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HEALTH INFORMATION TECHNOLOGY IN NURSING

The Impact of Health Information Technology on the quality of Nursing care. A literature review.

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ABSTRACT

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Health information technology has improved the quality of care by increasing patients' information accessibility and patients' safety. It has enhanced nurses' potentials to analyse a patient's overall wellbeing and aided nurses in decision making. It has increased adherence to care guidelines, and has improved on disease surveillance. It has reduced medication errors and has enabled efficient communication among nursing staff and clients. The purpose of this thesis is to describe the importance of health information technology in assisting nurses to provide quality care. The aim of this thesis is to raise awareness on the benefits of Health Information Technology in nursing care, and to encourage nurses to keep an up-to-date knowledge on Health Information Technology.

The study was carried out with a literature review of previous research done on the subject of Health Information Technology. Data in this study was collected from reliable academic resources and also from the institutions' data base. Articles were selected from SAGE, CENTRIAFINNA, Google Scholar and Science Direct.

According to the results, the rate of morbidity and mortality is directly affected by the quality of care administered by nurses. With a global shortage of nursing staff, introducing Health Information Technology has enabled nurses to provide care in a more vivid and evidence based manner, minimizing chances of error through barcoding medication administration systems. Health Information Technology has also assisted nurses to easily collect, analyze and safely store data through the use of electronic health records, and nurses can easily reach out to their patients with telehealth technologies.

Key words
Health Information Technology, Nursing care, Quality, Safety,

ABSTRACT
CONTENTS

1 INTRODUCTION

Health Information technology (HIT), involves all digital devices that are used to store, analyse, study, retrieve, transmit and communicate data/information. This ranges from simple hospital devices like electronic thermometers to computer systems. (Sheikh, Bates, Wright & Cresswell 2017.) The use of HIT has improved the health of individuals and enhanced the performance of care providers thus upgrading the quality of care administered to patients by nurses (Blumenthal 2010).

From the perspective of Mastrian (2011), nurses can easily access data from all relevant sources to update their knowledge in administering quality care, to better patient care outcome, and to create a safe working environment. With the rapid evolution of knowledge in the health sector, nurses need to embrace technological changes, be open minded to learn new skills and keep an up-to-date knowledge to apply these skills appropriately where need be. (Bonnel & Smith 2010).

In some developed countries, for example in Finland, clients have access to their health history through systems like Omakanta, by simply logging in using their bank credentials. Communication among nurses and physicians is easier, accountable and more reliable. Patients' medical history and prescriptions are easily accessible and it has improved the privacy of patients information. This information is stored in the national Archives of Health Information in Finland, and can be accessed through electronic health records. (Vehko, Ruotsalainen & Hyppönen 2019.) Each time a patients' data is accessed or logged into, it leaves tracks that can be traced, by whom, when and from where the data was accessed, making sure patients' information is used by the right people and for the right reasons. This ensures accountability and data privacy (Kanta 2020.)

2 THEORETICAL FRAMEWORK

The aim of this chapter is to provide a clearer view, based on previous studies, the impact HIT has on the quality of care and patient safety, focusing on evidence based practice, decision support systems, Telenursing, communication, data storage, security and patient participation.

2.1 Support Systems

Nurses work in challenging environments that demand quick and immediate attention to patients with complex and potentially unstable health conditions. This requires nurses to make decisions within split seconds. (Ignatavicius, Workman & Rebar 2016.) As noted by Greenes, Bates, Kawamoto, Middleton, Osheroff & Shahar (2017), information technology constitutes important efforts that help to improve patients' outcome and assist nurses in decision making. It uses tools such as electronic health records, clinical data, clinical decision support system, to process patient specific information (Greens 2014).

Nurses, on the other hand, use cognition and experience, in combination with data received from HIT, to make decisions for the best possible outcomes and quality of care (McGonigle & Mastrian 2014). Decision making links clinical judgment to practice by acting on information obtained from HIT. Clinical judgment is informed opinion using intuition, reflection and critical thinking, in assessing the risk and benefits of possible alternatives before making a decision. (Standing 2014.)

2.2 Telenursing

Telenursing, as defined by Soar, Swindel and Tsang (2010, 270), is the use of telecommunication devices and information technology to provide nursing services at a distance. This extends from simple devices such as fax machines to complex computer systems with cameras (Hanna & Ball 2011). As part of nursing informatics, telenursing is designed to support contact with medical and non-medical applications through teleconsultation and telemonitoring. Telenursing techniques involve remote patient monitoring in real time, by which the patients' treatment can be adjusted over distances. Telenursing platforms could include phone calls, SMS messages, video calls and chat services. (Soar et al. 2010.)

The use of telenursing became more prominent with the outbreak of COVID-19 pandemic in 2020. In Finland, telenursing was put in place as part of social distancing measures by public health experts, in order to curb the spread of the virus. Clients had to call health centres for screening on the seriousness of their symptoms to determine if they had a common flu or Covid infection. (Gogia 2019.)

2.2.1 Teleconsultation

Teleconsultation could be referred to as remote interaction using information and communication technology to overcome distances for diagnosis or treatment purposes between health providers, for example physicians or nurses who may need a second expert opinion, or between health providers and patients for therapeutic advice. (Banerjee, Chakraborty & Pal 2020.)

With teleconsultation, patients can easily get answers to questions regarding their health, or medical advice, or a diagnosis, from qualified medical experts, at a scheduled time convenient for the patient. Patients receive regular medical follow-up, especially those with medical conditions that require constant check-up, for instance, patients on anticoagulants could quickly and easily get their dosage adjusted without having to visit the hospital. (Bice-Urbach & Kratochwill. 2016, 27-43.)

