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**OVERVIEW OF HOW HEALTH TECHNOLOGY MONITORING VITAL SIGNS HAS CHANGED OVER A PERIOD OF TIME**

**A Literature Review**

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**ABSTRACT**

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<p>The introduction of health technology in hospital settings has improved patients' care, monitoring of vital signs, caused a decrease in medical errors, and increased the safety of the patients.</p> <p>This literature review provides an overview of how health technology has impacted in the monitoring of vital signs over the decades. The literature review was conducted by selecting articles from three different databases; Sage, Science direct, and Google Scholar articles. 13 selected articles were assessed and evaluated by the author. Finally, articles were analyzed and evaluated by inductive content analysis.</p> <p>The results from this study portrays that, patient assessment, patient observation, patient data, real-time monitoring of patients, the national early warning score and early warning score are the safety rules for monitoring patients' vital signs with the help of health technology.</p> <p>The result shows that technology plays an essential role in monitoring patients' vital signs. The monitoring of patients' vital signs over the years has tremendously improved due to the advancement in health technology. This has improved the quality of healthcare delivery, and a decline in medical errors increased the safety of the patient and bridged the gap in terms of communication between patients and nurses.</p> <p>Health technology plays an important role in the healthcare sector by bridging the gap between patients and healthcare workers in terms of communication, monitoring of vital signs of patients, diagnosing, and treatment of an illness. Monitoring of the various vital signs of patients is an essential part of nursing assessment and patient monitoring. The impact of health technology plays an important role in the patients' safety and ensures smooth care given by healthcare workers.</p>		

<p><b>Keywords</b> Health technology, Nursing Interventions, Patient monitoring, Safety, Vital signs.</p>
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## CONCEPT DEFINITIONS

APVU	Alert, Voice, Pain, Unresponsive
EBRARY	Electronic Library
EBSCO	Elton Bryson Stephens Company
HER	Electronic Health Records
EWS	Early Warning Score
ICU	Intensive Care Unit
MRI	Magnetic resonance imaging
MI	Myocardial Infarction
NEWS	National Early Warning Score
UAS	University of Applied Sciences
WHO	World Health Organization

**ABSTRACT**  
**CONCEPT DEFINITIONS**  
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## 1 INTRODUCTION

Advancement in health technology plays an important role in the healthcare sector and, has especially bridged the gap between patients and healthcare workers in terms of communication, monitoring of vital signs of patients, diagnosing and treatment of an illness, and it also helps for more productive research work in healthcare delivery. Health technology has ensured the safety and speedy recovery of patients where patients are being monitored to prevent or minimize human errors at the sector. Monitoring of the various vital signs of patients is an essential part of nursing assessment and patients monitoring. Various vital signs are being controlled regularly when the patient is being admitted or even at home; technology makes it possible for the vital signs to be controlled at home as well. These vital signs are generally monitored to detect any deterioration in patients' care, moreover, it has helped in many countries in reducing the incidence of deaths and cardiac arrest. The vital signs are respiratory rate, oxygen saturation, blood pressure, heart rate, and temperature. (Prgomet, Cardona-Morrell, Nicholson, Lake, Long, Westbrook, Braithwaite & Hillman 2016.)

Safety is a major concern in the healthcare sector and hence the call for thorough monitoring by nurses and healthcare institutions cannot be overemphasized. Health technology has transformed and is aiding the health system on how to monitor patients and improve their health even when the patient is out of the hospital. Health technology inpatient care has progressively become complex and has changed the phase of nursing care all over the world. Before the existence of technology, nurses used to depend solely on their senses such as touch, smell, hearing, a sight to screen the status of patients, and perceive if there is any change. They also used to count on any change by observing the skin colour and change in the mental status of the patients. Those things are still in existence, but technology has made it easier for them instead of them being reliant on their senses. Also, monitoring blood pressure with a manual device, palpitation of pulse, among others. Health technology has now taken over and helps to diagnose and treat fundamental causes. (Powell-Cope, Nelson & Patterson 2008.)

The purpose of this thesis is to do an overview of health technology in the monitoring of vital signs and safety of the patients. The goal is to increase nurses' knowledge and to make the impact of health technology better known in nursing.

## **2 THEORETICAL FRAMEWORK**

The theoretical framework provides a brief historic overview of how health technology has helped to nurse and impacted the healthcare over decades, the role it plays in healthcare in the monitoring of vital signs, patients' safety, and nursing interventions. Health technology has been defined as an "application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures, and systems developed to solve a health problem and improve quality of lives". (World Health Organization 2019.)

### **2.1 Review of the old and new health technology of nursing**

For decades, health technology has changed the approach of nurses in terms of health delivery, monitoring of patient's vital signs, and setting goals for patients. This has helped in the patient's treatment and improved upon the nurse's outcomes. Health technology has given a new definition of how things were being done previously, compared to recent times. In the nineties, sick people were on palliative care compared to this modern time where only people who are terminally ill are on palliative care. There has been an advancement of how patients are being cared for now to ensure their safety. (Klainberg 2013.)

Advancement in health technology has improved the quality of life and reduced the mortality rate over the last century. This innovation has improved upon the nursing care and helps in diagnosis and choosing better treatment for patients. Unlike the olden days, nurses influenced the diagnosis due to the lack of technology that would help to detect and diagnose an illness. This development has also helped to bridge the gap between health workers, not only nurses, but has formed a multidisciplinary team working together to achieve their target objective - which is the patients' wellbeing. (Ferrone, Granada & Tellez 2019.)

It is an undeniable fact that health technology equipment's has been in existence many years ago and continues to improve upon the health sector. There has been an advancement of the latest equipment's that are easy and fast to use than previously. The use of new devices permits nurses to monitor patients

in remote areas and have access to healthcare, accessing of patient's medical records, patient's identification to avoid errors, exchanging of information as well swift information between nurses and patients (Bajwa 2014.)

## **2.2 Health technology development trend in healthcare over the years**

Previously, there were lots of devices that could be used to monitor patients' vital signs separately, but health technology has made it possible to have a single machine that can measure all the vital signs at a go. The sphygmomanometer has different types from the automated to the manual. A lot of nurses still use the old sphygmomanometer in clinical settings today. (A'Court, Stevens, Sanders, Ward, McManus & Heneghan 2011.)

