

HYPERTENSION TREATMENT ADHERENCE WITH 3-D MODELS

By

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### Dedication

I dedicate this paper to my parents, who loved and adored me as their only child; parents who ensured I had the best education possible, although neither would not live to see me accept this degree, I know they both loved me unconditionally.

### Abstract

Hypertension treatment adherence is a significant issue in the United States. Almost half of patients with diagnosed hypertension are non-adherent with medications and/or diet and appointment keeping with their provider. Hypertension is the largest contributing factor in cardiovascular morbidity and mortality in the United States. 3-D modeling has recently become available and is now used in the setting of patient teaching. 3-D models provide a more lifelike experience for the patient, allowing them to visualize organs, with or without pathology, to increase the patient's understanding of a clinical condition. The goal of this DNP project was to have providers utilize commercially available 3-D organ models in the clinic setting and augment their hypertension teaching to their patients using the models. The goal was to increase the patient's hypertension treatment adherence while giving the providers an additional teaching tool when explaining the effects of uncontrolled hypertension to their patients. Outcome of this DNP project showed encouraging results for the use of 3-D models in teaching long term hypertension effects and has potential to be utilized on a larger scale, due to its ease of implementation and cost effectiveness.

*Key words: 3-D models, hypertension adherence, patient teaching, organ models, visual teaching models.*

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## Chapter One: Introduction

Hypertension is the most important risk factor for cardiovascular disease. Medication non-adherence is the most significant contributor to uncontrolled hypertension (Rajpura & Nayak, 2014). Medication non-compliance is the leading cause of death among senior citizens in the United States (Rajpura & Nayak, 2014). Reasons for patients' medication and other treatment (such as sodium restriction and follow up appointments with their provider) non-compliance are complex and varied, and include cost, health perception and the misunderstanding about the importance of medication maintenance (Rajpura & Nayak, 2014). The purpose of this DNP project was to address one aspect of hypertension non-compliance: education. The purpose of this chapter is to (1) describe the treatment compliance among hypertensive patients, and (2) how this QI project can solve non-adherence using 3-D models in patient education.

**Background Information.** Medication adherence is defined by the World Health Organization as "the extent to which a person's behavior does not coincide with medical or health advice" (Rajpura & Nayak, 2014, p. 19). A generally accepted benchmark for medication adherence is an adherence rate of 80% or greater (North, DeJesus, & Katzelnick, 2014). Fifty percent of patients with chronic diseases are non-compliant with their medications (CDC, 2018a). This puts them at increased risk for cardiovascular events due to uncontrolled hypertension (Hedegaard et al., 2015). This quality improvement project aimed to develop a teaching tool using 3-D organ models that depict end-target organ damage in hypertension. Educating patients about adverse health effects of poorly controlled BP is likely to increase treatment adherence (Hedegaard et al., 2015).

**Significance of Clinical Problem.** Hypertension is a major cause of morbidity and mortality in the United States (CDC, 2018b). According to the CDC (2018b), 32% of adults in the United States have hypertension. Hypertension was a major identified cause of over 360,000 deaths in the U.S. in 2013 (CDC, 2018c). Approximately 50% of individuals diagnosed with hypertension do not have their blood pressure under control, and a major factor in this is the lack of medication compliance (CDC, 2018a). Non-adherence to hypertension medications causes a significant increase in ischemic heart disease, including cerebrovascular events, and cardiovascular disease (Kim et al., 2016). Up to 10% of hospital readmissions can be attributed to non-adherence to medications (Verloo, Chiolero, Kiszio, Kampel, & Santschi, 2017). Up to \$300 billion dollars in avoidable healthcare costs have been attributed to medication non-adherence, which represents up to 10% of the total cost of healthcare in the United States (Iuga & McGuire, 2014). A similar problem exists in Europe, where it is estimated that the equivalent of \$336 million U.S. dollars could be saved by increasing hypertensive medication adherence to 70% (Vrijens, Antoniou, Burnier, de la Sierra, & Volpe, 2017). Specifically, for cardiovascular disease in the United States, patients' adherence to medications were found to have 23% less healthcare cost per year per patient (Iuga & McGuire, 2014). In terms of specific risk factors for low adherence, patients with low adherence to hypertensive medications were found to have a higher risk of ischemic heart disease and cerebral vascular hemorrhage than patients who were adherent to their hypertensive medications (Kim et al., 2016).

### **Question Guiding Inquiry (PICO)**

**Population.** The population for this DNP project was defined as (1) an adult patient over the age of 18, (2) an established diagnosis of hypertension (defined as having a blood pressure

equal to or greater than 140/90mm/Hg) and (3) on at least one medication to control their hypertension.

**Intervention.** This DNP QI project used a specific patient education teaching tool with 3-D organ models to educate non-adherent patients about hypertension's long-term organ damage effects. Use of 3-D models was selected due to the multiple educational sensory experiences it provided; this gave a more realistic feeling and impact to the teaching. The Hill-Bone Compliance Scale was chosen to review the patient's adherence to medications as it is specific to medication adherence in the hypertensive patient within a clinic setting (Lam & Fresco, 2015).

**Comparison.** The comparison for the 3-D model DNP project was standard hypertension adherence education teaching. The clinic provider explained orally the importance of medication adherence, along with an oral description of end target organ damage due to effects of uncontrolled hypertension.

**Outcome.** The goal for this DNP project was to have an increase in treatment adherence for hypertensive medications through education using 3-D models by measuring treatment adherence before and after 3-D model teaching using the Hill-Bone Compliance Scale.

**Summary.** Treatment adherence is a serious problem that affects half of patients diagnosed with hypertension. A significant factor is patients' low health literacy about their condition (Ahn & Ham, 2016). Hypertension in its early stages is usually asymptomatic (CDC, 2018b). The patient feels well and may not comprehend the dangers with poorly controlled blood pressure. The goal of this QI project was to increase the treatment adherence of the targeted population through 3-D models and patient education. Novel use of 3-D models demonstrated a positive outcome explaining end target organ damage. Patient education within

this QI project effectively increased patients' adherence to hypertension treatment. Improved treatment adherence will likely decrease their risks for cardiovascular complications. These research report findings support the idea of this proposed QI project. Using 3-D models for patient teaching among hypertensive patients could improve patient understanding of their disease. Better understanding of hypertension medication may increase treatment adherence.

## **Chapter Two: Review of the Literature**

This chapter presents a literature review of the application of 3-D models in hypertension treatment adherence. This literature review will discuss best practice guidelines for blood pressure control, treatment adherence, and using 3-D models as a patient teaching tool. The main goals of the literature review were (1) to obtain literature that supported using 3-D models as a patient teaching tool, and (2) to describe how patient teaching impacted treatment adherence among hypertensive patients.

### **Methodology**

#### **Sampling strategies**

A search via ECU OneSearch, Medline and Pubmed for "patient education, hypertension, medication" and limiting to articles from 2013-2018 in English returned 3,464 articles. An additional search for peer reviewed "3-D, patient education, models medication adherence" from 2015-2018 returned 68 articles. Of those 68 articles, one was included. Another search was implemented using the search terms "3-D printing, patient education, models, tool, anatomy" within the years 2013-2018 which returned 144 peer review articles. Of those 144 articles, one was included. In terms of hypertension medication adherence, the search terms "medication adherence, hypertension, health literacy" from 2015-2018, limited to nursing discipline returned

112 articles. Of those, two were selected. A PubMed search of “medication adherence, cardiovascular mortality, hospitalization, antihypertensive medications” returned 39 articles, of which one was selected. Another PubMed search 2013-2018 for “assessing medication adherence options” returned 17 articles, of which one was included.