2.2.2 Telemonitoring

Telemonitoring is the use of IT to observe and transmit data related to patients' vitals and physiology, directly to care providers, thus allowing constant and close supervision of a patients' overall health status. It aims at reducing hospital stay and improving health related quality of life. With the use of telemonitoring, appropriate and timely action can be initiated if need be, based on the evaluation of data received. (Angelucci & Aliverti 2019.)

Devices used in telemonitoring could be invasive or non-invasive. Non-invasive telemonitoring methods include, but are not limited to the use of mobile phones to report results measured either by the patient or a family member, interactive television-based systems, and other sophisticated systems which wirelessly transmit recorded data. Invasive telemonitoring includes pacemakers, implantable cardioverter defibrillators. These devices can automatically send signals without the patient initiating the transmission of data. (Mathew & Jefferies 2018)

2.3 **Data storage and security**

With the introduction of IT into the health care system, documentation has changed from paper-based to ERH (Maki & Petterson 2013). An EHR, as defined by Sadeghi and Naccache (2010), is the collection of patient information in an electronic format, stored and transmitted to other health care providers through a secure network, and used solely for the purpose of providing quality and efficient health care.

With the incorporation of information technology into the health system infrastructure, electronic health care services are more often used by patients, doctors, nurses and other health care providers to decrease cost and provide efficient quality of care (Yüksel, Küpçü & Özkasap 2017). Patients can access their health records from home through the internet. Remote patient monitoring had become more practical with the use of specialized sensors. (Balgrosky 2014.)

Because the information stored in the system of the EHR is very sensitive, it therefore needs to be secured. Good information promotes good care. Patient safety can only be assured when information is accessible, its integrity is protected against loss or damage, and confidentiality is maintained. In nursing, data security can be defined as the availability of patients information, to those who need it to provide care where and when needed, how the integrity of this information is protected from unauthorized alteration, damage and loss and the confidentiality of this information from those without authority to read, see or hear it. (NHS 2016.)

2.4 **Communication, patient participation and evidence based practice.**

Communication in nursing care is the way information is being analysed, interpreted, transferred, defined and retrieved (Nelson & Staggers 2016).

> Information recipients can include patients, clinicians and others involved in patient care delivery; information delivered can include general clinical knowledge and guidance, intelligently processed patient data, or a mixture of both; and information delivery formats can be drawn from a rich palette of options that includes data and order entry facilitators, filtered data displays, reference information, alerts, and others (Osheoff, Teich, levick, saldana, Velasco, Sittig, Rogers & Jenders 2012, 15 [Middleton, Sittig & Wright 2016]).

HIT has enabled patients to actively participate in taking responsibility for their own health care. With the ability of patients to access care portals, they are able to learn more effectively about their health condition, keep track of their medication and take note of new symptoms and side effects of the

medication they are on. They can easily interact with doctors and nurses to report any new developments in their condition. Patients feel more useful as part of the care-team when they are responsible for their care. The outcome is usually an improvement in quality of life and care. (Tobiano, Marshall, Bucknall & Chaboyer 2015.)

HIT facilitates nurses and other health care providers to access and evaluate information and other evidence-based clinical guidelines from a rich palette of sources online. This enables nurses to come up with the best possible patient-centered care strategy. Information on the patient is readily stored in their electronic health record. HIT facilitates the collection, processing, analysis and retrieving of patient-specific information for health staff. Health care administrators are responsible for implementing guidelines on the use of valid and trusted sites through which nurses can retrieve information that best suits the standard practice based on evidence (Nelson & Staggers 2016).

3 PURPOSE OF RESEARCH, RESEARCH QUESTIONS AND METHODOLOGY.

The purpose of this thesis was to describe the importance of health information technology in assisting nurses to provide quality care. The aim of this thesis was to raise awareness of the benefits of Health Information Technology (HIT) in nursing care, and to encourage nurses to keep an up-to-date knowledge on HIT.

The research questions were:
1. What are the impacts of health information technology on quality of care?
2. What aspects of information technology are used by nurses to enhance patient safety?

3.1 METHODOLOGY

A literature review was used to conduct the research by analyzing online articles from scientific databases. Search terms pertaining to health information technology, in combination with terms related to quality of nursing care were used to narrow down findings dealing with the research question. The research method reviews the literature from previous studies carried out, with relevant information on the use of health information technology to upgrade the quality of patients care.

3.2 Literature review

A literature review is an academic article that evaluates previous research, and discusses substantive findings pertinent to the research topic. In a literature review, the researcher surveys scholarly articles related to a specific topic. Reviewing the literature of academic articles gives an overview of current knowledge, thus allowing the researcher to identify relevant theories, methods and what is lacking in the existing research. (Williams & Whittaker 2019.)

A good literature review consists of the following steps; searching for relevant material with keywords from credible sources, evaluating and selecting sources most relevant to the research questions, identifying themes by taking note of concepts that occur periodically across the literature, identifying debates, conflicts or contradictions on where the sources disagree, identifying gaps, taking note of what is missing from the literature, outlining the structure of the literature review and writing the literature review. (Aveyard 2014.)

When writing a literature review, the author analyses, critically evaluates and synthesizes existing knowledge relevant to the research problem to give a clearer picture of the research topic. The author distinguishes what has been done and what needs to be done. (Hart 2018.) Significant findings are discussed, and possible reasonings or suggestions are offered. Citation of the source is essential in a literature review to avoid plagiarism and give credit to key researchers (Coughlan, Cronin & Ryan 2013).