Vital signs used to be taken on one basis, but the introduction of multi-parameters monitors has made it possible for a continuous monitor of inpatient vital signs because this device has almost all the vital signs equipment. It includes saturation, respiration, heart rate and blood pressure. This equipment is mostly used in the ICU unit though it can be used in a general ward. (Vaijeyanthi, Vishnuprasad, Kumar, Ramachandran, Gopinath, Kumar & Yadav 2014.)

There is not much difference in digital and electronic thermometers. The difference might occur due to where it was taken. (Hadgu & Murugan 2016.) In the 21<sup>st</sup> century, health technology has positively and tremendously contributed to every area of modern society in the health sector. This new revolution has changed the healthcare system as well as the nursing profession. It has added more value to the profession and enhanced patients' outcomes. (Clark, Mckenzie & Jamal 2009.)

According to Thimbleby (2013), health technology has intensely improved and enhanced patient records availability. Electronic charting has also helped the majority of nurses access the medical records of patients online which can be accessed by the patient and other health professionals when the need arises. Due to the advancement in health technology in non-invasive sonography, babies in the womb can be seen much earlier. Sonography can help in identifying cancers and tumours earlier with more to save lives. The use of health technological equipment has influenced how medicines are administered by nurses to patients to avoid errors and ensure accuracy in terms of measurement.

Health technology, in general, has contributed to the well-being of patients and continues to improve care daily. Health technology bridges the gap of communicating between patients, nurses, and other health professionals. Using health technology helps effectively during an emergency for a quick response from nurses to avoid mortality. It has brought a great transformation to the health sector making the nursing profession a bit easier without using manpower in taking care of the patients. Some of the health technological equipment that changed the phase of healthcare includes antibiotics that help to treat and prevent infection, dialysis machines that filter blood in removing excess water and waste product as a result of the kidney problems, infusion pumps, heart valve, MRI scanners among other equipment's. The use of patient checklist has saved many lives. A checklist is an identification tag that ensures every patient is identified appropriately. (Thimbleby 2013.)

Some health technology breakthroughs in the health sector include the development of NanoHealth, brain implants, sensors networked, artificial organs, exoskeletons, and genomics, among others. These technologies will be able to transform the approach to sickness and health, likewise, anesthesia was able to change the ethical method of pain. The pain was regarded as inevitable but because of technology there are a lot of painless procedures that patients went through without. (Thimbleby 2013.)

### **2.3 Monitoring of patients' vital signs**

Joanna Briggs Institute Library (2008) defined vital signs as an important element that helps to monitor the improvement of a child or adult when they are being hospitalized. This allows the nurses to know how the body functions to find if there be any delay in patients recovery of adverse proceedings. Vital signs are taken to know the general well-being of a patient. These are thoroughly done through an emergency to know the current situation if there is a need for more nursing intervention. Checking the vital signs of a patient is one of the commonest interventions being practiced in health care settings today.

Temperature can be taken to control the core temperature of individuals to establish a baseline that will help the health workers or nurses to track any form of abnormality. A rise in temperature can indicate an illness. The pulse rate measure how many times the heart beats per minute. Respiratory rate measures breaths a person takes per minute. This is usually done when the person is lying down to ensure accuracy. It is counted when the person breathes, and the chest rises. Oxygen saturation measures the oxygen level



in the blood. Finally, blood pressure is also taken to determine the hemodynamic status of the person. A rise in all of these may indicate an illness or underlying cause that needs monitoring. (DeLaune, Lawrence, Ladner, Mctier & Tollefson 2016.)

The vital signs consist of blood pressure, respiratory rate, pulse, temperature, and oxygen saturation. Monitoring these signs helps the nurses to identify any abnormalities that need immediate attention. There is a system known as Rapid response systems (RRSs) that escalate care to a medical emergency team when the vital signs of a patient have gone beyond the normal rate. This has been practiced in many countries and has brought the occurrence of sudden deaths and cardiac arrests in acute hospitals to the barest minimum. RRSs can only be effective when the vital signs are been checked frequently to identify any serious complication. (Prgomet, Cardona-Morrell, Nicholson, Lake, Long, Westbrook, Braithwaite & Hillman 2013.)

Measuring vital signs for hospitalized patients is the essential part of nursing care. Monitoring of patients comes along with other observations which include seizures, airway obstruction or if the level of consciousness in the patient has decreased. Any change in vital signs may indicate the patient is at serious risk of worsening. (Cardona-Morrell, Nicholson & Hillman 2015.)

Due to technology advancement, there is a medical tool called Early Sense Monitoring System which has been developed to monitor the respiration rate, heart rate for patients who are in rehabilitation centres, orthopaedics, post-partum, patient with long term acute care, surgical patients and those in oncology. These are being done continuously in the medical settings to check the situation before deterioration. Monitoring of vital signs of patients and assessing the situation will help to curb any emergency that can be deadly. Checking of the vital signs also means continuous checking of the oxygen saturation, any form of difficulty in breathing, and supplemental oxygen dose. (Helfand, Christensen & Anderson 2016.)

## **2.4 Patient safety**

Trust is the fundamental principle between patients and nurses. Patients trust their caregivers for safety, the right diagnoses by health professional and good treatment. They are assuming nurses are responsible for their safety through the care they receive from them. Advancement in technology provides safety for

the patient by enhancing the communication between patient-nurses. (Castle, Bates, Goossen, Kim, Paiva & Pedrdreira 2004.)

Many devices can help in supervising patients even if the nurses and health providers are not around. Technology over the years has helped to bridge the gap between nurses, patients, and families. Patients' data helps the nurses to support the patients and give maximum care. When the patients are moved to other facilities, there is continuity of care because of the data system. Though many people are abreast with the use of technology and how it can help in monitoring patients at home, some also do not know that apart from patients being monitored at the hospitals, there is a possibility of continuity of care even at home depending on the patient's condition. (Veer, Fleuren, Bekkema & Francke 2011.)

