Nurse Practitioner Use of Sublingual Nitroglycerin in Stable Ischemic Heart Disease

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Abstract

Problem Statement: Coronary artery disease is a leading cause of death in the United States. Millions of Americans have some form of cardiovascular disease, including angina. Angina affects quality of life. Sublingual nitroglycerin (SLNTG) is a mainstay of therapy for the self-management of angina. Literature suggests a discordance exists between guideline recommendations and SLNTG prescribing practices.

Purpose: To identify knowledge, barriers, and current practice of Nurse Practitioners (NPs) in primary care and specialty clinics in North Carolina (NC) in the use of SLNTG in the stable ischemic heart disease (SIHD) patient.

Questions: (1) Do NPs in NC practicing in primary care and specialty clinics report an understanding of the use of SLNTG for the self-management of angina? (2) Do NPs report an understanding of contraindications for the use of SLNTG? (3) Does the understanding and utilization of SLNTG in the SIHD patient differ among practice specialties (such as primary care compared to cardiology)?

Methods: This Doctor of Nursing Practice project was a non-experimental, cross-sectional, quantitative project using a descriptive survey administered via electronic-mail to a convenience sample of 2236 NPs in NC.

Analysis: Frequency distribution was used to score the respondents correct responses. Understanding and utilization of SLNTG among practice specialties was assessed with Chi-square for independence.

Significance: Nurse practitioner respondents were less knowledgeable about SLNTG as premedication for effort-induced angina; but were aware of correct dosing of SLNTG, use of SLNTG with phosphodiesterase inhibitors and when to replace SLNTG.

Keywords: nitroglycerin, guidelines, nurse practitioner, stable ischemic heart disease

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Section I: Introduction

Introduction to the Problem

Coronary artery disease (CAD) remains a leading cause of death in the United States (US). Based on data from 2010, every day over 2100 people in the US die of cardiovascular disease (CVD; which includes myocardial infarction (MI), angina, heart failure (HF), stroke (CVA), or congenital cardiovascular (CV) defects). That equates to approximately one person every 40 seconds (Go et al., 2014). Approximately one in three Americans have some form of CVD; nearly 17 million live with coronary heart disease (CHD), and ten million suffer from angina (Fihn, et al., 2012; Go et al., 2014).

Go and colleagues (2014) estimate the annual direct and indirect costs of CVD and stroke at around $315 billion. Hospitalizations account for more than one-half of the direct costs associated with ischemic heart disease (Fihn et al., 2012). Despite aggressive use of interventional cardiology procedures and antiplatelet medications, many individuals continue to experience chronic angina even after an acute coronary event and intervention (Arnold et al., 2009). Kempf, Buysman, and Brixner's (2011) study of health utilization costs for the CAD patient with and without angina in a managed care environment estimated that patients who have CAD with angina utilized many more health resources. Patients who have CAD with angina were more likely to visit the emergency department, have more clinic visits, more revascularization procedures, and had higher pharmacy costs (Kempf et al., 2011). "Total average CAD-related medical and pharmacy costs for patients with angina were $14,851 versus $4449 for patients with CAD without angina, and the average all-cause per-patient cost was $28,590 versus $14,334, respectively" (Kempf, et al., 2011, p. 353). By 2030, Go and

colleagues' (2014) estimate that 43.9% of those in the US will have some form of CVD and costs will increase substantially, up to $918 billion (based on 2012 dollars, in billions).

The *2012 American College of Cardiology Foundation (ACCF)/American Heart Association (AHA)/American College of Physicians (ACP)/American Association for Thoracic Surgery (AATS)/Preventive Cardiovascular Nurses Association (PCNA)/ Society for Cardiovascular Angiography and Intervention (SCAI)/ and Society of Thoracic Surgeons (STS) Guideline for the Diagnosis and Management of Patients with Stable Ischemic Heart Disease* (Fihn et al., 2012 [referred henceforth as 2012 SIHD Guideline]) is a valuable resource and basis for this DNP project. Sublingual nitroglycerin (SLNTG) or nitroglycerin spray is a class 1, level of evidence B recommendation for the immediate relief of angina in patients with stable ischemic heart disease (SIHD; Fihn et al., 2012). For the purpose of this project, all short-acting nitrate formulations were referred to as SLNTG. Several researchers discussed the underutilization of SLNTG and knowledge deficits in the use of SLNTG in patients with chronic CAD/stable angina and/or SIHD (Fan, Mitchell, & Cooke, 2009; Gallagher, et al., 2010, 2013; Walton-Shirley, 2014; Zimmerman, Fass, Katz, Low, & Franklin, 2009). Most studies focused on the patients' knowledge and use of SLNTG, whereas no studies were found on NP, physician or physician assistant (PA) knowledge, use, or prescribing practices in the SIHD patient. The absence of such evidence was considered the basis for this project exploring NPs' knowledge, barriers, and current use of SLNTG in the SIHD patient population.

Additionally, three of the four studies reviewed for this project on the knowledge and use of SLNTG in patients were from Australia (Fan, Mitchell, & Cooke, 2009; Gallagher, et al., 2010, 2013). These authors' findings about knowledge and use of SLNTG in patients was used as part of the foundation for development of the survey tool subsequently used to assess NPs'

knowledge on the use of SLNTG. The 2012 SIHD Guideline was also used as a basis for survey tool development.

Purpose of Project

The purpose of this Doctor of Nursing Practice (DNP) scholarly project is to identify knowledge, barriers, and current practice as reported by NPs practicing in North Carolina (NC) in primary care and specialty clinics in the use of SLNTG in the SIHD patient. Clinical project questions explored were:

1. Do NPs in NC practicing in primary care and specialty clinics report an understanding of the use of SLNTG for the self-management of angina?
2. Do NPs report an understanding of contraindications for the use of SLNTG?
3. Does the understanding and utilization of SLNTG in the SIHD patient differ among practice specialties (such as primary care compared with cardiology)?

Background of Problem of Interest

Given the burden of heart disease in America, care for the patient with CAD (or SIHD) is very common in adult healthcare practices. In 2010, there were over 10 million outpatient office visits with the primary diagnosis of CHD (Go et al., 2014). Chest pain or angina are often a manifestation of SIHD. Angina affects quality of life (Akyildiz & Ergene, 2014; Beltrame, Weekes, Morgan, Travella & Spertus, 2009) and is associated with long-term anxiety, depression and impaired physical functioning (Beatty, Spertus, & Whooley, 2014; Jespersen**,** Abildstrøm**,** Hvelplund & Prescott, 2013). Sublingual nitroglycerin should be considered a mainstay of therapy for the self-management of angina based on the 2012 SIHD Guideline (Fihn et al., 2012). Literature suggests there is a discordance between guideline recommendations and actual practice in prescribing SLNTG to patients with SIHD for the self-management of angina (Fan et

al., 2009; Gallagher et al., 2010; Walton-Shirley, 2014; Zimmerman et al., 2009). Based on the evidence, patients may misunderstand and inadvertently misuse SLNTG (Gallagher et al, 2010; Zimmerman et al., 2009). This author's goal was to increase awareness regarding the appropriateness of SLNTG in the SIHD patient and encouraged its use by NPs caring for the SIHD patient population according to the standard of care.

Significance of Problem

Although this project focused on NP SLNTG prescribing practice and barriers to prescribing SLNTG within the US, this author found no studies superficially addressing providers' (i.e., NP, physician or PA) SLNTG prescribing practice or patterns. However, several studies addressed the knowledge and use of SLNTG from the patients' perspective (Fan et al., 2009; Gallagher, et al., 2010, 2013; Zimmerman et al., 2009). One might postulate that dangerous misuse or underuse of SLNTG may be avoided by assuring NPs, physicians, and PAs are knowledgeable of and effectively communicate the appropriate indications, use and contraindications for safe SLNTG use.

Gallagher (2010) found that 37% (*n*=53) of patients with CAD were not prescribed SLNTG and of those that did receive a prescription for SLNTG, only 43% (*n*=38) reported receiving instruction in its use. Similarly, 38% (*n*=233) of patients participating in cardiac rehabilitation programs in New York, Michigan and Rhode Island did not have a prescription for SLNTG and 23% (*n*=88) had a prescription for SLNTG that was over one year old (Zimmerman et al., 2009).

Discussion of How Identified Practice Setting Supported Project

The practice setting for this project was primary care and specialty clinics (nephrology and cardiology) where adult patients are seen with the diagnosis of CAD/SIHD and who may

present with symptoms of angina or chest pain. The target audience for this author's scholarly inquiry was NPs in these primary care and specialty clinic settings.

Section II: Research Based Evidence

A thorough literature review in which one describes and appropriately synthesizes the literature on a given subject is paramount to delivery of high-quality evidence-based patient care (Timmins & McCabe, 2005).

Review of Literature

In order to answer the clinical questions pertaining to nurse practitioners' (NPs) knowledge of the use of SLNTG in the SIHD patient, a literature review was conducted using electronic databases including Medline via PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Review. The search was limited to 2009-2014 and English only articles. Keyword or Medical subject Headings (MeSH) terms used included angina, stable angina, nitroglycerin, nitrates (different forms), guidelines, evidence-based practice, nurse practitioner, barriers, practice patterns, knowledge, and quality of life. Figure A shows a summary of the search.

