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Nursing Informatics Progression Theory: (NIPT) – The 4A's of Adaptability

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ABSTRACT

The purpose of the adaptability theory is to clarify the various fundamentals of information technology in order to explain associations between perceptions and behaviors and to generate the ability to competently transition to a greater working knowledge of technology. Adaptability is the process of becoming able to adjust to new conditions. The adaptability process involves four steps necessary in order for technology concepts to be disseminated to nurses in a fashion that they accept without challenge. The four steps (4A's) for the Adaptability in Nursing Informatics Progression Theory (NIPT) are Assimilation, Acceptance, Application, and Advancement. The informatics progression theory was derived from nursing practice and education, and highlights the importance of increasing nurse's acceptance to translating technology information into practice. The theory is developed for nurses to absorb new information, gain a willingness to learn, and develop orientation towards new concepts. The 4 A's of the adaptability theory will assist nurses in embracing the advancement of technology where nurses can better plan, deliver, evaluate, and collect data to support evidence-based practice, and improve patient safety and the quality of patient care.

Introduction

Many new technologies are becoming available in nursing care that positively affects nurses' daily routines but are initially difficult to process. Technology has become a permanent part of healthcare and there are a multitude of innovators that are currently changing and improving the technology that is used in our industry. In today's high technological demands, computer skills are an essential skill set required to efficiently and safely care for patients. Information management and communication are key fundamentals in healthcare organizations that incorporate the quality of care provided by nurses. Computers can play an essential part in communicating this information that is directly related to the quality of information available to healthcare professionals caring for patients. Nurses' competency of computer technology became a vital element in successfully mastering the efficient use of computers, and facilitates creating a safer and more efficient patient-centered experience.

Background and Significance

The healthcare system is in a constant change due to the advances of technological improvements and transformation where nurses require knowledge and skills to integrate appropriate information technology. Nursing training should integrate information technology in nursing education in order for nurses to be competent in the ever developing technological requirements of healthcare clients.

The utilization of computers in healthcare advanced through the process of focused clinical needs. To better understand the future of healthcare innovation we need to look to the past to realize where we are today. Over the last thirty years, healthcare information has developed systems to assist in the clinical processes. In the 1960's people used mainframe computers with centralized processing, and in 1970's there was an increased interest in clinical applications, increased utilization of personal computers (PC) and expansion of clinical information systems in hospitals. By 2010, with the development of cloud computing, healthcare organizations started taking advantage of the internet, and "smart devices" started to evolve. At the same time e-prescribing, bar coding and personal health records (PHR) were utilized. Today, many nurses are using laptops, tablets, and smart phones in the healthcare setting to assist them with workflow and patient care. The paramount focus of healthcare technology assimilation is for nurses to understand the

real value, embrace the advancement, and to take advantage of the practicality of this technology.

Many nursing schools do not provide informatics education to nurses because many faculty members are not familiar with the nursing informatics concepts. According to Gonen, Sharon, Lev-Ari and Shuyan [1], the barriers incorporate the limited knowledge of faculty computer skills with technology, informatics education high costs, and lack of understanding nursing informatics advantages. The benefits associated with the nurses knowledge of technology is correlated with positive outcomes including standardized nursing language, patient safety, quality of care, and evidenced-based practice. In order to overcome these barriers a theory was developed for nurses that can easily acclimatize to the advanced technology.

The adaptability theory is to clarify the various fundamentals of information technology in order to explain the association between perceptions and behaviors and to generate the ability to competently transition to a greater working knowledge of technology. Adaptability is the process of becoming able to adjust to new conditions. The adaptability process involves four steps necessary in order for technology concepts to be disseminated to nurses in a fashion that they accept without challenge.

The four steps (4A's) for the Adaptability in Nursing Informatics Progression Theory (NIPT) are Assimilation, Acceptance, Application, and Advancement. The informatics progression theory was derived from nursing practice and education, and highlights the importance of increasing nurse's acceptance to translating technology information into practice.

The adaptability steps can be utilized in order to ease the learning curve and help eliminate the barriers placed by clinicians to absorb the new knowledge efficiently.