3.3 Data collection

Data for this study was collected from SAGE and Science Direct. A qualitative research method was used in conducting the search, with key words pertaining to Health Information Technology and Quality of Nursing Care. Keywords used in the search engine were, HEALTH, INFORMATICS, QUALITY, NURSING, CARE. The data collection process was carried out using inclusion and exclusion criteria as a tool to sort evidence-based material and by using keyword combinations to search material that were relevant for the studies. The TABLE 1 below illustrates data search results from the various data bases.

TABLE 1. **Data Search Results**.

Search Words	Science Direct	SAGE
Health + Information + Technology	397,877	84531
Health + Informatics	47,970	4687
Health Information Technology + Nursing Care + Quality of Care	1,492	844
Impact + Health + Information + Technology + Nursing	32,476	12633

The author further filtered the search to obtain more reliable and genuine result by using inclusion and exclusion criteria, illustrated on the table below.

TABLE 2. **Inclusion And Exclusion Criteria.**

Inclusion criteria	Exclusion criteria
Articles related to health information technology	Articles that were not related to health information technology
Articles demonstrating the impact of health information technology on quality of care	Articles that did not demonstrating the impact of health information technology on quality of care
Articles from 2010 till present	Articles written before 2010
Articles with full text and abstract	Articles without full text or abstract.
Articles that were free and without subscription	Articles requiring a fee and subscription
Evidence based scientific articles and journals related to the nursing	Articles not related to nursing and non-scientific
English articles	Articles in other languages

The author took into consideration the inclusion and exclusion criteria to further filter the search results. Articles were collected from SAGE and Science Direct. The table above illustrates conditions for the inclusion and exclusion criteria that determined the eligibility for search of articles that were fully written and with an abstract and were free of charge. The articles must have been published within ten years and should be evidence-based. Only English articles were considered. Moreover, the articles included had to deal with the research questions and correspond to the keywords. A total of 158 articles that met the inclusion criteria were originally collected from the database out of 582 articles.

To further reduce the number of articles, the author used a scoping review to select articles that dealt directly with the research question by reading through the abstracts which reduced the number of articles to 64. A Scoping review is used as a mapping tool for an existing literature to lay out the authors' interest in terms of the size, the nature, the quality of the research and the primary message the author is relaying in the research. The scoping review assesses the scope and the nature of the work

done in a research on a topic. It determines the value and credibility of articles and is used as a preliminary step to a systemic review. (Levac, Colquhoun & O'Brien 2010.) After reading the results of 64 articles, the researcher filtered the total number of articles down to 13 which were disseminated between 2010 till present. In addition, materials not meeting the inclusion and exclusion criteria were further omitted.

3.4 Data analysis

Data analysis was performed to examine the content of the literature. Data analysis provides the author with accurate conclusions through an informed decision making process in order to determine appropriate answers to the research question. As defined by Cuesta (2013), data analysis is the process in which raw data is ordered and organized to be used in methods that help explain the past and predict the future. The process involves collecting, evaluating, organizing, examining and condensing data in a systematic order based on the authors judgment and interpretation of data collected. (Moule & Goodman 2016.)

Data condensation, as defined by Miles, Huberman & Saldana (2013), refers to the process of selecting, focusing, simplifying, abstracting and transforming data from a published article, transcript and other documents. Data condensation makes the text stronger which is in contrast to data reduction, which makes the text weaker. With so much material to select from, data analysis aids the author in choosing meaningful and evidence-based data with regards to the research question. (Burns, Grove & Gray 2012.)

The preferred method of analysis was by using a qualitative content analysis. As suggested by Elo, Kääriäinen, Kanste, Pölkki, Utriainen & Kyngäs (2014), a qualitative content analysis systematically analyses data such as text or transcript to give meaningful results based on the authors' judgment and knowledge of the context of data collected. In this approach, the researcher will look for keywords that address the research questions (Moule & Goodman. 2016). This method of analysis ensures that maximum useful information addressing the research questions is extracted. The process of qualitative data analysis most often relies on the researchers' interpretation and perception skills of data collected. Thus, the authenticity and trustworthiness of the study might be questionable (Elo et al. 2014).

Two validation strategies were used to establish the credibility, trustworthiness and interpretation of the studies in other to demonstrate its neutrality. These were an audit trial, which presents a step by step approach to the research project, from the start of the research through the analysis of data to reporting findings. An audit trial supports the researcher's interpretation of data collected, in a concise form that maintains meaning and value. (Moule & Goodman 2016).

Another method employed was by asking a third party with knowledge of the topic and methodology, to theme code a sample of the data separately. This helped the author to take a second look on themes that were left out for further consideration. Themes were coded from search articles that were rigorously studied and selected by the author. The themes selected were Health Information Technology and Nursing Care Quality. Subtheme; were derived from the themes. Included in the sub themes were, systems aim at facilitating evidence-based decision in nursing, systems that store and secure patient data to maintain privacy and security and for corroboration purposes. Last but not the least were systems aiming at facilitating communication amongst health personnel. (Guest, MacQueen & Namey 2012.)

TABLE 3. Data Analysis Process Of Health Information Technology On Quality of Care.

Primary theme	Sub themes	Codes .
	Improve Accessibility	- Easy access to patient information. - Remote monitoring of patients. - Improve communication. - Empowers patient. - Gives patient access to their health information.
	Electronic health records	- Promotes evidence based decision support. - Streamline workflow of nurses. - Ensures quality control. - Facilitates reporting of results.

