced their productivity, had higher intention to use the system in their home care practice. This finding was corroborated by the qualitative findings. A number of participating nurses felt that the EDS enriched their communication and collaboration with allied HCPs and provided them with access to up-to-date and comprehensive patient health information; contributing to their level of comfort and experience with EDS usage in home care practice.

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For effort expectancy, the direct relationship of effort expectancy and nurses' intention to use EDS was not found to be statistically significant. This finding resulted in the rejection of the hypothesis that effort expectancy would have a positive and direct relationship with nurses' intention to use the EDS in their respective home care practice. In contrast, participating nurses in the qualitative phase of the study reported that the EDS was designed in a manner that made it easy to use and was user-friendly. The user-friendly system design was reported to positively influence nurses' level of comfort and experience with EDS usage in their home care practice. Although effort expectancy was not consistently identified in the quantitative and qualitative findings, the influence of the technological characteristics on nurses' intention, level of comfort and experience with EDS usage is aligned with findings of several studies examining nurses' acceptance, attitude, willingness, intention and actual usage of HIT such as EDS in acute and home care practice (Asua et al., 2012; Chung, Ho, & Wen, 2016; Ifinedo, 2016; Maillet et al., 2014; Phichitchaisopa & Naenna, 2013; Sharifian et al., 2014; van Howelingen et al., 2015). Further, of the limited studies conducted in the context of home care, technological characteristics (i.e., perceived usefulness) were also reported to influence the acceptance and adoption of telemonitoring systems and mobile technologies by home care nurses in Spain and Canada respectively (Gagnon et al., 2012; Zhang et al., 2010).

Organizational / Environmental Characteristics

The contribution of the organizational / environmental characteristics, social influence and facilitating conditions, was consistently identified in the quantitative and qualitative findings. A direct and statistically significant relationship was found between social influence and facilitating conditions and nurses' intention to use EDS in-home care practice. This finding resulted in the acceptance of the hypotheses that social influence and facilitating conditions would have positive and direct relationship with nurses' intention to use the EDS in their respective home care practice. This relationship implies that nurses who perceive having the support from colleagues (i.e., allied HCPs and managers) as well as the organizational (i.e., education and training) and technological (i.e., availability of IT support) infrastructures, have higher intention to use the EDS in practice. This finding is consistent with the qualitative findings. Participating nurses

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indicated that having the training to learn how to proficiently use the system and having the IT and peer social support, positively influenced their level of comfort and experience with EDS usage in their home care practice. These findings align with the limited existing empirical evidence on the association of the organizational / environmental characteristics with home care nurses' adoption of a home telemonitoring system and a mobile information technology (specifically a personal digital assistant) (Gagnon et al., 2012; Zhang et al., 2010). Additionally, the study findings are also consistent with the existing evidence of the influence of organizational / environmental characteristics on nurses' satisfaction, perception, concerns, facilitators and intention to use HIT in acute care practice (Bennani & Oumlil, 2014; Chung et al., 2016; Hung et al., 2014; Ketikidis et al., 2012; Kummer et al., 2013; Lee et al., 2013; Phichitchaisopa & Naenna, 2013; Sharifan et al., 2014).

Additional Factors

Three additional factors emerged from the qualitative data analysis as influencing nurses' level of comfort and experience with EDS usage. The first factor was the employment of workarounds with EDS usage to address the shortcomings of the technological characteristics of the system (i.e., poor connectivity, unscheduled EDS downtime, slow system, and poor EDS design). While limited evidence exists specific to EDS workarounds employed by nurses in the context of home care, the study findings are consistent with the evidence in the acute care context. For example, workarounds specific to the technological characteristic were found to be related to the poor EDS design and systems not being user-friendly, intuitive, having limited functionality, slow speed, and misalignment with nursing practice (Rathert, Porter, Mittler, & Fleig-Palmer, 2017; Ser, Robertson, & Sheikh, 2014; Strudwick et al., 2018; Topaz et al., 2016). Although the acute and home care sectors differ in practice environment and potentially the type of EDS being used in practice, the development and employment of EDS workarounds by nurses in both sectors may be due to EDS being often designed by non-nursing personnel that have limited knowledge and understanding of the complexity of nursing practice and documentation processes and requirements (Stevenson et al., 2010).

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The second additional factor found to influence nurses' level of comfort and experience with EDS usage was related to the nurse-patient interaction amidst EDS usage. The introduction and implementation of EDS within clinical practice particularly at the point-of-care, is said to influence the healthcare experience of patients, specifically the nurse-patient interaction (McNicol, Hutchinson, Wood, Botti, & Redley, 2018). Theoretically, the ability for nurses to access patients' health data quickly allows for more time with patients to explain diagnosis, treatment regimens, laboratory and test results, and address patients' concerns (Hsu et al., 2005). However, there may be unintended consequences of using the EDS at the point-of-care such with the shift of nurses' attention towards the technology; compromising communication with patients, limiting the opportunities to develop therapeutic relationships, and attending to patient's health care needs (Stewart, Kroth, Schyler, & Bailey, 2010). The findings from this study confirmed the unintended consequences of EDS usage during nurse-patient interactions. Some nurses commented that patients did not feel they were receiving the necessary and adequate attention during the interactions because the nurse was more focused on the system. Further, some nurses also felt that it was challenging to find a balance in maintaining eye contact, being mindful of their body position, and not entirely focusing on the system during interactions.

The study finding regarding the unintended consequences of the influence of EDS usage on provider-patient interaction is consistent with that of other studies. For example, Ajamai and Bagheri-Tadi (2013) found that physicians and nurses were unintentionally spending more time interacting with the EDS than with patients during visits. The clinicians understood the value of the face-to-face interaction with patients and decided to write down notes during interactions and transferring the information into the EDS at a later point in time. Similar challenges were noted by Duffy, Kharasch and Du (2010); they found that nurses, who had experience using electronic medical records in their acute care practice, were distracted by using and navigating the EDS during patient interactions. Further, there were reports of extended periods of silence, reduced eye contact and "time out" episodes while the nurses had to manage the system during patient interactions (Duffy et al., 2010). Similarly, Gaudet (2016) reported nurses acknowledged that they were faced with having to divide their attention between the technology and

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patients. Such a division made completing electronic documentation and prioritizing patients' health care needs demanding and challenging (Gaudet, 2016). In addition, Rose, Richter and Kapustin (2014) conducted a qualitative phenomenological study and reported that nonverbal communication such as maintaining eye contact during interactions was important to patients as it provided a sense of personal connection, being cared for and not ignored.

The third factor was the ability for nurses to provide input towards the system design. Some home care nurses reported that they had opportunities to provide feedback regarding the EDS design and that their feedback at times was incorporated towards system upgrades. This in turn, allowed the system to be better aligned and fitting with nurses' needs, workflow and practice; thereby optimizing the intention and experience of EDS usage in home care nurses practice in the study.

The study findings related to the influence of nurses' individual, technological and organizational / environmental characteristics on nurses' intention, level of comfort and experience with EDS usage, which is consistent with the study hypotheses and are also in alignment with the literature; demonstrating that the uptake of HIT such as EDS is a non-linear and dynamic process (Yen & Bakken, 2012). However, it is important to note that the majority of empirical evidence primarily pertains to nurses working in the acute care sector with only three studies (Gagnon et al., 2012; Ifinedo, 2016; Zhang et al., 2010) conducted in the context of home care and the acute and home care settings. The lack of literature specific to the home care sector is a gap in knowledge because of the increased delivery of health care services within home care coupled with the continued integration of EDS and differences in working environments and availability of resources within the acute and home care sectors (Lundy & Janes, 2014; Tourangeau et al., 2014).

Although the study confirms the various characteristics previously identified in the literature, it also extends our knowledge on additional factors that influence nurses' intention, level of comfort and experience with EDS usage in-home care that has not been previously explored and noted in the home care literature. For example, factors found in this study and not previously identified include: a) the influence of EDS usage on nurse-

patient relationships in home care practice; b) the development and employment of workarounds by home care nurses resulting from technological shortcomings of the EDS; c) the ability for home care nurses to provide feedback towards the EDS design and / or upgrades; and d) facilitating conditions (i.e., availability of IT support, organizational training and education) having the largest effect (relative to performance and effort expectancy, attitude, and social influence) on nurses' intention to use EDS in-home care practice.

