# Evidence-Based Practice Remote Patient Monitoring Curriculum Development: A Descriptive Pilot Project

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**Abstract**

The purpose of this project was to build a remote patient monitoring (RPM) evidence-based practice (EBP) curriculum using a curriculum matrix. The curriculum matrix includes technology, patient safety/quality, role, industry, and clinical skills to complete learning objectives regarding RPM information, applications, and clinical decision-making. ***Methodology***: This quality improvement project used subject matter experts were used to obtain a Content Validity Index (CVI) score on pre- and post-test surveys that measured RPM knowledge, experience, and attitude. The pre-test survey, RPM module, and post-test surveys were presented to online students obtaining a master's or doctorate. ***Results***: Quantitative results indicated that knowledge and experience were significantly improved with RPM content. There was no difference in the attitude score, which may be related to the students themselves because of a high pre-survey score of 9.4 for attitude. The significant results from this pilot project warrant expansion to a larger sample and other universities.

*Keywords*: remote patient monitoring, telemonitoring, virtual visits, telecare, telemedicine, telehealth AND curriculum, education, instruction, provider education, certification

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## Section I: Introduction and Background

Remote patient monitoring (RPM) is becoming a standard method of care delivery as the technology improves and as patients and providers become more interested in using a distance approach to health care delivery (Wicklund, 2018). As an emerging method of health care service delivery, RPM is similar to telehealth and telemedicine. More specifically, RPM involves gathering patient clinical information in the patient's home that is then transmitted to a remote centralized location where providers respond with protocol-driven interventions (Center for Connected Health Policy, 2018).

Certain environmental factors such as the age of the population (Intel-GE Care Innovations, 2015), the impact of contagious diseases in the community (Ross, 2020), and availability of RPM-competent health care professionals in the workforce (Association of American Medical Colleges, 2019; Heiser, 2018; Redford, 2018; Texas Center for Nursing Workforce Studies, (TCNWS), 2016; Texas Center for Nursing Workforce Studies, (TCNWS) & Texas Board of Nursing, (BON), 2018b), have influenced this trend. The purpose of this project was to explore the practice of RPM and the associated curriculum-based competencies to improve the quality and safety of RPM practice delivery. This section discusses chronic disease management amid healthcare personnel shortages and the associated clinical significance for RPM. The PEST analysis, project question, purpose, aim, objectives, and the theoretical frameworks utilized in this project are also discussed.

### Chronic Disease Management

In 2017, healthcare cost $3.5 trillion ($10,739 per person), 17.9 percent of the US gross domestic product (GDP) (Centers for Medicare and Medicaid Services, 2017b). The three areas that cost the most was hospital care 33% ($1.1 trillion), physician and clinical service 20% ($694.3 billion), and retail prescription drugs 10% ($333.4 billion) (CMS, 2017).

As of 2017, Medicare had 58 million enrollees, with 74% of them between the ages of 65 and 84

years old and 11% at 85+ (CMS, 2019). By 2034, the U.S. Census Bureau estimates that there will be more people 65 plus (77 million) than children under 18 and about 94.7 million older adults (65+) by 2060 (US Census Bureau, 2018). Medicare will gain 19 million enrollees in 2034 and an additional 17.7 million in 2060 (US Census Bureau, 2018), with a total of 36.7 million since 2017 enrollment information.

Chronic disease management is part of life for 80% of older adults with at least one chronic condition (Centers for Disease Control and Prevention, 2017b; Henriquez-Camacho et al., 2014), that is a leading cause of death, disability, and other diseases in the United States (Center for Disease Control and Prevention, 2015 (CDC); National Center for Chronic Disease Prevention and Health Promotion, 2020 (NCCDPHP)). Based on beneficiary data, Medicare services utilized the most were blood pressure screenings (96%), doctor visits (89%), and emergency room visits (28%) (Centers for Medicare and Medicaid Services, 2019). Medicare beneficiary data indicated that hypertension (57%), high cholesterol (41%), arthritis (33%), diabetes and heart disease (27%), and kidney disease (24%) are the top five out of ten prevalent chronic conditions with the remaining five that include depression, heart failure, COPD/emphysema, and Alzheimer's/dementia (<20%) (CMS, 2019; Chronic Conditions Data Warehouse, 2018). In 2015, CMS initiated chronic care management (CCM) to provide care outside of regular office visits for patients with chronic conditions (two or more) to help prevent their diseases from acute exacerbations, functional declines, decompensation, or even possible risk of death (CMS, 2017a). The population is growing older, along with the increase of multiple chronic conditions that need chronic care. RPM can help implement cost-effective, research supported chronic disease interventions to improve the quality and length of life (NCCDPHP, 2020).

**Healthcare Workforce Shortage**

The Association of American Medical Colleges (2019) predicts that primary care will have a shortage of physicians of approximately 14,800 to 49,300 and the different specialties physician shortage of 20,700 to 30,500 in the year 2030 (Heiser, 2018; Redford, 2018). The retiring physicians (13.5% and

those close to retirement age (27.2%) will contribute to the lack of physicians (AAMC, 2019; Heiser, 2018; Redford, 2018). In Texas, nurse practitioners (NPs) must have a supervising physician to practice, and with nearly 40.7% of physicians retiring or close to retirement will place an additional strain on NPs ability to practice (Auerbach et al., 2013; Buerhaus, Peter, 2018; Buerhaus, Peter I. et al., 2015; Perloff et al., 2016). The 2018 update Texas Department of State Health Services (DSHS, 2018b) indicated that Texas would have a 67% (3,375 full-time equivalents (FTEs)) increased need for primary care physicians by 2030 due to the shortage with the greatest need in general internal medicine (1,644 FTEs). Texas Center for Nursing Workforce Studies (TCNWS, 2016) stated that between 2015-2030 that Texas will have increased demands for nurse practitioners (NPs), certified nurse-midwives (CNMs), and certified registered nurse anesthetists (CRNAs) throughout Texas, but especially in North Texas, Gulf Coast, and Central Texas. Contributing to the shortage of production of new nurse practitioners in Texas is the lack of sufficient faculty.

According to the Texas Center for Nursing Workforce Studies (TCNWS) and Board of Nursing (BON) (2018), faculty vacancies are at 9.1% for full-time, 6.6% for part-time, with the graduate vacancy at 8.4%, and retirement as of September 2017, 28.3% of faculty were eligible for retirement, and an additional 33.3% would be eligible in 12 years that were between the ages of 50 to 61 years old (Bittner & Bechtel, 2017; Fang & Kesten, 2017; Nardi & Gyurko, 2013). Barriers to faculty vacancies included an insufficient supply of qualified candidates, non-competitive salaries, and geographic locations (Forsberg et al., 2015; TCNWS, 2016; TCNWS & BON, 2018). The lack of didactic and clinical faculty in each NP program led to having to turn away qualified applicants due to the limited number of full seats for each enrollment for the different programs. According to TCNWS and the BON (2018ab), even though there were 6,449 qualified applicants for NP programs for 2017, only 4,776 applicants were offered admission to fill 4,682 seats, which led to 25.9% of qualified applicants being turned away. That means that approximately 1,673 possible NPs could have helped with the current and future shortage. The reasons for denying these applicants were the lack of funding for additional faculty positions, lack of clinical sites,

lack of specialty clinical sites along with significant competition from other health professions (Forsberg et al., 2015; TCNWS, 2016; TCNWS & BON, 2018; TCNWS & BON, 2018). With 80% of older adults with at least one chronic condition (CDC, 2017a; NCCDPHP, 2020) and the same population expected to increase by a total of 36.7 million by 2060 (US Census Bureau, 2018), along with a shortage of physicians (AAMC, 2019), nurse practitioners (DSHS, 2018a), and faculty (Forsberg et al., 2015; TCNWS, 2016; TCNWS & BON, 2018; TCNWS & BON, 2018) there is an anticipated need for RPM to help manage the chronic conditions and in turn a need for RPM competencies and curriculum development. The Institute of Medicine (IOM) called for safer healthcare (2000), provided a comprehensive strategy for quality improvement (2001), provided competencies for health care professionals (2003), and provided for interprofessional education (2011), all to provide quality patient care. This DNP Scholarly Project incorporated the six aims of quality improvement: safe, timely, effective, efficient, equitable, and patient-centered care in the EBP RPM curriculum to provide a safer healthcare environment and improve the providers' competencies in the RPM delivery.

**Clinical Needs Assessment and Significance**

The clinical needs assessment to collect data to explore the practice of RPM and the associated curriculum-based competencies to improve the quality and safety of RPM practice delivery stemmed from the shortage of providers (AAMC, 2019) and faculty (Forsberg et al., 2015; TCNWS, 2016; TCNWS & BON, 2018a; TCNWS & BON, 2018b) and the continual increase of the aged population (U.S. Census Bureau, 2018) with multiple chronic conditions (CDC, 2017. The author used a sponsor (an RPM professor) and subject matter experts (SMEs) to formulate this evidence-based practice (EBP) quality improvement (QI) project. The project aims to build a remote patient monitoring (RPM) evidence-based practice (EBP) curriculum-based competency by identifying the gaps in RPM practice delivery. A PEST (Political, Economic, Socio-Cultural, and Technological) (MindTools, 2019; Weisberg & Suber, 2018) analysis was utilized to identify further factors, opportunities, and threats to improving the quality and safety of RPM practice delivery and the development of an evidence-based curriculum.

## PEST Analysis

The PEST analysis provided the ability to review RPM from a broad perspective and helped identify factors, opportunities, and threats (MindTools, 2019; Weisberg & Suber, 2018) to the EBP-QI project. The PEST analysis provided opportunities to explore RPM's practice and the associated curriculum-based competencies and helped distinguish between probable and possible threats to RPM's practice and the development of curriculum-based competencies. This PEST analysis was guided by two key sources from 1) MindTools (MindTools, 2019), and 2) How to Conduct Needs Assessment Part 2: PEST Analysis (Weisberg & Suber, 2018). Based on the PEST analysis described in the following sections, it was determined that the project was indeed feasible, and it would provide a substantial contribution to the RPM industry.

### *PEST Political*

**Factors:** The PEST Political Factors (PFs) helped analyze the influence that presidential, senate, and representative elections have on RPM's practice and the associated curriculum-based competencies (Bulger et al., 2017; Oberlander, 2019). The PFs analyzed Medicare changes and the impact on RPM's practice and the development of curriculum-based competencies (CMS, 2019; CMS, 2017; CMS, 2015; CMS, 2017; CMS, 2017; CCW, 2018; Oberlander, 2019; Yeager et al., 2018). The PFs investigated Chronic Care Management (CCM) and the potential to incorporate into RPM's practice and curriculum-based competencies (CMS, 2017; Clarke et al., 2017). The PFs reviewed the Doctor of Nursing Practice (DNP) Nursing Essentials and emphasized integrating into the RPM's practice and curriculum-based competencies (American Association of Colleges of Nursing, 2006; Polancich et al., 2018).

**Opportunity:** The PEST Political opportunities (POs) evaluated and analyzed the current government and CMS on policies and changes to increase access to care by utilizing RPM and CCM and the need for curriculum-based competencies to improve RPM practice delivery, quality, and safety (CMS, 2017; IOM, 2001; Yeager et al., 2018). The POs evaluated the need to implement evidence-based practice

(EBP) RPM curriculum-based competencies into the new DNP Nursing Essentials (AACN, 2006; Polancich et al., 2018; Zaccagnini & White, 2017).

**Threats:** The PEST Political Threats (PTs) becomes a genuine threat with every election and the changing of political affiliation and ideology that can modify the coverage and compensation for RPM practice and the curriculum-based competencies that can improve RPM practice delivery, quality, and safety of patient care (Bulger et al., 2017; Oberlander, 2019). The PTs can cause CMS to change CCM and RPM programs and who may be eligible and covered based on judicial, executive, and legislative decisions (Bulger et al., 2017; Oberlander, 2019). The PTs have been demonstrated by organizations such as AMA, who lobby and have states restrict full practice authority for nurse practitioners that prohibit them from practicing to the extent of their education in 22 states (Auerbach et al., 2013; Heiser, 2018; Neff et al., 2018; Redford, 2018; Xue et al., 2016; Xue, Kannan et al., 2018; Xue, Greener et al., 2018). These PTs further reduces the number of providers available to help with the shortage, the management of chronic conditions, or providers who would like to explore the opportunity of an RPM practice and the associated curriculum-based competencies to improve RPM practice delivery, quality, and safety (Auerbach et al., 2013; Heiser, 2018; Neff et al., 2018; Redford, 2018; Xue et al., 2016; Xue et al., 2018; Xue et al., 2018).

***PEST Economic***

**Factors:** The PEST Economic Factors (EFs) analyzed the effect of the ever-increasing age of the population with the age of 65 by 2035 (US Census Bureau, 2018) and RPM's need and the associated curriculum-based competencies (IOM, 2001; Kort et al., 2016; McBride & Tietze, 2019). The EFs investigated the high cost of chronic diseases, obesity and examined the National Health Expenditure (NHE) projected cost ($6 trillion) by 2027 (CMS, 2017) the need, and the importance of implementing RPM and the associated curriculum-based competencies to improve the cost (Clarke et al., 2017; Čurila et al., 2018; NCCDPHP, 2020; Phillips et al., 2020; Trusko et al., 2007; Wisdom & Creswell, 2013; Witt Udsen et al., 2017).

**Opportunity:** The PEST Economic Opportunities (EOs) revealed that Medicare would be the primary payer for the 65+ population and significantly impact RPM's practice and the need to develop curriculum-based competencies to improve practice delivery, quality, and safety (Buttorff et al., 2017; CMS, 2019; CMS, 2017; CMS, 2015; CMS, 2017; CMS, 2017; CMS, 2018; CCW, 2018). The EOs identified and exhibited a decrease in NHE spending and cost for chronic conditions with RPM, which leads to a greater urgency and demand to develop curriculum-based competencies (Buttorff et al., 2017; CMS, 2019; CMS, 2017; CMS, 2015; CMS, 2017; CMS, 2017; CMS, 2018; CCW, 2018).

**Threats:** The PEST Economic Threats (ETs) revealed that CMS currently only covers traditional Medicare beneficiaries for CCM and RPM, which omits the advantage programs (Buttorff et al., 2017; CMS, 2019; CMS, 2017; CMS, 2015; CMS, 2017; CMS, 2017; CMS, 2018; CCW, 2018). The ETs are valid for providers who cannot maintain their practice if CMS denies claims or reduces reimbursement for CCM and RPM (Ashman et al., 2019; Ward, 2017; Wisdom & Creswell, 2013).

In addition to economic factors, utility, the feasibility of this project was evaluated before implementation. Feasibility has been defined as:

> A feasibility study is an analysis that takes all of a project's relevant factors into account—including economic, technical, legal, and scheduling considerations—to ascertain the likelihood of completing the project successfully (Investopedia.com, 2019).

Thus, the feasibility of this project was evident based on the fact that: 1) students in a course focused on remote patient monitoring (RPM) were available, 2) that a course instructor with expertise in RPM was available and willing to incorporate the content, and 3) and additional resources such as subject matter experts were also available to participate in the project. Although part of the project cost, resources such as funds for instructor workload and needed software were not being charged for this project.

***PEST Socio-Cultural***

**Factors:** The PEST Socio-Cultural Factors (SCFs) identified healthcare disparities and the need to implement RPM practice and the associated curriculum-based competencies to decrease the disparity

(Ahuja et al., 2018; Marcin et al., 2016; Myers, 2018; National Academies of Sciences, Engineering, and Medicine et al., 2016; State of Reform, 2018; VanderWielen et al., 2015). The SCFs investigated the lack of access to care nationally and locally and the need for RPM practice and the associated curriculum-based competencies to improve access to care (State of Reform, 2018). The SCFs examined the lack of clinicians nationally and locally and the need for RPM practice and the associated curriculum-based competencies to fill the shortage (Altman et al., 2016; Heiser, 2018; Neff et al., 2018; Ortiz et al., 2018; Reagan & Salsberry, 2013; Redford, 2018; Spychalla et al., 2014; Streeter et al., 2017; Xue et al., 2018; Xue et al., 2018).

**Opportunity:** The PEST Socio-Cultural Opportunities (SCOs) demonstrated that RPM could decrease healthcare disparities and expand access to care in areas with a considerable shortage of providers, which leads to a tremendous need and significant demand for curriculum-based competencies (Ahuja et al., 2018; Marcin et al., 2016; Myers, 2018; National Academies of Sciences, Engineering, and Medicine et al., 2016; State of Reform, 2018; VanderWielen et al., 2015). The SCOs identified a need to increase the number of clinicians trained in RPM to reach more patients and the need for curriculum-based competencies to improve RPM practice delivery, quality, and safety (Altman et al., 2016; Heiser, 2018; Neff et al., 2018; Ortiz et al., 2018; Reagan & Salsberry, 2013; Redford, 2018; Spychalla et al., 2014; Streeter et al., 2017; Xue et al., 2018; Xue et al., 2018).

**Threats:** The PEST Socio-Cultural Threats (SCTs) are palpable with the shortage of providers and the increased demand for healthcare, especially with the baby boomers and their multiple chronic conditions, providers are unable to keep up with demands, but RPM can help alleviate the burden with curriculum-based competencies to improve RPM practice delivery, quality, and safety (Altman et al., 2016; Buerhaus, 2018; Buerhaus et al., 2015; CCW, 2018; Ghaffari et al., 2016; Heiser, 2018; Henriquez-Camacho et al., 2014; Mohktar et al., 2015; National Science & Technology Council, 2019; Neff et al., 2018; Nissen & Lindhardt, 2017; Ortiz et al., 2018; Park et al., 2019; Reagan & Salsberry, 2013; Redford, 2018; Spychalla et al., 2014; Streeter et al., 2017; US Census Bureau, 2018; Valdivieso et

al., 2018; Woods et al., 2019; Xue et al., 2016; Xue et al., 2018; Xue et al., 2018; Yeager et al., 2018). The SCTs are evident throughout the U.S. and especially in Texas, with a significant shortage of providers and their inability to provide coverage everywhere (Heiser, 2018; TCNWS, 2016; U.S. Department of Health and Human Services et al., 2014; Yee et al., 2013). The SCTs with the older generation unable to adapt to RPM and CCM could be improved with curriculum-based competencies to improve patient engagement and self-management (Foster & Sethares, 2014; Galambos et al., 2017; Ghaffari et al., 2016; Levy et al., 2014; Peek et al., 2014; Rush et al., 2019; Wolfson et al., 2014).

***PEST Technological***

**Factor:** The PEST Technological Factors (TFs) analyzed the effect of technological advances and the ability to manage chronically ill patients at home and the importance of implementing RPM and the associated curriculum-based competencies to improve RPM practice delivery's cost, quality, and safety (LeRouge & Garfield, 2013; National Academies of Sciences, Engineering, and Medicine et al., 2016; Wolfson et al., 2014). The TFs evaluated the Doctor of Nursing Practice (DNP) Nursing Essentials that include more technology and Informatics and the importance of integrating RPM practice and curriculum-based competencies (American Association of Colleges of Nursing, 2006; Clark et al., 2018; Polancich et al., 2018; Riner, 2015; Zaccagnini & White, 2017). The TFs investigated CMS' practice of paying for RPM and CCM equipment, visits, and the value of implementing RPM and the associated curriculum-based competencies to improve RPM practice delivery's cost, quality, and safety (CMS, 2019; CMS, 2017; CMS, 2015; CMS, 2017; CMS, 2017; CCW, 2018; Yeager et al., 2018).

**Opportunity:** The PEST Technological Opportunities (TOs) provide RPM's ability to utilize technology to render care to patients' in their home that illustrates a need for curriculum-based competencies to improve RPM practice delivery, quality, and safety (Bower et al., 2011; Čurila et al., 2018; Delahaye et al., 2019; Dunn & Hazzard, 2019; Eysenbach, Buis et al., 2019; Eysenbach, Ortega et al., 2019; Giger et al., 2015; Greenwood et al., 2014; Greenwood et al., 2017; Hansa et al., 2018; Kew et al., 2016; Lee et al., 2018; Malasinghe et al., 2019; Melia et al., 2018; Shane-McWhorter et al., 2014;

Soriano et al., 2018; Vishnu et al., 2019; Walker, et al., 2019). The TOs grants the opportunity to implement EBP technology and Informatics to the curriculum that will allow students to be ready for new NCLEX, demonstrating the need for curriculum-based competencies (AACN, 2006; Dolansky et al., 2017). The TOs identified RPM's potential as an avenue to generate increased revenue and the cost-saving potential on chronic condition management that further enhances the need for curriculum-based competencies (Čurila et al., 2018; Greenwood et al., 2014; Michaud et al., 2020; Perl et al., 2013; Soriano et al., 2018; Walker et al., 2019).