Health technology is intended to reduce or eradicate errors and procedures, to detect errors early before the occurrence of an injury. It has yielded a positive result in terms of patient safety and nursing care outcomes. Health technology has ensured the safety of patients. There are alarm systems that are used to detect errors before an injury occur. The bed exits alarms, IV pumps warnings signalling occlusions, call bell for patients, code alarms initiated by staff, alarm ventilators, and heart monitors. These alarms signal the nurses of impending danger and what is going on. (Powell-Cope, Nelson & Patterson 2008.)

Undoubtedly, health technology is a vital device that improves the safety of the patient and enhances the quality of healthcare. It reduces adverse medicine reactions, medication errors, and improves compliance with guidelines for practice. (Alotaibi & Federico 2017.)

## **2.5 Nursing interventions by using health technology**

Health technology has tremendously transformed the way care is being given to the patient and the delivery of nursing care. Before the widespread technology, nurses deeply depended on the senses of touch, smell, sight, and hearing to check the statuses of their patients' health in detecting any concern. In recent times the use of the senses by nurses to detect patients' condition has been changed to a health technology to check patients' condition. Nurses used to depend on the colour of the skin and the patient's mental status to detect primary fluctuations in oxygen saturation; arterial blood gasses were used to confirm their suspicions. The use of technological apparatuses like pulse oximetry in identifying a decrease in oxygenation before the appearance of medical symptoms, diagnosing, and treating underlying causes more promptly. (Powell-Cope, Nelson & Patterson 2008.) The use of health technology in a healthcare

setting has enhanced the quality of care, promoted patient-centered healthcare, and helped in educating patients and health expertise. (Rouleau, Gagnon & Côté 2015.)

Health technology has impacted the health setting and has helped nurses in intervening in patients' conditions by using the Early Warning Score which is a device meant for bedside evaluation. This has been built on physiological parameters such as the respiratory rate, pulse rate, patient temperature and APVU scale assessment, and systolic blood pressure. This is a guide that helps to determine a patient's illness. (Subbe, Kruger & Gemmel 2001.)

### **3 PURPOSE, AIM AND RESEARCH QUESTION**

The purpose of this research is to do an overview of health Technology in the monitoring of vital signs and safety of the patients. The goal is to increase nurses' knowledge and to make the impact of health technology better known in nursing.

The study provides an overview of addressing the following research question:

1. What are the safety rules for monitoring patients' vital signs with the help of health technology?

## 4 METHODOLOGY

This chapter outlines the kind of research that was used which includes literature review, data collection, data analysis, and ethical considerations and validity. The literature review examined articles that were scientific in analysing the safety rules for monitoring patients' vital signs with the help of health technology.

### 4.1 Literature Review

The study is a literature review that highlights the importance of health technology in monitoring the vital signs of patients. This study reviewed the relevance of technology over the years. In academic literature review, which is evidence-based, one can examine research work that has already been done by another researcher and it will recount the research question by the author, and these are scientific articles that are related to the study topic. The dissemination of the research findings' question aims at providing answers also to research, and then analyze articles from different sources that are relevant to the research, including journals and books in an organized order. Literature review when conducted gives a research idea, and combines what others have already known about a topic and allows the author to recognize the need for further knowledge about a subject - and the research would broaden their horizons. It helps the researcher to advance in hypotheses and inflaming one's research question. (Salji & Winchester 2016.)

Salji & Winchester explained how critical literature review is because it helps the researcher to evaluate data and determine its significance and clinical usefulness. According to them, research data which is short of a context is worthless. Literature review enables to find other research work that supports one's findings as well as of the outcomes that vary and help to position one's research in the field. Research findings dissemination provides reference points for new data and helps to recognize and distribute the impact the research is supposed to make whether it has been publicized in a peer-reviewed paper or just oral presentation.

## 4.2 Data Collection

The research for this topic was conducted from different sources such as the Sage, Science direct, and Scholar articles from the Centria database system. Various keywords that were used in this study comprises of vital signs OR vital signs monitoring OR safety measures for vital signs monitoring OR safety rules in monitoring patients' vitals with health technology. The summary of this can be found in table 1 where the author summarised and categorized. The measures that were carried out in this search involved using the keywords and reading abstracts searching for the title of articles that are important to this study. One of the major importance of reading the abstracts is, it helps the reader to have an idea of what the article is about and what should be expected. The author used 13 articles in the preliminary search for the research question. Table 1 demonstrates the total of articles that have been collected from the various database and the criteria process.

TABLE 1. Selecting the process of the study

Search Terms	SAGE	SCIENCE DIRECT	SCHOLAR ARTICLES
Vital signs	89028	246,669	303
safety measures for vital signs monitoring	8643	30,032	427
safety rules in monitoring patients' vitals with health technology	547	28	134

## 4.3 Inclusion and Exclusion criteria

The author used the inclusion and exclusion criteria presented in table 2 to search for the articles that would be used for this study. This standard was used to restrict the search into a few articles that would be utilized in this study.

TABLE 2. Inclusion and Exclusion criteria for selecting articles

<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
Free research articles	Payable articles
Research articles related to safety rules for monitoring patients' vital signs with the help of health technology	Articles not related to nursing and safety rules for monitoring patients' vital signs with the help of health technology.
Research articles in English	Different languages.
Peer-reviewed articles.	Research articles that were not peer-reviewed.
Articles related to nursing science	Not related to nursing science

Articles were retrieved from three databases with the first search from Sage which totalled 124,277 articles with the search keywords on the databases. Science direct yielded a total of 38, 1314, and finally from the Scholar articles all the articles gathered from the searches using a search on the database is 1, 099. The figures of the articles were very huge, this is because vital signs are a very broad topic and a lot of research, articles, books have been written on. Out of 506, 690 articles from the three databases 506,677 were excluded based on the titles, abstracts, and the full article. The titles and abstracts revealed that though the articles contained only vital signs, they were not related to the research topic. During the criteria process, 105 articles were selected for screening. In the 105 articles that remained, 10 articles required payment, so it was excluded, leaving 95 articles for further screening. Based on the inclusion and exclusion criteria of this thesis 13 (n=13) articles were selected for this research work after it had been systematically analysed and read according to table 1.