Implications

The study findings have implications to theory, practice, education, policy, and research. For *theory*, more than 50% of variance in nurses' intention was not accounted for in the adapted UTAUT model. This finding highlights the need for further research to determine the most appropriate and / or adaptation of another model that accounts for nurses as end-users within the home care context. This is likely because such models, including the UTAUT, originate from other disciplines (i.e., business, psychology and sociology) and therefore may not capture all factors relevant to nursing practice and the healthcare environment (Kijsanayotin et al., 2009; Venkatesh et al., 2003, 2012).

For example, as noted in the literature, several adaptations have been made to the UTAUT model when used to examine nurses' intention to use HIT such as EDS in practice. The adaptations to the UTAUT model entailed the inclusion of additional variables such as: computer self-efficacy (Maillet, Mathieu, & Sicotte, 2015), nurses' trust of the reliability and quality of the HIT (Bennani & Oumlil, 2014), concerns about privacy (van Houwelingen et al., 2015), and nurses' provincial area of practice (Phichitchaisopa & Naenna, 2013). Based on the findings from this study, potential variables that may be included in an adapted UTAUT model as factors influencing nurses' intention / actual use of EDS, and to be examined in future research are nurses' level of comfort and nurse-patient interaction. The suggested adaptations to the UTAUT model, have not been previously used in the home care literature.

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For *practice*, because nurses in general are the largest groups of EDS users (Rojas & Seckman, 2014), it is imperative for them to be represented throughout the EDS design, implementation and / or procurement processes (Moen, 2003; Rojas & Seckman, 2014; Stevenson et al., 2010; Strudwick et al., 2018). This in turn, may ensure the system is fitting with the needs, workflow and practice of the provider as the end-user; potentially optimizing the integration of the system into practice. The inclusion of nurses throughout the design and implementation processes of EDS, highlights the need for continued collaboration among health information technology professionals, nursing, HCPs, engineering and software developers of EDS (Moen, 2003; Stevenson et al., 2010). A strategy in support of the proposed collaboration consists of having software developers shadow HCPs in practice. For example, software developers can shadow home care nurses during their day-to-day practice to understand: a) the complexity of home care practice such as practicing in remote and rural areas (which may influence Internet connection and access to EDS) and the challenges of various working environments, which vary with every patient home care visit and are often not conducive for the delivery of home health care services; b) the various locations that home care nurses document (i.e., patient's home, provider's car, and agency office); and c) the nursing documentation process.

It is also important for nurse and health system managers as well as educators to foster a supportive environment and organizational culture for technology usage in home care practice. Fostering a supportive environment and organizational culture may be done through: a) enlisting provider champions (i.e., nurse educators and home care nurses who are innovative and have high levels of self-efficacy and technology-related experience) to support EDS usage; and b) offering technical support (within the respective home care agencies and remotely when nurses are conducting home care visits) (Furlong, 2015; Gagnon et al., 2012; Zadvinskis, Smith, & Yen, 2018).

Enlisting provider champions (i.e., home care nurses and nurse educators) has been recommended for the successful implementation of EDS in practice (Yuan, Bradley, & Nembhard, 2015). Champions are characterized as persons that are proactive, provide comprehensive instructions as well as freely share information with others (Yuan et al.,

2015). This approach is effective because champions may exert social influence, which may alter a persons' beliefs, perspective, attitude and / or behaviour based on the response of salient others (i.e., nurse educators and managers) (Gallivan, Spitler, & Koufaris, 2003). Although home care nurses tend to work more autonomously and have limited face-to-face interactions with allied HCPs in comparison to nurses working in facility-based sectors (i.e., acute care and long-term care), having a supportive working environment has been reported to be of great value to home care nurses (Flynn, 2007; Lundy & Janes, 2014; Tourangeau et al., 2014; Zhang et al., 2010). As such, although provider champions may not always be available in-person in the home care context, they may still connect with home care nurses through different means such as text messages, over the phone, and / or e-mail.

For technical support, it is essential for management (i.e., health system managers, nurse managers, and health information technology professionals) to ensure nurses are provided with the essential information technology (IT) support (Gagnon et al., 2012). The availability of IT support affords home care nurses with the resources needed to overcome technological barriers and mitigate technical shortcomings and challenges that may arise during EDS usage in home care practice, which in turn, may enhance the system usage as intended (Asua, Orruno, Reviriego, & Gagnon, 2012; Gagnon et al., 2012; Strudwick et al., 2018). The importance of the technical support becomes more amplified within the home care context because a patient-controlled environment is not necessarily designed and appropriately equipped for health care delivery (CNA, 2013). More specifically, the working environment for home care nurses varies (i.e., agency office, nurse's car, and patient's home) and includes an array of socioeconomic and geographical (i.e., remote and rural) settings (CNA, 2013). Further, the availability of resources, supplies and equipment may be more limited in comparison to facility-based environments such as acute and long-term care (CNA, 2013; Lundy & James, 2014; Tourangeau et al., 2014).

This research has implications for *nursing education*. Empirical evidence suggests that there has been limited integration and provision of health informatics within the curricula of nursing programs in Canada, which may be related to the shortage of faculty with health informatics competencies (Borycki, Joe, Armstrong, & Bellwood, 2011; Borycki et al., 2009; Jenkins, Eide, Smart, & Wintersteen-Arleth, 2018). This may be because over the past years, there has been investment in the development and integration of HIT such as EDS within healthcare and less of a focus on advancing faculty's health informatics competencies and providing them with opportunities to integrate the competencies within the curricula (Borycki et al., 2009). Additionally, most nursing programs often depend on the clinical care settings (i.e., clinical rotations and practicum) to educate students on the use of HIT particularly EDS (Jenkins et al., 2018). The dependency on the clinical care setting can lead to discrepancies in student learning and education because clinical sites, particularly those within the home care sector, vary in terms of provider agency, organization, type and frequency of EDS usage, and training offered (George, Drahnak, Schroeder, & Katrancha, 2016). With the heightened awareness of the rapid growth and increased development and integration of HIT within practice, the Canadian Association of Schools of Nursing (CASN) has been working towards incorporating nursing informatics in curricula and professional nursing practice (CASN, 2013). The incorporation of nursing informatics competencies within nursing curricula is essential to prepare and ensure nursing graduates meet and master the technological demands of their jobs, which has become an essential element within the workforce (Cheeseman, 2011).

The incorporation of nursing informatics competencies may be done within the curricula, at the undergraduate and graduate levels and take on a scaffolding approach to allow students to build on their technology-related knowledge, skills and literacy as they progress through the respective programs (Billings & Halstead, 2016). Such an approach can be attained through several means. The first is having a mandatory nursing informatics course within the first-year of entry-level baccalaureate and master's programs. The focus of the course would be on the science and practice of nursing with information and communication technology to promote the quality of care delivery and enhance practice in various sectors particularly home care. Nursing students would have

the opportunity to: a) explore, discuss and develop a conceptual and practical understanding of HIT through a nursing lens; b) understand the potential influence of EDS usage to support and / or augment the nursing care processes (i.e., safety, patient-related decision making, and care delivery); c) understand the design, implementation and evaluation processes of HIT within community and home care practice; d) understand how best to use EDS during nurse-patient interactions; e) understand the different types of HIT being used in community and home care practice (i.e., EDS and mobile solutions); and f) the strengths and limitations (i.e., legal, ethical and security) of HIT use in practice (Booth, 2013; Borycki et al., 2011; The National League for Nursing, 2017).

The second means to incorporate nursing informatics competencies within the nursing curricula, includes the opportunity for undergraduate and graduate nursing students to work on building prototype HIT with an interprofessional team to understand the design, implementation and evaluation processes of technological solutions and systems within the healthcare system (Booth, 2013). This type of opportunity may expand nursing students' knowledge and conceptualization of HIT and in turn, be better equipped to support the design and / or procurement of HIT such as EDS in clinical practice to ensure systems are fitting with practice and meeting their needs.

Finally, since EDS are being widely integrated within practice settings, such systems may be integrated within simulation laboratory exercises (Booth, Sinclair, Brennan, & Strudwick, 2017). The integration of EDS in simulation exercises may be done through the development of an in-house software as well as developing, purchasing or accessing web-based or cloud-based portals that provide faculty and nursing students with access to several EDS (Borycki et al., 2011; Choi, Park, & Lee, 2016; Kushniruk, Kuo, Parapini, & Borycki, 2014). The incorporation of EDS within simulation exercises may offer students with first-hand experience with the system and learn its features, functionality, how to use it during nurse-patient interactions, its strengths and potential limitations prior to entering a clinical setting. Further, such incorporation may afford nursing students with the opportunity to gain comfort in using the system in a safe

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environment where there are no direct implications to patient care and safety (Mannino & Cornell, 2014).