**Threats:** The PEST Technological Threats (TTs) are evident with the older generation, who are hesitant to adopt RPM technology but could be enhanced with curriculum-based competencies to improve patient engagement, self-management RPM technology education, utilization, and guidance (Cajita et al., 2018; Chang et al., 2017; Doñate-Martínez et al., 2015; Foster & Sethares, 2014; Galambos et al., 2017; Ghaffari et al., 2016; Giger et al., 2015; Lee, J. et al., 2019; Levy et al., 2014; National Science & Technology Council, 2019; Peek et al., 2014; Rivas Velasquez et al., 2014; Rush et al., 2019; Son et al., 2019; Takahashi et al., 2010; Tsertsidis et al., 2019; Witt Udsen et al., 2017; Wolfson et al., 2014). The TTs are magnified by the ever-changing technology that is developing at an unprecedented pace, and their lack of communication with electronic health records (EHRs) could be improved with an RPM curriculum-based competency that incorporates up-to-date changes (Edemekong et al., 2020; Eysenbach et al., 2019; Federal Register, 2018; Hewner et al., 2018; O'Connor et al., 2016).

## Project Question

Although the purpose of this project was to explore the need for RPM and the development of curriculum-based competencies for RPM to ensure delivery of safe, effective, efficient, equitable, patient-centered, timely, and quality practice of RPM, the specific question is:

Is there a difference between the students' knowledge, experience, and attitude before and after being exposed to remote patient monitoring content in an online environment?

### *PICOT Question of Inquiry*

| | | |
|---|---|---|
| Population | (P) | Online students (interprofessional) obtaining a master's or a doctorate |
| Interventions | (I) | Exposure to three remote patient monitoring modules |
| Comparison | (C) | The students' knowledge, experience, and attitude before and after being exposed to the content of remote patient monitoring |
| Outcome | (O) | Improvement in the students' knowledge, experience, and attitude |
| Time | (T) | Three weeks (by 9/30/2019) |

***PICOT Statement* - Problem Statement**

In the interprofessional online students (population) who are obtaining a master's or a doctorate that is exposed to three remote patient monitoring teaching modules (intervention), will there be a significant improvement (outcome) between the students' pre- and post-survey (comparison) in their RPM knowledge, experience, and attitude after three weeks (time)?

This EBP-QI pilot project is needed and warranted due to the emerging method of health care service delivery, involving gathering patient's clinical information in their home that is then transmitted remotely, the aging population (U.S. Census Bureau, 2018), the chronicity of care (CMS, 2019; CCW, 2018), and the impact of contagious diseases in the community (Ross, 2020). The development of curriculum-based competencies to improve RPM practice delivery's quality and safety is warranted explicitly due to the lack of availability of RPM-competent health care professionals (AAMC, 2019; Auerbach, et al., 2013; Heiser, 2018; Kleinpell et al., 2014; Oliver et al., 2014; Redford, 2018; DSHS, 2018; Xue et al., 2018).

**Project Purpose**

As noted, the purpose of this project is to explore the practice of RPM and the associated curriculum-based competencies to improve the quality and safety of RPM practice delivery. Specifically, the problem is the lack of education, curriculum, or certification for clinicians in Remote Patient Monitoring (RPM) (Flodgren et al., 2015; Inglis et al., 2015; Murray et al., 2005). The shortage of healthcare providers and the faculty to train them increases the need for alternative access to care. In order

to establish and maintain the six predominant improvements in healthcare that the IOM (2001) outlined to provide safe, timely, effective, efficient, equitable, and patient-centered care, an established training program for clinicians in RPM is needed (IOM, 2001).

Another consideration is creating the program with fidelity throughout all the development stages to establish a standard of evidence-based care. The program development took many cycles and iterations (Langley et al., 2009). This first cycle created three teaching sections of a module covering an RPM overview, clinical applications, and clinical decision-making via a case study. At the end of teaching the RPM modules, the students' knowledge, attitude, and RPM experience will increase. For this first iteration, the population consisted of interprofessional Informatics students in the 5000 and 6000 level of education and the setting is at a medium-size university in North Texas in the College of Nursing and the Informatics department with the beginning stages of fidelity criteria and the knowledge base for remote patient monitoring to improve clinicians' skillsets that provide care to patients from a distance. This project's end process was tested to see if improvement in RPM's knowledge, attitude, and experience occurred within the three teaching sections and how the students planned to utilize it.

**Project Aim (Specific Goals)**

This project aimed to develop three RPM curriculum-based competencies teaching modules that demonstrated fidelity to the establish a standard of care per the IOM (2001) guidelines to improve RPM practice's quality and safety. Since RPM is an emerging method of health care service delivery (Flodgren et al., 2015), gathering patients' clinical information in their home that is then transmitted remotely (McCabe et al., 2017), the age of the population (US Census Bureau, 2018), the chronicity of care (CMS, 2019; CCW, 2018), the impact of contagious diseases in the community (Ross, 2020), and the lack of available of RPM-competent health care professionals (AAMC, 2019; Auerbach et al., 2013; Heiser, 2018; Kleinpell et al., 2014; Oliver et al., 2014; Redford, 2018; DSHS, 2018; Xue et al., 2018), this project is needed and necessary to develop RPM curriculum-based competencies to not only improve the quality and safety of RPM practice delivery but also to begin building and securing competent RPM

providers and faculty to help with the shortage and manage the aging population's chronic conditions. The content for the RPM curriculum-based competencies teaching modules and for the pre- and post-survey will pass Content Validity Index (CVI) (Lynn, 1986) of 80% or greater by subject matter experts to provide validity to the curriculum competencies content by 8/30/2019. The interprofessional online students were expected to increase their RPM knowledge, experience, and attitude indicated with an increase of the mean from pre-survey to post-survey at least by 20% by 9/30/2019.

**Project Objectives**

The objectives of this scholarly evidence-based practice (EBP) quality improvement (QI) pilot project:

1. Initiate the development of curriculum and establishment of fidelity for remote patient monitoring (RPM) teaching content by employing the highest level of the evidence-based practice (EBP) via a review of the literature (Dang & Dearholt, 2018)
2. Validate the developed evidence-based practice RPM curriculum via subject matter experts and utilizing the Content Validity Index (CVI) (Lynn, 1986)
3. Develop the instrument to measure that learning occurred, pre- and post-survey (Lynn, 1986)
4. Validate the pre- and post-survey by using subject matter experts and the (CVI) (Lynn, 1986)
5. Implement the pilot project by administering the validated pre-survey
6. Administer the three validated RPM teaching modules
7. Measure if learning occurred by utilizing the validated post-survey
8. Analyze the data to evaluate if there was a significant improvement in RPM knowledge, experience, and attitude after being exposed to three teaching sections
9. Disseminate the results of the pilot project

**Theoretical Frameworks**

Multiple theoretical frameworks were utilized in this project. Overarching frameworks supported by sub-frameworks to accomplish the project, as indicated in Table 1: Theoretical Framework that

contains images. There are three main categories of frameworks: overarching, component development, and curriculum content.

The overarching theoretical framework is the National Implementation Research Network (NIRN), Active Implementation Frameworks (AIFs) was used to implement and create fidelity for the project (Blanchard et al., 2017; National Implementation Research Network, (NIRN), 2019). One of the sub-frameworks for component development was the Tietze Telehealth Framework to identify where RPM is situated in telehealth (Tietze, 2015). The second sub-framework for component development was the Nursing Education for the Healthcare Informatics (NEHI) Model to identify the different components of RPM's competencies included in this project (McBride & Tietze, 2019). A third sub-framework for component development was the John Hopkins Nursing Evidence-based Practice (JHNEBP) model for the optimum RPM curriculum creation via the literature (Dang & Dearholt, 2018). The final sub-framework for component development was the John Hopkins Practice question Evidence Translation (PET) theoretical framework (Dang & Dearholt, 2018), and elements of the chronic care management (CCM) (CMS, 2017) to translate current RPM literature into practical information that was utilized in the curriculum development (Dang & Dearholt, 2018).

One of the supporting sub-frameworks for curriculum content development was Bloom's taxonomy that guided the different educational learning levels (information, application, clinical decision-making) (Anderson et al., 2001; Su, M. et al., 2005). The second supporting sub-frameworks for curriculum content development was the IOM (2001), "Crossing the Quality Chasm" as the overall driving theoretical framework for patient-centered, safe, timely, effective, and efficient, equitable care in developing the evidence-based learning domains (IOM, 2001), and the three teaching modules (information, application, clinical decision-making). The flow of all the frameworks is shown in Table 1 Theoretical Frameworks.

## Section II: Evidence Synthesis

The evidence synthesis describes the search method, data relating to literature review sources, selection criteria, evidence synthesis, and evidence level. Additionally, the review will illustrate the inquiry question, EBP intervention, evaluation, and summation of the evidence-based literature, usability, feasibility relating to RPM curriculum-based competencies, and the IOM and competency themes.

### Evidence Synthesis

An exploration of the literature was accomplished utilizing the Texas Woman's University (TWU) library to explore many electronic databases. The databases utilized include Cumulative Index of Nursing and Allied Health Literature (CINAHL) Complete, MEDLINE (Ovid and EBSCO), PubMed (National Library of Medicine's database), Medical Subject Headings (MeSH), Cochrane Reviews, Cochrane Trials, Academic Search Complete, Nursing & Allied Health Database (ProQuest), Google Scholar, and Google. The electronic queries included scholarly, peer-reviewed, evidence-based, academic, governmental, professional, book chapters, and reports. Excluded sources were unpublished, thesis, dissertations, message boards, blogs, Wikipedia, and wikis.

The literature review focused on evidence-based competency, safety, technology, quality, roles, clinical skills, patient-centered, and engagement. Search terms, Boolean operators (AND, OR), and keywords such as remote patient monitoring, telemonitoring, virtual visits, telemedicine, telehealth AND curriculum, education, instruction, provider education, certification, and combinations were employed. The PubMed MeSH search on remote patient monitoring produced zero (0) entries. Zero articles found with remote patient monitoring AND curriculum, education, instruction, provider education, certification combination. The literature search had to be widened due to RPM's different terminology, such as home monitoring, telemonitoring, virtual visits, telehealth, telecare, and telemedicine. The additional search produced seven Cochrane systematic reviews, 46 Cochrane clinical trials, six Cochrane protocols, and fifteen systematic reviews. The results were then narrowed down to articles relevant to remote patient monitoring or monitoring patients with chronic conditions remotely that answered this evidence-based

practice quality improvement project's inquiry question.

**Selection Criteria**

Research studies, guidelines, governmental and professional websites, and grey literature were utilized to complete the background, clinical needs assessment, and significance section of this project. The inclusion criteria for this project's curriculum development included randomized controlled trials (RCTs), systematic reviews with and without meta-analysis for the highest level of evidence were used to translate into practical knowledge. Some grey literature, studies, governmental guidelines, and professional standards of care were utilized in the first RPM module's information overview to incorporate the curriculum's regulations. The research studies focused on patient engagement, disease self-management, patient-provider feedback, RPM technology, techniques, and clinical applications were included in this project.

The exclusion limiters were studies not in English, not full text, nonhuman, and older than five years old except for Cochrane reviews or seminal works. Studies that focused solely on telemedicine, telehealth, or mobile health (mHealth) and did not include remote patient monitoring, electronic patient engagement, or feedback were excluded from the literature review. Figure 1: Literature Diagram demonstrates the selection process.

**Evidence Synthesis**

The purpose of this project was to improve the practice of RPM and the associated curriculum-based competencies to improve the quality and safety of RPM practice delivery. This evidence-based practice quality improvement project's synthesis of the literature review will cover *Remote Patient Monitoring Operational Definition, Chronic Condition Management Operational Definition,* and *Remote Patient Monitoring Curriculum Clinical Relevancy*. Table 2 summarized the operational definition that are presented in detail below.

**Table 2.**

*Summary of Operational Definitions*

| Operational Term | Operational Description | Reference |
|---|---|---|
| Remote Patient Monitoring | Remote patient monitoring includes patient-centered care (patient engagement) that incorporates teaching or coaching the patient about their disease process to self-manage their chronic conditions | Oldenburg, 2013<br>Center for Connected Health Policy, 2019 |
| Chronic Condition Management | Chronic condition management (CCM) is an innovation from CMS to help increase the quality of life (QOL), manage the disease process to prevent organ damage, and reduce healthcare expenditures | CMS |
| Remote Patient Monitoring Curriculum | significant results and have positive effects when the IOM six aims are incorporated with patient-centered care (patient engagement) is a priority in RPM | Flodgren et al., 2015; Inglis et al., 2015; Kew et al., 2016; McCabe et al., 2017; McLean et al., 2011; Murray et al., 2005 |

***Remote Patient Monitoring Operational Definition***

Remote patient monitoring has many names from tele-homecare, virtual visits, telemonitoring, remote patient management, remote care. This evidence-based quality improvement project will utilize remote patient monitoring (RPM). The Tietze Telehealth framework comprises three levels of care, with RPM at the second level that employs protocols for care of chronic or emergent conditions that require continual monitoring (Tietze, 2015). RPM care can be performed at the patient's home, skilled nursing, and senior living (Tietze, 2015). The technology used for RPM care is based on the patient's needs and can be utilized by multiple disciplines for collaboration of care (Tietze, 2015). State and federal regulations regulate remote patient monitoring and are paid for through governmental, private, and public payers (Center for Connected Health Policy, 2019). Remote patient monitoring includes patient-centered care (patient engagement) that incorporates teaching or coaching the patient about their disease process to self-manage their chronic conditions (Oldenburg, 2013).

***Chronic Condition Management Operational Definition***

Chronic condition management (CCM) is an innovation from CMS to help increase the quality of life (QOL), manage the disease process to prevent organ damage, and reduce healthcare expenditures (CMS, 2017; CMS-CCM, 2017). Multiple studies have indicated that if patients with chronic conditions receive safe, timely, effective, efficient, equitable, and patient-centered care, that could reduce mortality, healthcare cost, and increase in QOL (Flodgren et al., 2015; Inglis et al., 2015; Kruse et al., 2017; McCabe et al., 2017). Research studies have signified that patient involvement in self-care and disease management education has led to better QOL, reduction in office, hospital, and emergency room visits (Bertini et al., 2015; Bower et al., 2011; Breen et al., 2017; Čurila et al., 2018; Delahaye et al., 2019; Eysenbach et al., 2019; Eysenbach et al., 2019; Giger et al., 2015; Greenwood et al., 2014; Greenwood et al., 2017; Hansa et al., 2018; Hassan et al., 2018; Hassan et al., 2019; Kalid et al., 2018; Kew et al., 2016; Malasinghe et al., 2019; Melia et al., 2018; Mittal et al., 2016; Noel et al., 2018; Park et al., 2019; Perl et al., 2013). The combination of RPM and CCM provides safe, timely, effective, efficient, equitable, and patient-centered care by reducing exacerbations, identifying initial changes in the patient's health that can be dealt with to prevent decompensation, frequent responses from the healthcare team, coaching and educating the patient when the need arises instead of waiting for a three-month follow-up appointment (Bertini et al., 2015; Bower et al., 2011; Breen et al., 2017; Cerrato & Halamka, 2019; Čurila et al., 2018; Delahaye et al., 2019; Dickinson et al., 2018; Dunn & Hazzard, 2019; Eysenbach et al., 2019; Eysenbach et al., 2019; Flodgren et al., 2015; Giger et al., 2015; Greenwood et al., 2014; Greenwood et al., 2017; Hansa et al., 2018; Hassan et al., 2018; Hassan et al., 2019; Kalid et al., 2018; Kew et al., 2016; Lee et al., 2019; Liu et al., 2016; Malasinghe et al., 2019; McCabe et al., 2017; Melia et al., 2018; Mittal et al., 2016; mTelehealth, 2019; Noel et al., 2018; Okamura, 2014; Park et al., 2019; Perl et al., 2013; Ramkumar, et al., 2019; Ramkumar, et al., 2019; Su, C. et al., 2019; Timmermans et al., 2018; Vishnu et al., 2019; Walker, J. P. & Richards, 2016; Walker et al., 2019).

***Remote Patient Monitoring Curriculum Clinical Relevancy***

Several RPM Cochrane studies were conducted in early 2000 with incremental follow-up studies that showed a progression of RPM care progressively getting better (Flodgren et al., 2015; Inglis et al., 2015; Kew et al., 2016; McCabe et al., 2017; McLean et al., 2011; Murray et al., 2005). However, some of the studies indicated a lack of consistency in measuring or defining the intervention or outcome measures or patient engagement (Flodgren et al., 2015; Inglis et al., 2015; Kew et al., 2016; McCabe et al., 2017; McLean et al., 2011; Murray et al., 2005). Most of the studies stated that RPM had some positive effect but could not generalize the results because of fear of possible bias or inconsistency in randomized control trials (RCTs) (Flodgren et al., 2015; Inglis et al., 2015; Kew et al., 2016; McCabe et al., 2017; McLean et al., 2011; Murray et al., 2005). Some of the current Cochrane and other studies have shown significant results and have positive effects when the IOM six aims are incorporated with patient-centered care (patient engagement) is a priority in RPM (Flodgren et al., 2015; Inglis et al., 2015; Kew et al., 2016; McCabe et al., 2017; McLean et al., 2011; Murray et al., 2005).

**Level of Evidence**

The majority of the articles were level I and II with seven (7) Cochrane Reviews, sixteen (16) systematic reviews, three (3) randomized control trials (RCTs), and one (1) mixed method, with the remainder of the articles between levels III to IV. The others were systematic reviews with or without meta-analysis, randomized control trials (RCTs), and explanatory mixed-method design that included only a Level I quantitative study quasi-experimental studies (Dang & Dearholt, 2018). Some of the articles were level II that contained a systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis explanatory mixed-method design (Dang & Dearholt, 2018). Some level III articles included a non-experimental study, a systematic review of a combination of RCTs, quasi-experimental and non-experimental studies, or non-experimental studies only, with or without meta-analysis qualitative study or meta-synthesis (Dang & Dearholt, 2018). Some level IV articles contained opinions of respected authorities and reports of nationally recognized expert committees or consensus panels based on scientific evidence (Dang & Dearholt, 2018). Some level

V articles included evidence obtained from literature or integrative reviews, quality improvement, program evaluation, financial evaluation, case reports, and nationally recognized experts' opinions based on experiential evidence (Dang & Dearholt, 2018).

**Inquiry question (problem statement)**

In the interprofessional online students (population) who are obtaining a master's or a doctorate that is exposed to three remote patient monitoring teaching modules (intervention), will there be a significant improvement (outcome) between the students' pre- and post-survey (comparison) in their RPM knowledge, experience, and attitude after three weeks (time)?

**Evidence-based Practice (Interventions)**

This evidence-based practice quality improvement project's intervention involved initiating the development of the RPM curriculum and establishment of fidelity for remote patient monitoring (RPM) teaching content by employing the highest level of the evidence-based practice (EBP) via review of the literature (Dang & Dearholt, 2018). The author developed the instrument to measure that learning occurred, a pre- and post-survey instrument (Lynn, 1986). The author validated the developed evidence-based practice RPM curriculum and the pre- and post-survey instrument via subject matter experts and utilize the Content Validity Index (CVI) (Lynn, 1986).

**Utility/Feasibility**

According to the literature (Hübner et al., 2019; Interprofessional Education Collaborative, 2016), there is a need to evaluate curriculum-based competency quantitatively, which supported this project's utility. Although practitioner competencies are central to impact of the project on patient care delivery, the utility and feasibility of the project should also be addressed. Utility and feasibility have previously been addressed in *Section I Introduction and Background* of this paper where the Political, Economic, Socio-Cultural, and Technological (PEST) analysis was outlined.

**Themes**

The themes associated with this project were the IOM Quality Chasm and Bloom's competencies domains. IOM Quality Chasm (IOM, 2001) is associated, as evidenced in the theoretical framework (see Table 1: Theoretical Framework and Appendix A: Evidence-based Remote Patient Monitoring Curriculum Competencies Domains). Bloom's competency domains (Anderson et al., 2001; Su et al., 2005) are associated with this project for aligning information, applications, and clinical decision making (see Table 1: Theoretical Framework and Appendix A: Evidence-based Remote Patient Monitoring Curriculum Competencies Domains). The themes also related to the research evidence extracted, synthesized, and incorporated into the project. The following studies are examples of support for these themes. Also, refer to the next section and Table 3: Evidence Table for more details.