Four studies undergirding this project centered on the patients' perspective and the use of SLNTG (Fan et al., 2009; Gallagher, et al., 2010, 2013; Zimmerman et al., 2009). Additionally, the 2012 SIHD Guideline were reviewed for specific information on guideline-directed medical therapy (GDMT) information on SLNTG in this patient population. Of note, ACC/AHA published a new *2014 Focus Update of the Guideline for Diagnosis and Management of Patients with SIHD.* Although the 2014 ACC/AHA updated guideline was reviewed, the 2012 SIHD Guideline was used for foundational evidence to support this author's project because the 2014 update provided no relevant information on the use of SLNTG (Fihn et al., 2014). Fihn and colleagues (2014) under the GDMT section in the Focus Update elaborated on the use of Chelation Therapy and Enhanced External Counterpulsation (EECP) both for the treatment of

angina. The 2014 SIHD Focus Update found the use of chelation therapy in cardiac disease "highly questionable" (Fihn et al., 2014, p. 1755). As for EECP, reviewed in the 2012 SIHD Guideline, the writing group confirmed their findings that EECP might have some benefit in patients with refractory angina. The writing group did support the ongoing need for well-design randomized controlled trials (RCTs) to further evaluate EECP therapy. Therefore, the 2014 recommendations are unchanged from 2012 – that "EECP may be considered for relief of refractory angina in patients with SIHD" (Fihn et al., 2014, p. 1756). Information from the 2012 SIHD Guideline as well as SLNTG knowledge/use issues in patients as identified in the studies above (Fan et al., 2009; Gallagher, et al., 2010, 2013; Zimmerman et al., 2009) was used to developed the survey used for this project**.**

Barriers to Use of SLNTG

The literature frequently addressed some of the barriers to why evidence-based practice (EBP) or clinical guidelines are not easily adopted (Cabana et al., 1999; Fineout-Overholt, Melnyk, & Schultz, 2005; Melnyk, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012; Powell-Cope, Luther, Neugaard, Vara, & Nelson, 2004). The author found no studies addressing NPs barriers to use of SLNTG. Boden and colleagues (2012) in their review of nitrates and their role in medical therapy for stable angina provided a brief summary of physician barriers to nitrate use. These researchers suggested that physicians were mainly concerned with the development of tolerance and/or tachyphylaxis (Boden et al., 2012). Tachyphylaxis is the "rapid appearance of progressive decrease in response to a given dose after repetitive administration" of, for example, the SLNTG (MediLexicon International, 2015, para. 4). Physicians in Boden et al.'s report were concerned the tachyphylaxis would limit the sustained benefit of the nitroglycerin. Fihn et al.

(2012) reported no development of nitrate tolerance with SLNTG; nor did the use of long-acting nitrates effect tolerance to the use of SLNTG.

In addition, the perception of physicians that medical therapy is less effective than invasive procedures such as percutaneous intervention (PCI) is also a barrier to use of SLNTG (Boden et al., 2012). Based on their research findings, Boden et al. (2012) posit that many patients limit their activity to avoid angina rather than use the SLNTG as indicated to alleviate the angina and do not know they can use the SLNTG for symptom prophylaxis.

Nurse practitioners and physicians alike reported barriers to the use of EBP and/or clinical guidelines. These barriers included lack of time in both staying abreast of most recent guidelines and implementation of guidelines; lack of education of the actual guidelines; lack of organizational support for use of guidelines, and lack of agreement with the guidelines (Cabana et al., 1999; Melnyk et al., 2012). A paucity of literature existed investigating NP knowledge, barriers, and current practice specific to the use of SLNTG in the SIHD patient.

Although not the case in the US, a prescription for SLNTG is not needed in Australia (Gallagher et al., 2010). Four knowledge points on the use of SLNTG by patients were extrapolated from research in other countries and the 2012 SIHD Guideline to develop the survey tool used to assess NP knowledge. The four knowledge points were 1) use of SLNTG as premedication for effort-induced angina, 2) SLNTG and the use of phosphodiesterase inhibitors, 3) dosing intervals for the use of SLNTG, and 4) replacement of SLNTG.

In an Australian study by Fan et al. (2009) and two studies by Gallagher et al. (2010 & 2013), it is important to note that patients in Australia do not have to have a prescription for SLNTG. It is available over-the-counter (OTC). “The pharmacist will ask some detail and check

that (the patients) are okay" before dispensing (personal communication, R. Gallagher, May 17, 2015).

In a non-experimental, retrospective descriptive design, Fan and colleagues (2009) surveyed 41 cardiac in-patients in an Australian hospital. The participants were surveyed using a modified version of the Sublingual Nitroglycerin Interview Schedule (SNIS) tool. Kimble and Kunik (2000) developed the SNIS tool to assess knowledge and use of SLNTG and cardiac-related quality of life in patients with chronic stable angina. The original tool was 69 items and took approximately 30-45 minutes to administer. Content and face validity were established for this tool, though the original research by Kimble and Kunik (2000) did not mention if construct validity and reliability was assessed. After instrument analysis, Fan et al. used only 58 of the original items, removing questions specifically related to the patient's last episode of chest pain. This modified tool was pilot tested with two people similar to the target population to ensure appropriate content and phrasing for the Australian setting, No other changes were made (Fan et al., 2009).

Fan et al.'s (2009) findings supported that participants needed to improve their knowledge of the use of SLNTG, which would provide the ability to self-manage their angina. Only 24% (*n*=10) of participants knew they could use SLNTG to prevent activity-related chest pain. Participants also were not aware of how to transport their SLNTG (i.e. keep in the original bottle, away from light, heat, etc.). Fifty-six percent (*n*=23) reported no ongoing education from their healthcare providers on the use of SLNTG, and approximately 48% (*n*=20) did not know the correct dosing sequence for the SLNTG medication.

In another Australian study, Gallagher and colleagues (2010) recruited 142 patients in cardiac rehabilitation (rehab) to survey regarding their use and knowledge of SLNTG. They cited

previous estimates of 15-37% of patients with suspected or confirmed diagnosis of coronary artery disease (CAD) who had not received a prescription for SLNTG. Of those patients previously studied, that had received a prescription for SLNTG, only 30-70% reported receiving instructions on the use of SLNTG (Gallagher, et al., 2010). Gallagher et al. (2010) sought to ascertain how often SLNTG had been prescribed to those patients in the cardiac rehabilitation program, as well as evaluate their knowledge of the use of SLNTG. Inclusion criteria included the ability to understand and speak English, recent discharge from the hospital with diagnosis of CAD, including acute myocardial infarction (AMI), percutaneous coronary intervention (PCI), and/or angina. Excluded were patients who were post coronary artery bypass grafting (CABG) as these patients are not typically provided a prescription for SLNTG.

The questionnaire used by Gallagher et al. (2010) was modified from an existing tool developed by Zimmerman (2009). This instrument comprised of 20 questions, addressed "prescription, experience, instruction, and the level and accuracy of knowledge of SLNTG" (Gallagher et al., 2010, p. 481). Those patients who had a SLNTG prescription were asked an additional 20 knowledge questions related to "type of symptoms treated; storage; method, sequence, and timing of administration; adverse effects; and safety issues including maximum dosage and responses when chest pain symptoms persist" (Gallagher et al., 2010, p. 481). Gallagher added four additional questions. Two of the questions were specific to the Australian population asking participants if a prescription was needed for SLNTG and/or if they (the patient) had ever used another person's SLNTG. The remaining two questions Gallagher et al. (2010) added were questions inquiring about patients' knowledge regarding concurrent use of SLNTG and nitroglycerin patch or SLNTG and sildenafil (Viagra).

Gallagher and colleagues (2010) found that only 43% (*n*=38) of participants recalled receiving any SLNTG education, which most often was provided by the nursing staff (37%, *n*=33). Sixty-seven percent (*n*=59) knew to keep the SLNTG in its original container and 51% (*n*=45) knew when the SLNTG would expire. Eighty-seven (*n*=77) to ninety-four percent (*n*=83) of participants reported knowing to stop an activity when chest pain occurred before using the SLNTG, to sit down to take the SLNTG and knew how and when to use the SLNTG. Conversely, only 70% (*n*=62) knew the correct sequence of dosing and/or maximum dosage per episode (69%, *n*=61). Of the 12% (n=10) of participants prescribed sildenafil, only 33% (*n*=3) knew that SLNTG should not be used concurrently. Seventy-five percent (*n*=66) of participants knew they could use the SLNTG concurrently with nitroglycerin patches. This study also noted that patients lacked knowledge regarding premedicating with SLNTG to prevent CP.

In 2013, Gallagher and colleagues once again recruited participants from an Australian cardiac rehabilitation program to participate in a pre-test, post-test designed study. Participants were in phase II of the cardiac rehabilitation program. Inclusion criteria again included patients with CAD (either AMI, PCI, or angina) attending cardiac rehabilitation for their initial assessment. Patients not prescribed SLNTG were excluded from this study. Sublingual nitroglycerin knowledge and use questions were similar to the 2010 study. Following the initial assessment of each participant, an educational intervention was done to address the deficits and misconceptions around the use of SLNTG identified in the initial assessment. Eighty-six subjects completed the study. The post-test portion of the study occurred approximately six to eight weeks after the initial educational session. The educational intervention did improve the knowledge scores (Gallagher et al., 2013). However, even after the standard educational

intervention, only 50% knew the recommended number of SLNTG doses per pain episode (*n*=43) or that SLNTG and nitroglycerin patches could be used together (*n*=12)

Zimmerman et al. (2009) recruited participants from nine cardiac rehabilitation programs in the New York, Michigan, and Rhode Island areas, surveying 617 participants. For inclusion, participants had a diagnosis of angina, myocardial infarction (MI), PCI, CABG or a combination of these diagnoses. They found 38% (*n*=233) of the participants did not have a prescription for SLNTG and 23% (*n*=148) of patients with SLNTG had tablets that were at least one year old.

Many studies and/or reports have been published on the diagnosis and management of CAD, angina, and non-acute coronary syndromes (Agarwal, Mehta, & Merz, 2010; Boden et al., 2012; Cassar, Holmes, Rihal, & Gersh, 2009; Fihn et al., 2011; Lewis & Davis, 2013; Palaniswamy & Aronow, 2011; Tobin, 2010). Most of the aforementioned studies identified SLNTG as one mainstay of angina treatment. Lewis and Davis (2013) provided an insightful educational review of the management of SIHD reviewing the 2012 SIHD Guideline. They discussed the use of SLNTG for the treatment of acute anginal symptoms and reiterated that SLNTG can be used prophylactically during exertional activities known to produce angina (Lewis & Davis, 2013).