From the databases, the author was able to retrieve a total of 506, 690 articles with several search terms that have been demonstrated on the table. But during the selection process, a lot of articles were excluded because they did not meet the criteria for inclusion. The author finally analysed and examined the information which was retrieved from three databases which include SAGE, Science direct, and Scholar, and

the results which were found were now categorized into the keywords that were used. The keywords: Vital signs contain 25 articles, with 10 abstracts and 15 of them have the full text, but 21 did not meet the criteria. The author finally read and analysed the remaining articles and 4 answered the research question.

Vital signs monitoring is another keyword that has been used and produced 20 articles in which 8 of them contained only abstracts while the remaining 12 contained the full. In the selection, the author read and examined the articles and 17 were excluded because they did not meet the criteria. Only 3 articles were found to answer the authors' research question. Safety measures for vital signs monitoring contained is another keyword that yielded 20 articles. 10 articles retrieved have abstract, 10 articles have full text. 19 articles did not answer the research question but 1 was good for inclusion because it answers the authors' research question.

The final keywords that were used in this research work such as, safety rules in monitoring patients' vitals with health technology, produced 30 articles. Out of it, 10 contained an abstract and 20 contained full text. 25 articles were excluded because it did not answer the research question. The author chose 5 for inclusion because it meets the criteria. In all the author was able to retrieve a total of 13 articles for the research question.

#### **4.4 Data Analysis**

Qualitative content analysis has been described as a study method of data analysis which is usually used in nursing and public health studies. Content analysis is important because it gives a better insight into data that helps to refine words into fewer categories that are related to the content that has been analysed. As a result of these categories, some words and phrases can share the same connotation. Content analysis affords the researchers to make a valid implication from data to their context to give new insights as well as provide knowledge that represents facts. The purpose of analysing content is to achieve a summarized and comprehensive data that describes an event. The author used data analysis methodology to analyse the data which was thoroughly read many times to find examples and explained the data accurately and made it easy to understand. The purpose of analysing data is to assess and be able to interpret the articles that have been selected to make it easier to understand by readers. (Elo & Kyngäs 2007.)



Qualitative content analysis is mostly utilized in analyzing qualitative data. The author used qualitative content analysis in examining this data which centered on trustworthiness. Qualitative content analysis trustworthiness often represented in use up of terms like dependability, authenticity, authenticity, credibility, and conformability. Qualitative content analysis is among the several qualitative approaches that analyses and interprets the true meaning of data. Analyses information: This is to describe and quantify data systematically and objectively. For content analysis data to be effective there should be a reduction of data to theories that define an event that creates concepts categories, a model, a conceptual map, or a conceptual system. (Elo, Kääriäinen, Kanste, Pölkki, Utriainen & Kyngäs 2014.)

According to Elo et al (2014), a qualitative content analysis approach can be done in two ways such as inductive and deductive. The inductive and deductive content analysis methods comprise of three main stages such as the preparation, organization, and reporting of results. In the preparation stage, suitable data is being collected for analysing the content that brings meaning and easy to understand, and to select the component of the analysis. The inductive method analyses involve the opening of the data and to create categories as well as abstraction. The deductive content analysis involves categorization matrix development where the data is being reviewed for content and coded for the association to or illustration of the classified categories.

The author used inductive content analysis in processing the results. The content analysis approach is mostly used in qualitative research. This is a research technique for making conclusions from writing to the contexts for their utilization which are replicable and substantial. Content analysis expects to give objective and efficient intends to valid conclusions from information while depicting an event. In the inductive content analysis method, ends are created from gathered information by joining new data together into speculations hypotheses (Bengtsson 2016) Appendix 1 illustrates how raw data was put together to form sub-categories that added results in the main categories.

#### **4.5 Ethical considerations**

Ethical matters in research standard improves the objective behind research which combines and disseminate information, revealing or saying reality; lastly, the need to check mistakes. Different steps that are important in research started with a proposal of research writing and approval that leads to the real research study. The appropriate methodology must be selected by a researcher to use, important methods for gathering information, present the findings of the research, and interpret appropriately. That will lead

to the presentation of data in a rational sequence. The information is then dissected and announced well in sort of a project report, an article, a book, or a thesis. The researcher needs to observe the right principles at all these phases during the research. Failure to follow this value could result in research misconduct. Fabrication of information and of the results and data undermines the ethics in research. Plagiarism is a vital concern in educational institutions of advanced learning. It is an act of a researcher or author using a word, text, or expressions without giving the credit to where the information was obtained. (Akaranga & Makau 2016.)

According to Golafshani (2003) validity decides if the research quantifies what it was proposed to quantify or how honest the research results are. Researchers generally decide validity by inquiring and will regularly search for the appropriate responses in the research of others. Initially, concerning reliability, it was regardless of whether the outcome is or was replicable. Moreover, concerning reliability, it was regardless of whether the methods for measurement are or were exact and whether they are or were estimating what they are or were expected to measure. Ethics of every research has a sort of guidelines that helps and instructs the researchers on what to do. The author has always been reminded of the penalties of plagiarism. The author acknowledged and referenced on every material that has been used. All the articles that were used are scientific and from reliable sources, as the Centria University of Applied sciences data system and scholars' articles which are highly reliable and used by many researchers. To avoid unethical issues the author deemed it necessary to spend time finding the right articles, examined them thoroughly and checked its authenticity before being used. This research was done accordingly and measures what it was supposed to with accurate conclusions. The author followed the general scientific rules conducting this thesis. All the articles that were selected for validity were judiciously analyzed and ensures it's relevant for this work.

Most of the articles that were used for this study were previously used by others as well. This is not a funded study, so the author used only free articles. In this case, the author was limited to only free articles but carefully evaluated before used for the study. Every article used for this is valid. This is the first literature review conducted by the author which should be taken into consideration. There were no sorts of plagiarism, fabrication or misappropriation. Every article used in this content was cautiously examined, documented, and mentioned as it is supposed to be. Some supervisors crosschecked the articles to detect any biased content. After the completion of this study, the whole work is checked by Urkund to detect any form of plagiarism.