Specific to *policy*, the implementation of EDS is a pan-Canadian initiative that includes the collaboration of Canada Health Infoway, health care organizations and agencies and the provincial and federal governments (Office of the Auditor General of Canada, 2010). The study findings support several recommendations for policy. The first recommendation is the development of a toolkit to prepare and support home care organizations and agencies for EDS implementation (Ko, Wagner, Okwandu, & Spetz, 2016). The toolkit may include: a) a staff and facility readiness assessment measures; b) a technical needs assessment given the challenges with connectivity and to determine the availability of resources (i.e., IT support) for nurses and allied HCPs upon the integration and usage of EDS in the respective home care practice; and c) a guide to engage leadership, management, educators, software developers, and home care nurses with the EDS design and / or procurement; potentially contributing to home care nurses' buy-in and ensure the system is fitting with their respective needs and workflow (Ko et al., 2016; McBride, Delaney, & Tietze, 2012).

The second recommendation is for provincial governments as well as home care organizations and agencies to strategically develop best practice guidelines for EDS education and training offered to home care nurses to build capacity in the workforce (Ko et al., 2016; RNAO, 2017). Best practice guidelines for EDS education and training is important because as found in this study and noted in the literature, there are inconsistencies regarding the length, duration, and frequency of education and training offered to home care nurses. Best practice guidelines for training of EDS usage serves two purposes: a) introducing the system, features, and functionality to the end-user; and b) assisting providers with the understanding of how the system can be leveraged in practice (Edwards, Kitzmiller, & Breckenbridge-Sproat, 2012). Well-timed and carefully delineated training has the potential to influence providers' willingness, acceptance and successful implementation of the system in practice (Bredfeldt, Awad, Joseph, & Snyder, 2013; McGinn et al., 2011). Training affords home care nurses with an understanding of

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the system (i.e., features and functionality) and how it works in improving practice and workflow (Furlong, 2015; Zadvinskis et al., 2018).

Findings from this study and other studies suggest that there are different methods (i.e., traditional instructor-led lectures, and delivery of information / instructions through hard copy, videos or the Web) employed for the training offered to HCPs including nurses by healthcare organizations and agencies (Edwards et al., 2012; Hunt et al., 2004). Although the most effective training and approaches has yet to be determined (Edwards et al., 2012), an approach that has become more integrated within training initiatives, as noted from participating nurses in this study and in the literature, is the blended learning approach (Bredfeldt et al., 2013; Edwards et al., 2012). The blended learning approach, which is founded on the principles of adult education, is a systematic integration of learning modalities such as instructor-led lectures, hard-copy and / or Web-based instructions, webinars, audio, video, and / or computer-based, demonstrations and hands-on practice (Bredfeldt et al., 2013; Edwards et al., 2012). The blended approach has the potential to synthesize both traditional learning and e-learning, which in turn helps to: meet the various learning needs of home care nurses as end-users; provide more time spent interacting and practicing (through scenario-based situations) with the EDS; and improve technology-related comfort and literacy prior to full system implementation (Makhdoom, Khoshhal, Algaidi, Heissam, & Zolaly, 2013; Wu, Tennyson, & Hsia, 2010).

The third policy recommendation is for provincial governments to collaborate with agencies responsible for telecommunication infrastructure to improve and increase connectivity in remote and rural areas (Khoja, Durrani, Nayani, & Fahim, 2012; RNAO, 2017). This is particularly important because as reported by participating nurses in this study, connection to the Internet and in turn the EDS, was a challenge when providing care to patients in remote and rural areas. The poor Internet connection resulted in nurses employing workarounds (i.e., writing notes on paper and transferring to the EDS when access became available) in their home care practice.

The final policy recommendation is for provincial and federal governments to provide financial incentives to health care organizations and agencies to mitigate barriers with the integration and adoption of EDS in-home care practice (Ko et al., 2016; RNAO, 2017). Empirical evidence suggests that the lack of financial resources from the government has the potential to slow the progression of HIT such as EDS and translating the full system benefits into reality (Yoshida, Imai, & Ohe, 2013; Ranasinghe, Chan, & Yaralagadda, 2012; Zinszer, Tamblyn, Bates, & Buckeridge, 2013). As such, financial incentives would: a) off-set the initial start-up costs required by the respective home care agencies and organizations to use the system in practice; b) establish and maintain the necessary IT support required, whether on-site or available by phone 24 hours; and c) purchase the necessary equipment and resources (i.e., tablets, laptops, and phones) needed (Khoja et al., 2012; Ko et al., 2016; RNAO, 2017; Salzberg, Jang, Rozenblum, Zimlichman, Tamblyn, & Bates, 2012; Yoshida et al., 2013).

Specific to *research*, the individual, technological, organizational / environmental characteristics were found to influence nurses' intention, level of comfort and overall experience with EDS usage in home care practice. Based on the study findings and recognizing that this is the first study to explore and examine factors that influence nurses' intention to use EDS in-home care practice in Ontario, there is a need for future research examining whether similar factors also influence nurses' actual usage, satisfaction, and overall experience with EDS in the context of home care. Future research can be done using a cross-sectional and / or a mixed methods research design with a provincial and national sample of home care nurses. Such an examination is warranted with the increased integration of EDS in-home care practice and the limited existing empirical evidence focusing on the home care sector. However, as previously noted, the acute and home care sectors vary (i.e., practice environments, geography, locations, and the availability of resources) (Lundy & Janes, 2014; Tourangeau et al., 2014); potentially influencing nurses' intention, experience, satisfaction, level of comfort and actual EDS usage differently.

Specific to the intention-behaviour relationship, observational studies can be designed to explore nurses' actual EDS usage in home care practice as well as quantitative studies testing which conceptual or adapted model and additional moderators and / or mediators (i.e., self-efficacy, personal innovativeness, and trust) best captures the full range of factors that influence nurses' actual usage of EDS. The factors proposed and found to influence nurses' intention to use EDS usage in home care practice were informed from the existing empirical evidence which primarily focused on the acute care sector.

Specific to individual characteristics, further research is warranted comparing the attributes of home care nurses who are resistant and receptive to technology usage in clinical practice. Such an exploration is imperative to inform interventions to optimize the successful adoption of EDS in practice. Further, the majority of research exploring factors that influence nurses' intention, satisfaction, acceptance, perception and actual usage of EDS in practice are conducted at one point in time. However, there is potential for a change in factors that influence home care nurses' intention and actual usage of the system following post-implementation; highlighting the importance of such an examination and addressing this knowledge gap.

Additionally, the influence of EDS usage on nurse-patient interactions is an important aspect to investigate in more depth. This can be done through: observational, cross-sectional, mixed methods, and qualitative studies with groups and or individual interviews with patients and home care nurses. Such an understanding is fundamental because point of care documentation has the potential to impact nurse-patient interactions by shifting home care nurses' attention from the patient towards the system, as noted in this study.

Strengths and Limitations of the Study

The study has both strengths and limitations. Specific to the strengths, the study was the first, to our knowledge, to examine and explore factors that influence nurses' intention and overall experience with EDS usage in the context of home care. This is of significant importance and relevance with the continued growth of the home care sector

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in Ontario coupled with the continued integration and adoption of such systems in practice. Second, a conceptual model derived from the UTAUT guided the quantitative phase of this study. The adapted model makes explicit the factors that are proposed to influence nurses' intention to use EDS in-home care practice. The application of a model to guide the quantitative phase of the study offered a systematic approach to identify the variables of interest and valid measures respectively. Third, to ensure a comprehensive and complete understanding was achieved, the quantitative data were complemented with open-ended questions in the survey and semi-structured, one-on-one, telephone interviews. Further, the findings from the online survey informed the semi-structured questions posed in the one-on-one interviews with participants. Fourth, was the use of a systematic random sampling method to minimize the potential for bias and enhance the sample's representativeness of the target population. Fifth, the instruments used to measure the variables, which were pilot-tested with a group of home care nurses, were reliable and valid. Finally, the sample size was large and provided adequate power to detect significant relationships among the variables; strengthening the statistical conclusion validity.