Concepts and Definitions Used in the Project

The evidence specific to the use of SLNTG in the 2012 SIHD Guideline provided the evidence-based foundation for this DNP project. In general, the scope of the 2012 SIHD Guideline was directed toward adult patients with "stable known, or suspected ischemic heart disease, including new-onset chest pain (i.e., those with low-risk unstable angina) or adults with stable pain syndromes" (Fihn et al., 2012. p. e50). Patients with ischemic or anginal equivalents, such as arm pain with exertion, dyspnea on exertion are included as well. These equivocal

symptoms are especially important to remember when dealing with women (and diabetics), as 65% of women who present with ischemic findings do so with atypical symptoms (Fihn et al., 2012). The 2012 SIHD Guideline does not apply to patients who experience chest pain symptoms early after revascularization (either PCI or CABG). Early, as defined by the guideline writing committee for this population, were patients with recurrent symptoms within six months of their revascularization (Fihn et al., 2012). The 2012 SIHD guideline and this DNP project did not include pediatric patients or those with heart transplant and subsequent anginal symptoms.

Guideline-Directed Medical Therapy (GDMT)

The term guideline-directed medical therapy (GDMT) was used to represent optimal medical therapy as defined by the ACCF/AHA guideline (primarily Class I) recommended therapies (Fihn et. al., 2012). The 2012 SIHD Guideline has a thorough review of optimal GDMT for SIHD. The purpose of this project was not to review each medication used for the management of patients with SIHD, but instead the use of SLNTG as a therapy for self-management of angina when a patient on GDMT has breakthrough chest pain. The 2012 SIHD Guideline suggested that patients are appropriately on anti-platelet medications, beta-blockers, calcium channel blockers, angiotensin converting enzyme inhibitors (ACEi), statin therapy, ranolazine and/or the combination of these meds; along with lifestyle modifications (diet, exercise, smoking cessation, blood pressure and cholesterol control, and glycemic control). Sublingual nitroglycerin is used as needed for self-management of breakthrough anginal (or chest pain) episodes. Inherent to the successful management of patients with angina and SIHD was patients knowing symptoms that are suggestive of unstable angina (worsening chest pain) and when to appropriately report to the emergency department for further evaluation.

Knowledge

Knowledge, as defined by the Oxford Dictionary (2015) is the practical, medical, or scientific understanding gained through experience and/or education. For the purpose of this project, one way knowledge was measured was by the use of scenario based survey questions. In this respect, knowledge of the use of SLNTG as described in the 2012 SIHD Guideline was evident if the respondent selects the guideline directed answer. As described below, each scenario question had one answer that was taken directly from the 2012 SIHD Guideline. For the purpose of this survey project, selection of that one particular response equates to knowledge of the 2012 SIHD Guideline.

Barriers

Barriers as related to the use of SLNTG in the SIHD patient and the use of EBP and clinical guidelines was another concept used in this project. Barriers related to both practice in using SLNTG when clinically appropriate and behavior barriers relative to evidence-based practice or clinical guidelines. Behavioral barriers included knowledge barriers (lack of familiarity to guidelines, too many guidelines and not enough time to stay informed), attitude barriers (disagree with guidelines, feel guidelines are too cookbook) and external or environmental guidelines (such as patients will not be compliant, organization where employed does not support the use of guidelines) are just a few ways barriers relate to this project (Cabana et al., 1999).

Theoretical Framework that Guided the Project

"Theory guides practice" (McEwen, 2011, p. 79). Roger's Diffusion of Innovation Theory (DOIT) is a theory that attempts to explain how, over time, an idea or product gains momentum and spreads (or diffuses) through a specific population or social system (Boston

University, 2013). The desire was that by utilizing the DOIT framework, one can identify areas of concern in diffusion of an idea by understanding the underlying principles of the theory and its application to a project or idea. The innovation for this DNP project was the use of SLNTG in the SIHD patient as outlined in the 2012 SIHD Guideline.

Diffusion of Innovation Theory

The framework for the DOIT dates back to at least 1903, with Tarde and his "laws of imitation" (as cited in Rogers, 2003, p. 41). Tarde (1903) suggested that adoption of an innovation was a social process through interpersonal communication and copying (or imitating) someone else's adoption of the innovation (as cited in Rogers, 2003). Nurses are proficient in the use of peer-to-peer learning strategies. However, practical knowledge (gained through experience) is not necessarily evidence-based (Proehl & Hoyt, 2012). In 1943, Ryan and Gross developed a more focused approach to the DOIT through their results on the use of hybrid-corn by Iowa Farmers (Wejnert, 2002). Rogers' theory was the basis for this project. He posited that in the agricultural setting, economics did not affect acceptance (or diffusion of the innovation) but rather interpersonal communication based on successful results lead to acceptance of the innovation and further diffusion of the practice (Balas, 2012; Rogers, 2003).

Key Theoretical Concepts

Rogers (2003) suggested there were four main elements that influence (or facilitate) the spread of a new idea (*diffusion*); "the (1) *innovation* (2) is c*ommunicated* through certain c*hannels* (3) *over time* (4) among the members of a *social system*" (p.11). Of importance to this author, especially in light of this DNP project, was that the term innovation typically suggested a new idea; and the use of SLNTG in the SIHD patient has been a mainstay of therapy for years (Fihn et al., 2012; Go et al., 2014, Murrell, 1879). The use of nitroglycerin for angina dates back

to at least 1879 (Murrell, 1879). Therefore, the use of SLNTG was not novel. However, the chronological novelty of a new discovery or idea as an innovation is less important than if the idea seems new to an individual. "Newness of an innovation need not just involve new knowledge" (Rogers, 2003, p. 12). One may know about an innovation (i.e. SLNTG) but not have developed an opinion or attitude about it one way or another.

Facilitating factors. Facilitating factors that affect the rate of adoption include (1) relative advantage – does the idea or product have a perceived value over that it supersedes? (2) Compatibility – is the idea consistent with the values, experiences, and needs of the potential adopters? (3) Complexity – is the innovation easily understood or is it difficult to understand or use? (4) Trialability – can the innovation be experimented with to test it out, as it is more likely to be adopted if able to try it out first. (5) Observability – to what degree are the results of the innovation visible to others? (Greenhalgh, Robert, Bate, Macfarland, and Kyriakidou, 2005; Rogers, 2003).

Barriers. Barriers to acceptance of an innovation can be similar to the facilitating factors outlined above. If the innovation lacks value, is not compatible with the value/needs of the adopter, too complex or not able to be trialed then may decrease the likelihood of adoption of the innovation being proposed (Rogers, 2003).

Innovation-decision process. The innovation-decision process consists of the five stages (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. Once an individual is aware of the initial knowledge of an innovation or new idea, one begins to form an attitude toward the innovation. This knowledge-gathering phase is followed by the decision to either adopt or reject the innovation. Once one decides to adopt an innovation, it is implemented and lastly, once implemented the individual will confirm the decision to continue to adopt the

innovation or elect to reject if need information is presented. This is the innovation-decision process (Rogers, 2003).

Knowledge. This is the point when an individual is exposed or learns of an innovation, such as use of SLNTG in SIHD, or more specifically, the use of SLNTG as a pre-medication for effort-induced angina. Innovation awareness can occur either passively or actively (Rogers, 2003). Passive awareness-knowledge is one learning of an innovation by accident while active awareness-knowledge occurs when one initiates or seeks out the innovation based on a need to know. "Change agents may create needs among their clients by pointing out the existence of desirable new ideas. Thus knowledge of the existence of an innovation can create a motivation to learn more about it and ultimately, to adopt it" (Rogers, 2003, p. 172).

Three types of knowledge are related to an innovation: awareness-knowledge, how-to knowledge, and principles-knowledge (Rogers 2003). Awareness-knowledge is the knowledge that an innovation exists which may lead the individual to seek out the second or third type knowledge (how-to or principle). How-to knowledge is the information needed to use an innovation properly. Principle-knowledge is the information needed to understand the principles underlying how an innovation works. One can adopt an innovation without principle knowledge, but this increases the chance of misusing the innovation or discontinuance of the innovation. Rogers (2003) suggests that a change agent should address each of these types of knowledge in the innovation-decision process.

Persuasion. Persuasion, as used by Rogers (2003) is not the use of intentional means to convince someone to adopt an innovation, instead is the individual's own change in attitude that affects if they adopt an innovation or not (Rogers, 2003). The person forms a favorable or unfavorable attitude toward an innovation based on actively for him/herself seeking out

information about the innovation. Individuals decide what they perceive as credible and decide how they will interpret the information received. This perception of the innovation is based on the perceived attributes of the innovation based on its relative advantage, compatibility, and complexity (Rogers, 2003). The ultimate outcome of persuasion is individuals' decision at accept or reject an innovation based on their attitude toward the innovation.

Decision. The decision stage in the innovation-decision process is when one intently seeks out activities that lead to adoption or rejection of an innovation. The opportunity to try out an innovation helps decreased the uncertainty of an innovation (Rogers, 2003). Just as one is likely to adopt an innovation, one can reject an innovation. One example of rejection can be simply forgetting about the innovation even after gaining awareness-knowledge or one can reject even after deciding to adopt.

Implementation. This stage of the innovation-decision process is the actual use of the innovation (Rogers, 2003). The innovation is put into practice. The concept of re-invention is often noted in the implementation phase. Re-intervention is when one modifies the innovation while adopting the innovation to meet their need (Rogers, 2003).

Confirmation. For some, the implementation is the final stage of the innovation-decision process. For others, once an innovation is adopted, they may seek out additional information or confirmation to reinforce the innovation-decision already made. This additional information may lead to rejection of an innovation if conflicting messages are received (Rogers, 2003). There are two types of discontinuance described by Rogers (2003). These two types of discontinuance are (1) replacement discontinuance and (2) disenchantment discontinuance. Replacement discontinuance suggests one decides to reject an idea in order to adopt a better idea that may

come along (Rogers, 2003). Disenchantment discontinuance is the dissatisfaction with the innovation's performance (Rogers, 2003).