Improves quality of nursing care.	Telehealth	- Slow down the spread of transmissible diseases. - Increases access to health care. - Improves integrated care. - Ensures access to medical specialist. - Ensures communication and continuity of treatment.
	Electronic patient portal	- Encourage patient participation in their health care. - Allows patients to request refills, and schedule appointments. - Encourages better patient compliance and adherence to treatment.

TABLE 4 Data Analysis Process Of Health Information Technology On Patient Safety.

Primary themes	Sub themes	Codes
Enhance patient safety	Bar code medication administration.	• Improves accuracy in drug administration. • Provides important information about the patient. • Minimise the chances of wrong prescription.
	Electronic hand off reports	• Prevents miscommunication among nurses. • Minimises error during change of shift. • Provides accurate and real time information of a patient. • Assist in decision making. • Facilitates continuity of care.
	Smart infusion pump.	• Minimises drug infusion error. • Intercepting errors such as wrong rate and wrong dose. • Cost effective.
	Monitoring devices.	• Provides real time information of patients overall health, most importantly, patients vital signs.
	Centralised command centre	• Analyse and provides nurses with real time data of the hospital.
	Education.	• Up to date knowledge with current guidelines through remote learning.
	Make up for Nurse shortage.	• Facilitate workload, in turn reducing nurse burnout

3.5 **Ethical consideration**

The author made references to the sources from which data were collected in order to acknowledge the works of previous researchers and to avoid plagiarism. The author strictly followed the guidelines of Cenria University of Applied Sciences and only accessed data through links and websites recommended by Centria to ensure the reliability and validity of the thesis. The articles chosen were rigorously analysed several times to make sure the information collected was a true reflection of the article and to avoid bias.

4 RESULTS

This chapter discusses the impact of HIT and the quality of care derived from implementing its various forms. The literature review consists of 13 articles used in the analysis process to answer the research questions. Based on findings obtained from data analysis, the author found a significant link between the implementation of HIT and improved nursing care quality, taking into consideration patient satisfaction and safety.

The rate of technological advancement in nursing creates a path in the future that overcomes current challenges nurses face in providing adequate care. It helps with the shortage of nursing staff by reducing work overload as it allows nurses to multitask without much effort and and thus reduces the incident of burnout in nurses. The use of technology by nurses to coordinate and provide adequate care is becoming a vital skill needed in the nursing field. Nurses play a role across many settings in almost all walks of life, and therefore will require a diverse set of skills to optimise the delivery of their service.

HIT has become increasingly dynamic, changing how nursing care is viewed and administered. To monitor patient status and identify changes, nurses previously relied on their senses of sight, touch, smell, and hearing before the implementation of technology. Over time, the unaided senses of nurses were replaced by monitoring technological devices designed to detect and record changes in patient conditions.

The results showed that Hospitals and other health care facilities now use a variety of technology to implement care, with nurses being the ones to operate them. Some of these include but are not limited to EHR, medication management tools, telehealth technology, mobile lab services and online appointments. The results also showed that, nurses take part in online training through video conferencing and other online courses to improve on their skills and have access to a wide variety of reliable information on the internet to keep an up to date knowledge with new concepts.

4.1 **Impact Of Health Information Technology On Quality Of Care.**

From the results obtained, there are various aspects of IT that makes it easy to access patients information and improve communication. Patients can be remotely monitored in a different geographic location with the use of telecommunication systems to receive care. HIT provides patients with access to medical records that allow them to become more aware of their conditions and enables them to engage actively in joint decision-making.

4.1.1 Electronic Health Record

An Electronic EHR is a digital collection of a patients' medical history in an electronic format, stored and transmitted to other health care providers through a secured network, and used solely to provide quality and efficient health care (Sadeghi & Naccache 2010). EHR is patient centered and contain real-time information of a patients' medical and treatment history such as diagnosis, health progress, health problems, medications, vital signs, immunization, allergies, radiology images and laboratory data (Maki & Petterson 2013).

Information in an EHR is instantly available to authorised users through a secure network. The EHR can streamline the workflow of nurses and promote evidence-based decision support, quality control and reporting of results. An efficient EHR offers accurate and timely reporting of patient diagnosis and treatment and provides a concrete resource for supporting adequate health care. (Finnell & Dixon 2013.)

Under the responsibility of a national health authority, an EHR scheme enables the medical records of patients to be made accessible to health practitioners in various health care institutions and offers access to relevant national health services, such as pharmacies, labs and specialist emergency and medical imaging facilities. The EHR provides rapid, comprehensive and timely patient information for the provision of care. (Smith, Fitzpatrick & Carpenter 2015.)

4.1.2 Telehealth and Electronic Patient Portal

Telehealth includes a wide range of non-clinical functions encompassing prevention, promotion and curative elements of health. It often involves the use of electronic means or methods for health care, public health, administration and support, research and health education. In recent years, telehealth has proven suitable for handling transmissible diseases. One main factor in slowing down the spread of a virus is social distancing by limiting contact between people and keeping a safe distance from one another . Telehealth may assist patients with COVID/19 or those showing symptoms with remote assessment and care. Telehealth may provide easy access to routine treatment for people who do not have corona virus, especially those with a high risk of being infected, for example the elderly and those with pre-existing medical conditions without, the risk of exposure in a congested hospital or at medical practice waiting rooms. (Smith, Thomas, Snoswell, Haydon, Mehrotra, Clemensen & Caffery 2020.)