### **Evaluation Criteria**

Articles were evaluated by their direct relation to the QI project, if their conclusions substantiated if patient teaching improved hypertension medication adherence. Inclusion criteria for this project were studies incorporating (1) Use of 3-D models and benefits of patient teaching and educating (2) hypertension medication adherence studies, (3) enhanced provider interactions, and (4) improving health literacy studies. Studies were excluded if they did not incorporate patient education (focusing on provider 3-D education), studies that had limited subjects (one study excluded only had one subject), and studies where the teaching had no positive correlation to a change in health behavior. The studies chosen ranged from a Level III experimental study to a Level IV qualitative study.

## **Literature Review Findings**

### **3-D Models**

3-D models are an innovative way to facilitate patient education that has emerged in the last 20 years (Bernhard et al., 2016). Two studies that were included specifically evaluated using 3-D models to enhance patient education about disease processes. Biglino et al., (2015), discussed use of 3-D teaching with congenital heart disease patients and staff. The study found that having a participatory approach with developing a 3-D model for patient specific congenital disease was helpful for patients (including children) in understanding their specific cardiac

disease. (Bernhard, et al., 2016). Both studies concluded that using 3-D models for patient teaching on disease processes was a helpful and valuable addition (Bernhard, 2016; Biglino et al., 2015).

### **Medication Adherence**

Four articles (Ahn & Ham, 2016, Hedegaard et al., 2015, Kim et al., 2016, Verloo et al., 2017) focused on teaching patients about the importance of medication adherence to hypertensive medications. In one study, participants in the study (those patients identified as having a low health literacy or motivation, would benefit from interventions to promote health literacy (Ahn & Ham, 2016). Similarly, Hedegaard et al., (2015), found that pharmacists' teaching improved medication adherence among hypertensive patients. The rate of non-adherence in the intervention group was 20.3%, versus the control group non-adherent rate of 30.2% (Hedegaard et al., 2015). The third article reviewed found a step wise increasing association between improving medication adherence among hypertensive patients and better blood pressure and cardiovascular outcomes (Kim, et al., 2016). Good adherence was defined as taking medication as prescribed as equal to or greater than 80% of the time (Kim, et al., 2016). Conversely, poor hypertension medication adherence was associated with an 81% higher risk of cardiovascular events (Kim, et al., 2016). The fourth article encompassed a systematic review assessing medication adherence, reviewing 14 articles addressing nurse led interventions- with 9 of the 14 studies showing an increased medication compliance with nursing interventions (Verloo et al., 2017).

Before labeling a patient as “non-adherent” to medications, a working definition of “adherence” needed to be defined. Lehmann et al., (2013) defined medication adherence as taking medication 80% of the time or greater. However, the article also stated currently there is

no standard to define non-adherence, although 80% adherence is the generally accepted threshold since the Haynes studies in tuberculosis, published in 1976 (as cited in Lehmann et al., 2013).

### **Enhanced provider interactions**

Two articles described provider interaction with patients- in terms of how patient education was provided, and how variances between providers impacts health literacy and health outcomes (Hickman, Clochesy & Alaamri 2016; Shipman, Lake, Van Der Volgen & Doman 2016). Hickman et al., (2016) conducted a non-randomized study, which found that high quality patient education by providers had direct positive effect on blood pressure control. High quality education is defined by Hickman et al., (2016) as providers who are exposed to communication skills training along with interventions focused on communication skill building. Shipman et al., (2016) researched provider education delivery, which found a wide variability on patient education delivery between providers, the lack of standardized delivery of patient education impacted patient outcomes, patient satisfaction, and reimbursement rates (Shipman et al., 2016).

### **Improved Health Literacy**

A few articles (Ahn & Ham, 2016; Hickman et al., 2016) discussed how low health literacy affects medication adherence- and how increasing health literacy through teaching improves medication adherence. Studies that used 3-D models for patient teaching found enhanced patient understanding (Bernhard et al., 2016; Biglino et al., 2015). Bernhard et al. (2016) noted up to a 50% improvement in patient understanding after patient teaching of their kidney disease after using a 3-D model for explanation of the disease process. Biglino et al., 2015, found the 3-D models (for congenitive heart disease) were well-received, however, there

were limitations of participants' short-term knowledge regarding their disorder (Biglino et al., 2015). The tool used for this project is the Hill-Bone Compliance Scale. The Hill-Bone compliance scale was developed by nurse researchers at Johns Hopkins School of Nursing, and it uses a Likert scale to score participants' responses to medication compliance. Reliability and validity of the scale was evaluated by clinical trials and expert review ((Kim, Hill, Bone, & Levine, 2000).

### **Limitations of Literature Review Process**

This literature review was limited by the relative lack of 3-D patient education studies. There appeared to be a lack of available studies linking 3-D model and patient education in the hypertensive patient. However, there is evidence that supports enhanced patient education and improved patient treatment adherence. It may be possible to infer a positive relationship between 3-D models in patient teaching with desired patient outcomes. Additionally, some of the studies were Level V or VI descriptive studies, thereby lacking randomization and controls. However, even with these limitations, evidence suggests that 3-D models can be used in patient education to impact treatment adherence among hypertensive patients.

### **Discussion**

#### **Conclusion of findings**

The literature review conclusion indicates an association between patient education and increased medication adherence among hypertensive patients (Anh & Ham, 2016; Hedegaard, et al., 2015; Kim et al., 2016, Verloo et al., 2017). The use of 3-D models is a useful adjunct to patient education and is shown to improve patients' understanding of their disease processes, as shown in renal disease and cardiovascular disease (Bernhard et al., 2016; Biglino et al., 2016).



This quality improvement project purpose is to use 3-D models in patient education to improve treatment adherence in the hypertensive patient. If treatment adherence can be improved, the larger goal is that with improved blood pressure control, cardiovascular risk factors may be minimized, thereby reducing overall mortality. Uncontrolled hypertension is the leading risk factor for cardiovascular disease worldwide (Ikeda et al., 2014). Medication adherence of 80% or greater has been shown to decrease cardiovascular related hospitalizations by 33% and emergency department visits by 45% in one study (Kim et al., 2016).

### **Advantages and disadvantages of findings**

A distinct advantage of the findings in this literature review was the strong relationship of how focused, evidence-based patient teaching improves patient treatment adherence. Use of 3-D models in patient education improved patient understanding of their disease process. Another advantage of the literature review was the importance of defining treatment adherence, and what an acceptable threshold should potentially be. Variability of providers' education when compared to increased effectiveness of standardized education provision is also an important finding.

There are disadvantages to this literature review. As noted, there are no studies included linking 3-D model patient education specifically to hypertension treatment adherence. Additionally, although increased medication compliance was noted in general, in some instances the increased medication compliance did not result in better blood pressure control (Hedegaard, et al., 2015). Furthermore, only one study included was a level III experimental study involving whether improving medication adherence in hypertension was obtained by intervention (Hedegaard, et al., 2015).

