# The Impact Of Technology On Nursing Education And Practice

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## Abstract

This paper is a general overview of current technologies and their uses in nursing practice and education. The complexity of the healthcare environment has increased dramatically over the past few decades, and as such, a greater understanding of technology is necessary in today's nursing practice. Many areas of clinical practice are being impacted by the introduction of information technology (IT). Over the last decade, electronic health records (EHRs) have increasingly been used in nursing. The major goal of these records is to improve the safety, quality, and efficiency of patient care. By incorporating knowledge-based tools within the EHR, new forms of clinical documentation, and various other innovative applications, the quality of care rendered to patients can be greatly improved.

Health care is in the midst of a technological explosion. The one element that nurses must not lose is the humanistic, caring essence of nursing.

**Keywords:** *electronic health records (EHRs), information technology (IT), clinical documentation.*

## 1. Introduction

A Over the past few decades, technological advancements have been remarkable, to say the very least. It is helping us in many ways, but one of the most important ways is the advancement of healthcare. It is very important to know what is coming out of the health science technology pipeline to ensure that one is providing for their personal healthcare needs in the best way possible. The more our healthcare mirrors the available science, the better we can be assured of the best outcomes. As we all know, technology is helping in the increase of life expectancy and, most importantly, the quality of life. In the particular field of helping the sick, the life-saving efficacy as well as ease of diagnosis has improved. This technology really helps us in providing more accurate treatment. Another recent phenomenon is the change to patient-centered care. The information age is helping everyone to be more informed, and this is especially true in the healthcare realm. People are taking a more active role in their healthcare,

and it has given way to more collaborative care, in which the patient is more involved in the decision-making process and choosing from the options that best suit their needs. Technology is also a driving force behind evidence-based practice, and it has provided us with more access to research articles, and it has made it far easier to conduct studies which are a huge factor in advancing the science of healthcare and ultimately devising the best treatment plans. These are important things to consider, as these changes may help us reduce the cost of our care while at the same time improving the results. With technology's track record, it is feasible to think this is possible. With the proposition of healthcare reform a near certainty, health informatics and the complications thereof are a growing priority in both the public and private sectors. This is a complex issue, and the more nurses understand it, the more they can influence the eventual outcomes. The function of technology in these various changes is often misunderstood, and it is vital for the nursing community to have a better comprehension of it. This is where understanding and leveraging the technology of today will be important for tomorrow. In light of these things, this article will examine technology's current and potential impact on education and practice for nurses. By way of monitoring the changes in a specific area over a decent interval and eventually comparing the outcomes, it is possible to better assess the effectiveness of these changes, and we **will** examine some ideas for doing this in the realm of nursing. (Chauhan et al.2024)
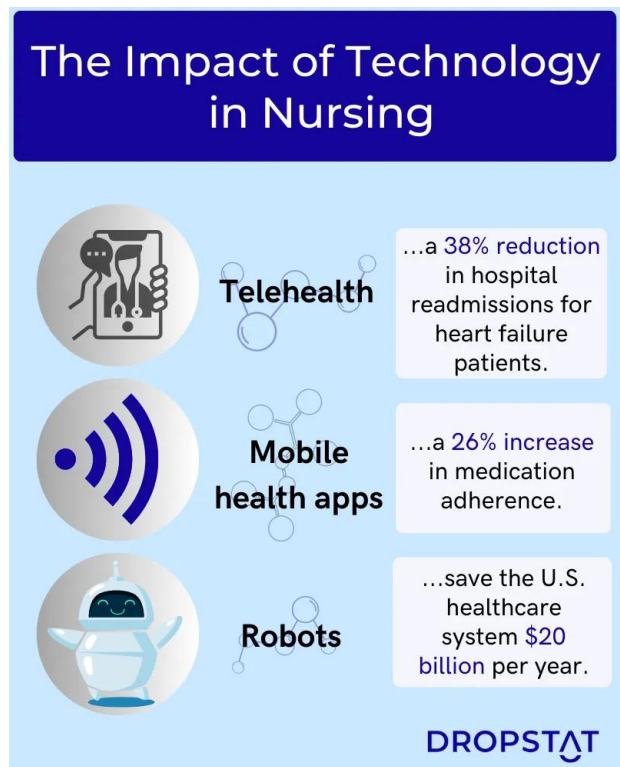