Communication channel. One additional concept addressed was the means in which the information about an innovation was communicated (Rogers, 2003). For the purpose of this project, the means of communication were via mass media (such as journal article) or through interpersonal channels (such as podium presentation, poster board presentation or one-on-one through dialogue with colleagues, precepting, etc.).

Application to Project

The aim of this project was to assess NP knowledge, barriers, and current practice around the use of SLNTG in the SIHD patient. The literature suggests there is a discordance between guideline recommendations and actual prescribing of SLNTG. Patients often lack the knowledge and understanding of how and when to use SLNTG as well as safety concerns associated with the medication (Gallagher et al., 2010; Zimmerman et al., 2009). A survey was developed to assess this knowledge and understanding of SLNTG in the SIHD patient. The survey obtained baseline data to identify if there are areas in the NPs' knowledge and practice that prohibit the adoption of SLNTG in the SIHD patient population. Based on this project's findings, post-doctoral work can focus on further dissemination of findings in hopes of enhancing the knowledge of NPs and other healthcare providers.

This practitioner's belief was that most NPs were aware of the use of SLNTG in this patient population but failed to prescribe it and educate patients secondary to oversight. Nevertheless, once an innovation is introduced, there are five stages in the adoption process. Those stages include – knowledge, persuasion, decision, implementation and confirmation (Rogers, 2003). It was anticipated that most providers being surveyed have some baseline

knowledge regarding the indication for and use of SLNTG. The survey should serve as an opportunity to reiterate to NPs information regarding the appropriate use of SLNTG and safety issues associated with its use (i.e., principle knowledge). As their awareness is increased, there was the expectation that clinicians would adopt the use of SLNTG in the SIHD patient population, be more consistent in its use, thereby improving the quality of life of these patients with SIHD. See Figure B for illustration of application of theory to this project.

CHAPTER III: Methodology

Overview

The methodology section is intended to describe how the project was done with relationship to the purpose of the project (Moran, Burson, & Conrad, 2014). A timeline for the DNP Program requirements/activities is shown in Appendix C, Figure C. The purpose of this DNP project evaluated 1) do NPs in primary care and specialty clinics report an understanding of the use of SLNTG for the self-management of angina; 2) do NPs report an understanding of the contraindications for the use of SLNTG; and 3) does the understanding and utilization of SLNTG in the SIHD patient differ among practice specialties (such as primary care compared with cardiology)?

Needs Assessment

There was no formal needs assessment done related to this DNP Project. There was however, a review of the literature to evaluate existing works on the use of SLNTG in SIHD. The 2012 SIHD Guideline provides a foundational basis for this project. This author found no studies evaluating NP knowledge and use of SLNTG. There were four studies used for this project that evaluated patients' knowledge and use of SLNTG. This author took the information on patients' deficits in their knowledge and use of SLNTG and the 2012 SIHD Guideline recommendations on the use of SLNTG and developed a tool to evaluate NP knowledge and use of SLNTG in the SIHD patient.

Additionally, five of the 24 objectives related to Healthy People 2020 (HP 2020) relate to cardiovascular health and reduction of risk factors – including improvement of quality of life (Institute of Medicine, 2011). Quality of life is often affected by angina (Akyildiz & Ergene,

2014; Beltrame et al., 2009). One mechanism to equip patients to self-manage their angina is through increasing their knowledge and access to SLNTG.

Project Design

The design for this DNP project was a non-experimental, cross-sectional, quantitative project using a descriptive survey. The survey was intended to assess knowledge, barriers, and current practice of NPs in the use of SLNTG in the SIHD patient. Eysenbach (2004) suggests survey response rates less than 70% are often viewed with skepticism – but admits, the 70% or so is an arbitrary cut-off point.

Sample. This project included a convenient, nonprobability sample of NPs in NC registered with the NC Board of Nursing (BON). Power analysis was not done, as this was a convenience sample. The electronic mail (e-mail) listserv was purchased from the NC BON. This sample included 5405 e-mail addresses of which 3156 were deleted, as these did not meet inclusion criteria; an additional 13 were removed because they did not have an e-mail address resulting in a total of 2236 participants who were sent an e-mail survey invitation to take the survey.

Initially working with the Excel listserv, the following fields were deleted: full name, address, approval number, initial approval date, expiration date, compact state, and registered nurse (RN) certification number. In preparation for exporting the data file to Qualtrics® (Qualtrics ®, Provo, UT, 2015), the web-based research survey software program that was used to design and administer the survey as well as download the survey data, the "name" column was replaced with a column labeled "firstname" and a second column labeled "lastname" and then each participant was renamed (literally) "firstname/lastname" in each cell to de-identify the data.

The participants were then further selected based on "practice type" and "primary and secondary specialty". Practice type/specialties included were primary care/internal medicine/family practice, nursing home/long-term care facility/assisted living facility/short-term rehabilitation facility, retail clinics, urgent/intermediate care facility as well as cardiology, nephrology and hospital (outpatient settings). The Excel file was then converted to a .csv (comma-separated values) file and imported to Qualtrics® to create e-mail panel for distribution of survey.

Methods/instrument. Based on the review of the literature, there were several areas of knowledge deficits identified in patients around the use of sublingual nitroglycerin. Those knowledge deficits included patients not being aware that they could take a SLNTG before an activity that induced angina (Fan et al., 2009; Gallagher, 2010); safety issues associated with the use of SLNTG and phosphodiesterase inhibitors (such as Viagra; Gallagher, et al., 2010); dosing intervals for the use of SLNTG (Fan et al., 2009, Gallagher et al., 2010, 2013); and when to replace their bottle of SLNTG (Gallagher et al, 2010; Zimmerman et al., 2000). The primary purposes of this DNP project and survey was to ascertain if NPs were knowledgeable in these areas, which are all reflected specifically in the 2012 SIHD Guideline (Fihn et al., 2012). The survey also looked at barriers to using SLNTG and current practice in the NP respondents. Therefore, based on these identified knowledge deficits in patients, the survey was designed to assess NPs' self-reported knowledge. Additional safety issues covered in the 2012 SIHD Guideline was the limited or rare use of SLNTG in patients with hypertrophic obstructive cardiomyopathy (HOCM) and/or severe aortic stenosis (AS). This was addressed in the survey as well.

No existing tool was found in the literature to assess these areas of knowledge in NP providers. Therefore, the author, over the course of one semester, developed a survey tool used in this project. The survey consisted of 21 questions and was expected to take 10-12 minutes to complete. The survey had a readability factor of 15.7 to 20.49, depending on which online word calculator used, which was consistent with college to graduate level readability per SMOG (Simple Measure of Gobbledygook; McLaughlin, n.d.; ReadabilityFormulas.com, n.d.; Trottier, 2009). Most questions were "force-response", with the exception of race, gender, and age. Eleven of the questions were demographic type questions to determine the respondents' highest education in nursing, highest education as NP, NP title (certification), practice location by region, NP practice type, years of clinical practice in current role, prescribing privileges, awareness of SIHD guideline, gender, race/ethnicity and age. Additional questions sought to ascertain the frequency, respondents saw the following conditions that either are or can cause angina (or chest pain) and how likely they were to provide an initial prescription for SLNTG – chest pain/angina, coronary artery disease (CAD), status post (s/p) myocardial infarction (MI), s/p percutaneous coronary intervention (PCI), s/p coronary artery bypass grafting (CABG), hypertrophic obstructive cardiomyopathy (HOCM), and severe aortic stenosis (AS). Four scenario-type questions were used to further evaluate NP knowledge around the use of SLNTG as pre-medication for effort-induced angina, use with phosphodiesterase inhibitors, dosing sequence (as reported in the 2012 SIHD Guideline) and when patients are to replace their bottle of SLNTG. The remaining four questions related to factors that prevented the NP from prescribing SLNTG when clinically appropriate, frequency of assessing clinical guidelines (CGs), resources used and/or have access to look up CGs and/or medications, and lastly, barriers to use of evidence based healthcare. Appendix D includes the Word version of the survey (as

downloaded from Qualtrics®) and The Nitroglycerin Handout developed as a downloadable attachment for the survey respondents on the use of SLNTG.

After multiple revisions of the survey with feedback from DNP faculty chair and committee member, face validity and content validity were obtained. Review of the survey by approximately eight DNP student colleagues provided face validity. Six expert NPs, two from primary care, two from cardiology and two from nephrology, were asked to provide content validity. A content validity index (CVI) of .84 and 1.00 was obtained during its development and revision, respectively (Polit & Beck, 2012). A limitation of the survey tool was the lack of construct validity and reliability prior to use (Polit & Beck, 2012). Multiple previews and pilot testing of the survey was done prior to launching it to the planned participants.

Protection of human subjects. Research involving human subjects must take into consideration adherence to ethical principles and safety of participants (Polit & Beck, 2012). Institutional review board (IRB) approval was received for this project. See Appendix E for IRB Letters of Approval. An amendment was also submitted after initial approval as the survey was revised; approval was granted. The setting for this e-mail survey allowed participants to complete the survey at their convenience on a computer that provided them with privacy. No Internet Protocol (IP) addresses were maintained. Additionally, because the data were aggregated and reported as a whole and not individually, the risk of identifying participants based on race, age, or location of practice was small. Consent to participate was implied when participants started the survey. Qualtrics® was used to administer the survey (Qualtrics®, Provo, UT, 2015). Data collected during the survey process were stored on the Qualtrics'® password protected website and a password-protected computer with adequate firewalls. Data will be stored for three years after completion of this project in accordance with Institutional Review Board regulations.