**Utilization of findings in practice**

This QI project will utilize 3-D models for patient teaching to improve treatment adherence in the hypertensive patient. The literature reviewed and included supports the theory that utilizing 3-D models can improve patient understanding and subsequent, their health literacy. This will be implemented in a rural NC federally qualified healthcare center for adult patients (>18 years of age), with an established diagnosis of hypertension, and on at least one medication to control their hypertension. Patients with diagnosed hypertension will be surveyed using the Hill-Bone Compliance Scale, to determine their current behaviors in regard to their anti-hypertensive medications and treatment adherence. A standardized quality teaching will be conducted during the office visit, using 3-D models for visualization for the patient. The patient will be followed up with a phone call from the provider or investigator at a later date, to evaluate if the 3-D teaching proved helpful to them, and if the teaching positively impacted their hypertension treatment adherence, and subsequently increased their health literacy regarding their hypertension diagnosis.

**Summary**

In summary, this quality improvement project aims to improve hypertension adherence with the use of 3-D models and patient education. This goal, supported by current literature, is to decrease cardiovascular disease morbidity by increasing treatment adherence among hypertensive patients. Goal will be achieved by increasing their health literacy and knowledge about hypertension.

## **Chapter Three: Theory and Concept Model for Evidence-based Practice**

### **Concept Analysis and Definition of Terms**

For the purpose of this project, terms used in this paper will be defined as described:

**Hypertension:** CDC defines hypertension as a blood pressure reading of greater than 140/90mm/Hg (CDC, 2018b). The participants in this study will have had a formal diagnosis of hypertension in their record and be prescribed at least 1 anti-hypertensive medication.

**Medication non-adherence:** Defined as taking a prescribed medication less than 80% of the time (Lehmann et al., 2013).

**3-D Models:** A plastic replica of major human organs depicting (for this project) end target organ damage due to uncontrolled hypertension on various organs.

### **Theoretical Framework**

The theory used for this QI project was Leventhal's common-sense model of self-reflection (CSM). Leventhal's common-sense model was developed in the 1960's and explored further throughout the 1970's. The model has four tenets: (a) the health threat, (b) illness representation, (c) coping, and (d) appraisal (Sonney & Insel, 2016). The model has been used in a variety of chronic illness settings, such as asthma or diabetes or hypertension but is also applicable to more acute illnesses (Sonney & Insel, 2016).

**Health threat.** The health threat as defined by Leventhal is the stimulus for action or inaction. A health threat within this framework can be defined as acute or chronic (Sonney & Insel, 2016). The focus of this QI project is the chronic health threat that includes potential lifestyle changes. In this project, the condition, hypertension, is frequently asymptomatic and not necessarily perceived as a health threat by the patient.

**Illness representation.** The concept of illness representation within the CSM is composed of five ideas. These include (a) identity (b) timeline, (c) consequences, (d) cause, and (e) control. These ideas influence how an individual perceives and responds to the health threat (Sonney & Insel, 2016).

The definition of identity within the Leventhal's theory describes what the individual with the disease thinks their disease is. This may be different from the actual physiological disease process (Nguyen, 2014). The concept of timeline in Leventhal's model is the idea of how the individual conceptualizes the timeline of their illness. The importance of an individual's understanding of the chronic illness is instrumental in adhering to a plan of care and medication regime (Hemphill, Stephens, Rook, Franks & Salem, 2013). Leventhal's tenet of consequences as described by Snell, Hay-Smith, Surgenor & Siegert, (2013), relates how the individual perceives the consequences of their disease, and if they underestimate or minimize the consequences, they can be less likely to adhere to a plan of care to manage the disease

The definition of cause within this theoretical framework is defined as the individual's perceived mechanism of the illness's cause. The individual's perception of the cause (whether accurate or not) can influence thoughts on how to approach or not approach chronic care disease management (Nguyen, 2014). Within this theoretical framework, control is defined as the individual's perceived controllability over their disease state. This may influence adherence to medications, and their self-regulation of their disease (Achstetter, Schultz, Faller, & Schuler, 2016).

**Coping procedure or action plan.** A coping procedure or action plan is a self-regulated health behavior and a response to the health threat (Rouse et al., 2016). Coping procedure or action plans may be positive or negative, however, the goal is to encourage a positive coping procedure

to improve the health outcome in relation to the individual's chronic illness (Rouse et al., 2016). The central idea of a coping procedure is that the individual drives it and education by healthcare professionals is a facilitator (Rouse et al., 2016). An expected outcome of a successful coping procedure is the decrease in the health threat to the individual, and subsequent positive feedback to the individual further encourages adherence to the action plan (Rouse et al., 2016).

**Appraisal.** The concept of appraisal within the CSM pertains to the individual's review of how they self-managed the health threat. Perceptions of successful self-management of a disease process can change over time. The goal is to have a positive appraisal of the overall self-regulatory action in relation to one's disease management (Sonney & Insel, 2016).

**Application to practice change.** Leventhal's common-sense model is the chosen theoretical model for this QI project. The model was chosen because it focuses on the patient's perception of the health threat, which is the hypertension treatment plan of care. The idea of health threat to the participant in this project is an instrumental idea that the project worked to change/improve. The concept of identity within the Leventhal's framework in this QI project addressed with the individual as to what they thought their disease was, and then educated them on the actual physiological disease process. Similarly, the concept of the cause of the disease (or what the participants think is the cause of their disease) was addressed during the education sessions. The concept of timeline within the framework within this QI project was applied in the teaching portion of the QI project, (using 3-D models), so the participants could conceptualize the timeline of organ damage when hypertension is not controlled.

The individual's belief in consequences of their uncontrolled hypertension is an important theory of this project. If the participant underestimates the consequences of the disease, the common-sense model suggests the individual is less likely to be adherent to a

treatment regime. The goal is to improve the participant's understanding of the consequences of their chronic disease by education and follow up questionnaire to determine whether the teaching had an impact on their understanding of those disease consequences.

The individual's perceived control over their disease is an important tenet, and a central idea to this project. Individuals with perceived low control over their disease were noted to have worse health outcomes than those who felt they were in control of their disease (Achstetter, Schultz, Faller, & Schuler, 2016). Control was addressed during the intervention, as a goal was to increase adherence to hypertension plan of care through education. Participants' adherence to treatment would potentially improve with increased control of their disease.

The goal for this QI project is to have a positive action plan, in this case, an improvement in their adherence to their hypertension plan of care. The expected outcome is a decrease in the health threat to the participant (Rouse et al., 2016). Appraisal within the CSM model and this QI project was assessed upon telephone follow-up after the intervention. The goal of this QI project is to have a positive effect on hypertension treatment adherence with the 3-D model teaching intervention.

### **PDSA Change Theory**

The change theory used for this project was the plan, do, study, act (PDSA) cycle. This change theory was initially proposed by Deming in 1982, implemented in the industrial field and then later adapted to healthcare (Prybutok, 2018). PDSA cycles have been used around the world and in a wide variety of settings. One of its earliest implementations was focused on improving manufacturing processes in post-World War II Japan economy (Harolds, 2015), to more recent more implementation in rural African hospitals by establishing safer childbirth (Gass, Kivondo, Kara, Semrau, & Hirschhorn, 2017).