## 1.1. Background

When one considers how information is accessed and used in today's teaching and learning environments, it is helpful to start with a brief overview of the educational theory and practice that has led us to this point. This is important as the tools employed become inextricably linked with how we think and the means by which we have gotten to our goal. Analogous to other disciplines, consumer technology and the internet have changed how information is accessed and delivered in the nursing educational realm. This is in stark contrast to the use of technology as a teaching tool which has traditionally been limited to showing students how to be proficient users of the operating tools of the trade. This is because computer-based technology is no longer supplemental, but is an embedded component in all things we do and computers have become the bridge to knowledge for all learners. Information is perpetually and ubiquitously at our fingertips and today's students are visual and active learners who are accustomed to the engaging, interactive, and colorful presentations that are offered by multimedia technology. The uptake of web-based learning, and its attendant multimedia resources, support the multiple

modes of learning in alternative learning environments and appeal to a vastly diverse student population. The visual and storied nature of web-based resources can offer a more personally meaningful learning experience for many. This is exemplified in the use of web-based multimedia resources that are designed to improve medication administration safety such as virtual dosing simulations and case studies in which students follow "virtual" patients through their drug therapy. The high level of interactivity and virtual immediacy offered by these resources teaches students to think critically and offers learning by doing; a pointed departure from the traditional passive and text-based learning. (Lokmic-Tomkins et al.2022)Nursing educators find themselves caught in a technology tsunami. Information is coming at them from all sides, in all forms. The knowledge and information explosion has changed the very nature of how one educates oneself and others. The days of nursing education through the use of stand and deliver lecture and textual materials as the primary source of knowledge acquisition are gone. The use of technology in education and information dissemination must not be an afterthought in the nurse educators practice, but rather it must become the foundation of knowledge and learning. And as educators endeavor to remain technologically relevant and access information that has become detached from any specific technology or format, we might ask, "What should I be learning?" An informed response to this question can elucidate the impact of technology on nursing education and practice.

1.2. Purpose

To discuss the use of technologies in nursing education and practice, it is important to understand the changing nature of both the educational and healthcare systems. Over the past decade, the availability of educational and clinical technologies has exploded, and the need to understand and apply these technologies is changing the way students are educated and the way clinicians provide care. In addition to these changing education and practice environments, there is an even more urgent need to prepare a nursing workforce that is diverse and able to practice in a healthcare system that is serving a

culturally and socioeconomically diverse population. Failure to attend to this need will perpetuate a disparity in which the healthcare system's technological advances benefit only the majority population, thus widening a disparity in which minority groups receive less effective care. These concurrent needs to prepare a technically savvy workforce and to eliminate minority health disparities have led to new pedagogical approaches in the use of technology to teach and a proliferation of educational technologies aimed at both students and practicing clinicians. This essay will describe a few emerging technologies that can be used at various levels of education and practice to address these needs, but it is likely that these technologies, which are currently in development, will be quickly replaced by newer models. For this reason, the discussion of specific technologies will be kept at a general level and will avoid specific brand names. (Venkatesan et al.2021)

## 2. Advancements in Technology

The concept of the Electronic Health Record (EHR) is now enshrined in healthcare systems across the globe. An EHR can be described as the systematic collection of electronic health information about individual patients or populations. It is a record in digital format that is theoretically capable of being shared across different healthcare settings, by being securely accessed by multiple users. The effects of EHRs on nursing practice is a broad subject because it affects nurses in many different ways. It is widely recognized that well-implemented EHRs can provide higher quality, safer, and more informed care within a healthcare system, and this is at the top of the list for any nurse and any system designed to cater for ensuring that patient care is safe and effective. EHRs have the potential to significantly improve patient outcomes and nursing quality indicators such as those relating to evidence-based practice.

As aforementioned, technology has reshaped every aspect of society. This is especially true for the professions that must engage with this rapidly changing landscape or risk becoming

obsolete. In a profession that deals with the health and well-being of society, it is essential that new technologies are used effectively and efficiently so as to not impede the nature of nursing practice. Unfortunately, it is often the case that nurses are not adequately prepared to meet the challenges of a technology-rich healthcare environment. This can be attributed to a lack of technological content in their basic education program and a slow uptake of ongoing education. But in focusing on the positive aspects of technology, it is not difficult to see how it has greatly impacted nursing education and practice. This impact has been so significant that it has changed the way we deliver care and educate future generations of nurses. (Sani et al.2020)