The study's limitations were related to non-consent bias, social desirability, recall bias and limited generalizability of findings. For non-consent bias, participants were volunteers and may have different perspectives and experiences with EDS to those that did not take part in the study. For social desirability, this may have been a potential limitation when participants responded to the survey and interviews. Although the survey was anonymous, transcripts were de-identified and data were coded and analyzed in aggregate format, there is a potential for participants to have reported more favourable responses; introducing the possibility of subjective bias. For recall bias, self-reporting has the potential to lead to recall bias as some participants may not have been able to correctly recall experiences related to EDS usage in practice that occurred in the past. For generalizability of findings, the inclusion criteria were limited to participants who were proficient in English, limiting persons speaking other languages from taking part in the study. The perspectives and experiences of nurses that did and did not partake in the study due to the inclusion criteria may differ. Further, the setting and culture of the home care sector in Ontario may differ from other provinces and countries, which may

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influence nurses' perception and experiences with EDS differently. Finally, there are different systems being used in the home care sector, varying by respective home care agency in which nurses are employed. As such, there may be differences in participants' perspectives and experiences; limiting the applicability and generalizability of the findings to all EDS being used in the home care sector in Ontario.

Conclusion

Electronic documentation systems remain a permanent fixture within Canada and the province of Ontario particularly with the increased initiatives underway for the continued transition and implementation of such systems. Such systems have the potential to enhance the quality of care delivery and patient health outcomes. This study was the first, to our knowledge, that sought to understand the factors that influence nurses' intention and experience with EDS usage in the context of home care. Such an examination and exploration are imperative as nurses play a significant role in the delivery of home health care services and are the largest user-group of such systems. The findings from this study showed that nurses' individual, technological and organizational / environmental characteristics influence nurses' intention, level of comfort and experience with EDS usage in home care practice. Additional factors found to influence nurses' experience with EDS usage were: development and employment of workarounds to address shortcomings of the technological characteristics, influence of nurse-patient interaction amidst system usage; and the ability to provide input towards the system design. Understanding the factors that influence nurses' intention, comfort and experience with EDS usage in their home care practice have implications to theory, practice, education, policy and research particularly as HIT continues to change nursing practice.

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Appendix A: Research Ethics Board (REB) Approval

Western University Health Science Research Ethics Board
HSREB Delegated Initial Approval Notice

Principal Investigator: Dr. Lorie Donelle
Department & Institution: Health Sciences/Nursing, Western University

Review Type: Delegated
HSREB File Number: 109426
Study Title: Registered nurses' intention to use electronic documentation systems: A mixed methods study

HSREB Initial Approval Date: October 05, 2017
HSREB Expiry Date: October 05, 2018

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Western University Protocol		2017/09/20
Letter of Information & Consent	Quantitative Phase	2017/09/20
Recruitment Items	Quantitative Phase - Reminder Follow-up Post Card - Received September 20, 2017	
Instruments	Questionnaire	2017/10/02
Recruitment Items	Email Script - Qualitative Phase	2017/07/25
Letter of Information & Consent	Qualitative Phase	2017/09/20
Other	Telephone Script- Qualitative Phase	2017/05/31
Instruments	Semi-Structured Interview Questions - Received June 8, 2017	
Other	Content Validity Tool - Received for Information	2017/07/25
Other	Request for CNO Data Form - Received for Information July 25, 2017	

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above named study, as of the I-ISREB Initial Approval Date noted above.

HSREB approval for this study remains valid until the HSREB Expiry Date noted above, conditional to timely submission and acceptance of HSREB Continuing Ethics Review, The Western University HSREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use Guideline for Good Clinical Practice Practices (ICH E6 RI), the Ontario Personal Health Information Protection Act (PHIPA, 2004), Part 4 of the Natural Health Product Regulations, Health Canada Medical Device Regulations and Part C, Division 5, of the Food and Drug Regulations of Health Canada.

Members of the HSREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Western University, Research, Support Services Bldg., Rm. 5150
London, ON, Canada N6G IG9

Appendix B: Research Ethics Board (REB) Study Closure

Date: 30 September 2018

To: Lorie Donelle

Project ID: 109426

Study Title: Registered nurses' intention to use electronic documentation systems: A mixed methods study

Application Type: Study Closure Form

Review Type: Delegated

Date Acknowledgement Issued: 30/Sep/2018

Dear Lorie Donelle

The Western University Research Ethics Board has reviewed the application, and the closure of this study is acknowledged. The REB file on this study is now officially closed.

Thank you for using the Western Research Ethics Manager System (WREM).

Sincerely,

The Office of Human Research Ethics

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations)

Appendix C: Cover Letter for Pilot Testing Adapted Measures

Cover Letter for Pilot Testing of adapted measures

Dear [Insert name of expert]:

You are being invited to participate in the pilot testing of adapted multi-item scales for the research study entitled *"Registered nurses' intention to use electronic documentation systems: A mixed methods study."*

The purpose of this study is to test a conceptual model to: 1) understand RNs' intention to using electronic documentation systems, that is, up-to-date and complete record of current care and services that are being delivered to a patient; and 2) examine factors that facilitate or inhibit the intention to using electronic documentation systems within home care practice. The adapted Unified Theory of Acceptance and Technology Use model is looking at the relationships among the following factors that influence RNs' intention to using electronic documentation systems in home care practice:

Effort Expectancy: the ease associated with the use of the technology (i.e., level of complexity and ease of use).
Performance Expectancy: degree to which the end-user believes the technology will provide benefits in performing certain activities and result in performance gains
Attitude: an individual's beliefs and corresponding positive or negative perspective of the potential outcomes of performing a specific behaviour
Social Influence: an individuals' beliefs and perception of social influence (i.e., colleagues, supervisors, allied healthcare professionals) on the adoption and performance of the behaviour
Facilitating Conditions: degree to which it is believed that the organizational (i.e., training) and technical infrastructure (i.e., IT support and availability of resources) exist to support technology usage.
Intention: RNs' plans to use electronic documentation systems within home care practice.

As an RN, you are being asked to review and evaluate the adapted multi-item scales to ensure the relevance of the items in capturing the concepts of interest in this study. More specifically, you are being asked to carefully read each item using a content validation tool (presented in the following page) and rate it based on relevance using a four-point scale ranging from 1= *not relevant* to 4= *highly relevant*. In addition to rating the relevance, if you can kindly comment on the following: a) sequence of questions; b) wording of questions; c) comprehension of the instructions and questions (i.e., if questions are easy to understand and not ambiguous); and d) ease of use. The feedback attained will guide the revisions of the items to enhance the relevance, comprehension and overall clarity of the content.

I would like to thank you for taking the time in reviewing the adapted multi-item scales and for providing your feedback.

Sincerely,

Sarah Ibrahim, RN, MN, PhD Candidate
Arthur Labatt Family School of Nursing
Western University

Content Validity Tool

Item	Not relevant	Slight relevant	Relevant	Highly relevant
Performance Expectancy				
1. Using the electronic documentation system in my job would enable me to accomplish tasks more quickly.	1	2	3	4
2. Using the electronic documentation system in my job would improve my job performance.	1	2	3	4
3. Using the electronic documentation system in my job would increase my productivity.	1	2	3	4
4. Using the electronic documentation system would enhance my effectiveness on the job.	1	2	3	4
5. Using the electronic documentation system would make it easier to do my job.	1	2	3	4
6. I would find using the electronic documentation system useful in my job.	1	2	3	4
Effort Expectancy				
7. Learning to operate electronic documentation system in my job would be easy for me.	1	2	3	4
8. I would find it easy to get the electronic documentation system to do what I want it to do.	1	2	3	4
9. My interaction with the electronic documentation system would be clear and understandable.	1	2	3	4
10. I would find the electronic documentation system to be flexible to interact with.	1	2	3	4
11. It would be easy for me to become skillful at using the electronic documentation system.	1	2	3	4
12. I would find using the electronic documentation system easy to use.	1	2	3	4
Attitude				

Item	Not relevant	Slight relevant	Relevant	Highly relevant
13. The use of electronic documentation systems improve patient care by giving the nurse more time with the patients.	1	2	3	4
14. Electronic documentation systems can be adapted to assist nurses in many aspects of patient care.	1	2	3	4
15. The time spent using an electronic documentation system is out of proportion to the benefits.	1	2	3	4
16. Computerization of nursing data through electronic documentation systems offer nurses a remarkable opportunity to improve patient care.	1	2	3	4
17. Electronic documentation systems make nurses' jobs easier.	1	2	3	4
18. Electronic documentation systems cause nurses to give less time to quality patient care.	1	2	3	4
19. Electronic documentation systems increase costs by increasing the nurse's workload.	1	2	3	4
20. It takes as much effort to maintain patient records in electronic documentation systems as it does by hand.	1	2	3	4
21. Electronic documentation systems create more problems than they solve in nursing practice.	1	2	3	4
22. The use of electronic documentation systems dehumanize nursing care.	1	2	3	4
23. Part of the increase in costs of healthcare is because of electronic documentation systems.	1	2	3	4
24. Nursing data does not lend itself to electronic documentation systems.	1	2	3	4
25. I am comfortable using electronic documentation systems.	1	2	3	4
26. Working with electronic documentation systems would make me very nervous.	1	2	3	4
27. I do not feel threatened when others talk about electronic documentation systems.	1	2	3	4