The first phase of the cycle is the *Plan* phase. In this phase, the question that needs answering or improvement needs to be defined (Morelli, 2016). Regarding this QI project, the question posed is: “Does 3-D model teaching improve hypertension treatment adherence?” The plan phase is also the planning of data collection phase- planning how the data will be collected to answer the proposed question (Morelli, 2016). For this QI project, the data collection will be in the form of the Hill-Bone hypertension adherence scale, an established Likert type questionnaire that measures participants’ adherence to hypertensive treatment (Kim, Hill, Bone, & Levine, 2000).

The second phase of the PDSA cycle is the *Do* phase. In this phase, the plan is carried out, and the data analysis is started (Morelli, 2016). This phase is where the change is implemented. Regarding this QI project the do phase consisted of the administration of the pre-teaching Hill-Bone survey, and implementation of the 3-D teaching by provider staff.

The third phase of the PDSA cycle is the *Study* phase. In this phase, the data was analyzed and compared (Morelli, 2016). Data in this QI project consisted of analyzing the Hill-Bone pre and post hypertension adherence questionnaire, comparing the data, and summarizing the findings of whether the 3-D model teaching positively impacted the participants’ treatment adherence.

The fourth phase of the PDSA cycle is the *Act* phase. In this phase, this QI project determined whether the change could be implemented (Morelli, 2016). This was accomplished in this QI project after analyzing the data, determining whether the education using the 3-D models was an effective intervention for improving treatment adherence for the hypertensive patient.

**Summary**

This QI project implemented the Leventhal's common-sense model theoretical framework, using it to define and understand the participants' thoughts of their chronic disease of hypertension. The framework was used to understand why participants may not be adherent to their hypertensive treatment plan, and whether an improved understanding of their condition (through the 3-D model education) improved their treatment adherence.

The PDSA change theory was used in this QI project to guide the practice implementation of using 3-D models to improve hypertension treatment adherence. Participants were given a Hill-Bone hypertension adherence survey before the teaching, the participants were taught about their hypertension using 3-D models by a trained provider, follow up was done two weeks after the education to determine if the participants felt the 3-D education had a positive impact on their hypertension treatment adherence. The goal for the teaching would be able to implement it in other practice settings, to positively impact the hypertension treatment adherence of patients.



## **Chapter 4**

### **Project Purpose**

The purpose of this project was to evaluate whether patient teaching using 3-D models improves hypertension treatment adherence in patients of a federally qualified healthcare clinic (FQHC) in North Carolina.

### **Organizational readiness for change**

This FQHC was ready for change. This FQHC is dependent on federal funding, and their clinical benchmarks are monitored, and reimbursement is based on their meeting certain clinical benchmarks. During a lengthy discussion with the clinic's manager, she stated this clinic was forced to return federal funding for not meeting clinical benchmark thresholds last year. (G. Lane, personal communication, January 25<sup>th</sup>, 2019). Therefore, as clinic manager, she was enthusiastic about a project that could potentially improve clinical outcomes. Additionally, this project leader worked previously in this clinic, and had a close relationship with its providers, and because of that close working relationship, they were open and amenable to trying this new patient teaching idea.

### **Inter-professional collaboration**

The project lead was the nurse practitioner that developed and orchestrated implementation of the project. The site champion was another nurse practitioner employed full-time at the site that agreed to help implement and evaluate the project as well as provide patient teaching on the 3-D models in absence of the project lead. Additional clinic providers were also participants in the project, teaching patients with the 3-D models. The RN clinic manager and support staff manager were available for any issues or questions during the planning, implementation, and evaluation of the project.

**Risk management assessment**

The strengths of this DNP project were ease and availability of teaching models, and simple instructions to providers to implement the teaching. The weaknesses of this project included additional allotted time for the provider to explain the disease process using the models. Opportunities included improvement in current adherence to hypertension treatment, and additional tools for patient education and explanation of hypertension effects. Threats included potential patient resistance to teaching, provider consistency in teaching, and lack of impact on patient's adherence to hypertension treatment. Provider consistency was addressed by having providers use a script for the teaching, and patient resistance to teaching was accomplished by thoroughly explaining the purpose of the project.

**Organizational approval process**

Organizational approval process was straightforward with this DNP project. Leaders of this FQHC were on board quickly as similar teaching models had been implemented in the past by this provider with positive results. The director of the clinics was previously at this targeted site as a manager and was familiar with the teaching with 3-D models, and therefore was agreeable to the project. This FQHC was amenable to the project as they were vested in improving their federal clinical benchmarks. This FQHC also had a current written agreement with East Carolina University, further ensuring a smooth approval process for the project.

**Information technology**

Information technology for this project and data collection tool was the Hill-Bone hypertension adherence scale (Kim, Hill, Bone, & Levine, 2000). Data from the Hill-Bone scale and one question regarding education level of the patient were collected and answers synthesized into a result spreadsheet. Additionally, non-identifying demographic data (age, gender, and race) were collected using the clinic's electronic medical record, and also coded into the results spreadsheet.

**Cost Analysis of Material Needed for Project**

The cost of the 3-D models was \$132.00 per set, available from an online vendor (A. Perkins, personal communication, September 11, 2017). One set was purchased. Other quantifiable costs included printing/copying supplies total of \$100.00. No paid time off was needed by staff for this project (Appendix B).

**Plan for Institutional Review Board Approval**

This site did not require IRB approval. The project was reviewed by East Carolina's IRB and determined to be quality improvement and not human subject research (Appendix B) and did not require further IRB approval.

**Plan for Project Evaluation**

The demographics collected for this project were age, race, gender, and level of education. Age was reported with a range, and a mean age of all participants was reported. Education was reported with a range, race and gender were reported descriptively (Appendix D).

**Outcome measurement**

The outcome measurement for this DNP project was the use of the 3-D models by providers, and a secondary measurement was to increase treatment adherence for patients with an established diagnosis of hypertension. Clinic providers taught patients about the hazards of long-term uncontrolled hypertension, using 3-D models of organs with the resultant end target organ damage, and this novel teaching method facilitated an increased understanding of the patients' disease process, and subsequent increased hypertension treatment adherence.

**Evaluation**

The evaluation tool chosen for this project was the Hill-Bone hypertension adherence scale (Kim, Hill, Bone, & Levine, 2000). The provider doing the teaching administered the scale both pre-teaching and post teaching. The survey was provided in written format, unless the patient was not literate, in which case the questions were read aloud to them by the provider. Questions were focused on limitations of salt intake, timely appointments with their provider, and accurate medication adherence (Appendix D).

**Data analysis**

The analysis plan for this DNP project was to follow up with the patients approximately two weeks after the intervention with the 3-D teaching. At the time of the follow up, the patients were contacted by phone and a repeat Hill-Bone Blood Pressure Therapy Scale was administered verbally during the phone call. A high total score on the Hill-Bone Therapy Scale is correlated with high hypertension treatment adherence and subsequent controlled blood pressure (Kim, Hill, Bone, & Levine, 2000). The Hill Bone Therapy Score pre and post implementation were compared for each patient who participated. The goal for this project was

to see an increase in the total score of the Hill-Bone Therapy Scale after the 3-D intervention teaching, and therefore an improvement in hypertension treatment adherence.