## 2.1. Electronic Health Records

Because EHRs are the new standard for charting and keeping patient information, a nurse needs to be competent in the use of this system to provide safe and effective care. Shifting from paper charting to using computers for all patient documentation has made it a requirement for nurses to have computer literacy. A study done by Gugerty, Bennett, and Deatrick investigated how EHR affected the work of pediatric oncology nurses. It was found that some older nurses who were not competent with the use of computers took longer to document information on the patients than they did with paper charting. This decrease in productivity can be a negative effect of EHR. The study also acknowledged that competent computer using nurses transferred information quicker and electronically accessing patient records allowed all nurses to have better access to patient information. This shows that the top priority to ensure effective care with the use of EHR is to fully educate all nurses in the use of this system. (Papapanou et al.2022)

Electronic health records (EHR) are the end result of putting patient health information into a computerized format. This system has had a huge impact on nursing education and practice. Because EHRs are a newer system, many older practicing nurses have not used them in the past and need to be educated on how to use them. This is where the impact on education sets in.

Educators are incorporating EHRs into their curriculum because they need to prepare students to use this system in their future practice. In a study done by Forcier and Stetson, nursing students saw the use of EHR simulations to be more effective in preparing them to work with the actual system than using EHR in clinical rotations. The students felt the use of actual EHR in the clinical setting did not provide them enough active participation and review in the system because nurses at the clinical facilities were still in the learning process to use EHR themselves.

## 2.2. Telehealth and Telemedicine

The most obvious application of telemedicine is the adoption of the electronic health record, which has revolutionized the way in which patient information is documented and processed. However, unlike many electronic health records today, these are designed to be more portable in order for the patient's information to be more easily accessed by different healthcare providers. As the EHR has also been developed in areas outside of telemedicine, we will only be considering the relevance of EHRs which are integrated within and used primarily to support telemedicine. This is because its impact is underpinned by the potential to automate and streamline the process of documentation, and because many other features of EHR systems are not unique to telemedicine and are therefore no different from in other medical fields. EHRs and web-based tools in telemedicine are also used in several other ways. One example is their employment to provide "online consultations" between patients and specialists in remote areas. This is of great benefit to the patient who avoids the inconvenience and costs of traveling and can receive more convenient and timely access to a specialist. The EHRs help to facilitate this by providing a platform through which the patient's clinical information can be examined, and they can also be used to store the findings and recommendations from the consultation. (Esteva et al.2021)

Telehealth is the use of telecommunications to deliver health services over a distance. It involves using information technologies to

exchange medical information from one site to another in order to improve a patient's health status. Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status. It includes a growing variety of applications and services using two-way video, email, smartphones, wireless tools, and other forms of telecommunications technology.

## 2.3. Simulation and Virtual Reality

Simulation and virtual reality provide an opportunity for students and professional nurses to keep their skills and knowledge up-to-date. By creating a risk-free environment, nurses can practice and learn from their mistakes. This type of learning is essential to promote safe practice. Virtual reality is the computerized simulation of a real-life situation. This type of learning can be self-directed or designed for a specific learning requirement. An example being developed at the University of Ulster in Ireland is a virtual home visit environment designed for community nurses. This allows a student to conduct a home visit to assess the health and social care needs of a family. Mistakes can be made and the exercise can be repeated until the student is competent at the skill or task. A similar idea has been developed by the University of Calgary, where they have created an emergency room in which students can be placed in a variety of emergency medical situations. This provides an easy, time and cost-effective way to provide education and teach complex decision-making and clinical reasoning skills. This is especially important when teaching skills for high-risk low-occurrence events, for example, cardiopulmonary resuscitation. Simulation with interactive multimedia can be used to provide a safe environment to prepare students to perform the skill. (Chen et al., 2022)



## 3. Benefits of Technology in Nursing Education

Technology has had a profound impact on the nursing profession. One of the largest impacts it has had is in nursing education. With the use of technology, students are learning more effectively and efficiently. According to the National League of Nursing, technology benefits students by providing a more flexible schedule for learning. Students can listen to podcasts and view classroom lectures online at a time that is most convenient to them. This allows for a student to work around their current schedule and not have to rearrange their lives to fit traditional classroom time. Another benefit that technology provides to students is increased simulation opportunities. High definition simulations are a safe and effective way for students to practice and apply clinical judgment. The additional simulations help to increase clinical judgment and decision-making ability before entering the workforce, hence leading to better patient outcomes. Virtual patient simulations also help to improve diagnostic skills by allowing the student nurse to practice these skills in a safe environment. Finally, technology increases student engagement by making learning more accessible. Students can use laptop computers in the classroom to take assignments or exams. Also, computer-based home assignments and exams can be easily stored and accessed by instructors. This allows for quicker feedback to students so that they can learn from any mistakes that they may have made. Student engagement and feedback are two very important factors for effective learning. (Tan et al.2021)