Item	Not relevant	Slight relevant	Relevant	Highly relevant
28. Electronic documentation systems do not scare me at all.	1	2	3	4
29. I feel aggressive and hostile toward electronic documentation systems.	1	2	3	4
30. Electronic documentation systems make me feel uneasy and confused.	1	2	3	4
31. I have a lot of self-confidence when it comes to working with electronic documentation systems.	1	2	3	4
32. Confidentiality is nearly impossible if patient records are in electronic documentation systems.	1	2	3	4
33. Confidentiality will not be sacrificed by patient records being entered into electronic documentation systems.	1	2	3	4
34. Electronic documentation systems represent a violation of patient privacy.	1	2	3	4
Social Influence				
35. People (such as nurses, managers, physicians, family members and colleagues) who influence my behavior think I should use electronic documentation systems.	1	2	3	4
36. People (such as nurses, managers, physicians, family members and colleagues) who are important to me think I should use electronic documentation systems.	1	2	3	4
37. The senior management of this business has been helpful in the use of the system.	1	2	3	4
38. In general, the organization has supported the use of electronic documentation systems.	1	2	3	4
Facilitating Conditions				
39. I have the resources necessary to use electronic documentation systems.	1	2	3	4
40. I have the knowledge necessary to use electronic documentation systems.	1	2	3	4
41. Electronic documentation systems are not compatible with other systems I use.	1	2	3	4

Item	Not relevant	Slight relevant	Relevant	Highly relevant
42. A specific person (or group) is available for assistance with electronic documentation system difficulties.	1	2	3	4
Behavioural Intention				
43. Assuming I had access to using electronic documentation systems, I intend to use it.	1	2	3	4
44. Given that I have access to using electronic documentation systems, I predict that I would use it.	1	2	3	4
45. I plan to use electronic documentation systems in the future.	1	2	3	4

Behavioural Usage
46. If you are already using electronic documentation systems in your home care practice, on average, how often do you use the electronic documentation system in your home care practice? Report Frequency
47. **If you are already using electronic documentation systems in your home care practice, on average, how much time do you spend using electronic documentation systems per shift?** Report total minutes or hours
General comments on sequence and wording of questions, comprehension of the instructions and questions (i.e., if questions are easy to understand and not ambiguous); and ease of use of completing the survey:

Appendix D: Cover Letter for Quantitative Phase

Project Title: Registered Nurses' intention to use electronic documentation systems: A mixed methods study
Principal Investigators:
Sarah Ibrahim, RN, PhD (Candidate), School of Nursing, Western University.
Lorie Donelle, PhD, RN, Associate Professor, School of Nursing, Western University.

Letter of Information

1. **Invitation to Participate**

   You are being invited to participate in the research study designed to explore factors that influence your intention to use electronic documentation systems in your home care practice. You are being asked to participate in the research study because you are a Registered Nurse, currently registered with the College of Nurses and are working in the home care sector in Ontario. The research study is being conducted by Sarah Ibrahim, a doctoral candidate at the Arthur Labatt Family School of Nursing, Western University. The project is under the supervision of Dr. Lorie Donelle.

2. **Purpose of the Letter**

   The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this study.

3. **Purpose of this Study**

   The purpose of this study is to understand the factors that influence Registered Nurses' intention to use electronic documentation systems in their home care practice. We are inviting approximately 1,500 Registered Nurses (RNs) to share their perspectives and the factors that influence their intention to use electronic documentation systems in their home care practice. The findings from this study will provide useful information for decision-makers and health care agencies to design effective strategies for the successful use of electronic documentation systems by Registered Nurses in their home care practice.

4. **Inclusion Criteria**

   To participate in this study, individuals who are currently registered with the College of Nurses of Ontario (CNO); currently employed full or part-time, practicing within the home care sector; and providing direct or coordinated patient care are eligible to participate in the study.

5. **Exclusion Criteria**

   Registered Nurses who are not working in the home care sector and not providing direct or coordinated patient care are not eligible to participate in this study.

6. **Study Procedures**

   If you agree to participate, you will be asked to complete an online questionnaire survey on a secured and confidential website, Qualtrics, at your own pace and convenience. The online questionnaire survey has two sections. The first section asks questions about yourself (like your age, education, employment status, region of home care you are employed within; type of documentation system currently using in your home care practice; and experience and comfort with using electronic documentation systems). The second section asks questions about factors that influence your intention to use electronic documentation systems in your home care practice. It is anticipated completion of the online questionnaire survey will take about 15-20 minutes. You can access the online questionnaire survey 24 hours a day, 7 days a week. The researcher will also send you post cards to remind you to complete the online questionnaire survey.

7. **Possible Risks and Harms**

   There are no known or anticipated risks or discomforts associated with participating in this study.

8. **Possible Benefits**

   You may not directly benefit from participating in this study, but information gathered may assist and inform healthcare agencies as well as policy and decision makers in developing effective and proactive strategies and interventions to support the successful use of electronic documentation systems by RNs in their day-to-day practice. This is particularly meaningful as RNs move into new roles that are enabled and supported by technology.

9. **Compensation**

   To thank you for your time and completion of the online questionnaire survey, you will be offered a $5 Gift Card to either Tim Hortons or Starbucks.

10. **Voluntary Participation**

    Participation in this research study is voluntary. You may refuse to participate, to answer any questions or withdraw from the study at any point in time without penalty. There is no cost in participating in this research study except your time in completing the online questionnaire survey.

11. Confidentiality

The information will only be accessible by the researchers of this study. For recruitment purposes, your name and mailing address will be the only identifiable information known to the researcher. However, this information will not be linked in any way to the online questionnaire survey. At the end of the questionnaire survey, you will be offered a $5 gift card to either Tim Hortons or Starbucks and to enter your contact information if you wish to be contacted to participate in a follow-up interview. This information will be collected and stored separately from the questionnaire survey. The data collected from the online questionnaire survey will be stored using Western University's Qualtrics Research Survey Tool. Through Qualtrics, it enables persons to complete online surveys in a secure manner. The results will be reported in aggregate format so that no one individual will be identified. Representatives of Western University Health Sciences Research Ethics Board may contact you or require access to your study-related records to monitor the conduct of the research. Identifiable data, specifically your name and mailing address, will be kept for a minimum of 5 years after the study and will then be shredded and destroyed to maintain confidentiality. The findings of this research study will be used to meet the requirements of the researcher's doctoral dissertation research and doctoral degree and may be used in academic publications and or conferences.

12. Contacts for Further Information

If you require any further information regarding this research project or your participation in the study you may contact the researcher, Sarah Ibrahim or her thesis supervisor, Dr. Lorie Donelle. If you have any questions about your rights as a research participant or the conduct of this study, you are welcome to call the Office of Human Research Ethics.

13. Publication

If the results of the study are published, your name will not be used. If you would like to receive a copy of any potential study results, please contact Sarah Ibrahim or select the option in the online questionnaire survey.

14. Consent

Confirmation of your consent to participate in our online questionnaire survey will been attained by checking the box on the online questionnaire survey.

If you are interested in taking part in this research study, please use the following link to access the online questionnaire survey:

goo.gl/7EMtQM

This letter is yours to keep for future reference.

Appendix E: Reminder Follow-up Cover Letter

Name of participant

Address

Dear Participants:

Recently you received a package inviting you to participate in a research project entitled "Registered Nurses' intention to use electronic documentation systems: A mixed methods study". Participating in this study involves completing an online questionnaire survey, which takes 15-20 minutes of your time.

If you have completed the online questionnaire survey, I would like to thank you for your time and participation. If you have not completed the online questionnaire survey, you may access it through the following URL link:

goo.gl/7EMtQM

Your response will remain confidential and anonymous. Your voluntary participation is greatly appreciated. As a token of appreciation for completing the online questionnaire survey, you will be offered a $5 Gift Card to either Tim Hortons or Starbucks.