### **Data management**

Completed surveys were secured in a designated locked office. Surveys were further coded for anonymity and stored on ECU's Pirate drive per institutional guidelines. Original surveys were then shredded onsite. The site champion had access to the clinic's electronic medical record to access patient data needed for the project. Final data from the surveys were presented in a table and bar chart.

### **Summary**

Although this federally qualified health clinic's management was motivated for change, the staff was somewhat less motivated. Management was motivated to increase their hypertensive patients' adherence as they were under financial incentive by the federal government to do so. However, the clinic providers were concerned about the additional potential workload and were more reluctant to implement the teaching, although most patients who were approached about the teaching were agreeable and receptive. There were minimal risks to the project, and staff stated after the project that it was not difficult to implement, despite the initial resistance. Cost for the project and additional time needed for the 3-D teaching were reasonable per participant feedback. The Hill-Bone adherence tool was a simple, Likert scale tool that was easily completed by the patients. In summary, this 3-D project although met with some resistance, was easily implemented, did not cost the provider any additional time, and was well received by the patient, as a means for supplemental hypertension teaching.

## **Chapter Five: Implementation Process**

### **Setting**

The setting for this DNP project was a federally qualified health care center (FQHC). This FQHC has 14 different clinics in north east North Carolina, and a patient population of 30,000. This is a federally funded clinic, in a designated provider shortage area (Health Resources and Service Administration, 2019). The specific clinic chosen for this project was one of the FQHC's high volume clinics, with a daily staff of three to four providers and approximately 20 ancillary staff members.

### **Participants**

Participants for this project were the providers in the clinic. During the education portion of the project, the providers were instructed on which patients would be appropriate for this intervention. For this intervention, patients had to be > 18 years of age, mentally capable to consent for themselves with an established diagnosis of hypertension and prescribed at least one anti-hypertension medication. Patients did not have to be literate to be included. Non-English-speaking patients were excluded, as a translator would have to be located, and the participants felt it would be too time consumptive. Patients with a new diagnosis of hypertension were also excluded from this study, as the survey tool was geared for the established hypertension patient.

### **Recruitment**

Participants for this project were identified and recruited by the project lead. All providers were approached about inclusion in the project, one decided to not participate due to work performance issues, and another provider did not participate due to a very high patient volume and a hearing impairment, so the clinic manager felt it would best to not include him.

Therefore, the participants were one nurse practitioner, and one nurse who explained the process to the patients and administered the Hill-Bone survey.

### **Implementation Process**

The implementation was started by approaching the site about allowing the project. After approval was obtained, the site champion and clinic nurse practitioner were identified and recruited. The clinic RN manager was then met with, and the project discussed and planned out. Frontline staff were also recruited, as the clinic manager wanted them involved in the process. A script was provided to the staff to follow. The first patient was identified, and the project lead implemented the project with the first patient, with the site champion and nursing staff present to observe the process.

The patient was first given the Hill-Bone survey (Attachment D) to complete either written or orally, as a baseline measurement of their hypertension treatment adherence, with an addendum question regarding education level at the bottom of the survey. After the survey was complete, teaching with the 3-D models was started using the written script as a guide by the provider (Appendix E). Patients were asked about their general knowledge of what the long-term effects of uncontrolled hypertension were on their body, specifically the long-term damage on their organs that are usually affected by uncontrolled hypertension. After this discussion, the provider asked the patient base knowledge questions regarding long-term effects of hypertension (to determine the basic health literacy of the patient), and explained (using the 3-D models) the long-term damage done to organs when hypertension is not controlled.

Patients were shown a 3-D model normal sized heart, and then a 3-D enlarged heart, and discussed how uncontrolled hypertension weakens and enlarges the heart over time. They were shown a 3-D model of an eye, and the damage uncontrolled hypertension does to the vessels in

the eye, leading to vision impairment. They were shown a model of the human brain, with a section impaired by a clot (illustrating a cerebral vascular accident) which is also a complication of uncontrolled hypertension. Then they were shown a kidney, and an explanation of how uncontrolled hypertension affects the kidney, by compromising the filtration. Patients could handle the models and ask any further questions they might have. At the end of the teaching, it was reiterated to the patient the importance of adhering to their hypertension treatment plan from their provider. After the teaching, the patient was called by the provider a few weeks later and the Hill-Bone survey was asked again over the phone. Answers from the Hill-Bone survey administered prior to the teaching and after the teaching were compared to evaluate if the 3-D teaching improved the patient's hypertension treatment adherence.

### **Variations**

There were variations in this DNP project. Initially the plan was to have the project leader and all clinic providers implement the 3-D teaching. However, this was changed for a few reasons. One provider proved to have a severe hearing impairment and an extremely heavy daily patient load, so the clinic manager deemed it not appropriate to have him participate in the project. Another provider was going to participate in the project, however, she was overwhelmed with her patient load, so it was deemed inappropriate for her to participate. Therefore, one staff member and one nurse practitioner participated in the project implementation. Another variation that occurred was the clinic manager who had helped plan out the project and support it since the beginning, had a medical issue in the middle of the implementation and was unable to be on site during the latter half of the project implementation.



**Summary**

As stated, the goal for this project was to improve patients' hypertension treatment adherence by teaching the long-term effects of uncontrolled hypertension, using 3-D organ models that depicted pathophysiological changes that occurred with uncontrolled hypertension in certain organs. Patients were recruited and recommended by their provider, and had an established diagnosis of hypertension, prescribed at least one anti-hypertensive medication. The Hill-Bone treatment adherence survey was administered before and after the teaching to assess if the 3-D teaching improved treatment adherence.

**Chapter Six: Evaluation of the Practice Change Initiative**

Clinic patients over the age of 18 with an established diagnosis of hypertension were approached to participate in the project. Patients did not have to be at a specific hypertension follow up appointment to be included. Patients who were adherent to their hypertension treatment plan were included, along with those who were non-adherent. One nurse practitioner and one staff member were participants, providing the 3-D organ model teaching to patients.

Sixteen patients were included in the project, completed the Hill-Bone survey pre-teaching, and received the 3-D teaching. Six of the sixteen patients were able to be contacted for a follow up Hill-Bone survey to compare pre and post teaching responses. Evaluation of the project's outcomes and findings are discussed below.

**Participant Demographics**

Participant demographics consisted of a female nurse practitioner with 30+ years of experience and an LPN with 5 years of experience. Sixteen patients participated in the project. Patient demographics included 7 male patients, and 9 female patients. Eight patients identified as Caucasian, 7 identified as African American, and one patient identified as Native American.

Patients' ages ranged from 38-77, with a mean age of 60.36. In terms of highest level of education attained of patients who participated, one patient identified as having a grade school education, one patient identified as having some high school education, nine identified as being a high school graduate, and five identified as having some college education.

### **Outcomes**

Short term outcomes for this DNP project were to introduce a new way for providers to teach patients about the long-term effects of uncontrolled hypertension; and for patients to experience hands on models that they could visualize and examine. The goal would be to give both the provider and the patient an extra tool to explain the long-term effects of uncontrolled hypertension. Intermediate outcomes were to have providers begin to change their way of teaching hypertension effects to patients, and for patients to begin to contemplate increased adherence to their hypertension treatment plan. Long term outcomes for this project are to (1) have providers change the way they approach patient education by implementing teaching using the 3-D organ models, and (2) have patients improve their adherence to their hypertension treatment, the subsequent goal is that the patient's treatment adherence improves, decreasing their risk of cardiovascular morbidity and mortality.