1. **IOM Quality Chasm:** Other Cochrane studies indicated that RPM provides efficient, effective, equitable, and timely care to detect initial signs of deterioration and timely treat and provide information to the patient (Flodgren et al., 2015; IOM, 2001).
2. **IOM Quality Chasm:** Other Cochrane studies indicated that RPM provides expanded access to care, improves self-awareness, provides patient education that empowers patients to take control of their chronic conditions, decreases readmissions, and improves medication adherence (Flodgren et al., 2015; IOM, 2001; Kruse et al., 2017).
3. **IOM Quality Chasm:** Another study indicated that collaboration and access with other diagnostic services, healthcare providers, and systems while delivering RPM care are ideal (IOM, 2001; Kruse et al., 2017).

1. **Bloom's competency domains (Information):** Cochrane studies indicated that both the provider and the patient need information and education to gain confidence and competencies in RPM (Anderson et al., 2001; Flodgren et al., 2015; Kruse et al., 2017; Su et al., 2005).
2. **Bloom's competency domains (Application):** Cochrane studies have shown an improvement in the quality of life in patients with heart failure, and patients with diabetes have a reduction in their LDL cholesterol, blood pressure, and hemoglobin A1C with telemonitoring applications

(Anderson et al., 2001; Flodgren et al., 2015; Kruse et al., 2017; Su et al., 2005).

3. **Bloom's competency domains (Clinical Decision-making):** a Cochrane study indicated that RPM provides timely clinical decision-making interactions with the patient to detect the initial signs of deterioration, administer appropriate treatments, and information to the patient (Anderson et al., 2001; Flodgren et al., 2015; Su et al., 2005).

**Evidence Table**

The literature supporting chronic disease management, the healthcare workforce shortage, and the remote patient monitoring curriculum clinical relevancy is reflected in Table 3 Evidence Table. The trend in these topics can be summarized separately.

Chronic disease management has become more critical as the population ages, and chronic conditions cause an increase in cost, with most of the cost occurring hospital care, physician, clinical service, and retail prescription drugs (CMS, 2017). Additionally, chronic conditions are a leading cause of death, disability, and other diseases (CDC, 2017; CDC, 2017).

Healthcare workforce shortage has become more significant with an expected deficit of primary care (14,800 to 49,300) and specialty physicians (20,700 to 30,500) by 2030, with an additional 40.7% of physicians retiring or close to retirement (AAMC, 2019; Heiser, 2018; Redford, 2018). A physician supervisor's requirement for nurse practitioners to practice in 22 states adds even more burden on the shortage (Auerbach et al., 2013; Buerhaus, 2018; Buerhaus et al., 2015; Donelan et al., 2013; Neff et al., 2018; Perloff et al., 2016; Reagan & Salsberry, 2013; Sonenberg & Knepper, 2017). There is an increased demand for NPs, CNMs, and CRNAs throughout Texas, especially in North Texas, Gulf Coast, and Central Texas, along with a 67% need for primary care physicians (TCNWS, 2016; TCNWS & BON, 2018; TCNWS, 2018; DSHS2018; DSHS2018; DSHS2019). Lack of faculty contributes to the shortage due to vacancies, retirement, and barriers (Bittner & Bechtel, 2017; Falk, 2014; Fang & Kesten, 2017; Forsberg et al., 2015; Nardi & Gyurko, 2013; DSHS, Texas Center for Nursing Workforce Studies, (TCNWS) & Texas Board of Nursing, (BON), 2018; TCNWS, 2018).

The workforce shortage and the aging population are the contributing factors for remote patient monitoring curriculum clinical relevance that provides education for the provider and the patient to improve the level of confidence and competencies on the utility of RPM and patient engagement to improve RPM practice delivery, quality, and safety (Flodgren et al., 2015; Kruse et al., 2017). RPM provides timely clinical decision-making interactions with the patient to detect the initial signs of deterioration, administer appropriate treatments and information to the patient (Flodgren et al., 2015; Hung KN & Fong, 2019; Inglis et al., 2015; Kew et al., 2016; Kruse et al., 2017; Lee et al., 2018; Liu et al., 2016; McCabe et al., 2017; McLean et al., 2011; Murray et al., 2005; Sarfo et al., 2018). RPM provides expanded access to care, improves self-awareness, provides patient education that empowers patients to take control of their chronic conditions, decreases readmissions, and improves medication adherence (Flodgren et al., 2015; Hung KN & Fong, 2019; Inglis et al., 2015; Kew et al., 2016; Kruse et al., 2017; Lee et al., 2018; Liu et al., 2016; McCabe et al., 2017; McLean et al., 2011; Murray et al., 2005; Sarfo et al., 2018). RPM has shown an improvement in the quality of life in patients with heart failure, and patients with diabetes have a reduction in their LDL cholesterol, blood pressure, and hemoglobin A1C (Flodgren et al., 2015; Greenwood et al., 2014; Hung KN & Fong, 2019; Inglis et al., 2015; Kew et al., 2016; Kruse et al., 2017; Lee et al., 2018; Liu et al., 2016; McCabe et al., 2017; McLean et al., 2011; Michaud et al., 2020; Murray et al., 2005; Sarfo et al., 2018; Shane-McWhorter et al., 2014; Walker et al., 2019).

**Institutional Review Board (IRB)**

The author completed the university "Quality Improvement Checklist" verification form to determine if this project was required to go through IRB. As seen in Appendix B, this project qualified as a quality improvement project and was not required to go through IRB.

## Section III: Methodological Framework

This DNP scholarly EBP QI pilot project's purpose was to explore the literature to determine need, feasibility, and best practices to develop and implement the RPM modules. Also, to improve RPM's practice and the associated curriculum-based competencies to improve RPM practice delivery quality and safety and create fidelity throughout all the development stages to establish a standard of evidence-based care. The methodology section will provide the different frameworks and methodological phases applied to complete this project.

### Inquiry question (problem statement)

This DNP scholarly EBP QI pilot project's purpose was to explore the literature to determine need, feasibility, and best practices to develop and implement the RPM modules. Also, to improve RPM's practice and the associated curriculum-based competencies to improve RPM practice delivery quality and safety and create fidelity throughout all the development stages to establish a standard of evidence-based care. Specifically, the problem is the lack of education, curriculum, or certification for clinicians in RPM. The project aimed to (a) develop EBP curriculum-based competencies for RPM to ensure delivery of safe, effective, efficient, equitable, patient-centered, timely, and to provide quality RPM practice, (b) created the program with fidelity establish a standard of care per the IOM (2001) guidelines to improve RPM practice's quality and safety. Specifically, the project's problem statement is there a difference between the students' knowledge, experience, and attitude before and after being exposed to remote patient monitoring content in an online environment?

### *Institute for Healthcare Improvement, Plan-Do-Study-Act*

The Institute for Healthcare Improvement (IHI) Plan-Do-Study-Act (PDSA), in combination with the AIFs framework, were utilized to facilitate the iterations cycles of EBP RPM curriculum development and implementation into practice (Langley et al., 2009). The PDSA incorporates four steps that allowed this project to plan and develop the EBP RPM curriculum, implement a curriculum sample to subject matter experts that tested and evaluate it for content validity (Lynn, 1986).

Step 1: Plan

- RPM weekly PDSA meetings with curriculum team and SME
- RPM weekly PDSA meetings with the chair and SME

Step 2: Do

- Weekly task on development of goals, objectives, criteria for the curriculum, implementation, evaluation
- Develop of Content Validity
- Develop Survey Questions
- Develop Course Content

Step 4: Study

- Obtained CVI results
- Second reiteration of content validity with SME

Act

- Revised Content based on CVI and SMEs' comments
- From the second reiteration, developed Survey and Course content.

**Project Design**

This evidence-based quality improvement project design entailed a CVI (Lynn, 1986) for the content's validity, a pre- a post-survey instrument to test if improvement occurred, and three EBP RPM teaching modules to help develop RPM competencies delivery of safe quality patient care (Lynn, 1986).

**Project Objectives**

The objectives of this scholarly evidence-based practice (EBP) quality improvement (QI) pilot project:

1. Initiate the development of curriculum and establishment of fidelity for remote patient monitoring (RPM) teaching content by employing the highest level of the evidence-based practice (EBP) via review of the literature (Blanchard et al., 2017; NINR, 2019)

2. Validate the developed evidence-based practice RPM curriculum via subject matter experts and utilizing the Content Validity Index (CVI) (Lynn, 1986)
3. Develop the instrument to measure that learning occurred, pre- and post-survey (Lynn, 1986)
4. Validate the pre- and post-survey by using subject matter experts and the (CVI) (Lynn, 1986)
5. Implement the pilot project by administering the validated pre-survey
6. Administer the three validated RPM teaching modules
7. Measure if learning occurred by utilizing the validated post-survey
8. Analyze the data to evaluate if there was a significant improvement in RPM knowledge, experience, and attitude after being exposed to three teaching sections
9. Disseminate the results of the pilot project.

**Detailed Outline of Plan**

First, the author met with the sponsor to identify the goals and objectives needed to meet for the project to succeed (Blanchard et al., 2017; NIRN, 2019) (see Project Objectives). Once the goals and objectives were identified, the sponsor introduced the author to an existing curriculum team that would become the subject matter experts for this project (Blanchard et al., 2017; NIRN, 2019).

Secondly, defining the problem for the need to develop three RPM curriculum-based competencies teaching modules and fidelity to establish a standard of care per the IOM (2001) guidelines to improve RPM practice's quality and safety, because of the chronicity of care (CDC, 2017; CDC, 2017), the impact of contagious diseases in the community (Ross, 2020), and the lack of available of RPM-competent health care professionals (TCNWS, 2016; TCNWS & BON, 2018; TCNWS, 2018; DSHS, 2018; DSHS, 2018; DSHS, 2019).

The IOM (2001), "Crossing the Quality Chasm" was the overall driving theoretical framework for patient-centered, safe, timely, effective, and efficient, equitable care in developing the evidence-based learning domains (IOM, 2001), and the three teaching modules (information, application, clinical decision-making). Moreover, throughout the whole project, the Institute for Healthcare Improvement

(IHI) Plan-Do-Study-Act (PDSA) (Langley et al., 2009) allowed the curriculum team to use data for decision-making (Venugopal et al., 2017). The PDSA cycles were crucial in making essential modifications, mitigating barriers, and attaining expected outcomes (Langley et al., 2009). The John Hopkins Nursing Evidence-based Practice (JHNEBP) model and the John Hopkins Practice question Evidence Translation (PET) theoretical framework were selected to provide the steps to search, evaluate, and translate evidence-based practice literature into practice (Dang & Dearholt, 2018). Furthermore, the (Blanchard et al., 2017; NIRN, 2019)'s Active Implementation Frameworks (AIFs) provided the overarching implementation and fidelity for this project (Blanchard et al., 2017; NIRN, 2019).

Once the literature was appraised and translated into practical knowledge, the author constructed preliminary modules and possible questions for the pre- and post-survey utilizing the Lynn method (Lynn, 1986) Content Validity Index (CVI) the validation of the content. The pre- and post-survey instrument was designed as the testing solution to determine if knowledge, experience, and attitude increased after completing the RPM modules. The three RPM teaching modules have been incorporated into the current interprofessional curriculum.

**Description of Intervention**

This evidence-based practice quality improvement project's intervention involved initiating the development of the RPM curriculum and establishment of fidelity for remote patient monitoring (RPM) teaching content by employing the highest level of the evidence-based practice (EBP) via review of the literature (Dang & Dearholt, 2018). The author developed the instrument to measure that learning occurred, a pre- and post-survey instrument (Lynn, 1986). The author validated the developed evidence-based practice RPM curriculum and the pre- and post-survey instrument via subject matter experts and utilize the Content Validity Index (CVI) (Lynn, 1986).

**Curriculum Development**

The development of this DNP Scholarly EBP QI RPM curriculum incorporated Bloom's taxonomy (Anderson et al., 2001; Su et al., 2005), JHNEBP, and PET (Dang & Dearholt, 2018)

throughout the process of creating modules: 1.2 Overview of Remote Patient Monitoring (RPM), 1.3 RPM Clinical Application Diabetes, and 1.4 RPM Clinical Decision Making. This project developed six evidence-based learning domains from the IOM (IOM, 2001) and the NEHI model (McBride & Tietze, 2019): technology, data, role, industry, clinical skills, patient safety, and quality that became the "Evidence-based RPM Curriculum Competencies Domains." (e.g., "see Appendix A Evidence-based RPM Curriculum Competencies Domains"). The evidence-based RPM curriculum competencies domains became the "Remote Patient Monitoring Curriculum Matrix." (e.g., "see Appendix C RPM curriculum matrix"). The curriculum matrix also included student learning objectives.

## Methodology Phases

This DNP scholarly EBP QI pilot project incorporated multiple methodology phases. The different methodological phases included curriculum development, survey instrument development, measurement methods, and the evaluation of outcome measurement to complete this project.

### *Bloom's Taxonomy*

Bloom's taxonomy defines the steps of learning from the beginning stage of knowledge (lower level) that progresses to comprehension, which was included in module 1.2, the overview of RPM (Anderson et al., 2001; Su et al., 2005). The overview included RPM principles, fundamental phases, technology, transmission, regulatory systems, and care management components (Anderson et al., 2001; Su et al., 2005).

In module 1.3, the learning advanced to application and analysis that included RPM's clinical application components for patients with diabetes. In this module, the students applied the acquired knowledge from the two modules and applied it to a chronic condition (Anderson et al., 2001; Su et al., 2005).

Module 1.4 utilized a higher level of Bloom's taxonomy synthesis and evaluation (Anderson et al., 2001; Su et al., 2005). In this module, the students were provided information, an instrument, and a clinical scenario (Anderson et al., 2001; Su et al., 2005). They had to compile the information, assess the

situation, apply the instrument, make a judgment, structure a plan, and evaluate the scenario's outcome (Anderson et al., 2001; Su et al., 2005).

***Module 1.2 Overview of RPM***.

Module 1.2 "Overview of Remote Patient Monitoring (RPM)," provided RPM's basic principles and the different phases of the remote patient management fundamentals (Center for Connected Health Policy, 2019; Cerrato & Halamka, 2019; Clarke et al., 2017; Delahaye et al., 2019; Greenwood et al., 2014; Joshi, 2011; Kalid et al., 2018; Lunney et al., 2018; Malasinghe et al., 2019; Vishnu et al., 2019; Walker et al., 2019). The students learned the critical aspect of patient engagement for RPM's success and the different types of transmissions utilized in RPM (Athilingam et al., 2016; Athilingam et al., 2018; Giger et al., 2015; Kho et al., 2019; McCabe et al., 2017; Michaud et al., 2020; O'Connor et al., 2016; Oldenburg, 2013; Shane-McWhorter et al., 2014; Volpp & Mohta, 2016). Module 1.2 covered RPM's care management components and the regulatory systems that must be maintained to ensure RPM's privacy and security (Cason & Cohn, 2014; Grady, 2014; Odendaal et al., 2020; Rutledge et al., 2017; Su et al., 2019; Talal et al., 2019; Tsertsidis et al., 2019; Walker et al., 2019; White et al., 2016). (e.g., “see Appendix D1 Sample of RPM Curriculum”).

***Module 1.3 RPM Applications – Diabetes***.

Module 1.3 "Clinical Application – Diabetes Management," presented information on how RPM affected the patient's disease management, evaluation of the types of technologies, and utilization (Flodgren et al., 2015; Greenwood et al., 2014; Greenwood et al., 2017; Kruse et al., 2017; Lee et al., 2018; McCabe et al., 2017; Michaud et al., 2020; Murray et al., 2005; Shane-McWhorter et al., 2014; Walker & Richards, 2016; Walker et al., 2019). The students were able to make recommendations of health-related technologies to facilitate individual solutions to health problems (Chaudhuri et al., 2013; Foster & Sethares, 2014; Henriquez-Camacho et al., 2014; Kalid et al., 2018; Kho et al., 2019; Lee et al., 2019; Lee, S., 2013; Majumder & Deen, 2019; Melchiorre et al., 2018; Tarricone et al., 2019). Additionally, the students could accurately critique colleagues' responses regarding how remote patient

monitoring affected the patient on the video and how they use computers, applications, telehealth, and healthcare tools to promote individuals, families, and underserved communities (Center for Connected Health Policy, 2019; Čurila et al., 2018; Delahaye et al., 2019; Giger et al., 2015; Greenwood et al., 2014; Kalid et al., 2018; McElreath, April 5, 2019; Mittal et al., 2016; Walker et al., 2019). The students were able to effectively assess RPM's importance in chronic disease management in the long term in healthcare implementation of health-related technologies to assure continuous quality improvement of rural and urban underserved populations (Flodgren et al., 2015; Joshi, 2011; Kew et al., 2016; Kruse et al., 2017; Park et al., 2019; Walker et al., 2019). Furthermore, the students could identify scientific evidence related to technological advances to clinical situations in chronic disease management to determine the most appropriate interventions for an individual, family, or community (Bower et al., 2011; Dickinson et al., 2018; Dunn & Hazzard, 2019; Giger et al., 2015; Greenwood et al., 2014; Greenwood et al., 2017; Kalid et al., 2018; Kim & Lee, 2014; Kristoffersson & Lindén, 2020; Malasinghe et al., 2019; Mittal et al., 2016; mTelehealth, 2019; Okamura, 2014; Park et al., 2019; Shane-McWhorter et al., 2014; Su et al., 2019; Walker & Richards, 2016; Walker et al., 2019). (e.g., “see Appendix D2 Sample of RPM Curriculum”).

***Module 1.4 RPM Clinical Decision Making***.

Module 1.4, "Clinical Decision Making," provided the students the opportunity to evaluate the "Acuity Scale critically," the different severity levels for the patients (Bullard, Musgrave et al., 2017; Bullard, Melady et al., 2017; Harper & McCully, 2007; Ingram & Powell, 2018). The student had the opportunity to analyze the case scenario's data, adequately assess disease management's prioritization, and make recommendations to the patients' appropriate clinician (Angelini et al., 2019; Bradway et al., 2015; Chang et al., 2017; Cruz et al., 2014; Fairbrother et al., 2013; Fisher et al., 2007; Georgsson et al., 2017; Georgsson, M. & Staggers, 2015; Inglis et al., 2015; Johnston et al., 2009; Kew et al., 2016; Lorig et al., 2016; Lunney et al., 2018; Maurizi et al., 2018; McCabe et al., 2017; McCleary-Jones, 2016; Nissen & Lindhardt, 2017; Ono & Varma, 2018; Park et al., 2019; Ponticelli et al.,; Rivas Velasquez et al., 2014;

Shahinian & Saran, 2010; Shane-McWhorter et al., 2014; Vizer et al., 2019; Walker et al., 2019; Woods et al., 2019). As an interprofessional clinician, the student reflectively evaluates scientific evidence relating to RPM and clinical situations to determine the most appropriate interventions for an individual. According to the student's profession, the student had to accurately critique scientific evidence relating to RPM and a chronic disease management outcome to determine the most appropriate interventions for an individual. The student had to effectively assess outcomes related to implementing chronic disease management interventions to assure the continuous quality of care. (e.g., "see Appendix D3 Sample of RPM Curriculum").

**Survey Instrument Development**

This DNP Scholarly QI EBP pilot required a measuring method to evaluate if learning occurred after the three RPM modules. A survey instrument was developed to measure the baseline of students' RPM knowledge, experience, and attitude. The development process included Bloom's taxonomy (Anderson et al., 2001; Su et al., 2005), JHNEBP, and PET (Dang & Dearholt, 2018), throughout creating the pre- and post-survey. The outcomes from the CVI were developed into the RPM pre- and post-survey instrument questions. The CVI section "Self-Assessment of RPM Knowledge," became "Section 1.A. that addressed general knowledge of remote patient monitoring. Section 1.A. contained ten multiple-choice questions. The CVI section, "Self-Assessment of RPM Skills and Attitudes," became "Section 1.B. that addressed perceptions of RPM. Section 1.B. contained six out of seven questions with a ten-point Likert scale ranging from 1 "Not Interested" to 10 "Enthusiastic/Supportive." The last question was a qualitative optional open-ended question that read, "Optionally, please feel free to provide any comment you would like about remote patient monitoring and your experience with these questions. We are eager to know what you think." (e.g., "see Appendix E Sample of CVI").

**Theoretical Framework**

This project employed multiple theoretical frameworks to complete this pilot project. The overarching theoretical framework was the PDSA and NIRN AIFs, and the sub-frameworks included

Tietze Telehealth Framework, NEHI, JHNEBP, PET, Bloom's taxonomy, and the IOM. (See Table 1: Theoretical Frameworks). Specifically, (a) used these frameworks to develop EBP curriculum-based competencies for RPM to ensure delivery of safe, effective, efficient, equitable, patient-centered, timely, and to provide quality RPM practice, (b) created the program with fidelity establish a standard of care per the IOM (2001) guidelines to improve RPM practice's quality and safety.