### 3.1. Enhanced Learning Opportunities

Both of these products have been developed by Microsoft and Apple Macintosh in order to provide the best learning environment for students. Simulation software is intended to recreate a real-life scenario, so that the user can practice using the functions of the system and assess the identified problem. Step by step computation of the identified problem can be implemented using the software. Microsoft Office Word is used for the purpose of academic writing and Microsoft PowerPoint is used to

prepare educational slides. All these software are available in the market and can be used on any PC. CD-ROMs have a vast amount of information stored in the form of text, pictures, and videos. This information is structured in the form of modules. The user can choose a module and go through the self-learning exercise. This type of learning can be fun if it is related to something like a game/action. Interactive learning can improve decision-making and cognitive skills. This approach is more flexible, in that the user can choose when to learn. They can return to the module at any time they desire. (Shehab et al.2022)

## 3.2. Improved Collaboration and Communication

Communication and collaboration are the cornerstones of nursing practice. According to the American Association of Colleges of Nursing (AACN, 2008), communication and collaboration are essential to providing safe, quality patient care. Robert Wood Johnson Executive Nurse Fellows (2010) reiterates this statement by stating that successful communication and teamwork are essential for high quality care and are necessary for preventing adverse patient outcomes and errors. There is overwhelming evidence that effective communication and collaboration have a positive impact on patient and organizational outcomes. While numerous technological advancements have been made and devices have been created to facilitate effective communication and collaboration, many still fall short of the goal. Historically, the most common form of communication between nurses has been verbal, either in person or over the telephone. While sound, this type of method does not create a record of communication and often times miscommunication occurs which can lead to adverse patient outcomes. Email has also been a widespread tool for communication, but it often not immediately accessed and often too impersonal and slow for the types of quick exchanges that often occur in a fast-paced healthcare environment. Servers and calls over handheld devices are another form of communication that are often too slow, too difficult to find another party, and often time-overloaded with other information. All methods mentioned are rarely standardized within an organization and most nurses and healthcare workers end up using multiple methods to attempt to locate and communicate with another party. There are clearly many inherent problems that need to be addressed to facilitate more effective communication and collaboration in nursing practice. (Al-Balas et al.2020)

## 3.3. Increased Access to Resources

As technology has developed, it is mandated that there is a need for nurse educators to benefit from the availability of resources found on the internet. This will create a new generation of nurses who are more technically savvy and independent. They are able to locate and have access to a wealth of information to help with their learning. Online resources have developed vastly over the years and are a valuable asset to student nurses to facilitate learning. Digital libraries are easily accessible by student nurses in their own homes. They have the ability to download key journal articles and book chapters for later access and can also locate them on the site through search functions. This will save them time and effort, as they will not need to locate the physical copy of the article or book. Moreover, the reader is often given a contents list with the abstract from a book, with electronic bookmarks on each heading; improving the speed and ease of navigation through the book. Audio and video resources are also available for students, which they may find useful for a different way of understanding a topic. E-learning packages are an increasingly popular way for nurse students to learn. They are interactive and cater for the variety of different learning styles. The packages often include quizzes and activities to test knowledge, with instant feedback; and interactive multimedia such as 3D models, audio voiceovers, and video clips. The internet is also home to a numerous amount of social networking sites on the internet which can help student nurses to communicate and collaborate. This can have relevance to the previously discussed point about improved collaboration and communication.

## 4. Impact of Technology on Nursing Practice

There are many benefits to using computerized documentation. Computerized documentation is often more organized and legible than paper documentation. Although, as with anything, there are varying degrees of proficiency when it comes to typing skills. Nursing assessments can at times be more detailed and more organized than other forms of documentation. Computerized documentation also has one very large benefit and that is that it promotes increased reimbursement as well as nurse participation in quality initiatives. When a nurse documents in a patient record it may be used as a comparison to other patients, in turn it may help regression of a particular diagnosis. This will mean that there is a better defined case mix and increased reimbursement. This is where the nurse is provided many opportunities to partake in studies which may help define standards of care to advance outcomes that are measured through diagnosis-related groups and other forms of reimbursement.

According to 4.1 documentation is key for any healthcare setting, it is the only way communication occurs amongst the entire healthcare team. In recent years, technology has made a huge impact on nursing documentation. Information is more readily available with more communication along the entire healthcare team. The days of using paper to write and store a patient's record is becoming obsolete. Computers are a large part of patient care and all members of the healthcare team now have access to a computer for a variety of different tasks.