### **Findings**

Sixteen patients participated in the project with one provider and one licensed practical nurse as facilitators. All sixteen patients had an established diagnosis of hypertension and were on at least one anti-hypertension medication. All completed the Hill-Bone pre-intervention survey and then received the 3-D teaching from the provider. All had an opportunity to ask questions after the teaching. Seven out of sixteen patients were able to be contacted for follow

up post-intervention and completed the Hill-Bone survey over the phone with the project leader. Eleven out of sixteen patients report good adherence to hypertensive medications pre-intervention. Post teaching, two of the seven patients post-follow up Hill Bone survey reported an increase in medication adherence, which they commented was directly related to their increased understanding of hypertension effects after the 3-D teaching.

In terms of dietary adherence (consuming fast food, adding salt, or eating salty foods) pre-teaching, fifteen out of sixteen patients stated they were non-adherent with diet at least some of the time. Post teaching, two of the seven patients who were able to be contacted noted an increase adherence to dietary restrictions, an adherence they verbally attributed to an increased understanding of hypertension, after the 3-D teaching.

Interestingly, there was no change in the adherence in the group in their appointment keeping habits. Three of the sixteen patients noted missing appointments at least some of the time, and there was no change in this for those who were able to be contacted post-intervention. Patients who were contacted stated that the clinic makes their appointments for them before they check out at a current appointment, and the clinic has an established system in place for telephone reminders, and electronic reminders for future appointment times.

### **Summary**

In summary, 68% of patients' pre-intervention had a good adherence to medications. Post-intervention, 7 patients were contacted, of which, 2 reported an increase in adherence, which represented an adherence increase of 29%, of the 7 patients contacted. In terms of dietary indiscretions, 87% of the patients reported non-adherence to excessive sodium intake and/or poor dietary choices pre-intervention, but post intervention, of the 7 patients contacted, the same two patients (29%) reported an increased adherence to diet. There was no change in appointment

keeping pre or post intervention, with 81% of patients' adherent with appointment keeping for follow up for hypertension.

This DNP project had positive effects on patients' hypertension treatment adherence. 43% of patients were able to be contacted for a post intervention Hill-Bone follow up survey. Positive effects were seen in both medication adherence, and dietary adherence, but no difference was seen in patients' appointment keeping post-intervention. Feedback from the practitioner and staff noted the teaching added minimal workload, which they felt was an important consideration due to a high patient volume. The practitioner commented she felt the models could have been more life-like, and to scale of real organs, however, they were easy to use and explain to the patient, and the recording system was also easy to use. Patient follow up survey results was 43%, additionally, the staff noted it is not unusual to have difficulty contacting patients of this clinic for follow up, as many are transient, homeless, or do not have phone access in this low income, rural area. Patients during the follow up survey call made some additional comments that the 3-D teaching made a significant difference-they stated they were able to relate the 3-D models to family members who developed complications from hypertension, and this along with the teaching inspired them to adhere to their treatment plan, as they did not want to develop similar medical issues.

### **Chapter Seven: Implications for Nursing Practice**

This chapter focuses on this project's implications for nursing practice and how this project meets the American Association of Colleges of Nursing's (AACN's) essentials for nursing scholarship. Eight essentials will be defined and explained how this DNP project fulfills each core element.

**Essential I: Scientific Underpinning for Practice**

This DNP project met this AACN essential by furthering the education of patients regarding the pathophysiology of hypertension. It used colored, 3-D models with pathological changes within the organs, so the patients can feel, and see the changes in their organs that occur if their hypertension is untreated long term. Literature review for this project showed favorable evidence suggesting using novel 3-D models with patient teaching had a more favorable outcome for patient's comprehension regarding their condition. Additional literature review also suggests that high quality patient education by providers had favorable clinical outcomes for patients, which supports the scientific underpinning for practice.

Nursing can be advanced through this project using 3-D organ models, to help patients understand the implications of their disease process, and to teach patients potential negative consequences of non-adherence to a treatment plan, using current evidence, and using critical analysis to develop a treatment plan. The literature review for this project focused on evidence for 3-D model teaching outcomes, medication adherence, enhanced provider interactions, and improved health literacy. The studies reviewed supported this project's quality improvement goal of implementing 3-D models with patient teaching by providers to potentially improve patients' hypertension treatment adherence.

**Essential II: Organization and Systems Leadership**

This DNP project met the AACN's Essential II by successfully implementing a quality improvement project within a busy, FQHC clinic. The project lead worked with senior administrative staff, and local clinic staff to approve and implement the project. This project identified a need in the local FQHC clinic to improve their patient's hypertension adherence, and providers implemented the teaching using 3-D models, explaining to patients the effects of

uncontrolled hypertension. The intervention was cost effective, using affordable, commercially available 3-D models for patient teaching, and was sensitive to cultural and educational differences by utilizing a teaching method that was based on a visual method that has been shown in the literature to have promising results for patient understanding of their clinical conditions.

### **Essential III: Clinical Scholarship and Analytical Methods for Evidence Based Practice**

Literature review and critical analysis for this DNP project was done on 3-D models and teaching, medication adherence, treatment adherence and patient teaching, and Leventhal's theoretical framework. The research completed was favorable to implementing this DNP project in different ways. Primarily, the literature reviewed regarding using 3-D models during patient teaching showed an improvement in patients' understanding regarding their condition, versus not using 3-D models. Further literature review regarding enhanced provider interactions, high-quality patient education, and increased health literacy were also shown to have a favorable effect on patients' clinical conditions. The knowledge gained from research review was applied to the DNP project that ensured a favorable outcome which could be further sustained in the clinic.

### **Essential IV: Information Systems**

Information systems were used in this DNP project to gather data regarding statistics related to the rates of hypertension in this clinic, and the county and state level. This information was used to determine the need for the project at the local level. An established survey tool (Hill-Bone hypertension tool) was used to gather data, both pre and post teaching. Demographic data was gathered using the clinic's EMR, along with hypertension diagnoses. Pre and post teaching changes were analyzed manually and reported in statistical reference.

**Essential V: Healthcare Policy for Advocacy in Healthcare**

Healthcare policy related to this DNP project was closely examined. This FQHC clinic falls under the federal Health Resources and Services Administration (HRSA, 2019). This clinic is obligated per HRSA policy to keep their patient's blood pressure under 140/90mm/Hg. It was noted during research for this project that the HRSA is using older Joint National Commission (JNC 7) guidelines, not the more current JNC 8 hypertension guidelines. Using incorrect guidelines could negatively impact this clinic's adherence to the HRSA standards (HRSA, 2019). It was also noted this clinic did not have any local policies regarding the need for patients' blood pressure control.

**Essential VI: Interprofessional Collaboration**

This DNP project used interprofessional collaboration from input during project development and implementation from different professions. Feedback and advice was obtained from the sales representatives for the 3-D models. The clinical operational director over this company's clinics was consulted for advice and feedback obtained regarding the needs of this clinic. The local clinic's director was consulted and provided valuable feedback regarding how the project should be implemented. Licensed clinical nursing staff explained the process to the patient and obtained the pre-intervention survey. The licensed provider implemented the teaching with the patient, and the project leader followed up with a post-teaching survey on the phone. People from different disciplines were critical in the successful outcome of this project to provide a project with a patient centered care focus.