Telehealth innovations have contributed significantly to patient accessibility. Telecommunications systems made it easier for patients living in a different regions to receive nursing care through remote patient monitoring, live video conferencing and mobile health apps. Nowadays, through the use of HIT, quality treatment is now available for those living in remote areas. Telehealth increases access to health care by eliminating time and regional barriers. It reduces the need for in-person consultation and travel, which enables patients to be provided with health services where they are most convenient. (WHO 2016).

Telehealth improves the quality of care through education and self-monitoring by empowering patients, which is regarded as a critical component in improving integrated care and management of health sector resources. It ensures access to medical specialists and improves communication and continuity of treatment between the health team members and the patient. It provides support for health care self-management and may offer opportunities to enhance the quality, collaboration and coordination of healthcare. Telehealth provides a secured online portal that enables clients to communicate with their nurses, schedule appointments or request for a refill of prescription medications. (WHO 2016, 31-38)

Nurses may also use the services of telehealth to gain input from colleague through virtual consultation when they have questions regarding a patients' treatment plan, or to get an expert's opinion on a case. These virtual consultations can avoid unnecessary referrals to a specialist, reduce waiting times for the

feedback of a specialist and minimize unnecessary travelling. There is a broad range of technology and applications that enables nurses and health practitioners to closely monitor the wellbeing of their clients, for example web-based or smartphone applications to upload information such as blood glucose readings and vital signs.

Electronic patient portals are electronic communications platforms which encourage patient participation through a secure online access to health data stored in an EHR and administered by the health care system. The portal provides patients with access to the Electronic Health Record (EHR) to pick clinical information such as laboratory test reports or summaries of their care plan. Moreover, electronic patient portals can allow patients to request refills, schedule appointments and connect with their care team by means of secure messaging systems. The portal should be user friendly with an easy-to-access menu that operates round the clock. This can result in better compliance and adherence to treatment. (Hawkins, Lawson, Starr, Borkan & Gonzalo 2016.)

4.2 Aspects of Information Technology used by nurses to enhance patient safety

HIT offers many opportunities for enhancing patient safety, some of which includes minimizing human errors, improving clinical performance, improving the quality and efficiency of nursing practice and maximizing the use of time. From the authors' analysis, implementing health information technology in administering care shows to have a positive impact on improving patient safety through possibilities which are not attainable on paper-based system. For example, paper-based systems cannot detect and alert clinical errors or abnormalities in vital signs. As a result, safer treatment standards in a HIT-enabled setting can be higher compared to a paper-based environment.

4.2.1 Bar Code Medication Administration System

A bar code medication administration system is a system designed to reduce human medication errors in drug administration in hospitals and other health care settings. From a nurses perspective it aims at improving accuracy in medication administration by ensuring that the five rights of drug administration, which are the right person, the right drug, the right dose, the right route and the right time, are followed through an inventory controlled network. (Kelley. 2016)

Medication error as defined by WHO is any preventable harmful situation that may occur due to the inappropriate use of medication or any pharmaceutical product, either by the health care staff or the

consumer. These errors present a major threat to patient safety. Adverse drug events arising from medication administration errors could prolong a patients' stay in the hospital and have a significant financial implication on the healthcare system (WHO 2016).

The technology comprises of a bar code scanner, a computer system with a user-specific software designed for the care facility, and a server. Drugs are labelled with unique barcodes that contain data encoded in the barcodes, which enables the prescribed drug to be matched with what was ordered for the patient. Before administering medication, a nurse scans the barcode on the patient's wrist band and the bar code on the medication and on the nurses' batch. The data is sent by electronic means to a computer software system which uses complex algorithms to search different databases for real-time information on the patient medical history. (Kelley 2016.)

It is worth noting that the barcode of each patient contains all important information about the patient and their medication. If the system is unable to match the information on the patients' barcode with the medication to be administered, it sends an alert to the nurse. Most systems automatically record the administration of a prescribed drug in an electronic medication administration record (eMAR). The eMAR is a system usually incorporated in the EHR that automatically documents the administration of prescribed medication by nurses. (Yoder-Wise, Waddell & Walton 2019.)

4.2.2 Electronic Hand-Off Reports

Communication among nurses is a critical factor in promoting clinical collaboration and improving patients' outcome. Adverse events and patient harm may result from miscommunication between members of the patient care team. Electronic clinical handoff has shown to be of particular significance to patient care and safety, by minimizing errors such as those that occur during shift changes. An electronic clinical handoff is a process of passing real-time patient specific information by electronic means from one caregiver to another or among members of an interdisciplinary team to ensure continuity of care and safety. The information transferred during hand-offs serves as the basis for patient treatment in the subsequent transition. (Yoost & Crawford 2019.)

If nurses do not share complete and accurate information during a handoff report, patients might not get adequate care, proper medications or the right therapy. An electronic handoff report provides accurate and timely information about the treatment and care given to the patient. As compared to other traditional methods of handoff reports, the electronic handoff report saves time as nurses can easily log in to the EHR system and read through the treatment and care given to the patient by nurses

of the previous shift or an interdisciplinary team. It minimizes the chances of errors in that after a long shift, nurses are tired and might forget to hand over some vital information orally. (Potter, Perry, Stockert & Hall 2014.)

More so, electronic handoff systems have checkboxes making it easy to fill in and read. Information entered in the electronic hand-off is stored in an EHR and can always be assessed for referral (Zerwekh & Garneau 2020). Electronic hand-offs help nurses build a shared understanding of the need for care and assist in organizing treatment and decision making in a safe and orderly manner to facilitate continuity of care thereby preventing events that might cause injury or increase the patients' length of stay in the hospital (Potter et al. 2014).