***IOM (2001), "Crossing the Quality Chasm"***

The IOM (2001) provided guidelines in "Crossing the Quality Chasm" to define how providers should care for their patients (IOM, 2001). The IOM specified that patient care should be safe, effective, patient-centered, timely, efficient, and equitable that also became the six-aims. This project incorporated the six-aims as the pillars of competencies for patient care (IOM, 2001).

***Tietze Telehealth Framework***

Tietze's Telehealth Framework (2018) identifies Remote Patient Monitoring (RPM) as the second level of telehealth and encompasses home-based, skilled nursing and senior living patient care. Tietze's framework distinguishes that RPM is a protocol-driven model (Tietze, 2015).

***Nursing Education for the Healthcare Informatics***

Nursing Education for Healthcare Informatics (NEHI) model (2019) contains three crucial domains for curriculum development that reiterates the IOM six-aims and the DNP essentials: (1) point-of-care technology; (2) data management and analytics; and (3) patient safety, quality (IOM, 2001; McBride & Tietze, 2019). RPM incorporates all three domains. This project developed six evidence-based learning domains from the IOM and the NEHI model: technology, data, role, industry, clinical skills, patient safety, and quality (IOM, 2001; McBride & Tietze, 2019).

***John Hopkins Nursing Evidence-based Practice, John Hopkins practice question Evidence Translation***

John Hopkins nursing evidence-based practice (JHNEBP) and the John Hopkins practice question Evidence Translation (PET) models employed techniques to ensure the optimum RPM curriculum

creation via the literature (Dang & Dearholt, 2018). The revised JHNEBP model incorporated three interrelated elements: inquiry, practice, and learn (Dang & Dearholt, 2018). The PET has three phases: practice question, evidence, and translation (Dang & Dearholt, 2018).

**Implementation Model**

This DNP scholarly EBP QI pilot project incorporated two implementation models throughout to complete this project. The National Implementation Research Network, Active Implementation Frameworks, and Institute for Healthcare Improvement, Plan-Do-Study-Act, were utilized to facilitate each step and ensure accuracy and create fidelity for this pilot project success (Langley et al., 2009).

***National Implementation Research Network, Active Implementation Frameworks***

The overarching theoretical and implementation framework for this project is the National Implementation Research Network (NIRN), Active Implementation Frameworks (AIFs) was used to implement and create fidelity for the project (Blanchard et al., 2017; NIRN, 2019). This framework provided the necessary implementation process and established fidelity for developing the EBP RPM curriculum to develop competencies in delivering safe quality RPM care (Blanchard et al., 2017; NIRN, 2019). This project utilized four sections of AIFs: usable innovations, curriculum team, stages, and implementation drivers (Blanchard et al., 2017; NIRN, 2019). The usable innovations helped identify operational definitions or core components of this project (Blanchard et al., 2017; NIRN, 2019). The implementation curriculum team helped distinguish the essential team members' qualifications, such as the subject matter experts who validate the CVI's content, curriculum, and pre- and post-survey (Lynn, 1986). The implementation stages included four functions: exploration, installation, initial implementation, and full implementation stages (Blanchard et al., 2017; NIRN, 2019). These stages are action-oriented that have a forward progression but allow for revisitation in any stage if need be (Blanchard et al., 2017; NIRN, 2019). There are three implementation drivers: competency, organization, and leadership that are considered the essential elements and foundation to succeed and sustain the implemented RPM curriculum (Blanchard et al., 2017; NIRN, 2019).

**Population**

This descriptive pilot project consisted of a convenient sample of 16 individuals from two interprofessional classes. The sample population consisted of students who already had at least one degree and were enrolled in either Nursing 5000 and 6000 level interprofessional classes. The students' backgrounds ranged from nursing, sociology and human relations, biochemistry, computer science, project management, health informatics with clinical application, mathematics, nutritional sciences, informatics, general studies with a focus on health and business, and occupational therapy. The students in the 5000-level class worked towards a master's in informatics with clinical applications. The students in the 6000-level class worked towards a Ph.D. or DNP.

**Measurement methods**

***Content Validity Index***

The Content Validity Index (CVI) (Lynn, 1986) process included identifying evidence-based practice literature to develop the RPM curriculum and the pre- and post-survey instrument questions. The CVI content was placed in a template in PsychData and had two parts (Lynn, 1986). The first part consisted of "Self-Assessment of RPM Knowledge," and part two consisted of "Self-Assessment of RPM Skills and Attitudes (Lynn, 1986)." The subject matter experts (SMEs) received an email with instructions, a link to the Psychdata CVI evaluation form, and the three RPM curriculum modules for evaluation (Lynn, 1986). The SMEs evaluated the items for relevancy on a scale from 1 to 4 (Lynn, 1986). The CVI was calculated, and items with a CVI of 80% were retained (Lynn, 1986). The content that received the validation became the foundation for the RPM curriculum and the pre- a post-survey instrument (Lynn, 1986).

***Curriculum Validation***

The evidence-based practice RPM curriculum's validity is a vitally critical factor that the content is relevant to RPM elements and representative of actual practice (Lynn, 1986), significant for fidelity and competency development (Blanchard et al., 2017; NIRN, 2019). The evidence-based practice RPM

curriculum was validated through the CVI process (Lynn, 1986). The curriculum validation process was the same as the survey validation, with the author providing the SMEs with instructions, a link to the Psychdata CVI evaluation form, and the three RPM curriculum modules for evaluation (Lynn, 1986). The RPM curriculum content's evaluation was based on relevancy on a scale from 1 to 4 (Lynn, 1986). The RPM curriculum content that received a CVI of 80% was retained (Lynn, 1986). The validated RPM curriculum content became the foundation for the RPM curriculum (Lynn, 1986).

***Survey Validation***

The RPM pre- and post-survey instrument's validity is a vitally important factor in measuring what it is intended to measure (Lynn, 1986). The RPM pre- and post-survey instrument was validated through the CVI process (Lynn, 1986). The SMEs received an email with instructions, a link to the Psychdata CVI evaluation form with the RPM pre- and post-survey possible questions for evaluation (Lynn, 1986). The SMEs evaluated the curriculum content for relevancy on a scale from 1 to 4. The CVI was calculated, and the content with a CVI of 80% was retained (Lynn, 1986). The validated content became the RPM pre- and post-survey instrument (Lynn, 1986).

**Curriculum Impact Evaluation of Outcome Measurement**

The data evaluation plan used for developing the RPM curriculum will use the PDSA reiterative cycles to evaluate if a change needs to occur after each Plan, Do, Study, Act cycle during the weekly curriculum team meeting (Langley et al., 2009). The CVI's data evaluation plan used the PDSA reiterative cycles to evaluate if a change needed to occur after each Plan, Do, Study, Act cycle during the creation process (Lynn, 1986). The data evaluation plan used for evaluating the pre- and post-survey results was the Mann-Whitney U Test (Group comparison) and case summaries.

**Data collection process and planning**

The author and the sponsor collected the CVI data electronically via email. The method of collecting data for the CVI incorporated a CVI instrument (Lynn, 1986) that contained the content that became the pre- and post-survey questions and the RPM curriculum. The CVI instrument (Lynn, 1986)

was sent to the subject matter experts, who validated the pre- and post-survey questions and the RPM curriculum (Lynn, 1986).

The author and the sponsor inputted the pre- and post-survey questions via PsychData, and a link was generated and placed in the appropriate modules. The pre-survey responses were collected into PsychData before module 1.2 was opened. Once the three modules were completed (three weeks), the post-survey was administered via a PsychData link. The survey responses were collected into PsychData, which were encrypted then downloaded into a zip file.

Both data collection methods were electronically performed that inter-rater reliability did not need to be determined. No personal information on the subject matter experts or the students taking the pre- and post-surveys were collected for both data collections. There were no anticipated or perceived barriers to data collection.

**Data Analysis Plan - Statistical Analysis Plan**

The data collected for the CVI utilized an online *PsychData link that was* downloaded, encrypted, and exported to Microsoft Excel for analysis. The data collected for the pre- and post-survey utilized an online *PsychData link was* downloaded, encrypted, and exported to SPSS for Mac and Windows on both the author's and sponsor's computer. The statistical software utilized was a Mann-Whitney U Test (Group comparison) and case summaries.

The sponsor prepared the data for analysis. The sponsor walked the author through the statistical process via a zoom shared video conference. The author transcribed and narrated the statistical findings for the DNP defense. The sponsor transcribed and narrated the statistical findings for the manuscript.

**Proposed budget, time, and resources plan**

Funding for projects based on curriculum development and education tends to be supported by their associated academic institutions (Brown University, 2020). For this project, one might consider that the time invested in developing the curriculum is commonly expected to support faculty in developing the curriculum. However, this time must be attributed to “faculty workload units,” multiplied by faculty

salary to yield the curriculum development cost. However, again, that approach is traditional in most academic institutions and may *not* be attributed to the project's cost.

In terms of resource planning, there is cost associated with two other components of the project: 1) statistical analysis of the pre- and post-educational impact of the course on students, and 2) cost of the license for IBM SPSS software program (IBM.com, 2019) license for the faculty and statistician. These are estimated to be $640 [16 hours of faculty wages of $40/hour] and then $225 of IBM SPSS license fee, respectively.

## Section IV: Findings

This project's findings, both quantitative and qualitative, were compiled to answer the project PICOT questions. Those are provided in sequence, along with their respective findings.

| | | |
|---|---|---|
| Population | (P) | Online students (interprofessional) obtaining a master's or a doctorate |
| Interventions | (I) | Exposure to three remote patient monitoring modules |
| Comparison | (C) | The students' knowledge, experience, and attitude before and after being exposed to the content of remote patient monitoring |
| Outcome | (O) | Improvement in the students' knowledge, experience, and attitude |
| Time | (T) | Three weeks |

### Results and Effect Size

The PICOT question's quantitative comparison component, the IBM SPSS statistical analysis software program (IBM.com, 2019) was used on the collected data from the project participants [students in a telehealth course]. Specifically, a Mann-Whitney nonparametric independent comparison (Pallant, 2016) was conducted. The Mann-Whitney is the statistical test of choice for two independent groups for non-normally distributed data (Pallant, 2016). The Mann-Whitney comparison of the curriculum content scores before and after an educational session was used to illustrate the impact of the potential improvement in scores before and after the educational session.

The Mann-Whitney (Pallant, 2016) results indicated statistically significant improvements in "knowledge" and "experience." "Attitude" about telehealth/RPM was high before the educational session so the increase was not significant. A Mann-Whitney U Test revealed a significant difference in the pre-knowledge scores (Md = 6.0, n = 16) and post-knowledge scores (Md = 8.6, n = 16), U = 25.0, z -3.952, p = .000. A Mann-Whitney U Test revealed a significant difference in the pre-experience scores (Md = 3.63, n = 16) and the post-experience scores (Md = 7.25, n = 16), U = 52.0, z = -2.871, p. = .004). Effect size was calculated for both, knowledge scores, which have an r = .988 and experience scores, which have an r = .718. Note that effect size larger than .5 is considered a large effect size (Pallant, 2016, p. 233). (See Table 4 and Figure 2 for details.)

**Table 4**

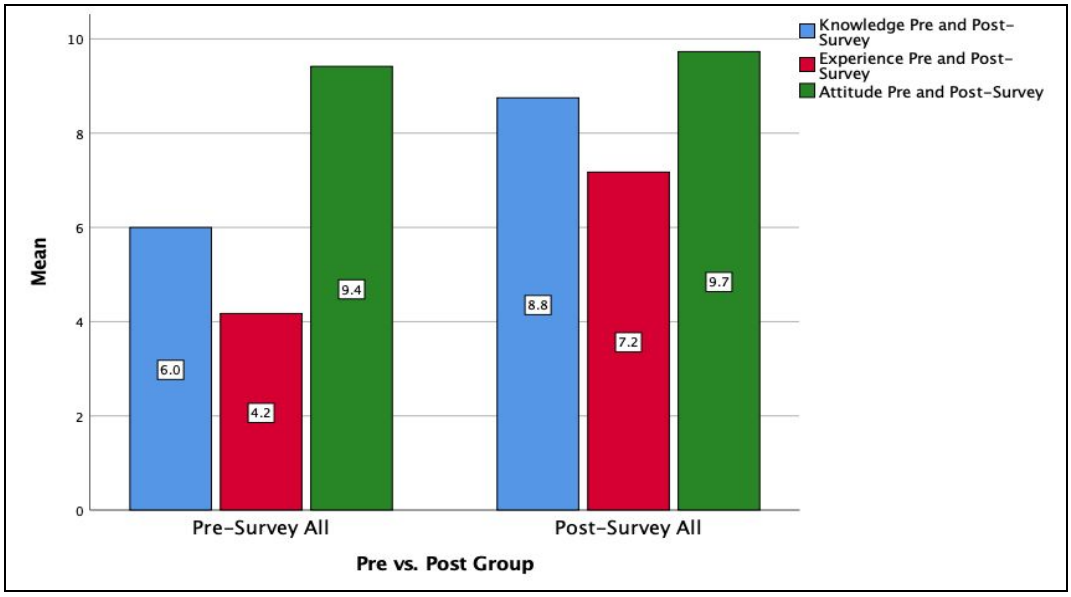
*Mann-Whitney Findings of Statistical Significance*

| Group [a] | Knowledge | Experience | Attitude |
|---|---|---|---|
| Mann-Whitney U | 25.000 | 52.000 | 114.000 |
| Asymp. Sig. (2-tailed) | .000*** | .004** | .506 |

*Note*: **p < .01, and ***p < .001
[a] Grouping Variable: Pre vs. Post Group.

**Figure 2**

*Mean Educational Pre- and Post-Education Session Scores on Knowledge, Experience, and Attitude*




The qualitative data was collected via open-ended questions on the pre- and post-survey comments. Qualitative data revealed themes among nurses and other providers. Question number 17 asked, "Optionally, please feel free to provide any comment you would like about remote patient monitoring and your experience with these questions. We are eager to know what you think." This open-ended question generated comments typical to these:

- "I am eager to learn more about remote patient monitoring and how it can be incorporated into healthcare."
- "I think remote patient monitoring is very useful for patients and will expand in the near future."

- "I want to learn more about the development of the interactive platforms."

**Discussion**

In summary, the critical project question for this project and the findings were:

Is there a difference between the students' knowledge, experience, and attitude before and after being exposed to remote patient monitoring content in an online environment?

1. Quantitative results indicated that knowledge and experience were significantly improved with RPM content.
2. There was no difference in the attitude score. This result may be related to the students themselves because of a high pre-survey score of 9.4 for attitude.
3. Significant results of this pilot project warrant expansion to a large sample and other universities.

**Recommendations**

This project involved a comprehensive approach to the clinical application of provider-based skills in the area of remote patient monitoring (RPM). As noted, RPM is a fast-growing care delivery option in the U.S. Key recommendations from this project will provide value for RPM's future deployment. Recommendations for such considerations are:

- RPM certification is warranted for optimum care delivery.
- Continued focus on evidence-based RPM curriculum content should occur for all health professionals.
- These approaches for teaching clinical decision-making seem to provide a sound methodology for creating competencies in RPM nurses.

**Conclusions**

This DNP scholarly descriptive pilot project explored RPM and developed evidence-based practice curriculum-based competencies to ensure delivery of safe, effective, efficient, equitable, patient-centered, timely, and quality RPM practices. The descriptive pilot project results were significant,

indicating an increase in the student's knowledge and experience after the three RPM teaching modules. There was no difference in the attitude score. The attitude score may be related to the students themselves because of a high pre-survey score of 9.4 for attitude. This pilot project's significant results warrant expansion to a larger sample and other universities, especially as RPM is emerging as an alternative method of health care for chronically ill older adults and the lack of available health care professionals that are trained and competent in RPM. Another reason to repeat this pilot project is to validate the established fidelity for the developed EBP RPM curriculum.

## Section V: Recommendations and Implication for Practice

This DNP scholarly descriptive pilot project explored RPM and developed evidence-based practice curriculum-based competencies to ensure delivery of safe, effective, efficient, equitable, patient-centered, timely, and quality RPM practices. The descriptive pilot project results were significant, indicating an increase in the student's knowledge and experience after the three RPM teaching modules. There was no difference in the attitude score. The attitude score may be related to the students themselves because of a high pre-survey score of 9.4 for attitude. This pilot project's significant results warrant expansion to a larger sample and other universities, especially as RPM is emerging as an alternative method of health care for chronically ill older adults and the lack of available health care professionals that are trained and competent in RPM. Another reason to repeat this pilot project is to validate the established fidelity for the developed EBP RPM curriculum.

### Recommendations Implication for Practice

The author recommends that RPM certification is warranted for optimum care delivery. The continuous focus of evidence-based practice RPM curriculum content should occur for all health professionals. The current approach to teaching clinical decision-making seems to provide a sound methodology for creating RPM nurses' competencies. The author recommends that RPM certification is warranted for optimum care delivery. The continuous focus of evidence-based practice RPM curriculum content should occur for all health professionals. The current approach to teaching clinical decision-making seems to provide a sound methodology for creating RPM nurses' competencies. This DNP scholarly descriptive pilot project needs to take the next step in the PDSA cycle by repeating the project with a larger sample size to validate the curriculum and the project results. Future PDSA cycle could expand this project to other universities or even to undergraduates and eventually to an RPM certificate program for all interprofessionals.

### Implication for Practice

The Institute of Medicine (IOM) called for safer healthcare (2000), provided a comprehensive strategy for quality improvement (2001), provided competencies for health care professionals (2003), and provided for interprofessional education (2011), all to provide quality patient care. This DNP Scholarly Project incorporated the six aims of quality improvement: safe, timely, effective, efficient, equitable, and patient-centered care in the EBP RPM curriculum to provide a safer healthcare environment and improve the providers' competencies in the RPM delivery. The following DNP Essentials were met through the completion of this DNP scholarly descriptive pilot project

***Essential I: Scientific Underpinnings for Practice*** (AACN, 2006)

This DNP scholarly project integrated nursing science and utilized multiple theoretical frameworks from other disciplines: National Implementation Research Network (NIRN), Active Implementation Frameworks (AIFs), Tietze Telehealth Framework, Nursing Education for the Healthcare Informatics (NEHI) Model, John Hopkins Nursing Evidence-based Practice (JHNEBP) model, John Hopkins Practice question Evidence Translation (PET), Bloom's taxonomy, IOM (2001), "Crossing the Quality Chasm." The author utilized multiple theoretical frameworks to integrate science and evidence-based practice into RPM curriculum development. The research evidence underpinning this project was relevant, aligned, and supported this project to develop three RPM curriculum-based competencies teaching modules and fidelity to establish a standard of care per the IOM (2001) guidelines to improve RPM practices quality, and safety. Since RPM is an emerging method of health care service delivery (Flodgren et al., 2015), gathering patient's clinical information in their home that is then transmitted remotely (McCabe et al., 2017), the age of the population (US Census Bureau, 2018), the chronicity of care (CMS, 2019; CCW, 2018), the impact of contagious diseases in the community (Ross, 2020), and the lack of available of RPM-competent health care professionals (AAMC, 2019; Auerbach, D. I. et al., 2013; Heiser, 2018; Kleinpell et al., 2014; Oliver et al., 2014; Redford, 2018; DSHS, 2018; Xue et al., 2018). This DNP scholarly descriptive pilot project is needed and necessary to develop RPM curriculum-based competencies to improve RPM practice delivery quality and safety and begin building

and securing competent RPM providers and faculty to help with the shortage and manage the aging population's chronic conditions.

***Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking*** (AACN, 2006)

This DNP scholarly project developed and evaluated RPM delivery of care to help meet the current and future health care needs for patients with chronic conditions based on scientific findings from Cochrane systematic reviews, RCTs, quantitative and qualitative studies. The author effectively communicated and led this quality improvement initiative to ensure patient safety in RPM care delivery via EBP RPM curriculum development.

***Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice*** (AACN, 2006)

This DNP scholarly project used the Institute for Healthcare Improvement (IHI) Plan-Do-Study-Act (PDSA) as the methodological framework, the John Hopkins PET method to translate existing scientific literature, applied it to the RPM curriculum development and evaluated the pilot project's outcome. The author employed the JHNEBP to analyze and critically appraise the literature and implemented evidence-based practice into the development of the RPM curriculum. The author developed the instrument (pre- and post-survey) to evaluate the outcome of implementing the three RPM modules and validated the instrument and curriculum content using the Lynn method (CVI) and subject matter experts.

***Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care*** (AACN, 2006)

This DNP scholarly project used information systems and technology to teach the RPM curriculum to the students. The author utilized PsychData to create the Content Validity Index (CVI) and pre- and post-survey and sent them electronically to the subject matter experts for evaluation. The students gained access to the pre- and post-survey via a link in their last module. The author analyzed the outcome data from the CVI and the pre- and post-survey results by employing technology and

information system software.

***Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes*** (AACN, 2006)

This DNP scholarly descriptive pilot project was incorporated into two interprofessional classes. The RPM curriculum was designed with interprofessional collaboration incorporated into the program to improve patient safety and healthcare quality and outcomes.

***Essential VIII: Advanced Nursing Practice*** (AACN, 2006)

This DNP scholarly descriptive pilot project intervention (RPM curriculum) was designed, implemented, and evaluated based on nursing science and scientific evidence from other disciplines. The RPM curriculum incorporated clinical decision-making in the third module to demonstrate advanced levels of clinical judgment.

**Barriers**

This DNP scholarly descriptive pilot project had barriers. . The sample size was too small to generalize the findings. The pilot project was limited to one of the three campuses in the university. Another limitation was that the pilot project was not offered to undergraduate students. Even though the sample population was diverse, the sample needed more healthcare providers because RPM incorporates several aspects of health care, such as physical therapy, physicians, and speech pathology. The RPM curriculum was limited to three teaching modules, which more information will need to be added in the future.

**Methods for dissemination**

This *Evidence-Based Practice Remote Patient Monitoring Curriculum Development: A Descriptive Pilot Study* was accepted and presented at two forums. The primary investigator was invited and presented at the American Nursing Informatics Association (ANIA), Dallas-Fort Worth chapter conference on November 14th, 2019. In the second forum, the primary investigator was invited and presented at the Graduate Nursing Student Academy (GNSA) Virtual Poster Presentation on September 25th, 2020. The

EBP RPM curriculum has been incorporated into both of the classes that were part of the pilot project.

**References**

Ahuja, R., Ayala, C., Tong, X., Wall, H. K., & Fang, J. (2018). Public Awareness of Health-Related Risks from Uncontrolled Hypertension. *Preventing Chronic Disease, 15*(0), E40. 10.5888/pcd15.170362

Altman, S. H., Butler, A. S., & Shern, L. (2016). *Removing Barriers to Practice and Care*. National Academies Press (US).

American Association of Colleges of Nursing. (2006). *The Essentials of Doctoral Education for Advanced Nursing Practice.* AACN Essentials. https://www.aacnnursing.org/Education-Resources/AACN-Essentials

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). *A taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives* (Complete ed. ed.). New York: Longman.

Ashman, J. J., Rui, P., & Okeyode, T. (2019). Characteristics of Office-based Physician Visits, 2016. *NCHS Data Brief, 0*(331), 1-8. https://www.ncbi.nlm.nih.gov/pubmed/30707670

Association of American Medical Colleges. (2019). *2019 Update: The Complexities of Physician Supply and Demand: Projections from 2017 to 2032.* (Report No. 0). Washington, DC: IHS Markit Ltd. https://www.aamc.org/data/workforce/

Athilingam, P., Clochesy, J., & Labrador, M. (2018). Intervention Mapping Approach in the Design of an Interactive Mobile Health Application to Improve Self-care in Heart Failure. *Computers, Informatics, Nursing, 36*(2), 90-97. 10.1097/CIN.0000000000000383

Athilingam, P., Osorio, R., Kaplan, H., Oliver, D., O'neachtain, T., & Rogal, P. (2016). Embedding Patient Education in Mobile Platform for Patients with Heart Failure: Theory-Based Development and Beta Testing. *Computers, Informatics, Nursing, 34*(2), 92-98. 10.1097/CIN.0000000000000216

Auerbach, D. I., Chen, P. G., Friedberg, M. W., Reid, R., Lau, C., Buerhaus, P. I., & Mehrotra, A. (2013). Nurse-Managed Health Centers and Patient-Centered Medical Homes Could Mitigate Expected Primary Care Physician Shortage. *Health Affairs, 32*(11), 1933 1941. 10.1377/hlthaff.2013.0596

Bertini, M., Marcantoni, L., Toselli, T., & Ferrari, R. (2015). Remote monitoring of implantable devices: Should we continue to ignore it? *International Journal of Cardiology, 202*(0), 368-377. 10.1016/j.ijcard.2015.09.033

Bittner, N. P., & Bechtel, C. F. (2017). Identifying and Describing Nurse Faculty Workload Issues: A Looming Faculty Shortage. *Nursing Education Perspectives, 38*(4), 171-176. 10.1097/01.NEP.0000000000000178

Blanchard, C., Livet, M., Ward, C., Sorge, L., Sorensen, T. D., & Mcclurg, M. R. (2017). The Active Implementation Frameworks: A roadmap for advancing implementation of Comprehensive Medication Management in Primary care. *Research in Social and Administrative Pharmacy, 13*(5), 922-929. 10.1016/j.sapharm.2017.05.006

Bower, P., Cartwright, M., Hirani, S. P., Barlow, J., Hendy, J., Knapp, M., Henderson, C., Rogers, A., Sanders, C., Bardsley, M., Steventon, A., Fitzpatrick, R., Doll, H., & Newman, S. (2011). A comprehensive evaluation of the impact of telemonitoring in patients with long-term conditions and social care needs: protocol for the whole systems demonstrator cluster randomised trial. *BMC Health Services Research, 11*(1), 184. 10.1186/1472-6963-11-184

Breen, S., Kofoed, S., Ritchie, D., Dryden, T., Maguire, R., Kearney, N., & Aranda, S. (2017). Remote real-time monitoring for chemotherapy side-effects in patients with blood cancers. *Collegian (Royal College of Nursing, Australia), 24*(6), 541-549. 10.1016/j.colegn.2016.10.009

Brown University. (2020). *Support for Faculty and Advisors: Course Development Funds.* Brown University. https://www.brown.edu/academics/college/support/faculty/coursegrants

Buerhaus, P. (2018). *Nurse practitioners: A solution to America's primary care crisis*. American Enterprise Institute for Public Policy Research.

Buerhaus, P. I., DesRoches, C. M., Dittus, R., & Donelan, K. (2015). Practice characteristics of primary care nurse practitioners and physicians. *Nursing Outlook, 63*(2), 144-153. 10.1016/j.outlook.2014.08.008

Bulger, R. E., Meyer, B. E., & Fineberg, H. V. (2017). The Formulation of Health Policy by the Three Branches of Government. In Bulger, R.E., Meyer, B.E., Fineberg, H.V. (Ed.), *Society's Choices* (pp. 335-357). National Academies Press.

Bullard, M. J., Melady, D., Emond, M., Musgrave, E., Unger, B., van der Linde, E., Grierson, R., Skeldon, T., Warren, D., & Swain, J. (2017). Guidance when Applying the Canadian Triage and Acuity Scale (CTAS) to the Geriatric Patient: Executive Summary. *Cjem, 19*(S2), S28-S37. 10.1017/cem.2017.363

Bullard, M. J., Musgrave, E., Warren, D., Unger, B., Skeldon, T., Grierson, R., van der Linde, E., & Swain, J. (2017). Revisions to the Canadian Emergency Department Triage and Acuity Scale (CTAS) Guidelines 2016. *Cjem, 19*(S2), S18-S27. 10.1017/cem.2017.365

Buttorff, C., Ruder, T., & Bauman, M. (2017). *Multiple Chronic Conditions in the United States*. RAND Corporation. 10.7249/tl221

Cajita, M. I., Hodgson, N. A., Lam, K. W., Yoo, S., & Han, H. (2018). Facilitators of and Barriers to mHealth Adoption in Older Adults with Heart Failure. *Computers, Informatics, Nursing, 36*(8), 1-382. 10.1097/cin.0000000000000442

Cason, J., & Cohn, E. R. (2014). Telepractice: An Overview and Best Practices. *Perspectives on Augmentative and Alternative Communication, 23*(1), 4-17. 10.1044/aac23.1.4

Center for Connected Health Policy. (2018). *Remote Patient Monitoring.* Center for Connected Health Policy. http://www.cchpca.org/remote-patient-monitoring

Center for Connected Health Policy. (2019). *About Telehealth: Remote Patient Monitoring (RPM).* Center for Connected Health Policy. https://www.cchpca.org/about/about-telehealth/remote-patient-monitoring-rpm

Center for Disease Control and Prevention. (2015). *Health-Related Quality of Life (HRQOL) Data.* Centers for Disease Control and Prevention. https://www.cdc.gov/hrqol/hrqoldata/index.html

Centers for Medicare and Medicaid Services. (2019). *Medicare Beneficiaries at a Glance.* Centers for Medicare and Medicaid Services, CMS.gov. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Beneficiary-Snapshot/Bene_Snapshot.html

Centers for Disease Control and Prevention. (2017a). *Chronic Disease Overview.* Centers for Disease Control and Prevention. https://www.cdc.gov/chronicdisease/overview/index.htm

Centers for Disease Control and Prevention. (2017b). *Healthy Aging: Promoting Well-being in Older Adults.* Centers for Disease Control and Prevention, Grand Rounds Home, On-Demand. https://www.cdc.gov/grand-rounds/pp/2017/20170919-senior-aging.html

Centers for Medicare & Medicaid Services (CMS). (2017). *Medicare Current Beneficiary Survey (MCBS).* Centers for Medicare & Medicaid Services (CMS), Office of Enterprise Data and Analytics (OEDA), Medicare Current Beneficiary Survey (MCBS). https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/MCBS/index?redirect=/mcbs

Centers for Medicare and Medicaid Services. (2015). *Medicare Multiple Chronic Conditions 2015 data.* Centers for Medicare and Medicaid Services. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/MCC_Main

Centers for Medicare and Medicaid Services. (2017a). *Chronic Care Management Toolkit.* Centers for Medicare and Medicaid Services. https://www.cms.gov/About-CMS/Agency-Information/OMH/Downloads/CCM-Toolkit-Updated-Combined-508.pdf

Centers for Medicare and Medicaid Services. (2017b). *National Health Expenditures 2017 Highlights.* Centers for Medicare and Medicaid Services. https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/highlights.pdf

Centers for Medicare and Medicaid Services. (2018). *Health Information Technology for Economic and Clinical Health (HITECH) Audits Overview.* CMS.gov, Centers for Medicare & Medicaid Services. https://www.cms.gov/Medicare/Compliance-and-Audits/Part-A-Cost-Report-Audit-and-Reimbursement/HITECH-Audits

Cerrato, P., & Halamka, J. (2019). Chapter Two - Innovations in mHealth, Part 2: Electronic Health Record–Linked Apps, Remote Patient Monitoring, and the Internet of Things. In P. Cerrato, & J. Halamka (Eds.), *The Transformative Power of Mobile Medicine* (pp. 17-40). Academic Press. //doi-org.ezp.twu.edu/10.1016/B978-0-12-814923-2.00002-7

Chang, C., Lee, T., & Mills, M. E. (2017). Experience of Home Telehealth Technology in Older Patients with Diabetes. *CIN: Computers, Informatics, Nursing, 35*(10), 530-537. 10.1097/CIN.0000000000000341

Chaudhuri, S., Le, T., White, C., Thompson, H. C., Faan, & Demiris, G. F. (2013). Examining Health Information-Seeking Behaviors of Older Adults. *CIN: Computers, Informatics, Nursing, 31*(11), 547-553. 10.1097/01.NCN.0000432131.92020.42

Chronic Conditions Data Warehouse. (2018). *Medicare Chronic Condition Charts.* Chronic Conditions Data Warehouse, Medicare Data, Medicare Charts, Medicare Chronic Condition Charts. https://www2.ccwdata.org/web/guest/medicare-charts/medicare-chronic-condition-charts/#b2_endo_renal_trend

Clark, C. A., Kent, K. A., & Riesner, S. A. (2018). A New Approach for Solving an Old Problem in Nurse Practitioner Clinical Education. *The Journal for Nurse Practitioners, 14*(4), e69-e75. //doi-org.ezp.twu.edu/10.1016/j.nurpra.2018.01.012

Clarke, J. L., Bourn, S., Skoufalos, A., Beck, E. H., & Castillo, D. J. (2017). An Innovative Approach to Health Care Delivery for Patients with Chronic Conditions. *Population Health Management, 20*(1), 23-30. 10.1089/pop.2016.0076

Čurila, K., Šmída, J., Lešetický, O., Heřman, D., Štros, P., Osmančík, P., Žďárská, J., Procházková, R., & Widimský, P. (2018). Cost effectiveness analysis of out-patient and remote monitoring of patients after pacemaker replacement from the perspective of the health care payer. *Cor Et Vasa (English Ed.), 60*(4), e387-e392. 10.1016/j.crvasa.2018.02.006

Dang, D., & Dearholt, S. (2018). *Johns Hopkins Nursing Evidence-Based Practice: Model and Guidelines* (3rd ed.). Sigma Theta Tau International.

Delahaye, C., Ninni, S., & Guedon, L. (2019). Analysis of remote monitoring of patients with subcutaneous defibrillator. *Archives of Cardiovascular Diseases Supplements, 11*(1), 86. 10.1016/j.acvdsp.2018.10.189

Dickinson, M. G., Allen, L. A., Albert, N. A., DiSalvo, T., Ewald, G. A., Vest, A. R., Whellan, D. J., Zile, M. R., & Givertz, M. M. (2018). Remote Monitoring of Patients with Heart Failure: A White Paper From the Heart Failure Society of America Scientific Statements Committee. *Journal of Cardiac Failure, 24*(10), 682-694. //doi-org.ezp.twu.edu/10.1016/j.cardfail.2018.08.011

Dolansky, M., Schexnayder, J., Patrician, P., & Sales, A. (2017). Implementation Science: New Approaches to Integrating Quality and Safety Education for Nurses Competencies in Nursing Education. *Nurse Educator, 42*(5S Suppl 1), S12-S17. 10.1097/NNE.0000000000000422

Doñate-Martínez, A., Ródenas, F., & Garcés, J. (2015). Impact of a primary-based telemonitoring programme in HRQOL, satisfaction and usefulness in a sample of older adults with chronic diseases in Valencia (Spain). *Archives of Gerontology and Geriatrics, 62*(0), 169-175. 10.1016/j.archger.2015.09.008

Donelan, K., DesRoches, C. M., Dittus, R. S., & Buerhaus, P. (2013). Perspectives of Physicians and Nurse Practitioners on Primary Care Practice. *N Engl J Med, 368*(20), 1898-1906. 10.1056/NEJMsa1212938

Dunn, P., & Hazzard, E. (2019). Technology approaches to digital health literacy. *International Journal of Cardiology, 293*(0), 294-296. 10.1016/j.ijcard.2019.06.039

Edemekong, P. F., Annamaraju, P., & Haydel, M. J. (2020). Health Insurance Portability and Accountability Act (HIPAA). *StatPearls* (pp. online). StatPearls Publishing.

Eysenbach, G., Buis, L., Omboni, S., Rodriguez, S., Hwang, K., & Wang, J. (2019). Connecting Home-Based Self-Monitoring of Blood Pressure Data Into Electronic Health Records for Hypertension Care: A Qualitative Inquiry With Primary Care Providers. *JMIR Formative Research, 3*(2), 1-8. 10.2196/10388

Eysenbach, G., Ortega, E., Wolff-Hughes, D., DeSmet, A., De Bourdeaudhuij, I., Chastin, S., Crombez, G., Maddison, R., & Cardon, G. (2019). Adults' Preferences for Behavior Change Techniques and Engagement Features in a Mobile App to Promote 24-Hour Movement Behaviors: Cross-Sectional Survey Study. *JMIR mHealth and uHealth, 7*(12), 1-11. 10.2196/15707

Falk, N. L. (2014). Retaining the Wisdom: Academic Nurse Leaders' Reflections on Extending the Working Life of Aging Nurse Faculty. *Journal of Professional Nursing, 30*(1), 34-42. 10.1016/j.profnurs.2013.06.012

Fang, D., & Kesten, K. (2017). Retirements and succession of nursing faculty in 2016–2025. *Nursing Outlook, 65*(5), 633-642. 10.1016/j.outlook.2017.03.003

Federal Register. (2018). *Medicare and Medicaid Programs; Electronic Health Record Incentive.* Federal Register. https://www.federalregister.gov/documents/2010/07/28/2010-17207/medicare-and-medicaid-programs-electronic-health-record-incentive-program

Flodgren, G., Rachas, A., Farmer, A. J., Inzitari, M., & Shepperd, S. (2015). Interactive telemedicine: effects on professional practice and health care outcomes. *The Cochrane Database of Systematic Reviews, 2015*(9), CD002098. 10.1002/14651858.CD002098.pub2

Forsberg, I., Swartwout, K., Murphy, M., Danko, K., & Delaney, K. R. (2015). Nurse practitioner education: Greater demand, reduced training opportunities. *Journal of the American Association of Nurse Practitioners, 27*(2), 66-71. 10.1002/2327-6924.12175

Foster, M. V., & Sethares, K. A. (2014). Facilitators and Barriers to the Adoption of Telehealth in Older Adults: An Integrative Review. *Computers, Informatics, Nursing, 32*(11), 523-533. 10.1097/CIN.0000000000000105

Galambos, C., Rantz, M., Back, J., Jun, J., Skubic, M., & Miller, S. (2017). Older Adults' Perceptions of and Preferences for a Fall Risk Assessment System: Exploring Stages of Acceptance Model. *Computers, Informatics, Nursing, 35*(7), 331-337. 10.1097/CIN.0000000000000330

Ghaffari, F., Navabi, N., & Gannat Alipoor, Z. (2016). Older adults' attitudes and barriers toward the use of mobile phones. *Clinical Interventions in Aging, 11*(1), 1371-1378. 10.2147/cia.s112893

Giger, J. T., Pope, N. D., Vogt, H. B., Gutierrez, C., Newland, L. A., Lemke, J., & Lawler, M. J. (2015). Remote patient monitoring acceptance trends among older adults residing in a frontier state. *Computers in Human Behavior, 44*(0), 174-182. 10.1016/j.chb.2014.11.044

Grady, J. (2014). CE: Telehealth: A Case Study in Disruptive Innovation. *AJN, American Journal of Nursing, 114*(4), 38-45. 10.1097/01.NAJ.0000445682.52553.89

Greenwood, D. A., Gee, P. M., Fatkin, K. J., & Peeples, M. (2017). A Systematic Review of Reviews Evaluating Technology-Enabled Diabetes Self-Management Education and Support. *Journal of Diabetes Science and Technology, 11*(5), 1015-1027. 10.1177/1932296817713506

Greenwood, D. A., Young, H. M., & Quinn, C. C. (2014). Telehealth Remote Monitoring Systematic Review. *Journal of Diabetes Science and Technology, 8*(2), 378-389. 10.1177/1932296813519311

Hansa, I., Semaan, S. J., Vaid, N. R., & Ferguson, D. J. (2018). Remote monitoring and "Tele-orthodontics": Concept, scope and applications. *Seminars in Orthodontics, 24*(4), 470-481. 10.1053/j.sodo.2018.10.011

Harper, K., & McCully, C. (2007). Acuity Systems Dialogue and Patient Classification System Essentials. *Nursing Administration Quarterly, 31*(4), 284-299. 10.1097/01.NAQ.0000290426.41690.cb

Hassan, M. K., El Desouky, A. I., Elghamrawy, S. M., & Sarhan, A. M. (2018). Intelligent hybrid remote patient-monitoring model with cloud-based framework for knowledge discovery. *Computers & Electrical Engineering, 70*(0), 1034-1048. 10.1016/j.compeleceng.2018.02.032

Hassan, M. K., El Desouky, A. I., Elghamrawy, S. M., & Sarhan, A. M. (2019). A Hybrid Real-time remote monitoring framework with NB-WOA algorithm for patients with chronic diseases. *Future Generation Computer Systems, 93*(0), 77-95. 10.1016/j.future.2018.10.021

Heiser, S. (2018). *New Research Shows Increasing Physician Shortages in Both Primary and Specialty Care.* Association of American Medical Colleges (AAMC). https://news.aamc.org/press-releases/article/workforce_report_shortage_04112018/

Henriquez-Camacho, C., Losa, J., Miranda, J. J., & Cheyne, N. E. (2014). Addressing healthy aging populations in developing countries: unlocking the opportunity of eHealth and mHealth. *Emerging Themes in Epidemiology, 11*(1), 136. 10.1186/s12982-014-0021-4

Hewner, S., Sullivan, S. S., & Yu, G. (2018). Reducing Emergency Room Visits and In‐Hospitalizations by Implementing Best Practice for Transitional Care Using Innovative Technology and Big Data. *Worldviews on Evidence‐Based Nursing, 15*(3), 170-177. 10.1111/wvn.12286

Hübner, U., Thyea, J., Shaw, T., Elias, B., Egbert, N., Saranto, K., Babitsch, B., Procter, P., & Ball, M. (2019). Towards the TIGER International Framework for Recommendations of Core Competencies in Health Informatics 2.0: Extending the Scope and the Roles. *Studies in Health Technology and Informatics, 264*(1), 1218-1222. 10.3233/SHTI190420

Hung KN, G., & Fong, K. N. (2019). Effects of telerehabilitation in occupational therapy practice: A systematic review. *Hong Kong Journal of Occupational Therapy, 32*(1), 3-21. 10.1177/1569186119849119

IBM.com. (2019). IBM SPSS software [computer software]. United States: IBM.com.