If you have any questions or concerns about the study, please do not hesitate to contact me at the address below.

Sincerely,
Researcher Name: Sarah Ibrahim, RN, MN, PhD Candidate
Researcher Address: Arthur Labatt Family School of Nursing,

Appendix F: Quantitative Phase Questionnaire Survey

Registered Nurses' intention to use electronic documentation systems Questionnaire

Instructions: You have received this questionnaire because you are a Registered Nurse practicing in the home care sector. To confirm this, please complete the following checklist before you respond to the questionnaire.

If any of the listed items do not apply to you, please do not complete the questionnaire, rather return it in the enclosed envelope.

If all items below apply to you, kindly complete the questionnaire and return it in the enclosed envelope.

- ☐ Currently a registered nurse (RN) with the College of Nurses of Ontario

- ☐ Currently practicing in the home care sector

- ☐ Involved in the provision of coordinated or delivery of care to patients within the home care sector in Ontario

Part One: Personal and Professional Information

The following are items related to your personal characteristics as a Registered Nurse. Please, respond to the following items by putting a check mark (√) in the space next to the appropriate answer or writing your answer in the provided space.

1.   **What it is your Age? _____** (enter years)

2.   **What is your Gender?**
           Male
           Female
           Transgendered
           Option to self-identify_____
           Prefer not to answer

3.   **What is your highest level of nursing education?**
           Diploma/Certificate
           Bachelor's Degree
           Master's Degree
           Doctoral Degree
           Other, please specify: _____

4.   **What is your current employment status?**
           Casual
           Employed Part-Time
           Employed Full-Time
           Other, please specify: _____

5.   **Who is your employer?**
           Service Provider Organization (e.g. Victorian Order of Nurses, CarePartners)
           Local Health Integration Network
           Other (please specify) _____

6.   **What is your current position?**
           Care Coordinator
           Nurse providing patient care
           Other, please specify: _____

7.   **Which region of Ontario are you currently employed in?**
           Erie St. Clair
           South West
           Waterloo Wellington
           Hamilton Niagara Haldimand Brant
           Central West
           Mississauga Halton
           Toronto Central

Central
Central East
South East
Champlain
North Simcoe Muskoka
North East
North West

8.   How many years have you been working within the healthcare system? ____

9.   How many years have you been working within the home care sector? _____

10.   Are you currently working outside of the home care sector?
          Yes
           No

10a.   **If <u>YES</u>, please indicate in which sector(s) you are working.**
          Community
          Acute-care (Hospital)
          Long-Term care
          Private Sector

10b.   **If <u>YES</u>, how many years did you work in the identified sector above? _____**

11.   Prior to working in the home care sector, did you work in the acute care sector?
          Yes
          No

11a.   **If <u>YES</u>, how many years did you work in the acute care sector? _____**

12.   Do you have experience using hardware (e.g., Smartphones, Blackberry, computers) or software applications (e.g., Computerized Provider Order Entry)?
          Yes
          No

12a.   **If <u>YES</u>, please describe the type(s) of hardware and or software applications you currently use:**

_____

_____

12b.   **If <u>YES</u>, how many years have you been using hardware and or software applications in your current practice? _____**

The following questions are related to **Electronic Documentation Systems.**

Electronic documentation systems are used to systematically document in a timely and comprehensive manner, patient health and care related information. The information entered into the electronic patient charts can include nursing-related assessments, diagnoses, derivation of expected outcomes and goals of client care, interventions implemented (i.e., client teaching), evaluation of nursing care and interventions (i.e., response to nursing interventions, teaching and treatment) as well as possible revisions to care plan

12. **Do you have any experience with using electronic documentation systems in your home care practice?**
      Yes
      No

12a. **If __NO__, please describe what type of documentation system you currently use. For example, a hybrid documentation system, that is, a combination of paper and electronic documentation.**

_____

_____

_____

12b. **If __YES__, please describe the type of electronic documentation system you currently use:**

_____

_____

_____

12c. **If __YES__, how many years have you been using electronic documentation systems in your home care practice? _____**

12d. **If __YES__, how often do you use the electronic documentation system in your home care practice?**
      Less than once a month
      Once every 2 weeks
      Every week
      Daily

13. **What is your comfort level with using electronic documentation systems in your home care practice?**
      Not comfortable at all
      A little comfortable
      Quite comfortable
      Very comfortable

13a.   Could you explain why you feel comfortable or uncomfortable using electronic documentation systems in your home care practice?

_____

_____

_____

14.   Have you developed approaches and ways around using the electronic documentation system as intended in your home care practice?

Yes

No

14a.   If <u>YES,</u> can you describe the approaches you have developed and why? For example, system not designed/aligned with how you would normally complete a task.

_____

_____

15.   Why do you use an electronic documentation system? [Select all that apply]

Mandated in your home care practice

Improves access to up-to-date patient health-related data

Improves patient-related decision making

Improves collaboration and communication

Improves patient care

Improves patient outcomes

15a.   Please elaborate on why you use electronic documentation systems in your home care practice.

_____

_____

_____

Part Two: Exploration intention to use electronic documentation systems in home care practice.

The following are statements about your use of **<u>electronic documentation systems</u>** in your home care practice. Please read each statement carefully and select the most appropriate response. There are no right or wrong answers to the statements below.

Electronic documentation systems are used to systematically document in a timely and comprehensive manner, patient health and care related information. Information entered into electronic patient charts can include: nursing-related assessments, diagnoses, derivation of expected outcomes and goals of client care, interventions implemented (i.e., client teaching), evaluation of nursing care and interventions (i.e., response to nursing interventions, teaching and treatment), and possible revisions to care plan.

Rating: Please answer the following questions/statements by selecting the most appropriate response based on your opinion and experience.

Performance Expectancy	Rating Scale
1. Using electronic documentation systems in my job would enable me to accomplish tasks more quickly.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
2. Using electronic documentation systems in my job would improve my job performance.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
3. Using electronic documentation systems in my job would increase my productivity.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
4. Using electronic documentation systems in my job would enhance my effectiveness on the job.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree

Performance Expectancy	Rating Scale
5. Using electronic documentation systems would make it easier to do my job.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
6. I would find using electronic documentation systems useful in my job.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree

Effort Expectancy	Rating Scale
7. Learning to operate electronic documentation systems in my job would be easy for me.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
8. I would find it easy to get electronic documentation systems to do what I want it to do.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
9. My interaction with electronic documentation systems would be clear and understandable.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
10. I would find electronic documentation systems to be flexible to interact with.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree

Effort Expectancy	Rating Scale
11. It would be easy for me to become skillful at using electronic documentation systems.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
12. I would find using electronic documentation systems easy to use.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree

Attitude	Rating Scale
13. The use of electronic documentation systems improve patient care by giving the nurse more time with the patients.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
14. Electronic documentation systems can be adapted to assist nurses in many aspects of patient care.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
15. The time spent using electronic documentation systems is out of proportion to the benefits.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
16. Computerization of nursing data through electronic documentation systems offer nurses a remarkable opportunity to improve patient care.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
17. Electronic documentation systems make nurses' jobs easier.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
18. Electronic documentation systems cause nurses to give less time to quality patient care.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain

Attitude	Rating Scale
	□ 4 = agree □ 5 = strongly agree
19. Electronic documentation systems increase costs by increasing the nurse's workload.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
20. It takes as much effort to maintain patient records in electronic documentation systems as it does by hand.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
21. Electronic documentation systems create more problems than they solve in nursing practice.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
22. The use of electronic documentation systems dehumanize nursing care.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
23. Part of the increase in costs of healthcare is because of electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
24. Nursing data does not lend itself to electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
25. I am comfortable using electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
26. Working with electronic documentation systems would make me very nervous.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree

Attitude	Rating Scale
27. I do not feel threatened when others talk about electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
28. Electronic documentation systems do not scare me at all.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
29. I feel aggressive and hostile toward electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
30. Electronic documentation systems make me feel uneasy and confused.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
31. I have a lot of self-confidence when it comes to working with electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
32. Confidentiality is nearly impossible if patient records are in electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
33. Confidentiality will not be sacrificed by patient records being entered into electronic documentation systems.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree
34. Electronic documentation systems represent a violation of patient privacy.	□ 1 = strongly disagree □ 2 = disagree □ 3 = uncertain □ 4 = agree □ 5 = strongly agree