### 4.1. Streamlined Documentation and Record-Keeping

Information management is a fundamental aspect of professional nursing. Nurses are the primary source of patient care and communication, and they continue to be the lynchpin holding together patient safety and quality care through effective assessment, knowledgeable decision making, and adequate documentation. While the eight rights of medication administration are considered to be best practice, one of the primary rights is often overlooked - the right documentation. Effective documentation has been shown to decrease the rate of medication errors and adverse events as well as improve patient outcomes (Institute of Medicine, 2003). The evolution of written documentation to electronic documentation systems (EDS) has been slow and tedious; however, technology has massively grown in the past decade and it is starting to infiltrate the clinical environment. The American Recovery and Reinvestment Act and the Health Information Technology for Economic and Clinical Health Act set aside a total of $27 billion dollars to incentivize hospitals and physician practices to adopt and effectively use EDS (Advanceweb, 2011). The adoption of EDS has had great implications for improving patient care and safety and is particularly relevant for nursing practice. Firstly, EDS has enhanced the ability to retrieve and analyze patient data. Written patient records are often scattered and retrieving specific information can be time-consuming and at times impossible. EDS organizes information and provides a methodical way to retrieve data, which can save a great deal of time. Access to complete and accurate patient data is critical to coordinated care, and electronic records can be shared among multiple platforms and settings. This enables all healthcare providers access to the same information and eliminates the detrimental consequences of poor communication and lost information. In turn, this will improve continuity of care and patient outcomes. (Grunberger et al.2021)

### 4.2. Improved Patient Care and Safety

Information technology cannot only decrease medical errors, but it may also have possible effects on nurses' performances. According to a recent study by AMIA, the yearly price savings through the avoidance of adverse events in U.S. hospitals using IT was projected to be $3.5 billion at $500,000 per prevented adverse drug event. These mistakes could be decreased through much better technology access to drug details that are certainly according to processes versus free text orders. It is going to have a small effect on the easy ordering of medications that too often leads to mistakes. Offering decision

assistance at the stage of care can supply the nurse with feasible patient circumstances which could occur from unclear orders, therefore leading to a greater understanding of the order itself. Much better interface design can guide nurses to using types of documentation that have been shown to be better than others in preventing errors. IT has the capability to improve patient safety by improving the quality of these various clinical methods. Nursing is a data-rich career that has been slow to automate due to clinical tradition and insufficient resources. When compared to other professional environments, nurses often depend on manual data entry that can occasionally lead to normal errors. Over the past decade, government and industry initiatives in the U.S. have shown it to be a pressing need to automate certain types of nursing documentation, such as clinical assessments. The recent emergence of clinical information systems that use standardized languages, such as NANDA (for diagnoses), NIC (for interventions), and NOC (for outcomes), are beginning to help automate the documentation of nursing's most data-intensive processes.

### 4.3. Enhanced Efficiency and Workflow

Decision support systems can potentially free up physician time, thereby shortening patient waits and improving flow-through in hospital environments. This should lead to smoother workflow for nurses, but it is a complex issue and there is potential for disruptive effects on nursing roles and interdisciplinary relationships. Lastly, in the larger picture of health system workflow, technology has a major role to play in linking together and enabling coordination of care within and across sectors. Ehealth systems and personally controlled health records have the potential to make significant efficiency savings, but this area is beyond the scope of the nursing workforce and thus the impact on nursing is unclear.

Although BCMA is a tool for patient safety and has clear implications for efficiency in terms of reducing time spent rectifying errors, it may actually lead to nurse staffing levels being considered insufficient. This is because the time saved on administration tasks is currently being consumed by the implementation of additional safety and documentation measures, and there are no measures to increase nursing time on direct patient care. This is an unintended consequence and indicates the complexity of the relationship between technology and efficiency in nursing. Other examples of the simplification and automation of tasks with potential to save nursing time are rostering tools and patient classification systems, but there is little evidence regarding their impact and uptake.

Workforce efficiency is vital for ensuring the effective delivery of healthcare - and the reorganization of work is often the keystone of efforts to improve healthcare. Technology has the potential to simplify, automate, and therefore enhance efficiency; and the evidence that it has delivered on this potential is a key factor in its widespread uptake. For nurses, the most visible example is the automation of routine tasks such as drug administration, using electronic medication administration systems. A growing body of evidence indicates that these systems not only reduce errors in drug administration but also free up time for other nursing tasks. For example, a study of bar-coded medication administration (BCMA) on two surgical wards found that administration errors decreased by 41% and 51%, and time spent obtaining medications decreased by 43% and 53%.