Inglis, S. C., Clark, R. A., Dierckx, R., Prieto‐Merino, D., Cleland, J. G., & Inglis, S. C. (2015). Structured telephone support or non‐invasive telemonitoring for patients with heart failure.

*Cochrane Database of Systematic Reviews, 2015*(10), CD007228. 10.1002/14651858.CD007228.pub3

Ingram, A., & Powell, J. (2018). Patient acuity tool on a medical-surgical unit. *American Nurse Today, 13*(4), 0. https://www.americannursetoday.com/patient-acuity-medical-surgical-unit/

Institute of Medicine. (2001). *Crossing the Quality Chasm: A New Health System for the 21st Century*. The National Academies Press. https://doi.org/10.17226/10027

Institute of Medicine, & Committee on the Robert Wood Johnson Foundation. (2011). *Transforming Education*. The National Academies Press.

Institute of Medicine, Greiner, A. C., & Knebel, E. (2003). *Health Professions Education: A Bridge to Quality*. The National Academies Press. https://doi.org/10.17226/10681

Institute of Medicine, Kohn, L. T., Corrigan, J. M., Donaldson, M. S., & Committee on Quality of Health Care in America (Eds.). (2000). *To Err Is Human*. National Academies Press.

Intel-GE Care Innovations (Ed.). (2015). *Older Populations Have Adopted Technology for Health: People Over 65 Will Use Remote Care Technology to Take Better Care of Themselves*. Intel-GE Care Innovations, LLC.

Interprofessional Education Collaborative. (2016). *Core Competencies for Interprofessional Collaborative Practice: 2016 Update.* (). Washington, DC: Interprofessional Education Collaborative. https://hsc.unm.edu/ipe/resources/ipec-2016-core-competencies.pdf

Investopedia.com. (2019). *Feasibility Study.* https://www.investopedia.com. https://www.investopedia.com/about-us

Joshi, V. (2011). *Architecture for Adaptive Remote Patient Monitoring*

Kalid, N., Zaidan, A., Zaidan, B., Salman, O., Hashim, M., & Muzammil, H. (2018). Based Real Time Remote Health Monitoring Systems: A Review on Patients Prioritization and Related "Big Data" Using Body Sensors information and Communication Technology. *Journal of Medical Systems, 42*(2), 1-30. 10.1007/s10916-017-0883-4

Kew, K. M., Cates, C. J., & Kew, K. M. (2016). Home telemonitoring and remote feedback between clinic visits for asthma. *Cochrane Database of Systematic Reviews, 2016*(8), CD011714. 10.1002/14651858.CD011714.pub2

Kho, S. E., Lim, S., Hoi, W., Ng, P., Tan, L., & Kowitlawakul, Y. (2019). The Development of a Diabetes Application for Patients with Poorly Controlled Type 2 Diabetes Mellitus. *Computers, Informatics, Nursing, 37*(2), 99-106. 10.1097/CIN.0000000000000485

Kim, Y., & Lee, S. (2014). Energy-efficient wireless hospital sensor networking for remote patient monitoring. *Information Sciences, 282*(0), 332-349. 10.1016/j.ins.2014.05.056

Kleinpell, R., Scanlon, A., Hibbert, D., DeKeyser Ganz, F., East, L., Fraser, D., Kam Yuet Wong, F., & Beauchesne, M. (2014). Addressing Issues Impacting Advanced Nursing Practice Worldwide. *Online Journal of Issues in Nursing, 19*(2), 5. http://www.ncbi.nlm.nih.gov/pubmed/26812271

Kort, H., Cate, t., Olle, Houwelingen, v., Thijs, Moerman, A. H., & Ettema, R. (2016). Competencies required for nursing telehealth activities: A Delphi-study. *Nurse Education Today, 2016*(39), 50-62. https://hbo-kennisbank.nl/record/oai:surfsharekit.nl:444af806-d9c3-4979-ae80-79c9bc82222b

Kristoffersson, A., & Lindén, M. (2020). A Systematic Review on the Use of Wearable Body Sensors for Health Monitoring: A Qualitative Synthesis. *Sensors (Basel, Switzerland), 20*(5), 1502. 10.3390/s20051502

Kruse, C. S., Krowski, N., Rodriguez, B., Tran, L., Vela, J., & Brooks, M. (2017). Telehealth and patient satisfaction: a systematic review and narrative analysis. *BMJ Open, 7*(8), e016242. 10.1136/bmjopen-2017-016242

Langley, G. J., Moen, R., Nolan, K. M., Nolan, T. W., Norman, C. L., & Provos, L. P. (2009). *The Improvement Guide* (2. Aufl. ed.). Jossey-Bass.

Lee, J., Freeman, G., Cheng, M., Brown, L., & Conly, J. (2019). Clinical Relevance of Home Monitoring of Vital Signs and Blood Glucose Levels: A Narrative Review. *International Journal of Technology Assessment in Health Care, 35*(4), 334-339. 10.1017/S0266462319000527

Lee, P. A., Greenfield, G., & Pappas, Y. (2018). The impact of telehealth remote patient monitoring on glycemic control in type 2 diabetes: a systematic review and meta-analysis of systematic reviews of randomised controlled trials. *BMC Health Services Research, 18*(1), 495. 10.1186/s12913-018-3274-8

Lee, S. (2013). Features of Computerized Clinical Decision Support Systems Supportive of Nursing Practice: A Literature Review. *CIN: Computers, Informatics, Nursing, 31*(10), 477-495. 10.1097/01.NCN.0000432127.99644.25

LeRouge, C., & Garfield, M. J. (2013). Crossing the telemedicine chasm: have the U.S. barriers to widespread adoption of telemedicine been significantly reduced? *International Journal of Environmental Research and Public Health, 10*(12), 6472-6484. 10.3390/ijerph10126472

Levy, H., Janke, A. T., & Langa, K. M. (2014). Health Literacy and the Digital Divide Among Older Americans. *Journal of General Internal Medicine: JGIM, 30*(3), 284-289. 10.1007/s11606-014-3069-5

Liu, C., Lim, R. L., McCabe, K. L., Taylor, S., Calvo, R. A., & Liu, C. (2016). A Web-Based Telehealth Training Platform Incorporating Automated Nonverbal Behavior Feedback for Teaching Communication Skills to Medical Students: A Randomized Crossover Study. *Journal of Medical Internet Research, 18*(9), 5. 10.2196/jmir.6299

Lunney, M., Lee, R., Tang, K., Wiebe, N., Bello, A. K., Thomas, C., Rabi, D., Tonelli, M., & James, M. T. (2018). Impact of Telehealth Interventions on Processes and Quality of Care for Patients With ESRD. *American Journal of Kidney Diseases, 72*(4), 592-600. 10.1053/j.ajkd.2018.02.353

Lynn, M. R. (1986). Determination and Quantification of Content Validity. *Nursing Research (New York), 35*(6), 382-386. 10.1097/00006199-198611000-00017

Majumder, S., & Deen, M. J. (2019). Smartphone Sensors for Health Monitoring and Diagnosis. *Sensors (Basel, Switzerland), 19*(9), 2164. 10.3390/s19092164

Malasinghe, L., Ramzan, N., & Dahal, K. (2019). Remote patient monitoring: a comprehensive study. *Journal of Ambient Intelligence and Humanized Computing, 10*(1), 57-76. 10.1007/s12652-017-0598-x

Marcin, J. P., Shaikh, U., & Steinhorn, R. H. (2016). Addressing health disparities in rural communities using telehealth. *Pediatric Research, 79*(1-2), 169-176. 10.1038/pr.2015.192

McBride, S., & Tietze, M. (2019). *Nursing informatics for the advanced practice nurse: Patient Safety, Quality, Outcomes, and Interprofessionalism.* (2nd ed.). Springer Publishing Company.

McCabe, C., McCann, M., & Brady, A. M. (2017). Computer and mobile technology interventions for self-management in chronic obstructive pulmonary disease. *Cochrane Library, 2020*(2), CD011425. 10.1002/14651858.cd011425.pub2

McElreath, D. (April 5, 2019). Telehealth in Education: Remote Patient Monitoring. Paper presented at the *Doswell Informatic Conference,* Dallas, TX. 1-15.

McLean, S., Chandler, D., Nurmatov, U., Liu, J., Pagliari, C., Car, J., & Sheikh, A. (2011). Telehealthcare for asthma: a Cochrane review. *Canadian Medical Association Journal (CMAJ), 183*(11), E733-E742. 10.1503/cmaj.101146

Melchiorre, M. G., Lamura, G., & Barbabella, F. (2018). eHealth for people with multimorbidity: Results from the ICARE4EU project and insights from the "10 e's" by Gunther Eysenbach. *PloS One, 13*(11), e0207292. 10.1371/journal.pone.0207292

Melia, R., Francis, K., Duggan, J., Bogue, J., O'Sullivan, M., Chambers, D., & Young, K. (2018). Mobile Health Technology Interventions for Suicide Prevention: Protocol for a Systematic Review and Meta-Analysis. *JMIR Research Protocols, 7*(1), e28. 10.2196/resprot.8635

Michaud, T. L., Siahpush, M., King, K. M., Ramos, A. K., Robbins, R. E., Schwab, R. J., Clarke, M. A., & Su, D. (2020). Program completion and glycemic control in a remote patient monitoring program for diabetes management: Does gender matter? *Diabetes Research and Clinical Practice, 159*(Article 107944), 1-8. 10.1016/j.diabres.2019.107944

MindTools. (2019). *PEST Analysis - Identifying "Big Picture" Opportunities and Threats.* MindTools: Essential skills for an excellent career. https://www.mindtools.com/pages/article/newTMC_09.htm

Mittal, S., Piccini, J. P., Snell, J., Prillinger, J. B., Dalal, N., & Varma, N. (2016). Improved survival in patients enrolled promptly into remote monitoring following cardiac implantable electronic device implantation. *Journal of Interventional Cardiac Electrophysiology, 46*(2), 129-136. 10.1007/s10840-016-0112-y

Mohktar, M. S., Redmond, S. J., Antoniades, N. C., Rochford, P. D., Pretto, J. J., Basilakis, J., Lovell, N. H., & Mcdonald, C. F. (2015). Predicting the risk of exacerbation in patients with chronic obstructive pulmonary disease using home telehealth measurement data. *Artificial Intelligence in Medicine, 63*(1), 51-59. 10.1016/j.artmed.2014.12.003

mTelehealth. (2019, December). Telehealth and Remote Patient Monitoring for Long-Term and Post-Acute Care: A Primer and Provider Selection Guide. https://mtelehealth.com/telehealth-and-remote-patient-monitoring-for-long-term-and-post-acute-care-a-primer-and-provider-selection-guide/

Murray, E., Burns, J., See Tai, S., Lai, R., & Nazareth, I. (2005). Interactive Health Communication Applications for people with chronic disease. *Cochrane Library, 2010*(1), CD004274. 10.1002/14651858.cd004274.pub4

Myers, C. R. (2018). Using Telehealth to Remediate Rural Mental Health and Healthcare Disparities. *Issues in Mental Health Nursing, 40*(3), 1-7. 10.1080/01612840.2018.1499157

Nardi, D. A., & Gyurko, C. C. (2013). The Global Nursing Faculty Shortage: Status and Solutions for Change. *Journal of Nursing Scholarship, 45*(3), 317-n/a. 10.1111/jnu.12030

National Academies of Sciences, Engineering, and Medicine, Olson, S., & Anderson, K. M. (2016). *The Promises and Perils of Digital Strategies in Achieving Health Equity*. The National Academies Press. 10.17226/23439

National Center for Chronic Disease Prevention and Health Promotion. (2020). *Cost-Effectiveness of Chronic Disease Interventions.* Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion (NCCDPHP). https://www.cdc.gov/chronicdisease/programs-impact/pop/index.htm

National Implementation Research Network, (NIRN). (2019). *Module 1: An Overview of Active Implementation Frameworks.* National Implementation Research Network (NIRN). https://nirn.fpg.unc.edu/module-1

National Science & Technology Council. (2019). *Emerging Technologies to Support an Aging Population.* (Technical Briefs No. 26). United States of America: Office of Science and Technology Policy (OSTP). https://www.nia.nih.gov/news/new-report-emerging-technologies-help-older-americans-maintain-independence

Neff, D. F., Yoon, S. H., Steiner, R. L., Bejleri, I., Bumbach, M. D., Everhart, D., & Harman, J. S. (2018). The impact of nurse practitioner regulations on population access to care. *Nursing Outlook, 66*(4), 379-385. 10.1016/j.outlook.2018.03.001

Nissen, L., & Lindhardt, T. (2017). A qualitative study of COPD-patients' experience of a telemedicine intervention. *International Journal of Medical Informatics (Shannon, Ireland), 107*(1), 11-17. 10.1016/j.ijmedinf.2017.08.004

Noel, K., Yagudayev, S., Messina, C., Schoenfeld, E., Hou, W., & Kelly, G. (2018). Tele-transitions of care. A 12-month, parallel-group, superiority randomized controlled trial protocol, evaluating the use of telehealth versus standard transitions of care in the prevention of avoidable hospital readmissions. *Contemporary Clinical Trials Communications, 12*(0), 9-16. 10.1016/j.conctc.2018.08.006

Oberlander, J. (2019). Lessons from the Long and Winding Road to Medicare for All. *Am J Public Health, 109*(11), 1497-1500. 10.2105/AJPH.2019.305295

O'Connor, S., Hanlon, P., O'Donnell, C. A., Garcia, S., Glanville, J., & Mair, F. S. (2016). Understanding factors affecting patient and public engagement and recruitment to digital health interventions: a systematic review of qualitative studies. *BMC Medical Informatics and Decision Making, 16*(1), 120. 10.1186/s12911-016-0359-3

Odendaal, W. A., Anstey Watkins, J., Leon, N., Goudge, J., Griffiths, F., Tomlinson, M., & Daniels, K. (2020). Health workers' perceptions and experiences of using mHealth technologies to deliver primary healthcare services: a qualitative evidence synthesis. *Cochrane Database of Systematic Reviews, 0*(3), 1-121. 10.1002/14651858.CD011942.pub2

Okamura, H. (2014). Remote monitoring of cardiovascular implantable electronic devices in Japan. *Journal of Arrhythmia, 30*(6), 421-427. 10.1016/j.joa.2014.04.012

Oldenburg, J. (Ed.). (2013). *Engage! Transforming Healthcare Through Digital Patient Engagement*. HIMSS Media.

Oliver, G. M., Pennington, L., Revelle, S., & Rantz, M. (2014). Impact of nurse practitioners on health outcomes ofÂ Medicare and Medicaid patients. *Nursing Outlook, 62*(6), 440-447. //doi.org/10.1016/j.outlook.2014.07.004

Ortiz, J., Hofler, R., Bushy, A., Lin, Y., Khanijahani, A., & Bitney, A. (2018). Impact of Nurse Practitioner Practice Regulations on Rural Population Health Outcomes. *Healthcare (Basel), 6*(2), 65. 10.3390/healthcare6020065

Pallant, J. (2016). *SPSS Survival Manual*. Taylor & Francis Group.

Park, C., Otobo, E., Ullman, J., Rogers, J., Fasihuddin, F., Garg, S., Kakkar, S., Goldstein, M., Chandrasekhar, S. V., Pinney, S., & Atreja, A. (2019). Impact on Readmission Reduction Among Heart Failure Patients Using Digital Health Monitoring: Feasibility and Adoptability Study. *JMIR Medical Informatics, 7*(4), e13353. 10.2196/13353

Peek, S. T. M., Wouters, E. J. M., van Hoof, J., Luijkx, K. G., Boeije, H. R., & Vrijhoef, H. J. M. (2014). Factors influencing acceptance of technology for aging in place: A systematic review. *International Journal of Medical Informatics, 83*(4), 235-248. 10.1016/j.ijmedinf.2014.01.004

Perl, S., Stiegler, P., Rotman, B., Prenner, G., Lercher, P., Anelli-Monti, M., Sereinigg, M., Riegelnik, V., Kvas, E., Kos, C., Heinzel, F. R., Tscheliessnigg, K. H., & Pieske, B. (2013). Socio-economic effects and cost saving potential of remote patient monitoring (SAVE-HM trial). *International Journal of Cardiology, 169*(6), 402-407. //doi-org.ezp.twu.edu/10.1016/j.ijcard.2013.10.019

Perloff, J., DesRoches, C. M., & Buerhaus, P. (2016). Comparing the Cost of Care Provided to Medicare Beneficiaries Assigned to Primary Care Nurse Practitioners and Physicians. *Health Services Research, 51*(4), 1407-1423. 10.1111/1475-6773.12425

Phillips, T., Munn, A., & George, T. (2020). Assessing the Impact of Telehealth Objective Structured Clinical Examinations in Graduate Nursing Education. *Nurse Educator, 45*(3), 169-172. 10.1097/NNE.0000000000000729

Polancich, S., James, D., Miltner, R., Smith, G., & Moneyham, L. (2018). Building DNP Essential Skills in Clinical Data Management and Analysis. *Nurse Educator, 43*(1), 37-41. 10.1097/NNE.0000000000000411

Ramkumar, P. N., Haeberle, H. S., Bloomfield, M. R., Schaffer, J. L., Kamath, A. F., Patterson, B. M., & Krebs, V. E. (2019). Artificial Intelligence and Arthroplasty at a Single Institution: Real-World Applications of Machine Learning to Big Data, Value-Based Care, Mobile Health, and Remote Patient Monitoring. *The Journal of Arthroplasty, 34*(10), 2204-2209. 10.1016/j.arth.2019.06.018

Ramkumar, P. N., Haeberle, H. S., Ramanathan, D., Cantrell, W. A., Navarro, S. M., Mont, M. A., Bloomfield, M., & Patterson, B. M. (2019). Remote Patient Monitoring Using Mobile Health for Total Knee Arthroplasty: Validation of a Wearable and Machine Learning–Based Surveillance Platform. *The Journal of Arthroplasty, 34*(10), 2253-2259. 10.1016/j.arth.2019.05.021

Reagan, P. B., & Salsberry, P. J. (2013). The effects of state-level scope-of-practice regulations on the number and growth of nurse practitioners. *Nursing Outlook, 61*(6), 392-399. 10.1016/j.outlook.2013.04.007

Redford, G. (2018). *Looming Doctor Shortage Could Impact Patient Care.* Association of American Medical Colleges (AAMC). https://news.aamc.org/medical-education/article/looming-doctor-shortage-could-impact-care/

Riner, M. E. (2015). Using implementation science as the core of the doctor of nursing practice inquiry project. *Journal of Professional Nursing: Official Journal of the American Association of Colleges of Nursing, 31*(3), 200-207. 10.1016/j.profnurs.2014.11.002

Rivas Velasquez, K. M., Hames, E., & Masri, H. (2014). Evaluation and Management of the Older Adult with Chronic Kidney Disease. *Primary Care: Clinics in Office Practice, 41*(4), 857-874. 2079/10.1016/j.pop.2014.08.006

Ross, C. (2020). *Hospitals turn to remote monitoring tools to free up beds for the sickest coronavirus patients.* Stat, 1-1. https://www.statnews.com/2020/03/25/coronavirus-hospitals-weigh-remote-patient-monitoring-tools/

Rush, K. L., Hatt, L., Gorman, N., Janicki, L., Polasek, P., & Shay, M. (2019). Planning Telehealth for Older Adults with Atrial Fibrillation in Rural Communities: Understanding Stakeholder Perspectives. *Clinical Nursing Research, 28*(2), 130-149. 10.1177/1054773818758170

Rutledge, C. M., Kott, K., Schweickert, P. A., Poston, R., Fowler, C., & Haney, T. S. (2017). Telehealth and eHealth in nurse practitioner training: current perspectives. *Advances in Medical Education and Practice, 8*(0), 399. 10.2147/AMEP.SI16071

Sarfo, F. S., Ulasavets, U., Opare-Sem, O. K., & Ovbiagele, B. (2018). Tele-Rehabilitation after Stroke: An Updated Systematic Review of the Literature. *Journal of Stroke and Cerebrovascular Diseases, 27*(9), 2306-2318. 10.1016/j.jstrokecerebrovasdis.2018.05.013

Shane-McWhorter, L., Lenert, L., Petersen, M., Woolsey, S., McAdam-Marx, C., Coursey, J. M., Whittaker, T. C., Hyer, C., LaMarche, D., Carroll, P., & Chuy, L. (2014). The Utah Remote Monitoring Project: Improving Health Care One Patient at a Time. *Diabetes Technology & Therapeutics, 16*(10), 653-660. 10.1089/dia.2014.0045

Son, Hyojin, M. S. N., Nahm, & EunShim, F. A. A. N. (2019). Older Adults' Experience Using Patient Portals in Communities: Challenges and Opportunities. *CIN: Computers, Informatics, Nursing, 37*(1), 4-10. 10.1097/CIN.0000000000000476

Sonenberg, A., & Knepper, H. J. (2017). Considering disparities: How do nurse practitioner regulatory policies, access to care, and health outcomes vary across four states? *Nursing Outlook, 65*(2), 143-153. 10.1016/j.outlook.2016.10.005

Soriano, J. B., García-Río, F., Vázquez-Espinosa, E., Conforto, J. I., Hernando-Sanz, A., López-Yepes, L., Galera-Martínez, R., Peces-Barba, G., Gotera-Rivera, C. M., Pérez-Warnisher, M. T., Segrelles-Calvo, G., Zamarro, C., González-Ponce, P., Ramos, M. I., Jafri, S., & Ancochea, J. (2018). A multicentre, randomized controlled trial of telehealth for the management of COPD. *Respiratory Medicine, 144*(1), 74-81. 10.1016/j.rmed.2018.10.008

Spychalla, M. T., Heathman, J. H., Pearson, K. A., Herber, A. J., & Newman, J. S. (2014). Nurse practitioners and physician assistants: preparing new providers for hospital medicine at the mayo clinic. *The Ochsner Journal, 14*(4), 545. http://www.ncbi.nlm.nih.gov/pubmed/25598719

State of Reform. (2018, -03-30T18:24:39+00:00). Report shows health disparities by county in Texas. https://stateofreform.com/news/states/texas/2018/03/report-shows-health-disparities-by-county-in-texas/

Streeter, R. A., Zangaro, G. A., & Chattopadhyay, A. (2017). Perspectives: Using Results from HRSA's Health Workforce Simulation Model to Examine the Geography of Primary Care. *Health Services Research, 52*(1), 481-507. 10.1111/1475-6773.12663

Su, C., Hajiyev, J., Fu, C. J., Kao, K., Chang, C., & Chang, C. (2019). A novel framework for a remote patient monitoring (RPM) system with abnormality detection. *Health Policy and Technology, 8*(2), 157-170. 10.1016/j.hlpt.2019.05.008

Su, M., Osisek, P., & Starnes, B. (2005). Using the Revised Bloom's Taxonomy in the Clinical Laboratory: Thinking Skills Involved in Diagnostic Reasoning. *Nurse Educator, 30*(3), 117-122. 10.1097/00006223-200505000-00014

Takahashi, P. Y., Hanson, G. J., Pecina, J. L., Stroebel, R. J., Chaudhry, R., Shah, N. D., & Naessens, J. M. (2010). A randomized controlled trial of telemonitoring in older adults with multiple chronic conditions: The Tele-ERA study. (Study protocol). *BMC Health Services Research, 10*(0), 255.