Nursing Informatics Progression Theory: (NIPT) – the 4A's of Adaptability
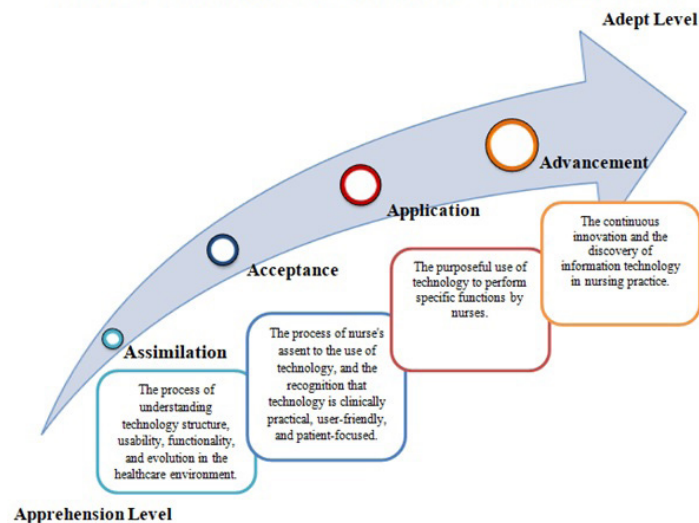
Research Hypothesis
The higher the nurses' technology knowledge, the higher are

his/hers discerned expectations of technology assimilation and acceptance.

The greater the advancement of nurse's technology proficiency, the more application and advancement of technology will be incorporated in nursing practice.

Theoretical Framework
The theoretical framework utilized for this theory is the Bandura's social learning theory where he believes that people process information by utilizing behavioral, personal and environmental factors. The Bandura's four step modeling process was influential in the development of the adaptability theory. These steps were reviewed and examined with other evidence based research and incorporated into the development of the nursing informatics theory. The first step, attention, is the extent in which the nurses are exposed to the behavior and they cannot learn unless they pay attention to other people utilizing technology [2]. Attention is very significant because it influences the nurse's expectations and behavioral consequences. The second step, retention, is important for the reason that the behavior is noticed, observed and remembered at a later time. This step depends on the nurse's ability to process the information in a simpler memorized outline that can be performed later. The next step, reproduction, is the capability of nurses to perform the behavior by requiring skills that were observed before. Motivation, the last step, is where the nurses are performing the behavior and recognizing that the importance of technology is crucial in patient care [2].

Literature Research
A comprehensive literature review was performed to analyze the nurse's comfort with technology, electronic documentation, informatics education for new nurses, and proficiency of assimilation. For the synthesis of literature and validation of the nursing informatics theory numerous electronic databases were searched dating from 2012 to 2017 using the following Medical Subject Headings (MESH) terms: nurse, technology, electronic health records, computer skills, nursing informatics, attitude, skills, and nurse perception. The databases searched include the Cumulative Index of Nursing and Allied Health Literature (CINAHL), Elton Bryson Stephens Company (EBSCO) host, PubMed and the National Library of Medicine - National Institute of Health. The following synthesis of literature reviews attempts to demonstrate the hypothesis of the theory proposed.

The study completed by Almutairi and McCrindlel [3], investigated the perceptions, attitudes, behaviors and level of knowledge of nurses utilizing the electronic medical records in two hospitals. Questionnaire was utilized as the research methods for this study where 1428 nurses from private and public hospitals participated. The study demonstrated that there was a significant relation between gender, age, knowledge and level of qualification towards the electronic system.

The authors, Darvish, Bahramnezhad, Keyhanian, and Navidhamidi [4], conducted a study where they examined the nurses

involvement in information technology educational programs to be included with the continuous evolution of technology. The authors completed an extensive literature search including the nursing informatics expertise and involvement for the efficient utilization of technology in all nursing practice. As part of the literature search the authors focused on informatics knowledge, computer skills, and informatics skills. The study determined that short term and long term educational needs are recommended to include the informatics courses.

A descriptive study was performed by Habibi-Koolaee, Safdari and Bouraghi [5], where they analyzed the role of nurses in successful implementation of the electronic systems. The descriptive-cross sectional study was done at the University of Medical Sciences where 284 employees were randomly selected and a self structured questionnaire was utilized to compile the data. The study revealed that the mean of computer skills, knowledge and attitude of nurses towards electronic health records was 43.4%, 51.2% and 65.2%. In conclusion, the study demonstrated that courses related to the health information systems should be included in the nursing curriculum.