## 5. Challenges and Concerns

With technology comes the need for increased training and expertise for its proper use. In nursing education, there is a need for more comprehensive and in-depth education regarding computer literacy and information literacy. This broad education must be directed towards students, educators, and practicing nurses in order to improve the general technological competence of those in the nursing profession. In terms of specific education methodologies for working nurses, distance learning may prove to be a difficult and isolating experience, although the trend towards increased use of the internet for education will make it a necessary skill. Time will be another factor for working nurses when considering

further education to increase technological ability, as many nurses will not have the time to refine their skills on the job due to more demanding work schedules, and the complex nature of the computer programs used may make the learning process more time consuming than the simple training seminars of the past. The challenge of maintaining the personal and sensitive nature of nursing care in a highly technological environment is a major issue for nursing with the growing trend of care automation and increased use of IT in practice. While computer automation has some potential to improve quality of care, some aspects cannot simply be replaced, particularly in the mental and emotional support that nurses provide to patients. Studies have shown that use of technology to replace nursing care can lead to increased risk of feelings of neglect in patients, and this can be particularly detrimental with vulnerable populations such as the elderly. An example would be the increased use of assistive robots in care of the elderly and disabled; while the efficiency of such technology is appealing, it runs the risk of isolating patients from human interaction and doing more harm than good in terms of their quality of life. It is imperative for nurses to maintain advocacy and ensure that such technology is only used where it can truly improve quality of care. (Zhang et al.2022)

5.1. Training and Education for Technology Adoption

The training and education of nurses and other healthcare providers in the use of new technology is an essential, although costly, component for successful technology adoption (McBride, 2005). It is important to distinguish between training and education. Training is the process by which an individual is taught a specific skill or set of skills, and education involves a broader understanding of the theoretical underpinnings and clinical applications of a given technology. In general, training has been provided by the vendors of technological systems and has been oriented towards providing the minimal skills necessary for using a system. The movement to computerize medical records, for example, has led to the training of clinicians to use specific software applications and has left many clinicians without an understanding of how using computers can change the way they practice or improve their practice. Nurses at all levels need opportunities to learn increasingly complex computer skills in both the academic and staff development settings, but they also need education that engages them in understanding the ways in which various uses of technology can improve patient outcomes and the efficiency of the healthcare system (Thielst, 2007). While nurses need computer and information literacy to develop over time, the nursing informatics specialists who will take key roles in shaping the information systems of the future will require graduate-level education that provides them with strong research and theory skills in addition to a broad understanding of the present and potential future state of healthcare technologies. This area of education is still in its early stages. Healthcare information technology is becoming an increasingly common area of study and specialization in graduate-level informatics programs, but the field lacks clear standards and competencies, and there is a shortage of qualified educators and mentors in the area (Remus & Kennedy, 2011). In response, to meet the demands of advancing technology, nursing and healthcare organizations are seeking individuals who have knowledge and abilities related to technology application and who have clinical expertise to work as developers of clinical applications and implementers of health information systems. This has led to a variety of innovative programs designed for nurses with varying levels of technological knowledge and interest. There are increasing numbers of workshops and intensive courses for basic computer skills and various applications, designed for both students and professional nurses. For those seeking a greater understanding, there are programs and courses at all levels designed to introduce nurses to the concepts and issues of healthcare information technologies, and there are increasing numbers of educational resources designed to introduce nurses to the wider world of possibilities in nursing and healthcare automation. (Qureshi et al., 2021)

## 5.2. Privacy and Security Issues

Security is a major concern, with threats to patient confidentiality. According to the ANA, only 55% of nurses are aware of the security measures used to protect health information, while only 40% are aware of their use at their own institutions. Ninety-four percent of hospitals use the internet, and only 47% have a comprehensive security strategy in place. Security strategies must be increased and continually updated to protect patient information. Another security concern is the potential use of nursing diagnosis data to deny reimbursement based on the severity of illness. Since nursing diagnoses are new to many in healthcare, there is a potential for them to be misunderstood. At a current hearing, a CMS representative stated, "The CMS approval (of NANDA diagnoses) only means that the diagnosis is 'valid to be made.' We do not approve nor disapprove the care plan maps, and it will not be used in the determination of medical necessity." Measures must be taken to ensure that nursing diagnoses are not taken out of context and used for purposes other than intended.