Talal, M., Zaidan, A., Zaidan, B., Albahri, A., Alamoodi, A., Albahri, O., Alsalem, M., Lim, C., Tan, K., Shir, W., & Mohammed, K. (2019). Smart Home-based IoT for Real-time and Secure Remote Health Monitoring of Triage and Priority System using Body Sensors: Multi-driven Systematic Review. *Journal of Medical Systems, 43*(3), 1-34. 10.1007/s10916-019-1158-z

Tarricone, R., Cucciniello, M., Armeni, P., Petracca, F., Desouza, K. C., Hall, L. K., & Keefe, D. (2019). Mobile Health Divide Between Clinicians and Patients in Cancer Care: Results from a Cross-Sectional International Survey. *JMIR mHealth and uHealth, 7*(9), e13584. 10.2196/13584

Texas Center for Nursing Workforce Studies, (TCNWS). (2016). *Nurse Supply and Demand Projections, 2015-2030.* Texas Department of State Health Services (DSHS). https://www.dshs.texas.gov/chs/cnws/Nursing-Workforce-Reports/

Texas Center for Nursing Workforce Studies, (TCNWS), & Texas Board of Nursing, (BON). (2018a). *Admissions, Enrollment, and Graduation Trends in Graduate Nursing Education Programs.* Texas Department of State Health Services (DSHS). http://www.dshs.texas.gov/chs/cnws/EducReports.shtm#Advanced

Texas Center for Nursing Workforce Studies, (TCNWS), & Texas Board of Nursing, (BON). (2018b). *Faculty Demographics in Graduate Nursing Education Programs 2017.* Texas Department of State Health Services (DSHS). http://www.dshs.texas.gov/chs/cnws/EducReports.shtm#Advanced

Texas Department of State Health Services, (DSHS). (2018a). *APRNs 2017.* Texas Health and Human Services - Texas Department of State Health Services (DSHS). http://www.dshs.state.tx.us/chs/hprc/tables/2017/APRN17.aspx

Texas Department of State Health Services, (DSHS). (2018b). *Texas Projections of Supply and Demand for Primary Care Physicians and Psychiatrists 2017 - 2030.* Texas Department of Health and Human Services -Health Professions Resource Center (HPRC). https://www.dshs.texas.gov/chs/hprc/

Texas Department of State Health Services, (DSHS). (2019). *APRNs, 2019.* Texas Health and Human Services - Texas Department of State Health Services (DSHS). https://www.dshs.state.tx.us/chs/hprc/tables/2019/APRN19.aspx

Tietze, M. (2015). *Tietze Telehealth Framework*. Tietze.

Timmermans, I., Meine, M., Szendey, I., Aring, J., Romero Roldán, J., Erven, L., Kahlert, P., Zitron, E., Mabo, P., Denollet, J., & Versteeg, H. (2018). Remote monitoring of implantable cardioverter defibrillators: Patient experiences and preferences for follow‐up. *Pacing and Clinical Electrophysiology, 42*(2), 120-129. 10.1111/pace.13574

Trusko, B., Pexton, C., Harrington, H., & Gupta, P. (2007). *Improving Healthcare Quality and Cost with Six Sigma* (1st ed.). Pearson.

Tsertsidis, A., Kolkowska, E., & Hedström, K. (2019). Factors influencing seniors' acceptance of technology for ageing in place in the post-implementation stage: A literature review. *International Journal of Medical Informatics (Shannon, Ireland), 129*(1), 324-333. 10.1016/j.ijmedinf.2019.06.027

U.S. Department of Health and Human Services, Health Resources and Services Administration, & National Center for Health Workforce Analysis. (2014). *Projecting the Supply and Demand for Primary Care Practitioners Through 2020*. U.S. Department of Health and Human Services.

US Census Bureau. (2018). *An Aging Nation: Projected Number of Children and Older Adults.* United States Census Bureau. https://www.census.gov/library/visualizations/2018/comm/historic-first.html

Valdivieso, B., García-Sempere, A., Sanfélix-Gimeno, G., Faubel, R., Librero, J., Soriano, E., & Peiró, S. (2018). The effect of telehealth, telephone support or usual care on quality of life, mortality and healthcare utilization in elderly high-risk patients with multiple chronic conditions. A prospective study. *Medicina Clínica, 151*(8), 308-314. 10.1016/j.medcli.2018.03.013

VanderWielen, L. M., Vanderbilt, A. A., Crossman, S. H., Mayer, S. D., Enurah, A. S., Gordon, S. S., & Bradner, M. K. (2015). Health disparities and underserved populations: a potential solution, medical school partnerships with free clinics to improve curriculum. *Medical Education Online, 20*(1), 27535-4. 10.3402/meo.v20.27535

Venugopal, U., Kasubhai, M., & Paruchuri, V. (2017). Introduction of a quality improvement curriculum in the Department of Internal Medicine, Lincoln Medical Center. *Journal of Community Hospital Internal Medicine Perspectives, 7*(1), 2-7. 10.1080/20009666.2016.1265288

Vishnu, S., Jino Ramson, S. R., Lova Raju, K., & Anagnostopoulos, T. (2019). Chapter 11 - Simple-Link Sensor Network-Based Remote Monitoring of Multiple Patients. In D. J. Hemanth, D. Gupta & V. Emilia Balas (Eds.), *Intelligent Data Analysis for Biomedical Applications* (pp. 237-252). Academic Press. //doi-org.ezp.twu.edu/10.1016/B978-0-12-815553-0.00012-4

Volpp, K. G., & Mohta, S. (2016). *Patient Engagement Survey Results: Better Tools Are Needed.* NEJM Catalyst. https://catalyst.nejm.org/patient-engagement-report-improved-engagement-leads-better-outcomes-better-tools-needed/

Walker, J. P., & Richards, M. B. (2016). Speech-Language Telepractice 101. *ASHA Leader, 21*(1), 36-37. 10.1044/leader.AE.21012016.36

Walker, R. C., Tong, A., Howard, K., & Palmer, S. C. (2019). Patient expectations and experiences of remote monitoring for chronic diseases: Systematic review and thematic synthesis of qualitative studies. *International Journal of Medical Informatics, 124*(0), 78-85. 10.1016/j.ijmedinf.2019.01.013

Ward, B. W. (2017). *Barriers to Health Care for Adults with Multiple Chronic Conditions: United States, 2012–2015.* (Data Brief No. 275). Hyattsville, MD: National Center for Health Statistics. https://www.cdc.gov/nchs/products/databriefs/db275.htm

Weisberg, A., & Suber, L. (2018). *How to Conduct Needs Assessment Part 2: PEST Analysis.* NC State Industry Expansion Solutions. https://www.ies.ncsu.edu/blog/how-to-conduct-needs-assessment-part-2-pest-analysis/

White, A. T.,Deborah S., K, & Ezeanochie, N. B., Sheana. (2016). Health Worker mHealth Utilization: A Systematic Review. *CIN: Computers, Informatics, Nursing, 34*(5), 206-213. 10.1097/CIN.0000000000000231

Wicklund, E. (2018). *Hospitals Are Finding ROI in Remote Patient Monitoring Programs.* mHealthIntelligence, 1-7. https://mhealthintelligence.com/news/hospitals-are-finding-roi-in-remote-patient-monitoring-programs

Wisdom, J., & Creswell, J. W. (2013). *Mixed Methods: Integrating Quantitative and Qualitative Data Collection and Analysis While Studying Patient-Centered Medical Home Models.* Agency for Healthcare Research and Quality (AHRQ). https://pcmh.ahrq.gov/page/mixed-methods-integrating-quantitative-and-qualitative-data-collection-and-analysis-while

Witt Udsen, F., Lilholt, P. H., Hejlesen, O. K., & Ehlers, L. H. (2017). Subgroup analysis of telehealthcare for patients with chronic obstructive pulmonary disease: the cluster-randomized

Danish Telecare North Trial. *ClinicoEconomics and Outcomes Research, 9*(1), 391-401. 10.2147/CEOR.S139064

Wolfson, N. E., Cavanagh, T. M., & Kraiger, K. (2014). Older Adults and Technology-Based Instruction: Optimizing Learning Outcomes and Transfer. *Academy of Management Learning & Education, 13*(1), 26-44. 10.5465/amle.2012.0056

Woods, L., Duff, J., Cummings, E., & Walker, K. (2019). Evaluating the Development Processes of Consumer mHealth Interventions for Chronic Condition Self-management: A Scoping Review. *CIN: Computers, Informatics, Nursing, 37*(7), 373-385. 10.1097/CIN.0000000000000528

Xue, Y., Greener, E., Kannan, V., Smith, J. A., Brewer, C., & Spetz, J. (2018). Federally qualified health centers reduce the primary care provider gap in health professional shortage counties. *Nursing Outlook, 66*(3), 263-272. 10.1016/j.outlook.2018.02.003

Xue, Y., Kannan, V., Greener, E., Smith, J. A., Brasch, J., Johnson, B. A., & Spetz, J. (2018). Full Scope-of-Practice Regulation Is Associated with Higher Supply of Nurse Practitioners in Rural and Primary Care Health Professional Shortage Counties. *Journal of Nursing Regulation, 8*(4), 5-13. 10.1016/S2155-8256(17)30176-X

Xue, Y., Ye, Z., Brewer, C., & Spetz, J. (2016). Impact of state nurse practitioner scope-of-practice regulation on health care delivery: Systematic review. *Nursing Outlook, 64*(1), 71-85. 10.1016/j.outlook.2015.08.005

Yeager, V. A., Wharton, M. K., Monnette, A., Price-Haywood, E., Nauman, E., Angove, R. S. M., & Shi, L. (2018). Non–Face-to-Face Chronic Care Management: A Qualitative Study Assessing the Implementation of a New CMS Reimbursement Strategy. *Population Health Management, 21*(6), 454-461. 10.1089/pop.2017.0196

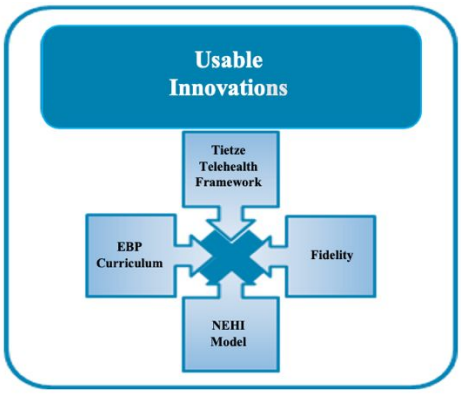
Yee, T., Boukus, E. R., Cross, D., & Samuel, D. R. (2013). *Primary Care Workforce Shortages: Nurse Practitioner Scope-of-Practice Laws and Payment Policies*. The National Institute for Health Care Reform - Research Brief.

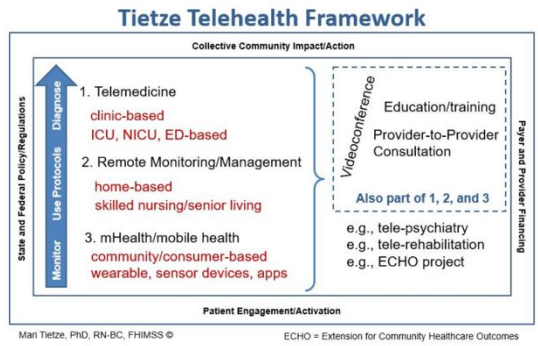
Zaccagnini, M. E., & White, K. W. (2017). *The doctor of nursing practice essentials* (Third edition. ed.). Jones & Bartlett Learning.

**Table 1**

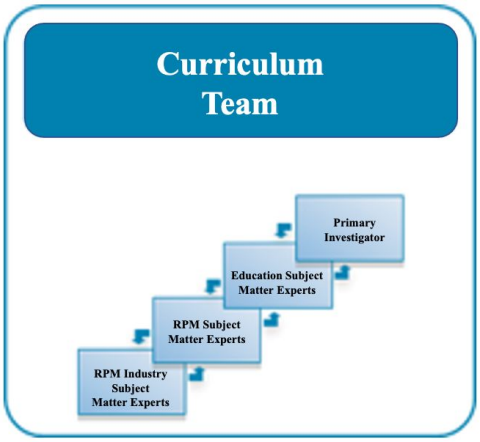
*Theoretical Frameworks*

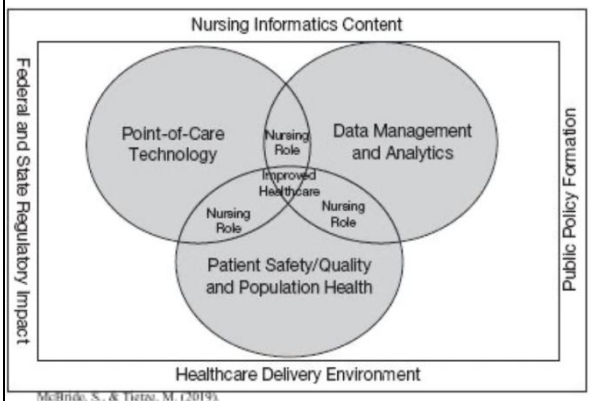
| Active Implementation Framework | Component Development | Curriculum Conten |
|---|---|---|
| Usable Innovations | Tietze Telehealth Framework | Bloom's Tax |
| Curriculum Team | NEHI Model | Crossing the Quality Cl |
| Stages | JHEBP | Evidence-based Lear (curriculum M |



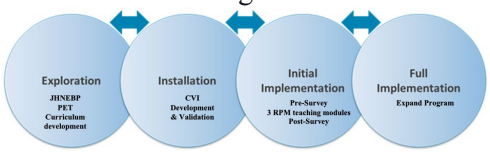



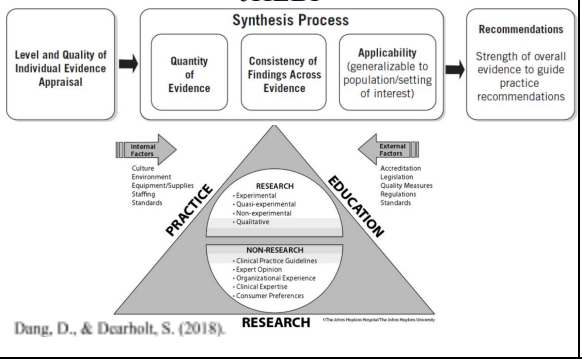


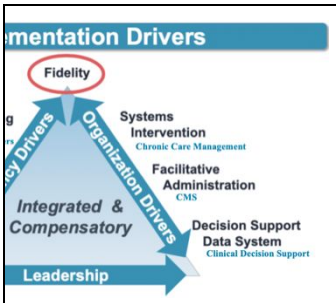




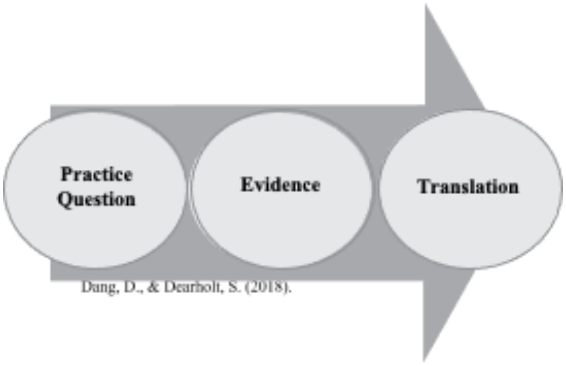



Implementation Drivers

PET




Dang, D., & Dearholt, S. (2018).

Three Teaching modules (d
clinical decision

| THREE LEVEL TR
SKILL DEVELO |
| --- |
| STUDENT LEARN OI
BSN/MS/DO
INFORMAT |
| STUDENT LEARN OI
BSN/MS/DO
APPLICATI |
| STUDENT LEARN OI
BSN/MS/DO
CLINICAL DECISIO |

A P

S D

**Table 3**

*Evidence Table*

**PICOT Question**: Is there a difference between the students' knowledge, experience, and attitude before and after being exposed to remote patient monitoring content in an online environment?