4.2.3 Smart Infusion Pumps and Monitoring Devices

A smart infusion pump is a computerized device that administers drugs or nutrition to a patient through intravenous, subcutaneous, intramuscular, intrathecal, epidural, or intra-arterial routes. It aims to minimize drug infusion errors through the use of a drug library. Unlike traditional infusion pumps, smart infusion pumps are programmed to include patient-specific data stored in the drug library. The drug library contains a list of prescribed drugs stored in its memory, and the most critical element of a smart pump. Drug libraries are designed according to the needs of each hospital. This is because each hospital has its protocol in medication administration. (Scarlat 2012.)

Smart infusion pumps can be categorized into large-volume and §-volume pumps. Large volume pumps are mainly used for the infusion of thicker fluids, for example patient , nutrient solutions, while small volume pumps are used to infuse less viscous fluids like hormones and other medications. The data programmed in the library of the smart pump includes the patient's details such as name, a list of medication with dosage, dosage unit and the concentration for each medication. The nurse sets the parameters of the infusion by infusion rate, maximum and minimum dosage. The pump notifies the nurse if the programmed infusion is out of the set parameters. (Sandberg, Urman & Ehrenfeld 2010)

 Monitoring Devices are technological devices that enable nurses to obtain biometric values of information. These devices include fetal monitors that can display a baby's heart rate still in the uterus; heart monitors that show a patient's electrical rhythm and heart pattern; and vital sign machines that take the patient's blood pressure, pulse, and breathing automatically. Other monitoring systems assess the pressure within the heart or brain or the amount of oxygen in the blood of a patient. Systems installed into the hospital bed report the weight or movement of a patient while asleep. (Watfa 2011.)

5 Education and Centralized Command System

An online college will help nurses obtain the training they need to progress their career. They have the opportunity to go to school while they continue working. They will be more comfortable with the computer skills needed in HIT and the versatility to do coursework on their schedule by using applications for online college programs. Competency-based education (CBE) ensures that nurses can take and use their job experience to help them progress through classes where they already have expertise and experience more quickly. As the field of nursing evolves with new technologies, nurses must adapt to it. Moreover, nursing staff could receive updated knowledge over the internet to facilitate their integration into the new system of HIT in hospitals and other health care facilities. Nurses who are well-equipped with knowledge stand a better chance of ensuring patient safety through the use of HIT. (Bonnel, Smith & Hober 2018, 242-243.)

The centralised command centre analyses data and provides real-time feedback to nurses and other health care workers to optimise care delivery. It provides an effective care delivery system with positive patient outcome and experience, and a better way for nurses to manage supplies with respect to capacity, through a system of centralised quality control and coordination of care. It provides nurses with current updates of room availability, schedules and the requirements of individual patients upon discharge. This allows for an efficient and effective workflow. Command centres facilitate and improve coordination between different hospital departments. (Grunden & Hagood 2012.)

6 Impact of Health Information Technology on shortage of nurses

Nurse shortages have been a significant factor in work-related burnout in nurses. Nurse burnout which is a common condition characterized by a decline of energy that manifests in emotional fatigue, loss of motivation, and feelings of anger and may contribute to decrease in the effectiveness of work. HIT will help reduce the pressure on nurses as it requires fewer nurses to provide efficient care. Telehealth also offers nurses the chance to access remote areas that are facing shortage of health care workers. This involves areas without reasonable numbers of healthcare workers in more rural regions; telehealth aims to overcome these shortages by delivering remote care to patients effectively. Ultimately, these advancements in telehealth technologies will minimize healthcare expenses by minimizing ER visits and hospital admission sessions. This in turn ensure a safer practice on the side of the nurses. (Billings & Halstead 2013, 100-105.)

7 DISCUSSION

This study explored the impact health information technology has on the quality of nursing care practice through the review of existing literature. The aim of this study was to raise awareness on the benefits of HIT in nursing care, and to encourage nurses to transition into modern nursing practice by implementing Health Information Technology (HIT) in administering care. This chapter further provides answers to the research questions based on results obtained by analyzing the literature.

The method of research was a literature review. The literature review was the most appropriate method to use because HIT is still an evolving field in nursing practice. Conducting an interview to find out the perception of nurses and patients on their experience with health information technology would have been a challenge. A literature review evaluates previous research carried out, discussing substantive findings relevant to the research topic. In a literature review, the researcher surveys scholarly articles related to a specific topic. A literature review gives an overview of current knowledge, thus allows the researcher to identify relevant theories, methods and what is lacking in the existing research (Williams & Whittaker 2019.)

Information obtained from the literature showed that the initiation of health information technology into nursing care was a challenge as nurses felt very reluctant to switch from the old ways of nursing practice. They thought technology will increase workload and will be stressful if they had to learn how to use this technologies. Some were skeptical about the reliability and efficiency of new technology in administering care and others were of the opinion that technology will cause unemployment. All these skepticism proved otherwise. Results from the analysis indicated that technology was a helping factor in administering efficient and safe care, it reduced work load and increased nurses' performance. Nurses have become more confident in carrying out their duty as they rely on the accuracy of technology which had proven to reduce the rate of human errors. It reduced operation costs, increased accessibility of patients' information and improved care coordination. (Khalifa 2013, 335-342.)