## 5.3. Potential for Depersonalization of Patient Care

A study on Emergency Department nurses' cognitive work in processing electronic medication alerts identified that nurses modify their practice to complete work tasks; that is, they attempt to revise the way they do their task to fit the constraints of the tool and change the task itself. This was evident when nurses had difficulty separating medication tasks from the alert tool, even though the alert was clinically irrelevant. The tool changed the task from giving the medication to making about a decision. This has a number of implications for nursing work and inpatient safety. Difficulty resuming a task after an interruption was the most common error recovery task for nurses.

Documentation through the use of electronic health records has caused unnecessary information to be included about the patient. Because of the sheer volume of information that can be entered into electronic health records, there is a growing risk that nurses will include all data rather than critically evaluate and filter information to include only what is necessary. While there are clear benefits to comprehensive patient information, it also means that there is more data to process and sift through to extract the most pertinent information. The risk of including too much data is that there may be great difficulty in determining the relevance of the data to a current health issue, which is likely to increase the time it takes to find and document the most relevant patient information.

## 6. Future Trends and Innovations

Nursing education needs to adapt to the rapid change in the practice environment, which will be facilitated by AI and robotics. The challenge for nurse educators is to identify the knowledge and skills required by an entry-level nurse practicing in a technology-rich environment. Without doubt, competencies related to informatics and information management will be an integral part of baccalaureate and graduate education. One would expect future nurses to be well-versed in patient care technology and information systems and that they will be competent in using these tools to effectively document and analyze patient findings and to support the decision-making process when they prescribe and delegate treatment. The method by which these skills are integrated into patient care will depend on the way in which automation and intelligent application tools are designed. Therefore, the learning process will be ongoing, and nurses in practice will need to be lifelong learners in using intelligent tools.

Artificial intelligence (AI) and robotics are identified by a group of nurse educators and informaticists as top trends to watch in the next few years. This has been identified as having a potential impact on nursing education, administration, practice, and research in the article. For instance, AI can be used to mimic human cognition in the analysis, interpretation, and comprehension of complex medical and health care data. AI can be used to support the development of nursing science and the facilitation of new models of data-intensive

research. The Academy of Medical-Surgical Nurses identifies a future trend where robotics will become an integral part of practice in the provision of care.

## 6.1. Artificial Intelligence in Nursing Practice

Artificial intelligence (AI) has made significant strides in the past decade and is set to revolutionize the way care is delivered. It is defined as the science and engineering of making intelligent machines. Johnstone (2017) describes AI as using data and programming algorithms to attempt to mimic human problem-solving. AI is widely used in various ways, such as in decision support systems, where the clinician makes decisions and the AI helps support this by providing in-depth information on the decision and/or predicting the probability of different outcomes. A well-known example of this is IBM's Watson, which uses machine learning algorithms to attempt to answer questions posed in natural language. Walker (2017) states that Watson is being used in a partnership with Memorial Sloan Kettering Cancer Center to help provide the country's oncologists with an expert second opinion at any time. This is conducted by Watson, who reads through the patient's medical records and other sources of data to provide treatment recommendations. Decision-support systems have the potential to significantly improve patient outcomes. A systematic review conducted by Garg et al. (2005) found that decision support systems can improve practitioner performance and patient outcomes in a number of areas. This has the potential to increase the level of care provided while also reducing costs. Another form of AI used in healthcare is robotics. Robotics can automate simple tasks, assist disabled patients, and even perform complex surgeries. Greenhalgh et al. (2016) argue that robots are reliable and consistent and can work for long periods without breaks. A study by Wagner et al. (2016) compared computer-assisted total hip replacement and the standard method and found that the computer-assisted method had significantly less blood loss. This would suggest AI has the potential to improve the safety and efficacy of procedures. The potential for robotics can be seen as scary by some due to the

belief that AI is a threat to the job market. However, Greenhalgh et al. (2016) argue that it is not robots that will replace decision-making clinical work; the robots will aid clinicians with decision support and automate simple tasks. Lastly, AI can improve the efficiency of care. Amelung et al. (2016) describe AI as being able to sift through big data rapidly to predict future patient needs and provide recommendations for care planning and delivery. This is important in a world with an increasing demand for care and a shortage of practitioners. AI comes with high potential; however, there are some significant precautions and challenges that come with it. AI is far from perfect, and there are concerns with patient safety and reliability. Walker (2017) highlights that computer software is prone to failure and can become obsolete. In an experiment conducted by Chang et al. (2010), it was found that computer-aided diagnosis provided poorer sensitivity than physicians in the diagnosis of pulmonary tuberculosis. Walker (2017) also poses the question: are machines able to process all information, including emotional and subjective, without oversimplification? This is a significant factor in care delivery, as patient care is more than just data. (Pugliese et al., 2021)