The e-mail survey was voluntary and anonymous, open only to those who received the e-mail invitation. A Qualtrics® feature prohibited respondents from submitting multiple responses or forwarding their personalized e-mail link to unintended participants. No incentives were offered to entice participation.

Data collection. To determine the NPs' knowledge of and contraindications of the use of SLNTG in patients with SIHD, 2236 NPs in NC were invited to participate in this project through completion of the e-mail survey. Once the survey was ready for distribution, it was activated in Qualtrics® and the e-mail survey function was used. The narrowed e-mail list was imported into Qualtrics®, an e-mail introduction was devised (and approved by the IRB) and the e-mail survey was first launched on Tuesday, February 17, 2015. Two additional reminder e-mails were sent out one-week apart on February 24, 2015 and March 3, 2015. The survey was closed on 3/11/15. A total of 347 surveys were returned, 226 surveys were used for the evaluation of data. This represents a ten percent response rate for the completed surveys. Incomplete surveys (n = 81) and those that selected hospital as practice type were not used in final analysis (n = 16). Also, those that elected to self-filter themselves out (n = 24) were not included in the 226 surveys used for evaluation of the data.

Data analysis. Once the survey was closed, data was downloaded from Qualtrics® into both Excel and Statistical Package for Social Sciences (SPSS) version 22. A codebook of the variables had already been created. Several of the items were recoded. Qualtrics® had assigned a "code" to the answers, such as 9=yes, 10=no, or 1=yes, 2=no, therefore, several of those codes were changed for consistency. One major challenge in data analysis for this survey was determining how to "score" the survey. Much discussion ensued regarding this and it was recognized that scoring could probably be done a number of different ways. However, based on

the author's intended purpose of the survey – which was to see if NPs expressed understanding of the use of SLNTG in SIHD as based on the 2012 SIHD Guideline, a correct response was given for only those answers that came directly from the guideline. Survey questions 9, 11, 12, 13 and 14 were used primarily to measure knowledge of use of SLNTG. (See Appendix D)

Question nine was used to see how likely NPs were to provide an initial prescription for SLNTG when clinically appropriate for conditions related to angina such as actual chest pain/angina, CAD, s/p MI, PCI, CABG, HOCM, and severe AS. (See Appendix D). Question nine had seven parts (9-1, 9-2, etc.). Answers 9-1 (CP/angina), 9-2 (CAD), 9-3 (s/p MI), 9-4 (s/p PCI) and 9-5 (s/p CABG) were recoded as one (1) to indicate a "correct" response if fields "always (1) or very likely (2)" were selected as it is appropriate to provide a prescription for SLNTG in these patient conditions. Additionally "very unlikely (3) or never (4)" were recoded as zero (0) indicating incorrect response. Conversely, answers 9-6 (s/p HOCM) and 9-7 (severe AS) were recoded with a one (1) as "correct" if respondents selected "very unlikely (3) or never (4)" to provide initial prescription in these patient types as the 2012 SIHD Guideline suggest use of SLNTG is a relative contraindication for the patient with HOCM and should be avoided in patients with severe AS (Fihn et al., 2012). Likewise, "always (1) or very likely (2)" was recoded as zero (0) if selected as this would not be a demonstration of knowledge of these relative contraindications for the use of SLNTG.

The scenario questions (survey questions 11, 12, 13, 14) were also recoded. (See Appendix D). Each scenario question had several yes/no responses (as to would they make the following recommendations – yes/no). Here again, design of the question was such that much discussion ensued about how to "score" the answers; it was decided, based on the purpose of the survey to note as a correct response (or a one[1]) for only the guideline selected answer (or

pivotal response or for the purpose of this project the "correct" answer). Therefore, participants' responses were recoded as one (1) if selected the pivotal response and zero (0) if they did not.

For the analysis of difference or relationship/association among practice specialties and knowledge of use of SLNTG – the proportion of number of correct answers for the same questions (9, 11, 12, 13, and 14) were analyzed. (See Appendix D). Knowledge scores per practice type (question 5) and NP title (question 3) were evaluated using frequency (*n*) and percentage (%) correct. (See Appendix D). Then cardiology was compared to all other practice sites. Cardiology was recoded as a one (1) and all other practice types were recoded as zero (0). Chi-square for independence was used for analysis.

Once questions had been recoded and data analyzed, the determination of normality of the data was done (Moran et al., 2014). The distribution of the data helped determine which statistical tests were appropriate to use. Basic descriptive analysis with measures of frequency/ percentages were used on many of the variables. Mean and standard deviation was used for age and years of experience. Additional analysis examined if an association existed between the variables. Appendix F, Table F1 shows portions of the survey questions, the research question it answers, and the statistical tests used for analysis.

Resources Used/Cost Analysis

The cost analysis section included financial analysis that determined the practicality and cost-effectiveness of the project (Moran et al., 2014). The majority of costs associated with this project was the author's time. This author's salary times the number of hours required (minimal 400 hours) for completion of the project (500 hours spent on project), which included approximately 60 vacation days taken away from work to complete the requirements of the program was $23,255.50. Actual monetary outlay for the project, not including tuition and

books, was $225 for the purchase of the NC Board of Nursing e-mail list serv and approximately $40 for gift cards given to those NPs who provided content validity to the survey process. Additional cost to this student was the use of a professional statistician (approximately $1500) and professional editor for final journal article (approximately $250). Additional personnel resources pertinent to the project and not calculated out based on their time would be the time spent by my committee chair, Dr. Robin Webb-Corbett and committee members, Dr. Candace Harrington, and Dr. Peter Wagner in providing feedback and guidance during the project design, survey design, implementation, and analysis. Additional personnel resources was time spent with the health science librarian, Qualtrics ® consultant with the College of Nursing (CON), statistician with the CON and IRB representative. This author's time with these individuals is included in the 500 project hours. The total estimated cost of this project was approximately $28,956.56.

Chapter IV: Results

Overview

This DNP project investigated the current knowledge and practice of NPs' use of SLNTG in the SIHD patient and identified barriers reported regarding the use of SLNTG based on the 2012 SIHD Guideline. The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) tool was the mechanism used to report the project results – see Appendix G for the completed CHERRIES tool (Eysenbach, 2004).

Sample Characteristics

The e-mail listserv of NPs in NC used for this project was purchased from the NC Board of Nursing. The participants were then selected based on reported practice type and primary and secondary specialty. Inclusion criteria for practice type included primary care/internal medicine/ family practice, nursing home/long-term care facility/assisted-living or short-term rehabilitation facilities, retain clinics, urgent/intermediate care facilities, cardiology, nephrology, hospital, and other (to include those that may see this patient type, but their practice setting was not listed). Ultimately, those participants that selected hospital as their primary practice setting were eliminated. Also, participants taking the survey were given the option to self-filter themselves out of the survey by selecting "I do not see patients with stable ischemic heart disease (or chest pain)".

Originally, 2236 e-mails sent to NPs in NC, 27 of the original e-emails were not deliverable. This left 2209 surveys sent for possible use. Qualtrics ® reported that 269 NPs completed the survey (2209-269 = 1940). One-thousand eight hundred and twenty-two surveys (1822) sent, were presumably never opened (1940-1822=118).Of this 118 that were opened, but

never finished, 79 were "partially completed"; 29 "opted out"; and 10 of the surveys' "session expired" (79-29-10=118).

Three hundred forty seven surveys were downloaded from Qualtrics ® to Excel for further analysis. A total of 81 (in Excel) were identified as "unfinished" (this was the 79 from above plus 2 that seemed to have opted out after finishing the survey). The 81 "unfinished" surveys were deleted. As part of the original survey design, question five regarding practice type, provided the option for subjects getting to this point but electing to self-filter out by selecting the "I do not see patients with SIHD (or CP)" to do so. This eliminated another 24 surveys. Due to incongruence with the author's objectives, those subjects who selected hospital as their primary practice site were discarded, eliminating an additional 16 surveys. Two hundred and twenty-six (*n*=226) surveys were used for analysis. This resulted in a 10% response rate for the e-mail survey.

Descriptive statistics. Demographic data for the group can be found in Appendix H. The majority of the NPs were female (93%, n=211)), approximately 84% (n=190) were white/Caucasian with a mean age of 47 years (SD = 10). Most participants (87%, n=197) had their Masters in Nursing Science (MSN), with approximately 70% (*n*=158) practicing as a Family Nurse Practitioner (FNP). The majority of participants (52%, *n*=118) practice in primary care/internal medicine/family practice followed by 14% (*n*=32) who practice in cardiology. The mean years of experience was 9.65 years (SD=7.64). Nearly all (99.1%, *n*=225) of the respondents reported having prescribing privileges and approximately 61% (*n*=137) acknowledged awareness of guideline for SIHD. The majority, approximately 59% (*n*=133), of the respondents practice in the Piedmont region of NC.

***Major findings*.** This section contains survey findings relating to the knowledge of the use and contraindications of SLNTG and barriers to use of SLNTG by NPs responding to this survey. Knowledge as previously defined for the purpose of this survey was selection of the response taken directly from the 2012 SIHD Guideline. Questions 9, 11, 12, 13 and 14 relate primarily to the first two clinical project questions of NP understanding in the use of SLNTG for the self-management of angina as well as understanding of the contraindications for the use of SLNTG.

Initially, question eight (see Appendix D) was designed to establish that chest pain or angina and other conditions often associated with angina are regularly seen in many adult clinics. NPs were asked how often they saw patients with the following seven diagnoses: chest pain/angina, CAD, status post (s/p) MI, s/p PCI, s/p CABG, and hypertrophic obstructive cardiomyopathy (HOCM) and/or severe aortic stenosis (AS). The NP respondents selected the frequency of seeing these type patients in their clinic on a Likert-type scale of daily, weekly, monthly, hardly ever or never. Patients with the diagnosis of CAD was the most reported patient type seen. Approximately 51% of the NPs (*n*=115) reported seeing these patient types in their clinic on a daily basis. Figure I1 displays the remaining diagnosis types and frequency seen.