## 5 RESULTS

This chapter shows the findings from the analysis. In total 13 articles were used for the analysis where the research question was answered with the table of appendices to reveal the summary of the findings, including the name of the authors, the year the book was published and its title.

### 5.1 Patients Assessment

Vital signs ensure patient well-being and communicate the severity of a condition that needs urgent attention. This is very useful in all the parameters especially in acute cases that support nurses to recognize any deterioration to diagnose, evaluate nursing interventions, and finally decide about a patient's response. Assessing patients' vital signs reduces or prevents impairment. That is, early identification of this problem helps with the healing process. (Bachion, Brasil, Boaventura, Bezerra, Teixeira<sup>1</sup>, Souza & Paranaguá 2015.)

Bachion et al (2015) further stated that if these signs are not recorded on time or failure to do so could lead to many medical failures or even deteriorate the health of the patients or even death. All the procedures that have been performed on the patients have to be fully documented. This is to ensure the patients' records and information are updated to avoid an error. Vital signs measurement looks simpler and easy a task to perform but failing to do it on time can create so many problems for the nurses as well as the patients.

Assessing patients' vital signs is important in every patient but those that have acute problems and are in the emergency department need it more. In most hospitals, there are surveillance cameras that help nurses to monitor the condition of the patients in their offices. These are all parts of the advancement of technology. Assessment of patients' vital signs signals the nurses of any early warning in the condition of the patients to prevent adverse situations. There is no guidance or standard in which the signs are checked, especially in the ED. Though this is widely used and accepted in many countries, its assessment depends on the order by the doctor, or from the nurses' judgment. And this is based on the condition of the patient. (Timothy, Weaver, Solo & Hobbs 2016.)

## 5.2 Patient Observation

Vital signs monitoring is an important factor in caring for patients to evaluate the effects of treatment, identifying any change in patients' status, and spot any procedural complications. Vital signs that are monitored consistently and recorded reduces adverse events and prevent any form of deterioration. Vital signs that are monitored within short intervals make greater contributions toward determining patients' vital sign trends. Nurses have been advised to use their clinical decisions concerning the occurrence observation. Patients that are not stable require continuous observation and monitoring till they are reviewed and alleviated. (Sydney South West Area Health Service 2010.)

Vital signs of patients should be recorded on admission and should be checked three times daily or even more depending on the patient's condition, and at every time the measurement should be recorded. The observation should also continue during the night. When the respiration, for example, is observed it should be checked every 30 minutes. Some patients need more observation and vital signs monitoring than others. For example, patients that are in the ICU, emergency department, patients whose condition has changed. (Sydney South West Area Health Service 2010.)

It has been recommended by the National Institute for Health and Care Excellence to observe and monitor at minimum every 12 hours, with the occurrence increasing if irregular functioning is noticed. It has been evidenced that insufficient responses to deteriorating continues to be the extremely common cause of serious events that have been reported to a national database. Effective observation of vital signs can prevent cardiac arrest or death or avoid the worsening of the patients' situation. It has been estimated that about 64 deaths have been prevented because of vital signs observations and two-thirds of these events happened due to the failure to take vital signs of the patient. (Griffiths, Saucedo, Schmidt & Smith 2015.)

Nights shift observation is very vital since it has been explained that there have a lot of acute cases and deterioration cases that occurred during the night because the nurses failed to take vital signs of the patients. It has been recommended that at the beginning of the night shift, the nurses should measure the vital signs of patients to see if there is any complication. Vital signs of electronic devices have improved the collection of vital signs process as well as reduced mortality. The execution of the early warning score has also helped the vital signs measurement and reduce mortality rate as well. (Griffiths et al 2015.)

Consistent vital signs observation is critically necessary for early detection of clinical deterioration in hospital settings. In many hospitals, nurses habitually measure and document the main important vital signs for all patients 2-3 times per day to form an assessment of the patient's ailment in which they use different clinical devices to measure and assess the patients. Measuring of a vital sign is commonly omitted as a result of nurses counting the movement of the chest wall in an exceedingly busy hospital situation which is not effectual, but cut back the work of the nurses. And so improve the standard of patient care. A sensible sign monitor for simultaneous measurement body temperature, respiratory rate, pulse rate has been advanced. (Ang, Cooper, Liaw, Mok, & Wang 2015.)

Failure to rescue and delayed escalation of care are predisposed to the deterioration of patients tracked by communication of patient deterioration to implement relevant care. The demonstration has shown that before the patient's condition will deteriorate there must be clear signs hours before such an incident. Systematic assessment of vital signs is said to be important in distinguishing patients in danger for serious adverse proceedings, permitting time for nursing interventions. One of the considerations of implementing continuous, synchronic observation of multiple very important signs is associate degree abundance of excess sonic alerts that interrupt nursing workflow and improve patient safety. (Booker, Watkins, Whisman 2016.)

### **5.3 Patients Data**

The healthcare has shifted from the use of paper for medical records to the use of EHRs. This advancement guarantees efficiency, safety, quality in the hospital setting. Some of the clinical tasks such as medication orders, laboratory tests, and diagnostic tests, documenting of a patient's visits, checking of test results, and how to track patients are all in an electronic record. (Ratwani 2017.) EHR comprise of some sensitive and critical data that is private for diagnoses and treatments in healthcare. This information is a valued basis of healthcare intellect.

The information that is shared is an important phase in making the organization cleverer to improve the excellence of the healthcare facility. The EHR is a structure that is in a numerical setup which includes the patient's health information which has been created and preserved during the life of the patients and is characteristically kept by spread, and this is distributed amongst several clinics, hospitals, and other health providers. Access to the patient's old data is retreated and is only available to qualified personnel to prevent wrong interpretation. If the patients have been given access to their information, they may

interrupt the facts in a splintered way that reproduces the nature of how the records are being handled (Costa, Mayer, & da Rosa Righi 2019.)