According to Hamer and Cipriano [6], traditionally, nurses have accepted change and modified their workflow to adopt new systems. It is also historical that nurses are known to obstruct change, especially when it comes to technology, because nurses and other healthcare workers are not getting sufficiently involved in the change process. Nurses have an exceptional opportunity to contribute to new innovations and to create better experience for patients by utilizing information technology.

Jelec, Sukalic and Friganovic [7], analyzed through many database research articles how the application of modern technology in nursing will affect the nursing profession, the required competencies, and nurse's implication in this process. The authors performed literature research to include 1209 systematic reviews, original research and reviewed articles. The data examined revealed that many elements are contributing to the adaptation of modern technology in nursing, including training of nursing staff to work with technology.

A study was done by C. Lin, I. Lin, I. and Roan [8] where they focused on perceived threat and perceived inequity of acceptance of technology by physicians. They studied 115 physicians from 6 hospitals and discovered that perceived threat was directly responsible for negative outcomes of perceived usefulness. The study demonstrated that perceived threat of technological advance became the prime obstacle to an open mind acceptance of the usefulness of technology.

Mitchell [9] performed a study that examined the confidence and competence of the completion of electronic documentation for the newly hired nurses. The author utilized descriptive statistics to examine competence, and confidence in data. Correlational statistics were utilized to establish relationships between post instruction confidence and competence. The study demonstrated that new nurses had a difficult time learning electronic documentation on the first weeks of orientation. The study also determined that the nurses would benefit from a longer practice session during the orientation.
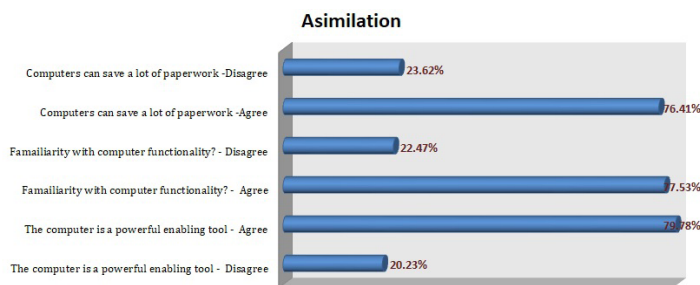
The research studies reviewed and evaluated showed a strong evidence and clear consensus in favor for better education in technology throughout the training cycle of new nurses and in continued education for experienced nurses. The implementation of new technology would benefit by incorporating computer training on a regular basis for nurses to stay level with the ever changing computerized systems.
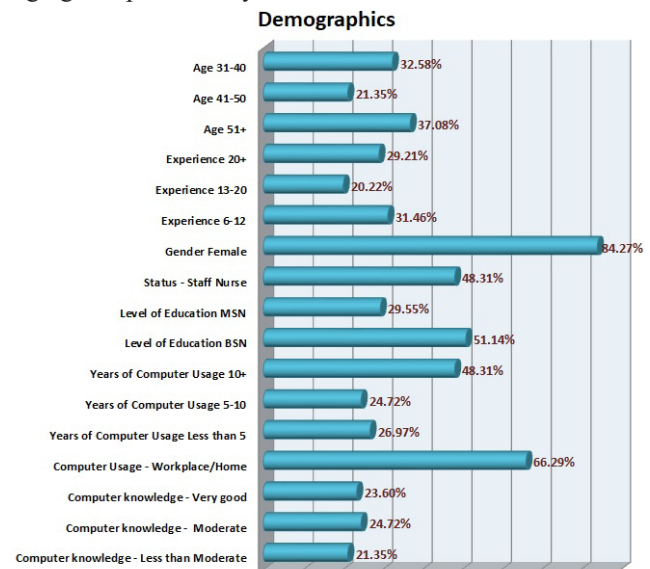
Theoretical Model
Step1 - Assimilation
Assimilation is the process of understanding technology structure, usability, functionality, and evolution in the healthcare environment. The utilization of technology in healthcare advanced through the use of medical diagnostic equipment that evolved over the years to more sophisticated equipment requiring the use of data transfer and monitoring. To better understand the future of healthcare innovation we need to look to the past to realize where we are today. Over the last thirty years, healthcare information has been improved by developers to assist in the clinical process. In the 1960's people used McBee manual punch cards for the first computers utilized in clinical practice, and in 1970's there was an increased interest in clinical applications, increased utilization of personal computers (PC) and release of computerized provider order entry system in hospitals [10]. By 2010, cloud computing was developed, healthcare organizations started taking advantage of the internet, and "smart devices" started to evolve. In 2012, trials wearable health monitoring devices were developed, e-prescribing, bar coding, and personal health records (PHR) were utilized [10]. Today, many nurses are using laptops, tablets, and smartphones in the healthcare setting to assist them with workflow and patient care. The paramount of healthcare technology assimilation is for nurses to understand the real value, embrace the advancement, and to take advantage of the practical usage of this technology.