**Essential VII: Clinical Prevention and Population Health**

This DNP project directly addressed clinical prevention of cardiovascular morbidity and mortality through the implementation of 3-D model teaching. It addressed hypertension treatment adherence in a federally qualified healthcare clinic. A Healthy People 2020 goal is to reduce the number of adults with hypertension in the United States (U.S. Department of Health and Human Services, Office of Disease Prevention and Promotion, ODPHP, 2019). The goal of this DNP project is to decrease uncontrolled hypertension in patients, by implementing additional novel teaching methods.

**Essential VIII: Advanced Nursing Practice**

This DNP project addresses the AACN's advanced nursing practice competency by instituting a novel way of advanced clinicians and licensed staff to teach patients about their hypertension. Nurses are teachers, and throughout the years they have developed new and innovative ways of improving patient care. They are the caregivers and healers. This DNP project encompassed advanced nursing practice by taking the skills already developed by licensed nurses and advanced practice nurses, and gave them an additional tool for teaching, to improve their patients' health outcomes.

**Summary**

This DNP project had providers and licensed clinical staff interact and teach patients about their hypertension using novel 3-D models. This project encompassed all eight AACN DNP core essentials. The goal of this project was to give clinical staff and providers an additional tool to teach patients, a visual aid that patients could see and feel, so they would increase treatment adherence. This project had a multidisciplinary approach, and people from disciplines outside of nursing had valuable input. Policies were evaluated and used as a



guideline for the project. It is the goal of this project that providers and staff will sustain this project, and patients will benefit from the 3-D teaching and become more adherent with their treatment plan.

## **Chapter Eight: Final Conclusions**

This chapter will discuss the outcomes and clinical significance of the project, and a discussion of findings, lessons learned, strengths and weaknesses, limitation, and the impact this project had on its patients and participants. There will also be a discussion of how the use of 3-D models in hypertension patient teaching could translate to other settings and populations. The project benefits will be discussed along with cost savings, process changes for efficiency and then finally project recommendations, including the recommendations for future practice change.

### **Significance of Findings**

The outcomes of this project showed promising results by introducing a novel approach to patient hypertension teaching for a provider, and for patients to be able to visualize long-term uncontrolled hypertension organ damage, by being able to see and feel pathologically correct organ models. However, there were many lessons learned along the way. Although the administration of the clinic was interested in improving their patients' hypertension adherence, the staff and providers were concerned about additional time needed for the project, including identifying and logging the patients, the actual teaching, administering the survey, and following up with the patient at a later point. Some of the staff and provider fears were reduced by explaining that the teaching should not take any additional time, as they were already doing hypertension teaching during the office visit. The patient's information needed to be logged, and the Hill-Bone survey administered, but all patients were able to read the survey and did not require a staff member to read the survey to them, therefore additional time was noted to be minimal.

A drawback of the project was that the patients included were those with an established hypertension diagnosis. However, their chief complaint on the day of the project implementation

may not have been for a hypertension follow-up, therefore, it made the teaching somewhat more awkward as some patients were being seen for an unrelated issue (such as an acute illness) and may not have been as receptive to the teaching as if they were being seen for their hypertension. Additionally, it may have been more helpful if patients who were identified by the provider as non-adherent be included, as one goal for the project was to increase adherence, and some patients who were included were already adherent with their hypertension treatment plan, therefore, those patients who were contacted later did not have a significant change in their behavior on their post Hill-Bone survey.

The organization impacted was a federally qualified healthcare clinic (FQHC) in rural northeast North Carolina. Of all patients in this FQHC's total patient population, 50% had a diagnosis of hypertension (a total of 16,141 patients), and of those patients, 62% had their hypertension under control. Conversely, of the 16,141 patients in this FQHC with hypertension, 38% (6,134 patients) did not have their hypertension under control (U.S Department of Health and Human Services, [HRSA] 2019a). This clinic and its providers and staff were introduced to a novel way to teach patients about the effects of hypertension. This impacted their way of educating patients, and the patients themselves were impacted by learning additional information about their disease process. This process would be easily implemented in other practice settings, as it is not specific to a clinic, does not utilize a specific EMR, and is based on Healthy People 2020 goal of hypertension control U.S. Department of Health and Human Services, Health Resources and Services Administration [HRSA], 2019b).

### **Project Strengths & Weaknesses**

This DNP project was simple to implement. Patients were identified by their hypertension diagnosis and age over 18. The Hill-Bone survey was a simple Likert scale, and

none of the patients reported difficulty understanding or completing the questions. The models were also easy to use, easily obtained, inexpensive, and all major organ systems were represented. Another strength of this project was as previously indicated, it was not specific to a clinic, or to an EMR, therefore able to be implemented in a wide variety of settings. Use of the models are also able to be utilized for additional teaching for other diagnosis (such as the effects of uncontrolled diabetes).

Weaknesses of this project included that although all patients who participated in the project had a diagnosis of hypertension, some were already adherent to their treatment plan, and some were not being seen for a follow up for their hypertension, which made the teaching somewhat more awkward, as it was not the reason for the visit. Other potential weakness of the project was the provider stated she would have preferred a more lifelike model (3-D models used were scaled smaller than an actual organ). However, patients did not verbalize this, and seemed to appreciate the models as presented.

### **Project Limitations**

Limitations of this project included having a short amount of time to implement and evaluate the project (eleven weeks) and only one provider participated in the project, instead of the expected 3-4 providers as originally planned. Other limitations were time constraints of an extremely busy clinic, and provider perception of the need for extra time to complete the teaching, although this was overcome by the end of the project, with the participants realizing the teaching did not take any additional time to implement, and in fact was as efficient as standard hypertension patient teaching.

### **Project Benefits**

Benefits of this DNP project were many. Staff learned a new way to explain the effects of uncontrolled hypertension to patients, and patients learned through the 3-D models a realistic representation of potential organ damage if their hypertension was not controlled. The project was easy to implement, and applicable to a wide range of healthcare settings. It is also applicable to different ethnic groups and cultures. The Hill-Bone survey has been used in different cultures and has been translated to different languages with success (Nashilongo et al., 2017)

This project can be implemented in many settings, and to a wide range of patients and providers. If done correctly, it can be implemented with minimal additional (or no) time allotments in a busy clinic schedule. This project could potentially save time in the long run if patients are able to make lifestyle changes and have improved adherence to their hypertension treatment plan, less time will be needed for education and counseling for the non-adherent patient.

This DNP project has the potential for significant cost savings. As discussed, the models are available for a cost of \$132.00 per set, and can be used indefinitely, and shared among providers and staff members if needed. Uncontrolled hypertension has a devastating financial effect, from the individual patient level, to the national level. Approximately half of 64 million Americans with hypertension do not have their blood pressure controlled. Hypertension is the number one contributing cause of cardiovascular deaths in the United States. Healthcare savings are almost unlimited, if hypertension and its subsequent cardiovascular mortality are reduced (Moran et al., 2015).