Electronic health record system has been beneficial to the nursing profession and its availability helps nurses to do their jobs and give the best care for their patients more proficiently and safely. It has changed the phase of nursing, and as a result, nursing today is not the same as it was some years ago. This has also committed to following a routine procedure that is normally mentioned as "The Nursing Process", which comprises assessment, diagnosis, planning and outcomes, implementation, and evaluation (AD-PIE). The ADPIE leads the nurses in executing their nursing care duties. Many emerging health technological devices have improved upon nursing care to the patient but the most vital one is the electronic health records; and computerized doctor care order entry, a clinical decision that has been taking concerning the patient. The health record continues to change due to the improvement of health technology and any deviations in the documentation of patient care would have a substantial influence on the nursing profession. (Houston 2013.)

Houston further explained that electronic records which also are digital records contains the medical history of the patients, previous medical records, and other vital information. This record also helps with the continuity of care in case the patient has been transferred to another hospital or facility. The location, name of the care providers including the previous and the public health agencies are very important in record keeping. The record is always available and ensures built-in protections that assure the confidentiality and security of the patients.

#### **5.4 Real-Time Patients Monitoring - wearable body sensors and remote monitoring**

Health technology has not been beneficial to only hospitalized patients but helpful to patients outside the clinical environment and helps them to monitor their health during an activity to track their health. These wearable body sensors give continuous monitoring to patients that are in different locations for easy access. It can also be beneficial to patients who have been discharged from a particular hospital to give them real-time monitoring, thus, providing the nurses and clinicians with the data that can easily be transferred and tracked by their level of well-being. This invention can also help a patient that is in a tragic scene for easy location. (Alm, Gao, Greenspan, Welsh & Juang 2005.)

These devices measure all the vital signs ration parameters including skin perspiration. This has been developed and designed in a way that is for a real-time monitoring system assimilates vital signs sensors. It has electronic patient records, location sensors, ad-hoc networking, and web portal technology that allows patients status to be monitored remotely. They further explained that it consents to the ambulatory acquisition of vital signs as well as to monitor health status over a period which can be day or weeks remotely Alm et al (2005.)

There are lots of medical devices with sensors connected to the patients' bodies to measure the necessary medical information that is needed; such as the sugar level, blood pressure, medical signals, and heart rates. This gives pragmatic therapeutic information to nurses or other healthcare workers through wireless media with cellular networks, aimed at transferring results and the information to the health care professionals for extra diagnosis. ( Kim, Lee, Shahzad & Xiong 2018.)

Previously nurses used their senses to monitor patients and detect any change in their health but due to the advancement of technology, many sensors can be used to monitor patients. Today, health technology bids many suitable answers to the nurses, patients, and all healthcare givers. In diabetic patients, they have different types of sensors that help to detect any change in their sugar level. While they are at home the healthcare workers can monitor their sugar level. (Hasan, Shahjalal, Chowdhury & Jang 2019.)

### **5.5 The National Early Warning Score and Early Warning Score**

The National Early Warning Score (NEWS), is a tool that determines the amount of illness of a patient and prompts an intervention. It was introduced by the Royal College of Physicians in 2012 as an unpredictable approval. NEWS contains ix physiological measurements namely respiratory rate, oxygen saturation, systolic blood pressure, temperature, heart rate, and level of consciousness. Among these individually is a measure with the score from 0 to 3, and added together to give a total score with an extra two points for supplemental oxygen. The scores are between 0 and 20, with higher scores resultant from worse physiological measurements. (Garrett, Northstone, Pullyblank, Scott, Redmond, Whiting 2019.)

In a situation of secondary care, the scores for escalation triggers are 3, 5 and 7, with three triggering which comes with hourly observations if there is a premium of three points within a single parameter, five triggering hourly observations (regardless of weighting) and seven triggering a life-threatening care transfer; in the up-to-date arrangement, these levels of care can only be delivered in a hospital. The

earlier to detect any kind of change in the physiological parameters with timely detection avoids further escalation and improves better results. (Garrett et al 2019.)

Early warning score (EWS) is a guide that is used in monitoring the vital signs of patients in a different form. This type of guide helps to quickly determine the level of deterioration of a patient, abnormal results based on the scoring system. This is often used in acute cases and intensive units to assess any deteriorating or improvement of the patients. The higher scores call for urgent treatment without delay or escalation to the intensive care unit (ICU). EWS is usually calculated by the nursing staff or other healthcare workers, they can always contact other team members, and that depends on the score of the patients with the assessment of treatment escalation as specified. This is used in acute settings worldwide as bedside a monitoring device. (Jayasundera, Neilly, Smith & Myint 2018.)

EWSs comprises of oxygen saturation (SpO<sub>2</sub>), blood pressure (BP), temperature, heart rate, and (HR) respiratory rate (RR). It also assesses the consciousness level, and this is typically done by using the alert/responds to voice/pain/unresponsive (AVPU) system. This is good for different types of situations such as myocardial infarction (MI), sepsis, stroke, and cerebrovascular procedures. An increase in the EWSs shows deteriorating in patients' condition and is also used in selecting patients that will benefit from good care, especially those in the ICU. (Jayasundera, Neilly, Smith & Myint 2018.)

A new system known as the modified early warning score (MEWS) has been designed to smooth the monitoring and identifying of deteriorating cases in patients. This was first authorized in recognizing a patient that is critically ill in the ICU, surgical ward, and medical ward. The scoring system aid to find or have a high sensitivity of pre-hospital findings of life-threatening diseases. It counts the severity of the patient's illness to fluctuations of their functional constraints. (Peng, Hassan, Bustam, Noor Azhar, & Ahmad 2018.)

Most emergency departments MEWS have been authorized to envisage whether patients need to be in the observation ward, hospitalized, observation ward admission, in-hospital deaths, or whether the patients require a high level of care. This scoring system is not endorsed for patients that are traumatized because it can lead to underscoring and the outcome cannot reduce the number of mortalities in trauma patients. (Peng et al 2018.)



## **6 DISCUSSION**

This chapter briefly reviewed and summarised the literature method that was used, the findings and conclusions. The chapter also discussed further studies and what was learned during this research process.