## 6.2. Wearable Devices and Remote Monitoring

The evolving digital era has given rise to a multitude of computing devices and technologies that are being incorporated into healthcare to enhance the practice of nursing. Wearable devices are small electronic tools or technologies that are designed to be worn by patients to monitor and record specific biometric data, improving their quality of life. A comprehensive review of wearable devices in healthcare by Najafi et al. determines the various roles for wearable technologies in thorough monitoring of patients' chronic conditions, monitoring patient safety during recovery or improvement from surgeries, and those susceptible to acute or gradual changes in health status. The authors propose an ideology that this form of around-the-clock monitoring will lead to a 'paradigm shift' in healthcare and promote independent living. This concept is parallel to nursing care for patients with chronic conditions, which is a progressive move towards

caring for patients in a community environment instead of direct care in a hospital environment. This shift in patient care has been utilized by technological advancement, which has recently seen a rise in the development of smart homes and aged care facilities that are also equipped with sensor technologies to monitor patient activity and health status. Wearable technologies can be well integrated into nursing care for these patients in the community as a means to continuously assess and record patient health status to identify any signs or symptoms of decompensation and prompt early intervention to prevent avoidable hospital admissions. This form of ongoing surveillance, with the potential for nurses to have direct access to device data, will assist in meeting the complex care needs of this patient group, who often have multiple health issues and diseases.

## 6.3. Integration of Big Data Analytics

"Big data" refers to large and complex data sets that are difficult to process using on-hand data management tools or traditional data processing applications. These data have the potential to uncover patterns, associations, and trends related to human behavior and interactions. Health care is rich with big data, and the application of big data analytics promises to improve the quality and efficiency of patient care. Predictive models and data mining could be used to identify at-risk patients, and automated machine learning techniques could be used to analyze Electronic Health Record (EHR) data and develop and implement decision support tools for nursing practice. In the community and public health settings, big data analytics could be used to identify health trends and disparities for targeted interventions. Despite the potential benefits, there are drawbacks and challenges to using big data in healthcare. Issues related to patient privacy and the security of health information are of the utmost concern and must be carefully considered in research and practice. Nurses will need to be educated in these methodologies and understand how to apply them in areas that directly impact patient care. (Pugliese et al., 2021)

The integration of big data analytics into nursing education and practice is largely unexplored. This innovative technology has the potential to revolutionize the ways in which health care data are used to inform policy and practices. Although some research involving nursing and health care data exists, it has been slow to evolve and has not kept pace with changes in U.S. health care environments and the growing complexity of patient care. Traditional methods of collecting and managing health data are no longer adequate (Hannah, Ball, Edwards, 2003). Nurses are often overwhelmed by the need to document care and are unable to effectively use data to inform practice. Moreover, nurses generally lack the knowledge and skills required to participate in the design and implementation of healthcare information systems, leaving this task to MIS professionals and others. A fundamental shift is needed in nursing education and practice so that nurses are competent and skilled in using data to directly influence health care outcomes. (Fang et al.2020)

## 7. Conclusion

This essay has looked at how technology in the nursing profession has changed the nature of nursing education and how the role of a nurse has evolved. A comparison has been made between the education of a pre-registration nurse in 1983, the job description, and the context in which care is provided in clinical practice. An exploration has been made into the use of information technology as a learning resource for nurse students. This was supported by my own personal experiences regarding the employment and education of the student nurse. In terms of the education of a pre-registration nurse, the findings of Tyrrell, Smith, and Bynre & Nelson's recurring theme were "change.". This is also the case in nursing practice. During the time when I was employed, in which the nurse students of today were learning how to become nurses, there was a major shift to move from paper-based to digital resources. E-learning and the use of the internet have now become standardized forms of learning and can be a much more efficient way of learning than traditional didactic teaching and paper-based

resources. This can be a cost-effective method of learning, as the internet can provide a wide range of resources with just one simple click. E-learning sites such as Blackboard or WebCT are widely used by universities. This mode of technology-based learning can also be good for students who are educational activists and like to learn independently. With e-learning, there is an increased use of multimedia resources, which might be a more appealing way for many young adults to learn. Technology-based learning can take place anytime and anywhere as long as there is a computer with internet access. This flexibility in learning suits student nurses who are juggling study and family commitments. In relation to the research question, the nature of learning and the learning resources have changed significantly, creating an "age gap" in learning between the knowledge of the teacher and the knowledge. (Zalat et al., 2021)

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