Technological evolution has drastically improved the way providers process information and deliver services. Health care environments increasingly use robust technology to manage the administration of care. For this reason, learning is a continuous process for both entry-level and experienced nurses, as nursing schools create innovative curricula that serve the new caregiving environment. With nurses

being the majority of the care team and front line caregivers, the most noticeable changes in HIT has occurred in the nursing sector. (Thimbleby 2013, 160-167).

Communication is key to safe and efficient care. Nurses use sophisticated technology to provide quality care, health information technology provides an effective means of communication, which maximizes nurses' use of time. Hospitals and other health care settings operate better by integrating HIT with EHRs. Nurses and other health care professionals use HIT to optimize the value of EHRs to store, interpret, and use real-time patient data to make crucial decisions. (Allender, Rector & Warner 2013, 329.)

Another very important tool in health information technology emphasized in the literature was telenursing. Telenursing has proven to effectively reduce unnecessary hospital visits, minimize the risk of cross-infection, and still deliver efficient and safe care. The technology could be used in both emergency and non-emergency situations. In emergencies, nurses could participate in a virtual triage set-up that enables them to monitor a patient's vital signs by using a platform that guides the patient with a variety of simple questions. Answers to these questions enable nurses to come up with the best possible nursing care plan there is to address the situation. In non-emergencies, patients can be instructed on how to dress wounds or treat minor injuries like bruises and burns. (Heydarikhayat, Ashktorab, Rohani & Zayeri 2018.)

In addition to providing care, HIT is used to train nurses though distance learning. More so, nurses will be able to advance their skills through courses offered online without necessarily being there physically. It has also shown to provide access to remote clinical facilities which previously were short of staff with particular skills, thus increasing access to care and reducing the time and cost of traveling thereby enhancing a timely intervention for the care of patient's needs. (WHO 2020)

Telenursing has also shown to be fundamental in disaster situations where there is usually a shortage of specialized clinicians and nurses at the scene of incident. Such events could be natural disasters like hurricanes and earthquakes and non-natural disasters like in warzones or traffic accidents. In most cases, nurses at the scene do not have sufficient knowledge to provide trauma-specific care and need guidance. For instance, neck trauma which requires unique positioning, hypovolemic shock, blood product prescription, ventilation settings, using an Ambu bag and other types of nursing care which

might require special skills could all be managed from afar distance through audio-visual means or phone calls to prevent further damage.(Nejadshafiee, Bahaadinbeigy, Kazemi & Moghadam 2020).

A study carried out by Moughrabieh & Weinert in 2015 showed that postoperative care management, patient transfers, telephone treatment orders to nurses, and disconnecting the patient from the ventilator were among the services offered by nurses through telenursing during the Syrian war. Another study by Lau, Bartle-Clar & Bliss in 2019 showed that telenursing had an important role in the triage management of injured patients and timely referral of cases to specialist. It also showed an overall decrease in financial spending on the health care system.

Another very important tool for a smoothly operating HIT system is the EHR. EHR have revolutionized the health care system from an analogue, paper-based to a more advanceD digital one which assists nurses with real-time information to deliver better quality care to their patients. Data from the literature proves that the implementation of electronic health records in hospitals has been very beneficial to both the nurses and patients. The results from a research conducted by Mold, Lusignan, Sheikh, Majeed, Wyatt, Quinn, Cavill, Franco,Chauhan, Blakey, Kataria, Arvanitis & Ellis, in 2015, a total of 176 studies patients were very satisfied with provision of access to their information online and with services offered online as compared to the more tradition methods used decades ago.

With the high demand of nurses around the world, health information technology helps to bridge the gap between shortage of nurses and patient care by assisting nurses complete a task within a shorter amount of time as compared to doing it the paper-based traditional way. Nurses can now multitask, attending to more than one patient at a time. It reduces burden on the nurses and work burnout amongst nurses which is one of the causes of early retirement. Even though critics will argue that health information technology reduces the time nurses spend with patients, the results are more beneficial for the patients, the nurses and the health care system.

Continuous research has to be done in relation to this topic as HIT is still evolving and newer technologies are developed on a daily base. All the material used in this research was from database recommended by CENTRIA. It would be very beneficial for the students to learn more about HIT, as it is becoming the new normal for nurses to carry out their duties. More so, experienced nurses should be sensitized and encouraged to learn how to use HIT systems integrated in the hospitals.

8 AUTHORS' LEARNING PROCESS

As a learning process, this research enlightened me with a new experience of carrying out a research. It made me appreciate the work of registered nurses, as they are key to the wellbeing of patients and are fundamental to the success of a health care delivery system. I also learned a lot about new technologies used to deliver care, and came to realise how much work there is to be done to acquaint and stay in line with ever evolving technology in the care delivery system. I have learned a lot about time management and prioritising things accordingly, which used to be a weakness. Before this study, I was oppose to using technology in delivering care. I am glad I chose to write on this topic because, I have been so much enlightened on the benefits of HIT. This came at a very trying time with the COVID-19 pandemic in 2020 were technology has played a role in curbing the spread of the virus. People could safely distance and still receive efficient care from their homes. Henceforth, I advocate the use of technology in every system of care delivery and will recommend nurses to endeavour educating themselves with the vast variety of health information technology that exist.

What motivated me to choose this topic was the rate at which I saw information technology and artificial intelligence evolving in every other field. More so coming from a less developed country, I was intrigued to find out advantages of information technology in the develop world and its effect on the quality of care administered as compared to the more natural systems we have back in my country. More so, I was interested in finding out if information technology has a big role in playing in the lower hospital dead rates compared to less developed countries which have a higher hospital dead rate. It was quite interesting to find out that not all HIT skills are taught in nurses schools. Most of the skills are obtained with work experience and more so, different hospitals or health care systems have different software running their technology and different care procedures.