### **Practice Recommendations**

The results from this DNP project favor implementation of the project to give providers an additional teaching tool, and for patients with diagnosed hypertension to be able to see the effects of their disease on bodily organs. Practice recommendations would be to implement the project at the clinic level, and any clinic where patient teaching for hypertension is discussed. The project is easily implemented, and does not require any specific EMR or training, except for the purchase of the organ models. Another recommendation would be for future implementation to use models with a more realistic scale, rather than the half-sized models that were utilized. Additionally, although patients with a new diagnosis of hypertension were excluded for this project, patients with a new diagnosis of hypertension would benefit from the 3-D teaching, as part of their initial hypertension treatment teaching and plan of care. Staff who participated in the project stated they would recommend the models be used for diabetic teaching, as the pathophysiological changes on the models were essentially the same as hypertension changes, and therefore could also benefit diabetic patients.

Although ideally used with the Hill-Bone pre and post adherence survey, the teaching could be done without it, and just utilizing the 3-D organ models if necessary. The Hill-Bone scale provides a needed qualifiable measure of whether the patient's adherence improved with the teaching, however, the end goal is to have the patient be more adherent with medications, and the teaching could be done without the scale, if it would help the patient to understand their condition. Along with that, this project may be used in other cultures and languages, although the Hill-Bone tool would need author's permission to translate into a different language.

### **Final Summary**

In conclusion, this DNP project implemented 3-D models with patient teaching for hypertension adherence by providers in a federally qualified healthcare clinic in rural North Carolina. Easy to use models were utilized to show patients the long-term damage uncontrolled hypertension could do to their organs. Providers were briefed with a script and identified patients with established hypertension. Patients were very receptive to the teaching and follow up discussion with patients showed that the 3-D model teaching had a significant impact on their adherence, with two patients commenting how it was essentially a catalyst for changing their behavior, and dramatically increasing their hypertension treatment adherence. Sixteen patients were included in the project, and one provider and one staff member implemented the teaching, along with one project lead.

Despite limitations of time, resources and staff, this DNP project showed promise in implementing a novel way of teaching, a way that patients could understand the health threat, by allowing patients to see and feel models with pathological changes due to hypertension. The teaching enabled patients to also ask questions regarding their illness, and therefore possibly have a deeper understanding of what happens to their body when their disease is not controlled.

One in three adults in the United States has hypertension, and of those, approximately half do not have it under control. The individual, regional, and national healthcare costs and stakes are immense, and improved hypertension treatment adherence is imperative to the health of millions of Americans, and the novel approach of 3-D model teaching could help increase adherence.

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Appendix A



<b>Rural Health Group at Enfield</b>	<b>252-445-2332</b>
<b>Rural Health Group at Henderson</b>	<b>252-438-3549</b>
<b>Rural Health Group at Jackson</b>	<b>252-534-1661</b>
<b>Rural Health Group at Lake Gaston</b>	<b>252-586-5411</b>
<b>Rural Health Group at Norlina</b>	<b>252-456-2009</b>
<b>Rural Health Group at Rich Square</b>	<b>252-539-2082</b>
<b>Rural Health Group at Roanoke Rapids</b>	<b>252-536-5000</b>
<b>Rural Health Group at Scotland Neck</b>	<b>252-826-3143</b>
<b>Rural Health Group at Stovall</b>	<b>919-690-0815</b>
<b>Rural Health Group at Twin County</b>	<b>252-586-5151</b>
<b>Rural Health Group at Whitakers</b>	<b>252-437-2171</b>
<b>Rural Health Group Family &amp; Women's Health</b>	<b>252-536-5800</b>

July 20, 2018

To Whom It May Concern

We at Rural Health Group have reviewed Susan Minter’s DNP Project title “Use of 3-D Model Teaching to Increase Hypertension Medication Adherence.” Mrs. Minter has organizational support and approval to conduct her project within our institution. We understand that for Mrs. Minter to achieve completion of the DNP program, dissemination of the project will be required by the University, which will include a public presentation related to the project and a manuscript submission will be encouraged.

Our organization has deemed this project as both research and quality improvement initiative and not requiring institutional IRB review.

Thank you,

[signature]

Julie Campbell, RN

Director of Clinic Services



## Appendix C

**Quality Improvement/Program Evaluation Self-Certification Tool**

Projects that do not meet the federal definition of human research pursuant to 45 CFR 46 do not require IRB review. This tool was developed to assist in the determination of when a project falls outside of the IRB's purview.

Instructions:

Please complete the requested project information, as this document may be used for documentation that IRB review is not required. Select the appropriate answers to each question in the order they appear below. Additional questions may appear based on your answers. If you do not receive a STOP HERE message, the form may be printed as certification that the project is "not research", and does not require IRB review. The IRB will not review your responses as part of the self-certification process.



## Appendix D

## Hill Bone Hypertension Adherence Scale

How often do you forget to take your high blood pressure medication? (Circle one)

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you decide not to take your high blood pressure medication?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you eat salty food?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you shake salt on your food before you eat it?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you eat fast food?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you make the next appointment before you leave the doctor's office?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you miss scheduled appointments?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you forget to get your prescriptions filled?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you skip your high blood pressure medication before you go to the doctor?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you miss taking your high blood pressure pills when you feel better?

1. None of the time      2. Some of the time      3. Most of the time      4. All of the time

How often do you miss taking your high blood pressure pills when you feel sick?

1. None of the time
2. Some of the time
3. Most of the time
4. All of the time

How often do you take someone else's high blood pressure pills?

1. None of the time
2. Some of the time
3. Most of the time
4. All of the time

How often do you miss taking your high blood pressure pills when you are careless?

1. None of the time
2. Some of the time
3. Most of the time
4. All of the time

Additional question: What is your level of education?

1. Grade school
2. Some high school
3. High school graduate
4. Some College
5. College graduate

## Appendix E

## 3-D Teaching Script for DNP project

- Identify a patient with a diagnosis of established hypertension to participate.
- Ask the patient if they would mind learning new information about their high blood pressure (no formal consent needed).
- Give the patient the Hill-Bone and demographic surveys to complete (pre-teaching). (may be given to the patient by nursing staff prior to the appointment).
- Briefly assess the patient's general base knowledge of what they think happens to their organs when their high blood pressure is not controlled over time.
- After determining the patient's base knowledge, use the 3-D models to explain any knowledge deficits the patient may have regarding long term hypertension effect on their body. Examples: if they do not verbalize eye damage, show them the 3-D eye and the microvascular damage on the model, or if they are unsure of heart damage, show them the normal 3-D heart, then the enlarged 3-D heart to illustrate the long term damage. Brain model has a clot within its vasculature. Kidney has normal glomerulus capsules but show the patient these may be destroyed with uncontrolled hypertension. Available organs are the kidney, brain, 2 hearts, and an eye (cross sectioned).
- After teaching, reiterate the need to (1) limit sodium intake in their diet, (2) keep regular follow up appointments with you, and (3) take their medication as directed consistently.
- After the teaching, we will follow up a few weeks later to determine if the 3-D teaching improved their treatment adherence.

Record the patient's name on the flowsheet provided (keep in locked office when not in use).

Record the patient number (not the name or identifiers) on the survey they filled out (i.e.: patient #1, etc.). Completed surveys will be kept in locked office.