Knowledge statistics. Question nine (see Appendix D) evaluated how likely NPs seeing patients with chest pain/angina, CAD, s/p MI, s/p PCI, s/p CABG, and HOCM and/or severe AS in clinic provided an initial prescription for SLNTG when clinically appropriate. Question nine was designed to assess knowledge, use (current practice) as well as contraindications to use of SLNTG. The responses were recoded to reflect "always/very likely" or "very unlikely/never".

Major findings. Only 41% (*n*=93) of the NPs would provide the initial prescription of SLNTG to patients with CAD. Fifty-nine percent (*n*=133) of the NPs responding to this survey

would rightly provide a prescription of SLNTG to patients with chest pain/angina. Whereas, only 39% (*n*=88) would provide SLNTG prescription for patients s/p MI; 32% (*n*=72) for patients s/p PCI, and 30% (n=68) for patient's s/p CABG. Even though less than 5% (*n*=11) of NP providers responding to this survey saw patients with HOCM or severe AS on a daily basis, 88% (*n*=198) of those responding to the survey knew to "hardly ever/never" give an initial prescription for SLNTG to these patients. Figure I2 displays these results.

Questions 11-12 (see Appendix D) scenario questions measured knowledge of the use and contraindications of the use of SLNTG as outlined in the 2012 SIHD Guideline. These questions corresponded to areas in the literature of patient deficits. This author identified four themes relative to the patient deficits found in the literature. These deficits included the use of SLNTG as premedication for effort-induced angina (Fan et al., 2009; Gallagher, 2010); SLNTG and the use of phosphodiesterase inhibitors (Gallagher, et al., 2010); dosing intervals for the use of SLNTG (Fan et al., 2009, Gallagher et al., 2010, 2013); and replacement of SLNTG (Gallagher et al, 2010; Zimmerman et al., 2000). Each of these topics are covered in the 2012 SIHD Guideline. A scenario was developed regarding the themes, and participants were provided with three to five recommendations to which they were to agree (yes) or disagree (no). Selection of the correct recommendation as taken directly from the 2012 SIHD Guideline indicated knowledge of the guideline.

Similar to the body of evidence, only 35% (*n*=79) of NPs reported an awareness of the appropriate instructions for patients to premedicate with the SLNTG before activities that can cause angina (such as gardening, sexual activity, etc.). Seventy-seven percent (*n*=169) of NPs did report knowledge of the use of SLNTG and phosphodiesterase inhibitors. Nearly all (97%, *n*=219) reported knowledge regarding dosing instructions for SLNTG and 83% (*n*=187) reported

knowing when to instruct patients to replace their bottle of SLNTG. Displayed in Figure I3 in Appendix I are the correct knowledge scores for all NPs per questions 11-14.

To answer the last clinical project question regarding any differences or associations between knowledge and practice type, this author analyzed knowledge questions 11 through 14 and NP role (such as acute care NP, adult NP, family NP, etc.) and knowledge questions 11 through 14 and practice type. It was of interest to see if NPs in one practice type or NP role were more knowledgeable about the topics of interest than another. Table J1 displays the percent correct by NP title and practice type.

Since the data for these questions were categorical in nature (NP role and practice type), the Chi-square test was used. However, once the contingency tables were ran and reviewed, the "minimum expected cell frequency" (Pallant, 2014, p. 227) was violated as several cells had expected counts less than five. Therefore, those results were not reported.

Given the above violation of expected cell outcome with individual practice type, the author elected to recode data to look at cardiology versus all other practice types. The data was collapsed and recoded as cardiology (1) and all others (0). A Chi-square was done on the new collapsed practice type (cardiology vs. all others) for each of the scenario questions and the pivotal responses from each (i.e., 11-3, 12-3, 13-3, and 14-2). Each of these pivotal responses represented knowledge in areas on premedicating with SLNTG before activities causing angina (11-3); use of SLNTG and phosphodiesterase inhibitors (12-3); dosing of SLNTG (13-3); and when to replace the bottle of SLNTG (14-2). Chi-square was done with each permutation. Table J2 displays the percent correct per scenario question with the *p*-value for each Chi-square analysis.

The responses to question 11-3, premedicating with SLNTG for effort-induced angina and practice type (cardiology vs. all others). A Chi-square for independence (with Yates Continuity Correction) indicated no significant association between practice type (cardiology vs. all others) and knowledge of the use of SLNTG as premedication for effort-induced angina, χ^2 (1, n = 226) = .219, p = .64, *phi* = .04. Forty-seven percent (47%, n=15) of NPs in cardiology compared to 34% (n=66) of all other NPs knew to recommend to patients to premedicate with SLNTG for effort-induced angina. Statistically, NPs working in cardiology were no more knowledgeable than all other practices. Table J2 displays this information.

The responses to question 12-3, use of SLNTG and phosphodiesterase inhibitors and practice type (cardiology vs. all others). A Chi-square for independence (with Yates Continuity Correction) indicated an association between practice type (cardiology vs. all others) and knowledge of the use of SLNTG and phosphodiesterase inhibitors (like Viagra). χ^2 (1, n = 226) = 4.64, p = .03, *phi* = .159. Approximately 94% (n=30) of cardiology NPs answered the question correctly; whereas, approximately 75% (n=145) of non-cardiology NPs answered correctly. Statistically, this suggests NPs in cardiology are more knowledgeable than other NPs in all other practice types in the knowledge of potential interaction between SLNTG and phosphodiesterase inhibitors. Table J2 displays this information.

The responses to question 13-3,* d*osing of SLNTG and practice type (cardiology vs. all others). A Chi-square for independence (with Yates Continuity Correction) indicated no significant association between practice type (cardiology vs. all others) and knowledge of the dosing schedule for SLNTG. χ^2 (1, n = 226) = .31, p = .57, *phi* = -.074. This suggests that 94% (n=30) of NPs working in cardiology know the correct dosing of SLNTG (per the 2012 SIHD Guideline) whereas 97% (n=188) of non-cardiology specialty NPs report knowledge of dosing

sequence. There was no statistically significant difference between the two groups. Table J2 displays this information.

The responses to question 14-2, when to replace SLNTG bottle and practice type (cardiology vs. all others). A Chi-square for independence (with Yates Continuity Correction) found no significant association between practice type (cardiology vs. all others) and knowledge of when to tell patients to replace their SLNTG bottle. χ^2 (1, n = 226) = .000, p = .99, *phi* = .018. Lastly, 84% (n=27) of cardiac specialty NPs reported knowing when to have patients replace their SLNTG; and 82% (n=159) of non-cardiac specialty NPs knew this information. Here again, there was no statistical difference between knowledge of NPs working in cardiology and those in other practice types. Table J2 displays this information.

Overall, the NPs that responded to this electronic survey were aware of correct dosing of SLNTG, use of SLNTG with phosphodiesterase inhibitors, and when to tell patients to replace their SLNTG. However, NPs respondents were less knowledgeable about SLNTG as premedication for effort-induced angina. The only statistically significant finding noted when comparing NPs working in cardiology to all other practice types, was their knowledge in the contraindication of the use of SLNTG and phosphodiesterase inhibitors; NPs in cardiology were more knowledgeable about this information. However, there was no statistically significance in knowledge of NPs working in cardiology compared with all other practice types around the use of SLNTG as premedication for effort-induced angina, dosing sequence of SLNTG and/or when to tell patients to replace their SLNTG.

Barriers statistics. One other aspect of the survey (question 16) looked at NPs' use of clinical practice guidelines (CPG) in general. (See Appendix D). Since this practitioner was evaluating the use of the 2012 SIHD Guideline, it was asked how often NPs look up CPGs.

Twenty five percent of the respondents reported looking up CPG two to three times per week, followed by 22% (*n*=50) who look up CPG daily.

Major findings. Question 15 of the survey was to inquire as to what factors NPs reported as barriers to prescribing SLNTG when clinically appropriate (See Appendix D). Approximately 62% (*n*=142) of NPs identified they had no problems with writing an initial or refill prescription for SLNTG; while 57.5% (*n*=131) NPs had no problems writing refill for SLNTG once initial prescription provided by cardiology provider. Other factors reported that prevent NPs from prescribing SLNTG included the belief that all patients with chest pain should go to the hospital (7.5%, *n*=17) or they report practicing with a supervising physician who believes patients with stents or CABG do not need a prescription for SLNTG (0.9%, *n*=2). See Appendix K for list of all responses to remaining survey questions (questions 15, 16, 17, and 18).

Questions 17 assessed what resource(s) NPs had access to and/or used to look up CPGs or medication information (see Appendix D). Eighty-four percent (*n*=190) reported assess to asking their supervising physician; followed by 82.7% (*n*=187) had access to Google/Bing/Yahoo and 75% (*n*=169) had access to Up-To-Date. Sixty percent (*n*=137) reported having asked (or used) their supervising physician and 60% (*n*=137) used Up-To-Date. Fifty-seven percent (*n*=128) of NPs had also used Google/Bing/Yahoo and/or Epocrates to look up CPG or medication information. Further analysis revealed that most NPs respondents had up to five years of work experience (*n*=94, 42%). Of those 94 NPs, 60 (64%) had asked their supervising physician about CPGs and/or medication information. See Appendix K, Figure K1 for further details regarding years of work experience and NPs who asked their supervising physician.

Finally, barriers that prevent NPs from consistently practicing evidenced-based healthcare (EBHC), the majority (61%, *n*=127) reported no barriers to practicing EBHC; followed by "try to use guidelines, but patients are not compliant" (23%, *n*=53), whereas, 22% (*n*=50) selected "not enough time to stay informed."