### **6.1 Review of the literature review method**

This literature review looked at the overview of health Technology in the monitoring of vital signs and safety of patients. The goal was to increase nurses' knowledge and to make the impact of health technology better known in nursing. I researched on the important role technology plays in nursing settings in the previous years compared to the 21<sup>st</sup> century and all the new health technology devices that have advanced in recent times. The results displayed the safety rules or guidelines monitoring patients' vital signs with the help of health technology. Health technology has changed nurses' method of how a patient's vital signs are being monitored and the role they play to ensure the safety of the patients.

This literature review provides an overview of how health technology has impacted in the monitoring of vital signs over the decades. A literature review was conducted by selecting articles from three different databases; Sage, Science direct, and Scholar articles. 13 selected articles were assessed and evaluated by the author. Finally, articles were analyzed and evaluated by inductive content analysis.

Constant measuring of patients' vital signs and recording it communicates the well-being of a patient whether there should be a concern for deterioration or urgent need. Early detection of patients' situations can save the patient's condition from worsening. In as much as technology has been beneficial in the health settings and impacted the lives of patients, it has improved upon the nurses' care which helps to deliver more efficiently and in a safer way. More so it has also changed the phase of nursing, and arguably, nursing care, when it comes to health technology with patients monitoring of vital signs. It has been more advanced now compared to 30 years ago. (Sydney South West Area Health Service 2010.)

There are lots of health technology devices but the one that helped nurses is the electronic health records system. This system has drastically reduced a lot of errors and saves time for the nurses as compared to previously working and document patients' information on paper, which was time-consuming. Initially,

nurses depended solely on their senses in monitoring patients to detect any physiological change in their health, but health technology has made it easier. Vital signs monitoring is an important aspect of nursing care and cannot be underestimated. The vital signs of patients need to be monitored regularly, especially those in ICU or the emergency department. Those in the general ward vital signs can be taken at least, 3 times a day. (Houston 2013.)

## **6.2 Review of the findings**

I also believe that shift observation should be taken seriously because most times patients are being monitored during the day thoroughly but at night there is not much observation. With the research, nurses have been advised to measure the vital signs of their patients to spot early any complications. There have been a lot of nursing interventions when it comes to the safety of the patients. In this study, I found some guidelines or rules that ensure the safety of the patient and helps to intervene and determine the condition of patient observation and assessment. Assessing and observing a patient is a critical part of nursing.

This guide helps nurses to gather information about the patient and this information about the patients' situation and calls for the kind of care that will be given to the patient. This assessment and observation includes gathering information from the patient, doing a physical examination on the patient, detecting any illness - among many things, checking the vital signs as well.

I see the importance of taking patients' vital signs and document for safety. Gathering articles were a big hurdle for my research study. I discovered that there were lots of information about technology and very interesting ones, but the unfortunate part was that they were not scientific since I was looking for only scientific articles. I got scientific articles but not what I was looking for, but hopefully, there would be enough information on them in the future. Some of them were more closely and great articles but need to be paid for before one can access them. There were enough articles that helped me with the theoretical framework but articles for the results were very challenging due to the content, and they were not precise.

The materials used for this research are from Centria databases and evidence-based articles from Google scholar. It took me almost a year to put this thesis together because I had enough time to research and gather more articles. It would be of great benefit for nursing students in Centria if the teachers can also

teach the students more on the role health technology plays in the health sector and its importance, especially when it comes to the monitoring of vital signs of patients.

### **6.3 Conclusion**

It is evident through this study that technology plays an essential role in monitoring patients' vital signs. The monitoring of patients' vital signs over the years has tremendously improved due to the advancement in health technology. This has improved the quality of healthcare delivery, decline in medical errors, increased the safety of the patient and bridged the gap in terms of communication between patients and nurses.

The results from this study reveals that patient assessment, patient observation, patient data, real-time monitoring of patients, the national early warning score and early warning score are the safety rules for monitoring patient's vital signs with the help of health technology.

The findings also portray the effectiveness of medical health records in reducing medical errors and improving the safety of patients. Electronic medical records give detailed information about the patient and they also improve patient safety and care in a critical setting, because of its timeliness, effectiveness, and efficiency.

Safety plays a major role in the nursing setting and without proper monitoring, taking precautions, and working according to the safety rules, it would be chaotic and the patient life will always be in danger. Advancement of technology has ensured to a larger extend the safety of patients compared to the past. This has reduced many errors and improved the safety of the patient and enhanced the quality of healthcare. Taking vital signs is very important because it helps the nurses to know the general well-being of their patients.

### **6.4 Further studies**

Furthermore, continuous care for a patient can be done through wearable body sensors that have the vital signs sensors and help patients to track their vitals. These sensors can benefit a patient that is in a tragic scene for them to be tracked and located. This device helps them to be monitored until they are admitted.

Finally, patient assessment and observation are vital in nursing care because they provide information about the well-being of their patients and their condition. Consistent observation and assessment reveal any form of deterioration in the patients. Delayed in observation or assessment can cause escalation and it has been stated that the patient's condition will deteriorate. There must be clear signs hours before such an event. Systematic assessment of vital signs is very vital to distinguish patients in danger for serious adverse proceedings, allowing time for nursing interventions. Patients monitoring is an important event to ensure the safety of every patient.

### **6.5 Personal learning process**

During this research, I have learned the important role vital signs play in the lives of patients especially, and I had a hand on during my practical placements. Most decisions that doctors take are based on vital signs. I have also learned that vital signs help nurses to detect deterioration or improvement in patients' condition, and any need for an emergency. Also, during my studies, I read that vital signs are an important component and it helps to monitor the improvement of a child or adult when they are hospitalized. This helps nurses to know how the body is functioning if there be any delay in patients' recovery of adverse proceedings.

Before this, I used to reason that vital signs and patients monitoring are only carried out in the hospital settings alone where all gadgets and other devices are placed on the patient to check their vital signs. I realized there are a lot of wearable body devices that have sensors that can be used remotely and work effectively as well. One of the inspiring aspects of this research was the exposure I had when it came to health technology. It was quite interesting to know the consequences and the effect of lack of commitment or consistent checking of patient vital signs can cause. Amazingly, failure to record just one vital sign could lead to so many complications or even death. This topic reminds me of my practice when I was asked to check patients' vital signs from room to room and document it. I realized the nurses were so much concerned about it and this is not done only once but consistently.