It was very difficult to find articles that detailed the impact of health information technology on nursing. Most of the articles were in relation to medicine. More difficult were Finnish related articles written in English. Even though nurses constitute the majority of personnel's in the health field, there isn't sufficient studies to show how significant their role is in the overall well-being of a patient in relation to health information technology. More than a third of the articles had more materials on physicians role with HIT. I tried as much to elaborate on each topic with emphasis so its importance should clearly be understood.

From the studies I realised Finland is one of the advanced countries leading in the use of HIT in their health system, perhaps the reason it is amongst the best care systems in the world. The whole research process took me almost two years. It was quite difficult to come up with the right wordings for the topic to express my interest, then was the thesis plan, of which I did not understand the outline. Searching for the materials was also very difficult as they were very materials to search from.

9 CONCLUSION

From the authors' findings, health information technology has improved both the nurses and patients' quality of life. Patients can access medical information regarding their care and treatment plan. This practice allows them to actively participate in their treatment, increases transparency and accountability, while enabling patients to find answers to their questions, thus taking responsibility of their health care. This is possible through the use of patient electronic portal.

From the results, it is therefore evident that HIT advances can help reduce the stress of many tedious and repetitive tasks; this was typical with the case of the 2020 COVID-19 pandemic were time was of the essence in curbing the spread of the virus. Hopefully, these tools will further become commonplace in nurses' everyday work life in the near future. The WHO's State of the World's Nursing Study 2020 draws particular attention to the role of health information technology in both nursing education and nursing practice.

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APPENDIX 1

Articles included in the literature review.

Author(s)	Name of article	Year published and research type	Summery of result
Angelucci, A. & Aliverti, A.	Telemonitoring systems for respiratory patients: technology aspects.	2019	The architecture behind a telemonitoring system.
Brittany, J. Urbach, B. & Kratochwill, T..	Teleconsultation: The use of technology to improve evidence-based practices in rural communities	2016 of school psychology.	Use of telecommunication in remote teaching and consultation.
Tobiano, G. Marshall, A. Bucknall, T. & Chaboyer, W.	Patients participation in nursing care on medical wards	2015. International Journal of Nursing Studies : An integrative review	Patients participation through electronic patient portal engages them in their own care and improves on safety
Greenes, R. Bates, D. Kawamoto, K. Middleton, B. Osheroff, J. & Shahar, Y.	Clinical decision support models and frame work. Seeking to address research issues underlying implementation success and failures.	2017. Journal of biomedical informatics	Impact of information technology on clinical decision support system. And gradual implementation by health care facilities.
Mold. F, Lusignan.S, Sheikh. A, Majeed. A, Wyatt. J, Quinn. T, Cavill. M, Franco. C, Chauhan. U, Blakey. H, Kataria. N, Arvanitis. T and Ellis. B.	Bringing research to clinical practice.	2015. British Journal of General Practice. A systematic review.	Patients access to their online records improved patients satisfaction and patient cantered care.
Nadarzynski, T. Miles, O. Cowie, A. & Ridge, D.	Acceptability of artificial intelligence (AI)-led chatbot services in healthcare	2019. A mixed-methods study. Medical journal.	Artificial Inteligence could potentially increase access to healthcare, improve nurse and patient communication, or help to manage the increasing demand for health services such as via remote testing, medication adherence

			monitoring or teleconsultations.
Nejadshafiee. M, Bahaadinbeigy. K, Majid Kazemi. M, & Nekoei-Moghadam. M.	Telenursing. A step for care management in disaster and emergencies.	2020	The use of telenursing in disasters and emergencies.
Patricia. S,Wise. Y, Waddell. J & Walton. N.	Leading and Managing in Canadian Nursing.	2019	Discusses the function of electronic medication administration records that allows nurses to view and document medication administration for their patients.
Sadeghi, A. Naccache, D. & Tuyls, P.	Towards hardware-Intrinsic Security. Foundation and practice. Security and Cryptography	2010	EHR is a set of components that form the mechanism by which patient records are created, used, stored, and retrieved and located in a health care setting
Scarlat. A.	Electronic Health Record. A Systems Analysis of the Medications Domain	2012	Introduces the Structured Systems Analysis tools and methodology and shades light on data in workflows, procedures, operations, and tasks management.
Sheikh, A. Bates, D. Wright, A. & Cresswell, K.	Key Advances in Clinical Informatics: Transforming Health Care through Health Information Technology	2017	An overview of the most current subjects and implementation of health information technology
Vehko, T. Ruotsalainen, S. & Hyppönen, H.	E-health and E-welfare of Finland. National Institute for health and welfare report.	2019	Implementation of E-health into the Finnish health system. The benefits.
Williams, T. & Samarth, A. 2010.	Electronic Health Record for Dummies.	2010	Implementation and use of an electronic

			health record system to facilitate care delivery.

APPENDIX 2

Representation of theoretical framework.

Objective of study	Primary category	Sub category	Data analysed.
Impact of Health Information Technology on quality of Nursing care.	Health Information Technology on patient safety Health information technology on Nursing Care Quality.	Systems aim at facilitating evidence based decision in nursing. Systems that store and secured patients data to maintain privacy and security and for corroboration purposes. Systems aim at facilitating communication amongst health personnel.	▪ Decision support ▪ Telenursing ▪ Data storage ▪ Information Security ▪ Patients privacy ▪ Patients participation ▪ Evidence based practice ▪ Education ▪ Communication