Asimilation

Computers can save a lot of paperwork -Disagree — 23.62%
Computers can save a lot of paperwork -Agree — 76.41%
Famailiarity with computer functionality? - Disagree — 22.47%
Famailiarity with computer functionality? - Agree — 7.53%
The computer is a powerful enabling tool - Agree — 79.78%
The computer is a powerful enabling tool - Disagree — 20.23%
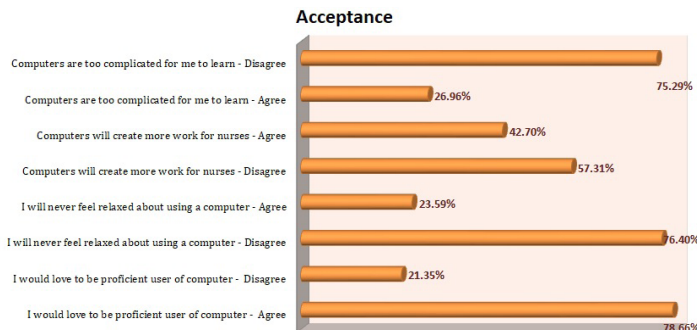
Step 2 – Acceptance

Acceptance is the process of nurse's assent to the use of technology and the recognition that technology is clinically practical, user-friendly, and patient-focused. Technology can be a great advantage for nurses and a positive benefit for patient's safety. Modern nurses need to accept and welcome health information that is available to assist them with the workflow in direct patient care. A technology acceptance model was developed by Davis [11], where he created a number of factors that impact new user's decisions on how and why they utilize the technology. The model included the perceived usefulness (PU) that involves the user's degree of acceptance that the technology will improve the work performance, and perceived ease-of-use (PEOU) that takes into consideration the user's acceptance that utilizing the technology would ease the workflow.

The first model, PU, is very important because the success of accepting new technology depends on the nurse's behavioral responses. One of the most significant indicators is the nurses' belief and attitude towards technology. In many organizations, there are still nurses that consider technology as a disturbance to their practice standards and interruptions from bedside care [6]. One of the challenges in information technology is acceptance in nursing practice where nurses are lacking the understanding of the benefits of technology. Some of these challenges are: "Why do we need to change, we were always doing this way?", "It was better on paper before!" and "It takes too long to document!". Nurses must accept that computer-based programs enable them to collect, store and recover data, provide the ability to integrate clinical data with nursing activities, improve patient care, and advancement of nursing knowledge [12].

The second model, PEOU, is also important because the users need to accept that the technology will improve their work conditions. There are many advantages to technology information in the healthcare environment. Some of the most effective technology is the wireless patient monitor where sensors are integrated into the patient's bed to provide continuous bed movement observation. This technology alerts nurses when the patient is getting out of bed, and as a result, the falls events can be avoided. Another good example of these efficient technologies is the interactive patient system that provides two-way communications and delivers education video content at the bedside. The system can provide updates about their stay, lab results, schedules and any other important facts about their health condition.

The identification of these methods and associated factors can

be utilized in developing strategies to assist nurses in accepting technology information. The critical element for successful acceptance of technology is the nurse's satisfaction of the application of the clinical computer-based program. The advantages of utilizing the electronic system, including user-friendliness, flexibility, and usage outcome, evaluated by the nurses, are needed in order to accept technology.