Summary of Results

This survey assessed NPs and their knowledge and use of SLNTG according to the 2012 SIHD Guideline. Contraindications in the use of SLNTG and barriers NPs self-reported to providing a prescription for SLNTG were also assessed. Nearly 61% (*n*=137) of NPs report being aware of the guidelines for the diagnosis and management of patients with SIHD and 51% (*n*=115) of respondents see patients with CAD on a daily basis. Yet only 41% (*n*=93) of NPs would provide an initial prescription for patients being seen in their clinic. In addition, only 35% (*n*=79) of NP respondents seem aware of the appropriate recommendation to advise patients to use SLNTG as premedication for effort-induced angina. Similarly, only 24% (*n*=10) of patients knew to use SLNTG in this way (Fan et al., 2009). An interesting finding was that the majority of NP respondents (62%, *n*=142) reported no barriers to providing an initial or refill prescription for patients when clinically appropriate, followed by nearly 58% (*n*=131) having no problems providing a refill for SLNTG once initial prescription provided by cardiology provider.

CHAPTER V: Discussion

Survey projects are a way to obtain descriptive information using self-reported data (Melnyk & Fineout-Overholt, 2015). This DNP project assessed knowledge, barriers, and current practice as reported by NPs in adult care clinical settings in their use of SLNTG based on the 2012 SIHD Guideline. One outcome of such evaluation was the dissemination of findings in such a way to inform and educate clinicians in the reported findings and areas of improvement. The overall encompassing goals of information from this project are concurrent quest of better care for individuals, better health for populations, and lower per capita costs of health care (Berwick, Feeley, & Loehrer, 2015) as implied by the Institute of Health's Triple Aim (IHI-Institute of Health, 2014).

When asked how often NPs saw patients in their clinics with clinical diagnoses associated with the symptoms of CP/angina or with conditions that can present with angina, the majority of NPs reported seeing patients with CAD on daily basis, followed by CP and s/p MI weekly. NPs reported that monthly it was common to see patients who were s/p PCI or CABG whereas; patients with HOCM and/or severe AS were hardly ever seen in their clinics.

Only 59% (*n*=133) of the NPs report they would provide an initial prescription for SLNTG to the patients with CP/angina; whereas 41% (*n*=93) would not. Forty-one percent (*n*=93) or less of NPs would provide an initial prescription for SLNTG to patients with CAD, s/p MI, PCI and/or CABG. As appropriate, the majority of NPs (88%, *n*=198) would be very unlikely or would never provide a prescription for SLNTG in the patients with HOCM and/or severe AS. This suggests that 12% (*n*=27) of NPs would provide a prescription for SLNTG to these patient with HOCM and/or severe AS, which according to the 2012 SIHD Guideline is contraindicated (Fihn et al., 2012).

When given a scenario type question and asked if they would (yes) or would not (no) make the following recommendations (see Appendix D), 65% (*n*=147) of NPs would not suggest the use of SLNTG as a pre-medication for effort-induced angina. Nearly all, 97% (*n*=219), report knowing the dosing sequence of SLNTG as per the 2012 SIHD Guideline. Seventy-seven percent (*n*=174) of NPs are aware of recommendations around the use of SLNTG and phosphodiesterase inhibitors. Eighty-three percent of NPs report knowing when to have patients replace their bottle of SLNTG.

Implications of Findings

Walton-Shirley's (2014) commentary on the lack of availability of SLNTG in patients clinically appropriate to have a prescription initiated this author's investigation. Further examination of the literature found no information on NP or physician provider knowledge of the use of SLNTG. The few studies that looked at knowledge and use of SLNTG were from the patients' perspective. These studies suggested that many patients, if they had a prescription for SLNTG, did not always report an understanding of how or when to correctly use the medication. Chronic stable angina (CSA) in SIHD is common and often seen in most adult care offices (Go et al., 2014).

For practice. In the 2012 SIHD Guideline, Fihn and colleagues outlined the goals for treating patients with SIHD as twofold: to decrease the possibility of death while maintaining health and function. Two objectives cited to achieve these goals were preserved or improved functional capacity and quality of life while eliminating ischemic symptoms (Fihn et al., 2012). One strategy used to achieve improved functional capacity, quality of life and elimination of ischemic symptoms is with GDMT, such as the use of SLNTG, while avoiding drug interactions

and unwarranted side effects (Fihn et al, 2012). These project findings have implications for NPs' clinical practice and the use of SLNTG related to achievement of the above objectives.

Evidence-based practice (EBP) is the use of best available evidence, combined with nursing expertise while maintaining the values and preferences of individuals, families and communities (Sigma Theta Tau, 2004). Clinical practice guidelines are one resource for providing evidence-based healthcare. The majority (24.8%, *n*=56) of NPs surveyed for this project reported looking up CPGs two to three times a week. Most, nearly 61% (*n*=127), reported no barriers to practicing EBP (or evidence-based healthcare); yet evidence from the responses suggest a discordance between their perception of using EBP and their knowledge of the concepts evaluated in this survey.

Survey findings suggest opportunities for improvement in the care for the SIHD patient population. Congruent with the literature (Walton-Shirley, 2014; Gallagher et al., 2010), patients often do not have a prescription for SLNTG when clinically appropriate (i.e., diagnosis of CAD). In this survey, only 41% (*n*=93) of NPs reported, they were to likely provide an initial prescription for SLNTG in the CAD patient. Yet, when asked what factors prevent the NP from providing a prescription for SLNTG when appropriate, nearly 62% (*n*=140) reported no problems with providing an initial (or refill) prescription for SLNTG. Respondents to the survey may have provided socially desirable responses to the question regarding factors preventing them from prescribing SLNTG when clinically appropriate (Dillman, Smith, & Christian, 2014).

Likewise, the literature on patient knowledge suggested that only 24% (*n*=10) of patients knew they could use SLNTG as a pre-medication for effort-induced angina (Fan et al., 2009; Gallagher, 2010). This was very similar to the survey's finding that only 35% (*n*=79) of NPs who would make this recommendation as evaluated in scenario question 11. (See Appendix D).

Though 77% (*n*=174) of NPs who were aware of the contraindications between the use of SLNTG and phosphodiesterase inhibitors, still 23% (*n*=52) of NPs appear unaware of this danger. This finding was in contrast with Fihn et al.'s (2012) recommendation that attention be given to avoid drug interactions for successful management of angina.

The majority of NPs, 97% (*n*=219), reported understanding dosing instruction for SLNTG as based on the 2012 SIHD Guideline. Lastly, 83% (*n*=187) of NPs are aware of when to tell patients they should replace their bottle of SLNTG. Keeping a current bottle of SLNTG available for use when needed for self-management of angina was imperative for quality of life, as well as improved functional capacity.

For education. Past research suggested knowledge deficits in patients in the correct use and understanding of SLNTG (Fan et al., 2009; Gallagher, et al., 2010, 2013; Zimmerman et al., 2009). The findings of this NP survey identified NP knowledge deficits as well**.** Knowledge deficits identified in the NP survey included the use of SLNTG as a premedication for exercise induced angina and potential interactions between SLNTG and phosphodiesterase inhibitor use. Therefore, there are opportunities for ongoing clinical education for patients and NP providers. The development of a chest pain action plan would provide evidence-based clinical care for patients with SIHD. Therefore, post-doctoral efforts by this author will include the development of a chest pain action plan for dissemination.

The author, as a DNP prepared graduate, is well positioned to disseminate the survey findings. As part of this DNP project a handout for providers which bulleted many aspects of the use of SLNTG was developed. After completing the survey, the handout was available for download. In addition, a manuscript for a clinical professional journal will be prepared to increase dissemination of the educational awareness information to NP colleagues. Lastly,

survey findings can be diffused further through professional presentations and one-on-one with colleagues and while precepting NP students.

For scholarship. Boyer's (1990) definition of scholarship in nursing (as cited by the American Association of Colleges of Nursing [AACN], 1999) is defined as

> … those activities that systematically advance the teaching, research, and practice of nursing through rigorous inquiry that 1) is significant to the profession, 2) is creative, 3) can be documented, 4) can be replicated or elaborated, and 5) can be peer-reviewed through various methods (p. 2).

Clinical scholarship as related to this DNP scholarly project was an opportunity to close the gap between research and practice (Moran et al., 2014).

The literature suggested there is a discordance that exists between guideline recommendations and actual SLNTG prescribing practices. Previous research regarding the use and knowledge of SLNTG in the SIHD patient has been from the patients' perspective. This project was an original attempt at evaluating NP providers' knowledge of the knowledge, barriers, and current practice of the use of SLNTG in the SIHD patient. The findings from this DNP project can be translated into clinical practice to improve the knowledge base of and subsequently improve the quality of life for individuals with SIHD. (Sigma Theta Tau Clinical Scholarship Task Force, 1999). Opportunities exist for ongoing work in this clinical area. As previously discussed, the tool, developed specifically for this project needs further work for reliability and construct validity. Lastly, a poster or podium presentation of the project findings at a state or national NP conference is planned.

Limitations

The greatest limitation in this project design was the development and design of the actual survey. The author found no pre-existing instrument to measure NP knowledge in this area of clinical interest and the development of the survey was pivotal to the success of the information gathered. Although this survey was revised multiple times during its development, there are still areas for ongoing improvement. Most notable to any future endeavor, it is critical to clearly identify the concept to measure to facilitate the identification of the appropriate tool and statistical analysis (Pallant, 2013). Future efforts in survey projects by this author would include self-directed continuing education course work on survey design and/or seeking out a national expert on survey design who could provide feedback to improve content and face validity. One could also change the methodology of the project to include a focus group to assess knowledge.

In hindsight, involvement of a statistician during survey design would have allowed for more stringent data analysis techniques. This student felt that factor analysis and reliability of the survey were beyond the expectations of the program and the lack of reliability and factor analysis of the survey items is a limitation.

A specific revision to the Nitroglycerin Handout embedded as a link at the end of the survey for participants would the inclusion of the use of SLNTG as a pre-medication for effort-induced angina.