Social Influence	Rating Scale
35. People (such as nurses, managers, physicians, family members and colleagues) who influence my behaviour think I should use electronic documentation systems.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither agree or disagree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
36. People (such as nurses, managers, physicians, family members and colleagues) who are important to me think I should use electronic documentation systems.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
37. The senior management of the home care organization has been helpful in the use of electronic documentation systems.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither agree or disagree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
38. In general, the organization has supported the use of electronic documentation systems.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither agree or disagree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree

Facilitating Conditions	Rating Scale
39. I have the resources necessary to use electronic documentation systems.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
40. I have the knowledge necessary to use electronic documentation systems.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree

Facilitating Conditions	Rating Scale
	□ 7 = strongly agree
41. Electronic documentation systems are not compatible with other systems I use.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
42. A specific person (or group) is available for assistance with electronic documentation systems difficulties.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree

Behavioural Intention	Rating Scale
43. Assuming I had access to using electronic documentation systems, I intend to use it.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
44. Given that I have access to using electronic documentation systems, I predict that I would use it.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree
45. I plan to use electronic documentation systems in the future.	□ 1 = strongly disagree □ 2 = moderately disagree □ 3 = somewhat disagree □ 4 = neutral (neither disagree nor agree) □ 5 = somewhat agree □ 6 = moderately agree □ 7 = strongly agree

Behavioural Usage	
46. If you are already using electronic documentation systems in your home care practice, on average, how often do you use the electronic documentation system in your home care practice?	Report frequency: _____
47. If you are already using electronic documentation systems in your home care practice, on average, how much time do you spend using electronic documentation systems per shift?	Report total minutes or hours: _____

This is the end of the questionnaire. Thank you for taking the time to complete the questionnaire

SEPARATE QUALTRICS SURVEY

1. What is your preference for completing questionnaires for research purposes:
      Online
      Hard mailed copy

2. Would you like a copy of the research findings?
      Yes
      No

3a. If YES, please indicate how you would like to receive the information. For example, by e-mail or mail. Please provide your information below:

As a token of appreciation for your participation in the study, we would like to offer you a $5 Gift Card. Please indicate to which store you would like to receive the Gift Card for.

      Tim Hortons
      Starbucks

4. Please provide your mailing address to receive the gift card.

In this study, we would like to talk with nurses about their experiences with electronic documentation systems in more depth.

5. Would you be willing to take part in a 30-60 minute telephone interview to discuss your perspectives and experiences with using electronic documentation systems in your home care practice?
      Yes
      No

6. If YES, please provide your preferred method of contact and information (i.e., email address, telephone number) for the researcher to contact you.

Thank you for your time and participation in the research study.

Appendix G: Letter of Information for Qualitative Phase

Project Title: Registered Nurses' intention to use electronic documentation systems: A mixed methods study

Principal Investigators:

Sarah Ibrahim, RN, PhD (Candidate), School of Nursing, Western University
Lorie Donelle, PhD, RN, Associate Professor, School of Nursing, Western University.

Letter of Information

1. **Invitation to Participate**

   You are being invited to participate in the research study designed to explore factors that influence your intention to use electronic documentation systems in your home care practice. You are being asked to participate in the research study because you are a Registered Nurse, currently registered with the College of Nurses (CNO) and are working in the home care sector in Ontario. The research study is being conducted by Sarah Ibrahim, a doctoral candidate at the Arthur Labatt Family School of Nursing, Western University. The project is under the supervision of Dr. Lorie Donelle.

2. **Purpose of the Letter**

   The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this study.

3. **Purpose of this Study**

   The purpose of this study is to explore and understand your perspective of using electronic documentation systems within your home care practice. We are interviewing approximately 15-20 Registered Nurses. The interviews will help us understand your perspectives of using electronic documentation systems in your home care practice.

   The findings from this study will provide useful information for decision-makers and health care agencies to design effective strategies for the successful use of electronic documentation systems by registered nurses in home care practice.

4. **Inclusion Criteria**

   To participate in this study, individuals who are currently registered with the College of Nurses of Ontario (CNO); currently employed full or part-time, practicing within the home care sector; and providing direct or coordinated patient care are eligible to participate in the study.

5. **Exclusion Criteria**

   Registered Nurses who are not working in the home care sector and not providing direct or coordinated patient care are not eligible to participate in this study.

6. **Study Procedures**

   If you agree to participate, you will be asked to participate in a telephone, one-on-one interview. The interview includes questions about your perspective of the transition from paper-based to electronic documentation systems; factors that facilitate or pose as barriers to using electronic documentation systems; and your feelings about electronic documentation systems to improve communication and collaboration with allied healthcare providers to improve delivery of health care. Audio-recording of the interview is required and if you do not wish the interview to be recorded, you should not participate in this study. It is anticipated that the interview will take about 30-60 minutes of your time. The interview will be held on a day and time that is convenient for you.

7. **Possible Risks and Harms**

   There are no known or anticipated risks or discomforts associated with participating in this study.

8. **Possible Benefits**

   You may not directly benefit from participating in this study, but information gathered may assist and inform healthcare agencies as well as policy and decision makers in developing effective and proactive strategies and interventions to support the successful use of electronic documentation systems by RNs in their day-to-day practice. This is particularly meaningful as RNs move into new roles that are enabled and supported by technology.

9. **Compensation**

   You will be compensated with a $20.00 Gift Card to a store of your choice for your participation in this study.

10. **Voluntary Participation**

    Participation in this research study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any point in time without penalty. There is no cost in participating in this research study except your time in taking part in the interview.

11. Confidentiality

For the publishing of this study, your name will be changed to a pseudonym and no identifying information will be linked to the data to ensure anonymity. During the audio-recorded interview, you are asked to refrain from disclosing any information that will or may identify you or others. Should any identifying information be disclosed during the interview, it will not be included in the transcript and data analysis. All data will be stored in a locked cabinet in the Arthur Labatt Family School of Nursing at Western University, data will only be accessed by members of the research team. The data on the computerized databases and computer files will be saved on password protected, encrypted USB keys. The data collected will not be provided to anyone, except as required by law. The names of the participants will not be recorded on any form completed nor will their names be identified in any report that may be published. The results will be reported as a group so that no one individual will be identified. Representatives of Western University Health Sciences Research Ethics Board may contact you or require access to your study-related records to monitor the conduct of the research. Identifiable information (e.g., your name, mailing address, email address or phone number) will be collected for the purposes of explaining the research study, providing the letter of information and consent form, organizing a time for the interview and compensation. The researcher will keep any personal information about you in a secure and confidential location for 5 years and will then be shredded and destroyed to maintain confidentiality. A list linking your study pseudonym with your name and contact information will be kept by the researcher in a secure place, separate from your study file. If you choose to withdraw from this study, your data will be removed and destroyed from our database. You do not waive any legal rights by signing the consent form.

12. Contacts for Further Information

If you require any further information regarding this research project or your participation in the study you may contact the researcher, Sarah Ibrahim or her thesis supervisor, Dr. Lorie Donelle. If you have any questions about your rights as a research participant or the conduct of this study, you are welcome to call the Office of Human Research Ethics.

13. Publication

If the results of the study are published, your name will not be used. If you would like to receive a copy of any potential study results, please contact Sarah Ibrahim.

This letter is yours to keep for future reference.

Consent Form

Project Title: Registered nurses' intention to use electronic documentation systems: A mixed methods study

Study Investigator's Name: Sarah Ibrahim, RN, MN, PhD (Candidate); Lorie Donelle, PhD, RN, Associate Professor, School of Nursing, Western University.

I have read the Letter of Information, have had the purpose of the research study explained to me and I agree to participate. All questions have been answered to my satisfaction.

I consent to this interview being audio recorded □

Participant's Name (please print):   _____

Participant's Signature: _____

Date: _____

Researcher obtaining informed consent: _____

Signature: _____

Date: _____

Appendix H: Email Script for Participant Recruitment for Qualitative Phase

Subject Line: Invitation to participate in research

Dear Mr/Ms:

You are being invited to participate in a study that we, Sarah Ibrahim, PhD Candidate and Dr. Lorie Donelle are conducting at Western University in the Arthur Labatt Family School of Nursing. You are receiving this email because you selected the option that you are interested in potentially taking part in a one-on-one telephone interview in the questionnaire you completed on the factors that influence Registered Nurses' intention to use electronic documentation systems your home care practice.