Acceptance

Computers are too complicated for me to learn - Disagree — 75.29%
Computers are too complicated for me to learn - Agree — 26.96%
Computers will create more work for nurses - Agree — 42.70%
Computers will create more work for nurses - Disagree — 57.31%
I will never feel relaxed about using a computer - Agree — 23.59%
I will never feel relaxed about using a computer - Disagree — 76.40%
I would love to be proficient user of computer - Disagree — 21.35%
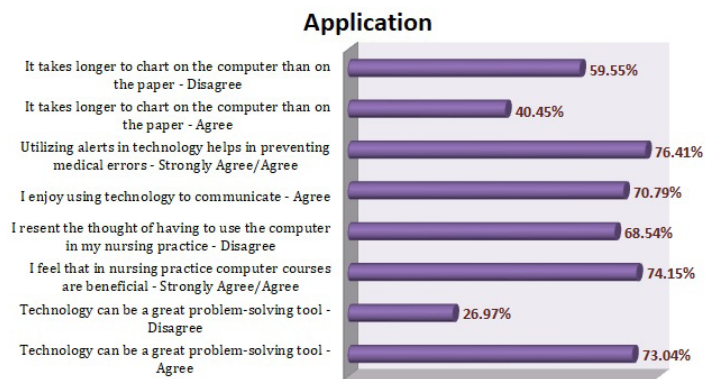I would love to be proficient user of computer - Agree — 78.66%

Step 3 - Application

Application is the purposeful use of technology information to perform specific functions by nurses. The application of technology information has made patient care safer. Nurses are applying technology information every day in their workflow to assist them with patient care. For example, the barcoding medication administration (BCMA) is one of the technologies designed for patient's safety. The main target with the BCMA process is to ensure that patients are receiving the right medications with the right dose at the right time by electronically verifying and documenting medications. Nurses are now utilizing handheld computers regularly to record important real-time patient data and to share that data including lab results or vital signs with the patient and patient's family [12]. Technology plays a pivotal role in tracking procedures, monitoring patient's progress and utilizing this data to improve the quality of patient's care. Nurses are also utilizing smartphones to monitor patient's vitals and receive alerts when critical results are detected.

The use of technology should not change the ingrained behavior of nursing. Nurses should not rely on technology to perform patient care; patient care should remain as it always has been where nurses use common sense, judgment, and critical care thinking as they were taught in school. Nurses should still depend on their senses of sight, hearing, scent, and touch to monitor and become aware of changes in patient status.

Computerized provider order entry (CPOE) application systems are intended to reduce illegible handwriting and transcription errors that were unpredictably associated with increased mortality because of reduced capability of nurses to foresee the needs of patients on admission. The CPOE orders are transmitted to the appropriate departments including pharmacy, radiology or laboratory where the order is accepted and performed. The system provides real-time clinical decision support by decreasing medical errors. In addition, the CPOE is used in other hospitals situation resolving problems including the eliminations of abbreviations

or acronyms and increases the speed of order entry [14]. The application of technology is embraced by many nurses by transforming the way nursing care is conceptualized.

Application

It takes longer to chart on the computer than on the paper - Disagree — 59.55%
It takes longer to chart on the computer than on the paper - Agree — 40.45%
Utilizing alerts in technology helps in preventing medical errors - Strongly Agree/Agree — 76.41%
I enjoy using technology to communicate - Agree — 70.79%
I resent the thought of having to use the computer in my nursing practice - Disagree — 68.54%
I feel that in nursing practice computer courses are beneficial - Strongly Agree/Agree — 74.15%
Technology can be a great problem-solving tool - Disagree — 26.97%
Technology can be a great problem-solving tool - Agree — 73.04%

Step 4 - Advancement

Advancement is the continuous innovation and the discovery of information technology in nursing practice. More than any other factor, technology changes the healthcare structure where the affect of technology continues to expand into all levels of care. The advancement in technology includes a selection of systems, software, and devices that are developed to decrease the time spent on various tasks and improve accuracy, efficiency and patient safety. This technology advancement also allows nurses to spend more quality time with their patients. Nursing practice will be changed by the many emerging technologies that are arising. Some of these technologies are biometrics, genetics, genomics, healthcare robotics, and clinical decision support [14].