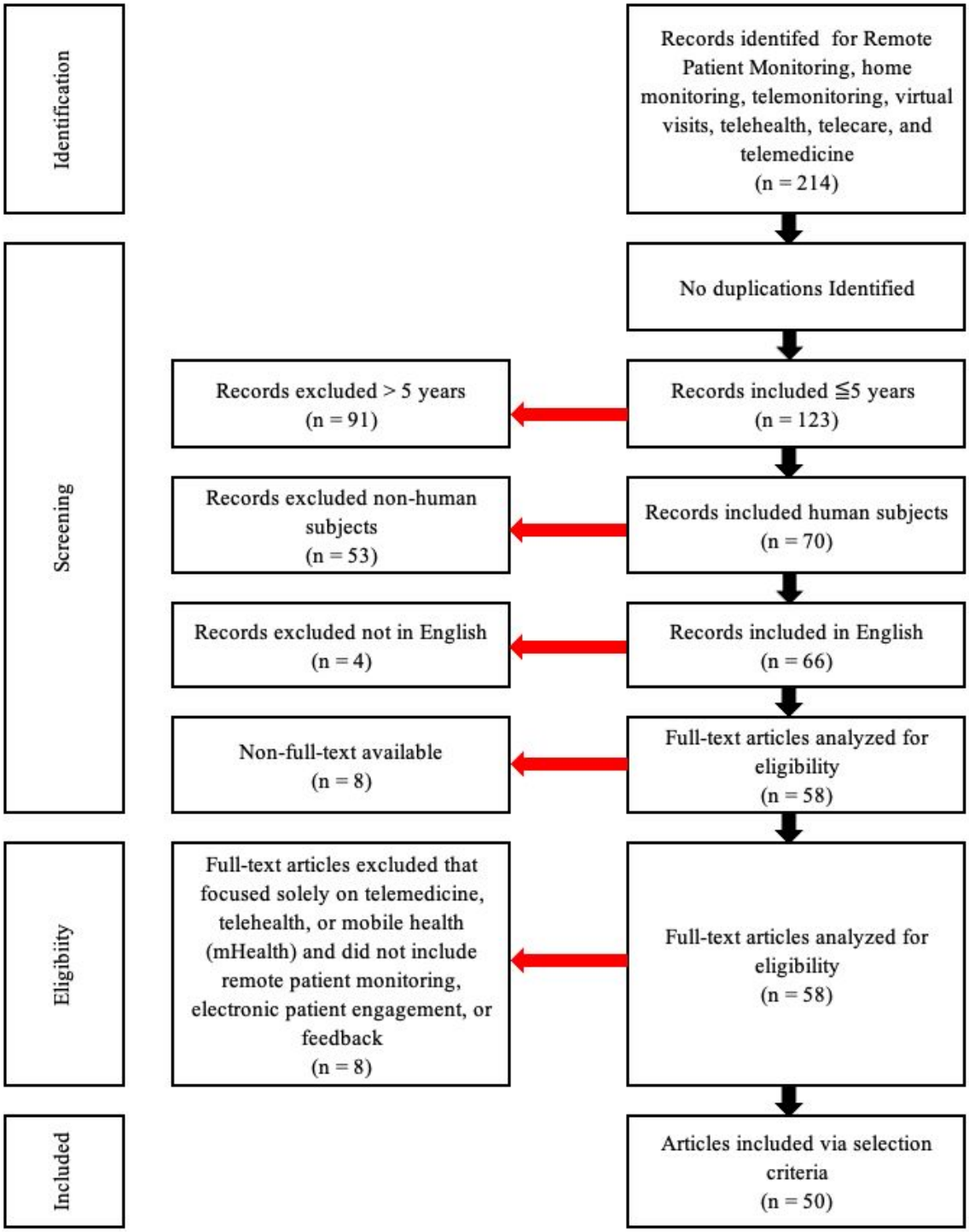
| Theme | Citation | Evidence Type | Findings That Help Answer the EBP Question | Evidence Level, Quality |
|---|---|---|---|---|
| Clinical Relevance | Flodgren, G., Rachas, A., Farmer, A. J., Inzitari, M., & Shepperd, S. (2015). Interactive telemedicine: effects on professional practice and health care outcomes. The Cochrane Database of Systematic Reviews, 2015(9), CD002098. | Cochrane Database of Systematic Reviews | Monitoring of a chronic condition to detect early signs of deterioration and prompt treatment and advice<br>Improved quality of life<br>Improve the control of blood glucose in those with diabetes. Lower glycated hemoglobin (HbA1C %)<br>Decrease in LDL<br>Improved blood pressure control in participants with hypertension<br>Improved symptom scores for those with a respiratory condition<br>Improving access to health care<br>Higher patient satisfaction with care<br>Providing training to both providers and patients in how to manage the equipment and the development of user-friendly systems may also improve implementation<br>Patients had better medication adherence and disease control<br>Potential to improve the equity, and accessibility of care, especially in areas where health care is less accessible, as often is the case in low- and middle-income countries<br>Provide access to diagnostic services | Level I<br>High Quality |
| Clinical Relevance | Inglis, S. C., Clark, R. A., Dierckx, R., Prieto-Merino, D., Cleland, J. G., & Inglis, S. C. (2015). Structured telephone support or non-invasive telemonitoring for patients with heart failure. Cochrane Database of Systematic Reviews, 2015(10), CD007228. | Cochrane Database of Systematic Reviews | Significant improvements in health-related quality of life.<br>Adherence to medication<br>Acceptance of the intervention<br>Cost-effectiveness<br>Decrease in costs<br>Significant improvements in heart failure knowledge and self-care behaviors<br>Reduce the risk of all-cause mortality and heart failure-related hospitalizations<br>Improvements in health-related quality of life<br>Participant satisfaction<br>Learn to use technology efficiently | Level I<br>High Quality |
| Clinical Relevance | Greenwood, D. A., Gee, P. M., Fatkin, K. J., & Peeples, M. (2017). A Systematic Review of Reviews Evaluating Technology-Enabled Diabetes Self-Management Education and Support. Journal of Diabetes Science and Technology, 11(5), 1015-1027. | A Systematic Review of Reviews | Improvement of Hbg A1c with technology diabetes self-management<br>Two-way communication<br>Self-management feedback loop with individualized feedback<br>Tailored education<br>Patient-centric approach | Level I<br>High Quality |

**PICOT Question**: Is there a difference between the students' knowledge, experience, and attitude before and after being exposed to remote patient monitoring content in an online environment?

| Theme | Citation | Evidence Type | Findings That Help Answer the EBP Question | Evidence Level, Quality |
|---|---|---|---|---|
| Chronic Condition Management | Center for Disease Control and Prevention<br>CDC.(2015). Health-Related Quality of Life (HRQOL) Data<br>CDC. (2017). Chronic Disease Overview | Grey literature: EBP Guidelines | Information on the population's age<br>The chronicity of the aged population<br>Quality of life<br>Chronic disease<br>Cost-Effectiveness Interventions | Level IV<br>High Quality |
| Chronic Condition Management | Centers for Medicare & Medicaid Services.<br>CMS. (2019). Medicare Beneficiaries at a Glance<br>CMS. (2017). Medicare Current Beneficiary Survey (MCBS)<br>CMS. (2017). National Health Expenditures 2017 Highlights<br>CMS. CCW. (2018). Medicare Chronic Condition Charts | Grey literature: EBP Guidelines | Care outside of regular office visits<br>Prevent their diseases from acute exacerbations<br>Prevent functional declines<br>Prevent decompensation<br>Prevent the risk of death.<br>Healthcare cost<br>Medicare services utilized | Level IV<br>High Quality |
| Healthcare Workforce Shortage | Association of American Medical Colleges. (2019). 2019 Update: The Complexities of Physician Supply and Demand: Projections from 2017 to 2032 | Grey literature | Physicians shortages & retirement<br>Full-time equivalents | Level IV<br>High Quality |
| Healthcare Workforce Shortage | Texas Department of State Health Services, DSHS. (2018). Texas Projections of Supply and Demand for Primary Care Physicians and Psychiatrists 2017-2030<br>DSHS. (2019). APRNs, 2019 | Grey literature | Texas - Physicians & Nurse practitioners shortages<br>Full-time equivalents | Level IV<br>High Quality |
| Healthcare Workforce Shortage | Texas Center for Nursing Workforce Studies, TCNWS. (2016). Nurse Supply and Demand Projections, 2015-2030<br>TCNWS & BON. (2018). Admissions, Enrollment, and Graduation Trends in Graduate Nursing Education Programs<br>TCNWS & BON. (2018). Faculty Demographics in Graduate Nursing Education Programs 2017 | Grey literature | Texas - Physicians & Nurse practitioners shortages<br>Faculty Shortages | Level IV<br>High Quality |

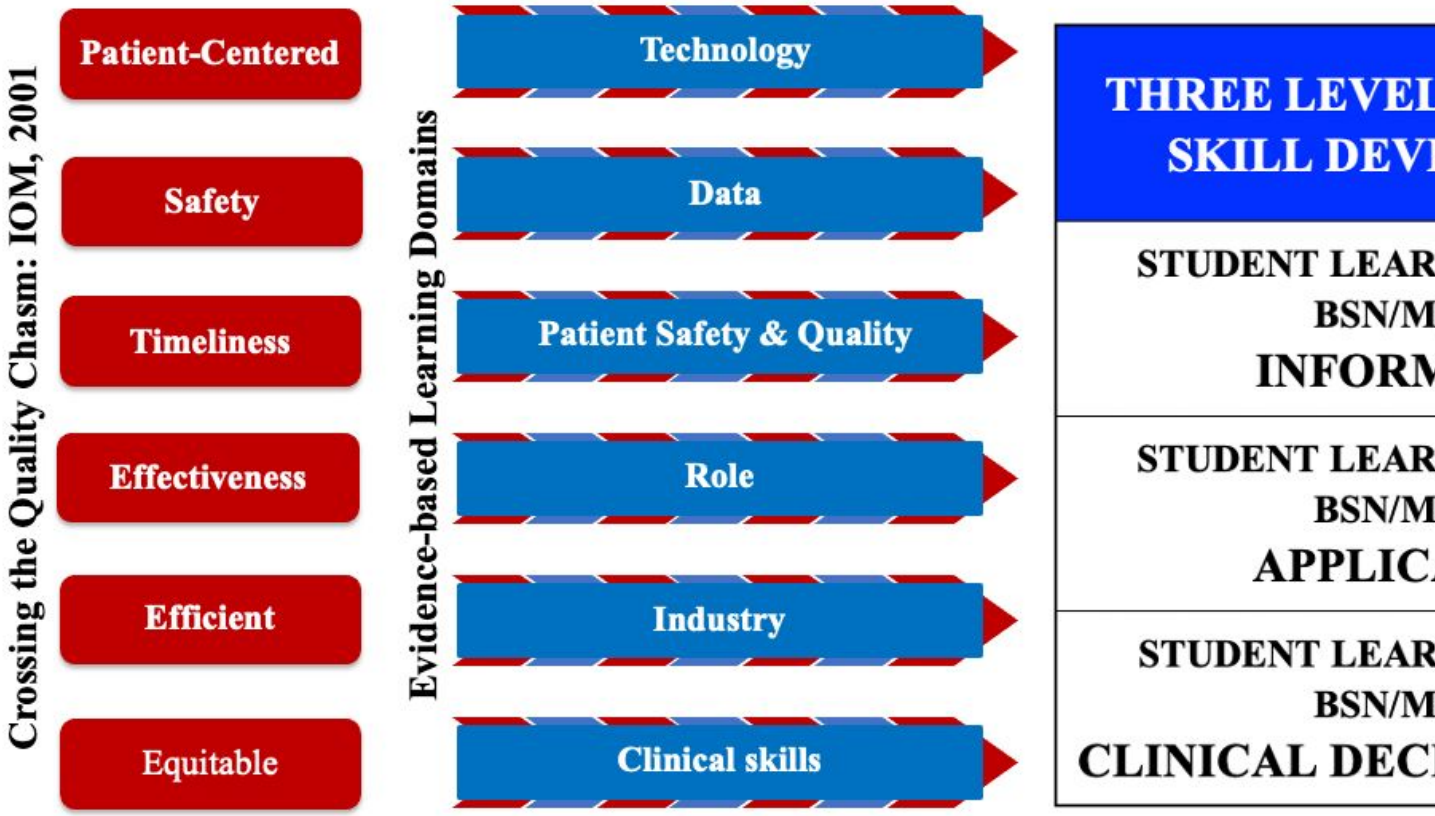
**Figure 1**

*Literature Diagram*



**Appendix A**

**Evidence-based Remote Patient Monitoring Curriculum Competencies Domains**




Institute of Medicine(IOM). (2001). Crossing the quality chasm: A new health system for the 21st century. Washington (DC) : National Academies Press (US): National Academies Press (US). Retrieved from http://search.ebscohost.com/login.aspx?direct=true&d

## Appendix B

## Quality Improvement Checklist

**TEXAS WOMAN'S UNIVERSITY**

**QUALITY IMPROVEMENT CHECKLIST**

**Date:** June 6, 2019

**Department:** College of Nursing

**Project Title:** Evidence-Based Practice Remote Patient Monitoring Curriculum Development: A Descriptive Pilot Project

**Project Leader Name:** Irene R. Wolf

| **Instructions:** Answer **YES** or **NO** to each of the following statements: | **YES** | **NO** |
|---|---|---|
| The purpose of the project is to: (mark which is true):<br>• improve the process or delivery of care with established /accepted quality standards<br>• improve performance on a specific service or program | ☒<br>☒ | ☐<br>☐ |
| The project is NOTdesigned to:<br>• develop or contribute to generalizable knowledge<br>• test the effectiveness of a new intervention on clinical quality | ☒<br>☒ | ☐<br>☐ |
| The project does NOT follow a research design (such as testing a hypothesis, randomization of patients, or group comparison). | ☒ | ☐ |
| The project is flexible to make on-going changes as needed to improve the process or delivery of care, activity or program, and is guided by data, actual experiences or clinical results. | ☒ | ☐ |
| The project does NOT follow a protocol that over-rides individualized clinical decision-making. | ☒ | ☐ |
| There is NO intention of using the data for research purposes. | ☒ | ☐ |
| The project is conducted by faculty, staff, and/or students who provide care or are responsible for performance quality at TWU. | ☒ | ☐ |
| The project involves as 'participants' TWU faculty, staff, students, or patients who are seen by them. | ☒ | ☐ |
| The project has NO funding from research-focused government agencies, sponsors or organizations, and is not receiving funding for the implementation research. | ☒ | ☐ |
| The project has **NOT** been approved by another institution's or agency's IRB as a research study and is not otherwise being conducted under IRB oversight. | ☒ | ☐ |

**ANSWER KEY:**

- If the answer to **ALL** of the questions is **YES**, the activity is likely a Quality Improvement/Measurement activity that does not meet the definition of research, and therefore may not require IRB review.
- If the answer to **ANY** of the questions is **NO**, the project likely *does* meet the definition of research and will likely require IRB review.

***For verification, submit your completed checklist to the IRB office with any supporting documentation (e.g. project outline/summary, data collection materials, grant/contract, etc.). If you are unsure of any information contained on this form, contact the IRB office:*** **81-3378 or** research@twu.edu.

**Appendix C**

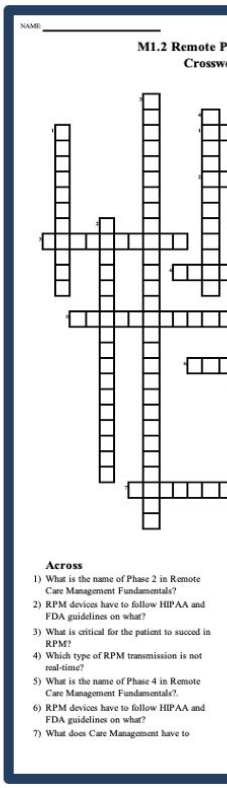
**Remote Patient Monitoring Curriculum Matrix**

| | Technology | Data* | Patient Safety & Quality | Role | Industry | Clinical skills |
|---|---|---|---|---|---|---|
| **SLO 1 BSN/MS/DOC INFORMATION** |  | | |  |  | |
| **SLO2 BSN/MS/DOC APPLICATIONS** |  | |  |  | | |
| **SLO3 BSN/MS/DOC CLINICAL DM** | | |  |  | |  |

- Each cell represents a PowerPoint of information, reading, and rubric-based performance evaluation (grade/sco
- = Data skill development was covered by Dr. Tietze later in the semester.

## Appendix D1

## Sample of Remote Patient Monitoring Curriculum – Information

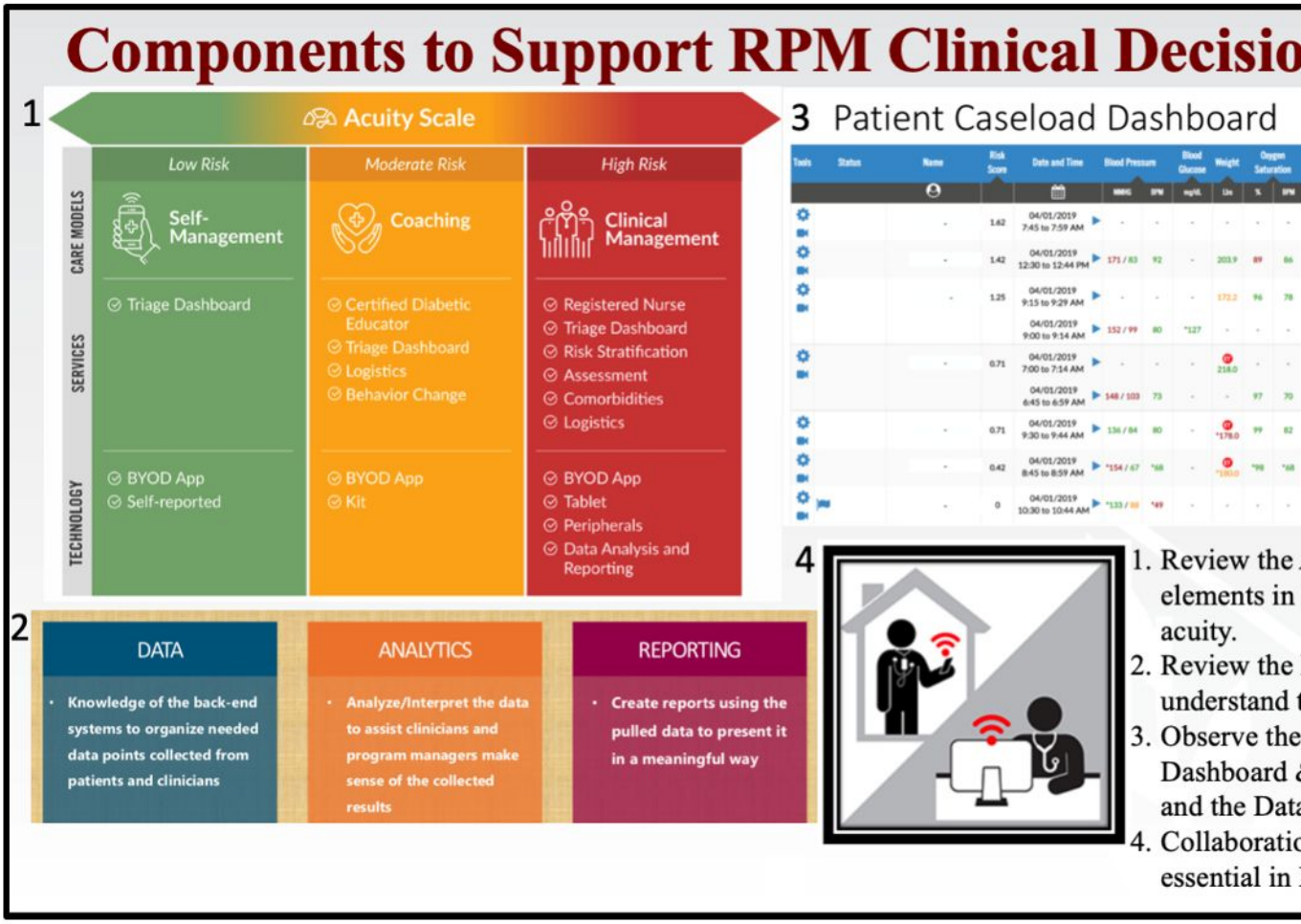



**Appendix D2**

**Sample of Remote Patient Monitoring Curriculum – Application**

**Appendix D3**

**Sample of Remote Patient Monitoring Curriculum – Clinical Decision Making**



## Appendix E

## Sample of the CVI of RPM for Technology Enhanced Health Promotion Course

TEXAS WOMAN'S UNIVERSITY

**Instructions:**

Read each of the following items, then for each item, consider the extent to which it may or may not apply to the concept described as the objective of the survey.

Using the 1 to 4 rating scale below, mark (select) in the column of the number that best reflects the relevance of each item to the above-named concept. The relevance score is the 1 – 4 scale is:

1 = Item does not measure concept

2 = Item measures concept but is not clearly stated

3 = Item needs minor revision for clarity

4 = Item measures concept and it is clearly stated

UK = Unknown/No opinion can be used when you cannot assess the relevance

If you believe that an item is not clearly stated or needs revision for clarity, please make your suggestions or changes on the form. Feel free to add any items that you think are missing.

There are two CVI sections for the topics that match the three levels of learning objectives for the content:

I. Self-assessment of RPM knowledge

II. Self-assessment of RPM skills and attitudes

### I. Self-Assessment of RPM Knowledge

Instructions to subject matter expert: The purpose of these questions is to measure knowledge gained toward Remote Patient Monitoring after a teaching module. Accordingly, please rate the relevancy of each item, in your opinion.

*1) S1Q01. What is Remote Patient Monitoring?

--Select-- ▼

- 1 Item does not measure concept [Value=1]
- 2 Item measures concept but is not clearly stated [Value=2]
- 3 Item needs minor revision for clarity [Value=3]
- 4 Item measures concept and it is clearly stated [Value=4]
- UK Unknown/No Opinion [Value=5]

### II. Self-Assessment of RPM Skills and Attitudes

Instructions to subject matter expert: The purpose of these questions is to measure skills and attitudes gained toward Remote Patient Monitoring after a teaching module. Accordingly, please rate the relevancy of each item, in your opinion

**Instructions to student:** Please comment on how you expect this material to integrate with your current or future studies, or career.

*41) S2Q01. Please comment on what SKILLS you have gained as a result of this Module

--Select-- ▼

- 1 Item does not measure concept [Value=1]
- 2 Item measures concept but is not clearly stated [Value=2]
- 3 Item needs minor revision for clarity [Value=3]
- 4 Item measures concept and it is clearly stated [Value=4]
- UK Unknown/No opinion [Value=5]