One interesting part I also learned was that, during my practice, the nurses were concerned about the kind of device we used for checking the vital signs of the patients. Sometimes, if there is any form of concern, for example, when we use an armpit thermometer (axillary thermometer), we would be asked

to use the one for the ear (tympanic thermometer) so that we can document both. And during that time, if there were any elevation or deterioration in patients' health, we continuously checked the patient throughout.

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**APPENDIX 1**

## Content analysis for safety rules for monitoring patients' vital signs

Raw data	Sub category	Main Category
Patients well-being Patient response Detention of acute cases Evaluate nursing intervention prevent adverse situation	Vital signs measurement	Patients Assessment
Identifying any change in patient's status Spot any procedural complications Reduces the adverse events Prevent deterioration Nights shifts observation Systematic assessment of vital signs	Comprehensive vital signs monitoring	Patients Observations
Contains patient's health information Continuity of care Diagnose and treatment in healthcare Patients medical history Protect and assures the confidentiality and security of the patient Reduces error	Patients safety	Patients Data
Sensors applications Benefit patient that are in a tragedy scene for easy location Continuous monitoring remotely Patients data transferable	Health status tracking	Real Time Patients Monitoring - wearable body sensors and remote monitoring

Suitable to provide care for patients with chronic diseases		
<p>Prompt an early intervention</p> <p>Avoid further escalation</p> <p>Determine level of deterioration of a patient</p> <p>It counts the severity of patient's condition and fluctuations</p> <p>Shows deteriorating in patients'</p>	Level of deterioration	The National Early Warning Score and Early Warning Score

**APPENDIX 2**

Table of Articles

<b>Authors</b>	<b>Year, Journal</b>	<b>Title of article</b>	<b>Findings</b>
Dias. D, Cunha, J.  2018.	Journal of Sensors	Wearable Health De- vices—Vital Sign Monitoring, Systems and Technologies.	This research shows how the wearable body sensors with four functionalities aimed to monitor patients' vital signs, check medical record storage, tracking location and tracking triage status. The findings show that wearing of these sensors help monitor patients' vital signs remotely and also to ensure patient total wellbeing.
Bachion. M., Brasil. V., Boaventura. R., Bezerra. A., Teixeira1. C., Souza. A., Parana- guá. T.  2015.	Scielo Analytics Jour- nal	Vital Signs Measure- ment: An Indicator of Safe Care Delivered to Elderly Patients.	This finding indicates the importance of as- sessing patient's well- being especially the el- derly and communicate the severity of a condi- tion that needs urgent attention.
Cardona-Morrell M., Nicholson M., Hill- man K.  2015.	Qualitative Observational Research	Vital Signs: From Monitoring to Preven- tion of Deterioration in General Wards.	The findings illustrated how the measurement of vital signs can pick out deterioration. Con- tinuous recoding and

			the intervals in recording of vital signs decreases serious deterioration, unconsciousness and other complicated health issue.
Cooper, S., Kim Ang, E., Liaw, S., Mok, W., Wang, W.  2015.	International Journal for Quality in Health.	Attitudes towards vital signs monitoring in the detection of clinical deterioration: scale development and survey of ward nurses	According to the findings it was specified that consistent and accurate checking of vital signs can reduce deterioration.
Da, R., da Costa, Mayer, A. H., & Righi, R.  2019.	Health of Informatics	Electronic health records in a Blockchain.	The findings highlight the role EHRs plays in the life of patients and its benefits to the nursing care.
Griffiths et al.  2015.	Research Article	Vital signs monitoring in hospitals at night.	Night observations and recording of vital is the most critical part of care and a little neglect could lead many complications even death.
Hasan, M.K., Shahjalal, M., Chowdhury, Z., Jang, M.  2019.	Journal of Sensors	Real-Time Healthcare Data Transmission for Remote Patient Monitoring in Patch-Based Hybrid OCC/BLE Networks.	Conferring to this finding it has been indicated that monitoring of patients remotely by wearable sensing network improves the recent healthcare. This wearable device con-

			tinuously monitors patients with chronic illness vital signs.
Huston, C.  2013.	The Online Journal of Issues in Nursing	Health Information Technology, Patient Safety, and Professional Nursing Care Documentation in Acute Care Settings	The findings confirmed the use of EHR for documenting patient's information is useful and enhances patient safety, maximise efficiency and evaluate quality of care quality that measures staffing need.
Jayasundera, R., Neilly, M., Smith, T. O., & Myint, P. K.  2018.	Journal of Clinical Nursing	Are Early Warning Scores Useful Predictors for Mortality and Morbidity in Hospitalised Acutely Unwell Older Patients?	The findings demonstrated the usefulness of the EWSs in predicting mortality and morbidity acute patients and also in identifying patients with worsening condition to adopt the appropriate interventions.
Kim, Y., Lee, Y., Lee, M., Shahzad, A., Xiong, N.  2018.	Journal of sensors	Real-Time Cloud-Based Health Tracking and Monitoring System in Designed Boundary for Cardiology Patients,”	This finding reveals the importance of connecting wearable sensors to the body of the patients as it measures the necessary parameters. Measuring the necessary parameters.
Peng, L. S., Hassan, A., Bustam, A., Noor	Hong Kong Journal of Emergency Medicine.	Using modified early warning score to predict need of lifesaving	The findings explained how the adoption of the early warning score



Azhar, M., & Ahmad, R.  2018.		intervention in adult non-trauma patients in a tertiary state hospital.	helps in predicting and detecting deterioration in ill patients to avoid further deterioration and escalation.
Ratwani, R. M.  2017.	Journal Indexing and Metrics	Electronic Health Records and Improved Patient Care: Opportunities for Applied Psychology.	The findings illustrate that the implementation of EHRs embraces incredible promise for improving quality, efficiency as well as safety of the patients.
Scott. J., Redmond. M. Garrett, <i>et al</i>  2019.	Emergency Medicine Journal	Distribution of the National Early Warning Score (NEWS) across a healthcare system following a large-scale roll-out.	This indicates that NEWS is a vital tool designed to determine the level of illness of a patient and prompt an intervention to avoid deterioration.