Advancement

Technology promotes quality of care - Strongly Agree/Agree — 63.64%
Computers are a great tool for patient education - Strongly Agree/Agree — 71.91%
Computers help me to keep up to date with nursing knowledge and research - Agree — 77.27%
The future promise of technology in healthcare excites me - Disagree — 42.69%
The future promise of technology in healthcare excites me - Agree — 70.79%

Methods – Theory Validation

Descriptive statistics was utilized to validate the proposed nursing informatics theory. The sample consisted of 89 nurses from New Jersey, Minnesota and California hospitals. Out of 89 nurses, 74 were females (84.27%) and 14 males (15.73%). The majority of participants reported being 20 to 30 years of age (n = 8, 8.99%), 31 to 40 years of age (n = 29, 32.58%) followed by 41 to 50 years of age (n = 19, 21.35%), and 51 years of age or older (n = 33, 37.08%). For education, the majority had an Associate's degree (n = 16, 18.18%), Bachelor's degree (n = 45, 51.14%), and Master's degree (n = 26, 29.55%). The range was more diverse for total years' experience as a nurse with the majority having between 5 years or less (n = 17, 19.10%), 6-12 years (n = 28, 31.46%), 13 to 20 years (n = 18, 20.22%), and more than 20 years (n = 26, 29.21%). The nurses worked in various departments including intensive care units, surgery, outpatient, pediatric, behavioral health, emergency and medical surgical units.

The questionnaire was comprised of two sections of which

Section 1 was the demographic data which included highest level of nursing education; total years in the nursing profession; total time/years working in the hospital; position, and age. Section 2, was composed of 25 questions related to the comfort, attitudes, usability, adaptability and confidence of computerized electronic system. The questions utilized a 5 point Likert scale with the following choices, "Strongly Agree", "Agree", "Not Certain", "Disagree" and "Strongly Disagree". Data management and analysis was performed with the Statistical Package for the Social Sciences (SPSS) by using descriptive analysis.

The first step of the informatics progression theory, assimilation, revealed that when asked "Computers can save a lot of paperwork", the majority responded strongly agree or agree (n = 73, 76.41%). Many participants of age 51+ answered disagree and strongly disagree (n = 16, 17.98%). For the Acceptance step of the theory, when asked "Computers will create more work for nurses", 51 nurses (n = 51, 57.31%) answered disagree and strongly disagree and 38 answered agree and strongly agree (n = 38, 42.70%). The Application questions were "Technology can be a great problem solving tool" where 42 nurses between age of 41-51+ answered "disagree". For the question "It takes longer to chart on the computer than on the paper" 32 nurses age 51+ answered "Agree". The last step, Advancement, where the question was: "Technology promotes quality of care", many nurses between the ages 20-40 answered "agree".

The data clearly reflects that approximately 68% of nurses are comfortable with the technology where they utilize the technology efficiently. The rest of the participants were from the older generation including baby boomers and some generation X where their comfort and efficiency was affected by the unfamiliarity and intimidation of technology. For these nurses adapting to the electronic medical record and other digital platforms will be very challenging, resulting in a steep learning curve. The younger generation might be very experienced in technology but not experienced in nursing practice. This creates a temporary restriction in recognizing the importance of integrating technological knowledge with patient care. The theory was developed to enable older nurse to mentor younger nurses in daily patient care while younger nurses help bring the concepts and understating of technology to the older nurses creating balance in the work place. The limitations of the project were the small sample size. Future innovations to the current theory application can be used on a broader class of nursing practice. The data examined also proved that many elements contribute to the adaptation of modern technology in nursing practice, including training of nursing staff to work with technology.

Conclusion

Nurses must continuously acclimatize and learn new technologies and properly utilize these tech advances to their benefit. The 4 A's of the adaptability theory will assist nurses in embracing the advancement of technology where nurses can better plan, deliver, evaluate, and collect data to support evidence-based practice, and improve patient safety and the quality of patient care. It is

evident that technological advances must be part of the nursing curriculum in colleges and nursing schools. Application of the latest developments in technology science in schools will give nursing students tools that will enable them to achieve the aptitude necessary to incorporate new technology in nursing practice.

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