Briefly, the study involves taking part in a telephone, one-on-one semi-structured interview. The interview includes questions about your perspective of the transition from paper-based to electronic documentation systems; factors that facilitate or pose as barriers to using electronic documentation systems; and your feelings about electronic documentation systems to improve communication and collaboration with allied healthcare providers to improve delivery of health care. Audio-recording of the interview is required and if you do not wish the interview to be recorded, you should not participate in this study. It is anticipated that the interview will take about 30-60 minutes of your time. The interview will be held on a day and time that is convenient for you. Participants will be offered a $20 gift card to a store of choice as a token of appreciation for taking part in the semi-structured interviews.

Attached please find a letter of information that highlights all key elements of the research study for you to review at your earliest convenience. If you have any questions about the study, please contact the researcher at the contact information given below.

If you are interested in taking part in the research study upon reviewing the letter of information, you are asked to sign the attached consent form, e-mail it back and provide your availability for the telephone one-on-one interview.

Thank you for your time.

Sincerely,

Researcher Name: Sarah Ibrahim, RN, MN, PhD Candidate
Researcher Address: Arthur Labatt Family School of Nursing,
                             Western University

Appendix I: Semi-Structured Interview Questions

Question: How do RNs' perceive the use of electronic documentation systems (EDS) within their home care practice?

1) Are you currently using EDS in your home care practice?
   - If **<u>yes</u>**, how would you describe your experience?
     - In what way is your work and performance different since using EDS?
   - If **<u>no</u>**, what are your thoughts about using EDS in your home care practice?
     - How do you think it would impact your work and performance?
2) What factors, or do you see as, facilitate your intention to use EDS in your home care practice?
3) What factors, or do you see as, are barriers to using EDS in your home care practice?
   - What do you think should be done to overcome these barriers?
4) What is, or do you think, your level of comfort and/or discomfort with using EDS would be?
5) How does the design of the technology influence your adoption and/or intention to use EDS in your home care practice?
   - Do you think the EDS were designed for nurses and their practice?
6) How do your beliefs and technology experience influence your adoption and/or intention to use EDS in your home care practice?
7) Do you think personal characteristics, such as one's age and level of education, influence adoption and/or intention to use EDS in home care practice?
8) How do your colleagues, patients, and/or allied HCP affect your adoption and/ or intention to use EDS in your home care practice?
9) How does the organization affect your adoption and/or intention to use EDS in your home care practice?
10) Do you have any other thoughts regarding your adoption and/or intention to use EDS in your home care practice that we have not discussed?

Thank you for your time and participation. Collect mailing information and preference for gift card.

Curriculum Vitae

Name:	Sarah Ibrahim

**Post-secondary
Education and
Degrees:**

Ryerson University
Toronto, Ontario, Canada
2007-2010 BScN

Ryerson University
Toronto, Ontario, Canada
2010-2012 MN

McMaster University
Hamilton, Ontario, Canada
2013-2015 Ph.D.

Western University
London, Ontario, Canada
2015-2019 Ph.D.

**Honours and
Awards:**

Ontario Graduate Scholarship (OGS)
2016-2017; 2017-2018

Iota Omicron Chapter Research Grant
2016; 2018

Age Well Graduate Student and Postdoctoral
Award in Technology and Aging
2015-2017

Helen Fasken Nursing Bursary
2015; 2016

Toronto General Hospital, School of Nursing
Alumnae Association Scholarship
2011; 2016

Nursing Graduate Program Scholarship,
Western University
2015

Related Work Experience:

Co-Investigator
Title: Using Interprofessional, Student-Directed Simulation to Enhance Critical Thinking and Collaboration in Emergency Situations in Community Health Settings
Funding: Instructional Technology Innovation Fund (ITIF)
Lawrence S. Bloomberg Faculty of Nursing, University of Toronto
2017

Co-Investigator
Title: Arterial Blood Gas Interpretation: Development of an Innovative, Technology-enabled Assessment Module for Undergraduate Nursing, Nurse Practitioners and Physician Assistant Students
Funding: Instructional Technology Innovation Fund (ITIF)
Lawrence S. Bloomberg Faculty of Nursing, University of Toronto
2016

Graduate Research Assistant
PI: Dr. Lorie Donelle
Arthur Labatt Family School of Nursing, Western University
2018

Graduate Research Assistant
PI: Dr. Sandra Regan and Dr. Lorie Donelle
Title: Integrating primary health care and home care through health information technology: Implications for policy, planning, and practice.
Arthur Labatt Family School of Nursing, Western University
2015-2016

Co-Investigator
PI: Canada Research Chair of Interventions, Dr. Souraya Sidani
Funding Source: Canadian Institute of Health Research (CIHR)
Title: Exploration of Strategies for Culturally Tailoring Health Interventions
Health Interventions Research Centre, Ryerson University
2013-2015

Publications:

Ibrahim, S., Donelle, L., Regan, S., & Sidani, S. (submitted). Exploration of Nurses' experiencewith using Electronic Documentation Systems in Home Care. *Global Qualitative Nursing Research Journal.*

Ibrahim, S., Donelle, L., Regan, S., & Sidani, S. (submitted). A qualitative content analysis of nurses' comfort and employment of workarounds with Electronic Documentation Systems in Home Care Practice. *Canadian Journal of Nursing Research*

Ibrahim, S., Donelle, L., Regan, S. & Sidani, S. (submitted). Predicting Registered Nurses' Intention to use Electronic Documentation System in Home Care: Application of an Adapted Unified Theory of Acceptance and Use of Technology Model. *Canadian Journal of Nursing Leadership*

Ibrahim, S., Donelle, L., Sidani, S., & Regan, S. (submitted). Factors influencing registered nurses' intention to use health information technology in clinical practice: An integrative literature review. *Canadian Journal of Nursing Leadership*

Sidani, S., **Ibrahim, S.,** Lok, J., Fan, L., Fox, M. (accepted). Implementing the integrated strategy for the cultural adaptation of evidence-based interventions: An illustration. *Canadian Journal of Nursing Research*

Sidani, S., **Ibrahim, S.,** Lok, J., Fan, L., Guruge, S., & Fox, M. (2017). An integrated strategy for the Cultural Adaptation of Evidence-Based Interventions. *Health,* 9(4), 738-755.

Ibrahim, S., & Sidani, S. (2016). Intervention Fidelity: An Integrative Literature Review. *Research and Theory for Nursing Practice*.

Ibrahim, S., & Sidani, S. (2015). Fidelity of Intervention Implementation: A review of instruments. *Health*, 7(12), p. 1687-1695.

Matthew-Maich, N., Harris, L., Ploeg, J., Markle-Reid, M., Valaitis, R., Gafni, A., **Ibrahim, S.,** & Isaacs, S. (2016). Designing, implementing and evaluating mobile health technologies to support older adults with chronic conditions: A scoping Review. *JMIR mHealth and uHealth*.

Presentations:

Lok, J., **Ibrahim, S.**, Cambly, E., Parry, M., Kanofsky, S., & MacInnes, N. Arterial Blood Gas Interpretation: Development of an online, technology-enabled assessment module. World Conference, October 16-19, 2017; Toronto, Canada.

Donelle, L., Regan, S., Booth, R., Kerr, M., McMurray, J., Ward-Griffin, C., Fitzsimmons, D., **Ibrahim, S.** & Tobah, S. A New Kind of Team! A Nurse-Led Technology Enabled Interprofessional Palliative Home Care Model. Oral Presentation at the 28th International Nursing Research Congress, July 27-31, 2017; Dublin, Ireland.

Ibrahim, S. Regan, S., & Donelle, L. Registered Nurses' intention to using new health information technology within home care. Poster presentation at the Age Well NCE Conference and Annual General Meeting, October 18-20, 2016; Montreal, Canada.

Ibrahim, S., Regan, S., & Donelle, L. Exploring the perceived acceptability of end-users for an innovative technology-enabled model of palliative home care. Poster Presentation at the Sigma Theta Tau 27th International Nursing Research Congress, July 21-25, 2016; Cape Town, South Africa.

Ibrahim, S., Regan, S., & Donelle, L. Exploring the perceived acceptability and preference of end-users for a new and innovative model of care. Poster Presentation at the: Age-Well NCE Conference and Annual General Meeting. October 22-23, 2015; Calgary, Alberta.

Ibrahim, S., Markle-Reid, M., Ploeg, J., Matthew-Maich, N., Harris, L., Bender, D., Taberner, C., & Valaitis, R. (2014). My Stroke Team (MYST): An Integrated KT Approach to Innovate a Mobile Health Solution to Enhance Interprofessional Community-Based Stroke Care. Poster Presentation at the KT Annual Scientific Meeting, June 2014; Quebec City, Canada.