Generalizability. Factors affecting the generalizability of these DNP project findings are the use of a convenience sample, use of self-reported data, and the low survey response rate. Power analysis was not done since a convenience sample was used. Adams, Soumerai, Lomas and Ross-Degnan (1999) concluded there was often an over-estimation of adherence to practice

guidelines when using self-reported means, such as a survey. The response rate of only 10% was a limitation that would affect generalizability.

The results of the project are generalizable only to the sample surveyed, but the findings reveal opportunities for further education of NP providers who in turn would be equipped to facilitate patient education. To enhance the generalizability of these findings, further development of the tool is needed in the areas of reliability/construct validity and factor analysis. Increasing the sample size to a regional or national NP database would contribute to generalizability. The project findings serve to inform NP practice in NC and provide a foundation to fill a noted gap in the nursing knowledge for the provision of high quality evidence-based practice in the SIHD patient populations.

Delimitations

Delimitations are decisions made by the author from the beginning. One delimitation for this project was in sample selection. This DNP student elected to begin evaluation of knowledge with fellow NPs in NC. Physicians and physician assistants were not included in this survey. Additionally, it was decided to limit respondents to adult care settings and cardiac medicine, and did not include those from cardiac surgery because providers in cardiac surgery often follow this patient population short-term and in the initial post-operative phase after CABG. Therefore, cardiac surgery providers would generally expect patients who experience chest pain to report to emergency room for further evaluation instead of self-managing their symptoms. In addition, the author, elected not to use responses from participants who reported the hospital as their primary setting, as they do not generally follow patients on a long-term basis in the clinic setting.

The process for assigning (or scoring) knowledge was identified as a potential issued during survey design. Different scoring methods could have been used.

One additional delimitation was the strict use of the 2012 SIHD Guideline (Fihn et al., 2012). As previously discussed, the ACCF/AHA published the 2014 Focus Update to the 2012 SIHD Guideline; however, the newer guideline discussed primarily diagnostic testing and added nothing to the GDMT section as addressed in the 2012 SIHD Guideline related to SLNTG. Fihn and colleagues (2014) under the GDMT section only elaborated on the use of Chelation Therapy and EECP both for the treatment of angina. In addition, at least two survey respondents mentioned that the dosing of SLNTG had changed from instructing patients to call 911 after taking their third SLNTG five minutes apart to calling after the first SLNTG. The dosing schedule used in this project was taken from the 2012 SIHD Guideline, which instructed providers to have patients call 911 after the third SLNTG if relief does not occur. The 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction (STEMI; O'Gara et al., 2013; Rosenberg, 2005) reflects an updated recommendation to have patients call 911 after taking only one SLNTG. The intent behind this new recommendation was to avoid delay in arrival of EMS services. However, for the purpose of this DNP project, the SIHD patient is the focus, not the patient with a STEMI.

Recommendations

Few NPs responding to this DNP survey were aware of the use of SLNTG as pre-medication for effort-induced angina. Therefore, one lesson learned from this evaluation of NP knowledge is the opportunity to equip providers and patients with an option to improve functional capacity by instructing them to use SLNTG as a pre-medication for effort-induced angina.

Findings indicated opportunities for improvement in the use of SLNTG from the NPs' perspective. As practitioners, NPs need to recall the basics in the use of SLNTG. Angina affects

quality of life (Akyildiz & Ergene, 2014; Beltrame et al., 2009) and is associated with long-term anxiety, depression and impaired physical functioning (Beatty et al., 2014; Jespersen et al., 2013). The literature suggests there is a discordance between patients needing a prescription for SLNTG and those patients who have a prescription as well as not understanding the use and/or purpose of SLNTG. The findings of this DNP project support similar findings of NP providers completing this survey. Therefore, additional education of providers or even increased awareness in these basic knowledge items in the use of SLNTG may improve the quality of care in the SIHD patient population.

Overall Conclusion

The *American Association of College of Nursing's (AACN) Essentials of Doctoral Education for Advance Practice Nursing* (AACN, 2006) served as a roadmap of required elements for completion of this DNP program. From the selection and exploration of a clinical issue to the completion of the project to this point, this author believes they have met those requirements. Appendix K reviews aspects of the project as they relate to the eight essentials.

As a NP working in an adult cardiology practice in eastern NC, this student appreciated the clinical scholarship of delving more deeply into the management of patients with SIHD (*AACN Essential II*). The initial commentary from Walton-Shirley (2014) suggested the need for a "global practice-improvement initiative" (para. 1) exploring nitroglycerin prescribing provided the first-step for which this DNP scholarly project was begun. Review of the literature found little on this topic and what literature was discovered was from the patients' perspective (*AACN Essentials II, III*).

Based on the research findings that patients often do not possess either an actual prescription for SLNTG nor the knowledge to appropriately use SLNTG, this author proceeded

to explore NPs' knowledge and use of SLNTG in the SIHD patient population. Aspects of cardiovascular care are included in five of the 24 objectives for HP 2020 including improvement of quality of life (*AACN Essential III*). Helping patents better self-manage their angina with SLNTG has the potential to improve their quality of life, decrease the misuse or overuse of healthcare resources, and improve overall care for this patient population (*AACN Essential V*).

A major portion of this DNP project was the development of an original tool used to assess NP knowledge around the use of SLNTG. The basis for survey research was reviewed and the tool was developed (*AACN Essential III*). Collaboration with the DNP Project Committee Chair and Members, statistician, NP colleagues and one of the authors whose work was referenced for this project was required in the development of the tool (*AACN Essential VI*). Noting the limitation of a tool lacking statistical reliability and validity, the results proved interesting and paralleled some of the knowledge deficits of cardiology patients. As discussed, though the tool had some weakness or limitations for use, the information obtain was informative and often paralleled the findings of patients as mentioned in the literature. Technology was used in the DNP project through use of Qualtrics ®, Excel, SPSS and many other aspects of computer technology (*AACN Essential IV*).

Findings from this DNP Project provided an opportunity to remind practitioners in many health care settings about the use of SLNTG (*AACN Essential VIII*). Educating NPs on the use of SLNTG as a premedication for effort-induced angina and reminding them of the potential interaction between phosphodiesterase inhibitors are two knowledge deficits identified in survey respondents. Ongoing efforts to educate both providers and patients will enhance the care provided to the SIHD patient population and add to the knowledge and scientific underpinnings of nursing practice (*AACN Essentials I, VII*).

In closing, patients with SIHD are seen in many healthcare settings. Angina is one manifestation of SIHD. Guideline-directed medical therapy is an important aspect of the care for these patients. Sublingual nitroglycerin is a mainstay of GDMT for these patients with SIHD with anginal symptoms. This DNP project demonstrated opportunities for NPs to get back to the basics in caring for these patients with SIHD by re-educating themselves and their patients in the use and contraindications for SLNTG. Equipping patients with tools to self-manage their symptoms can help improve quality of life, increase physical functioning and decrease overall healthcare costs.

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Appendix A

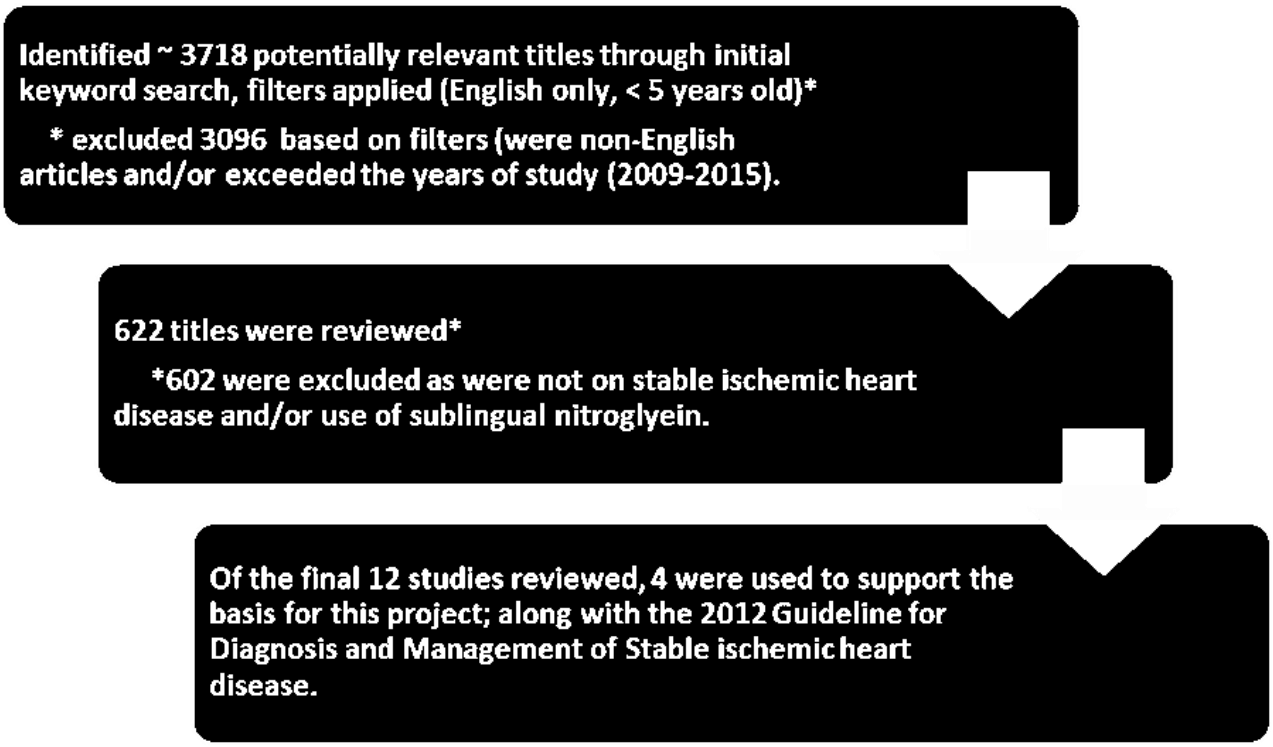


Figure A: Results of Literature Review Search

Appendix B

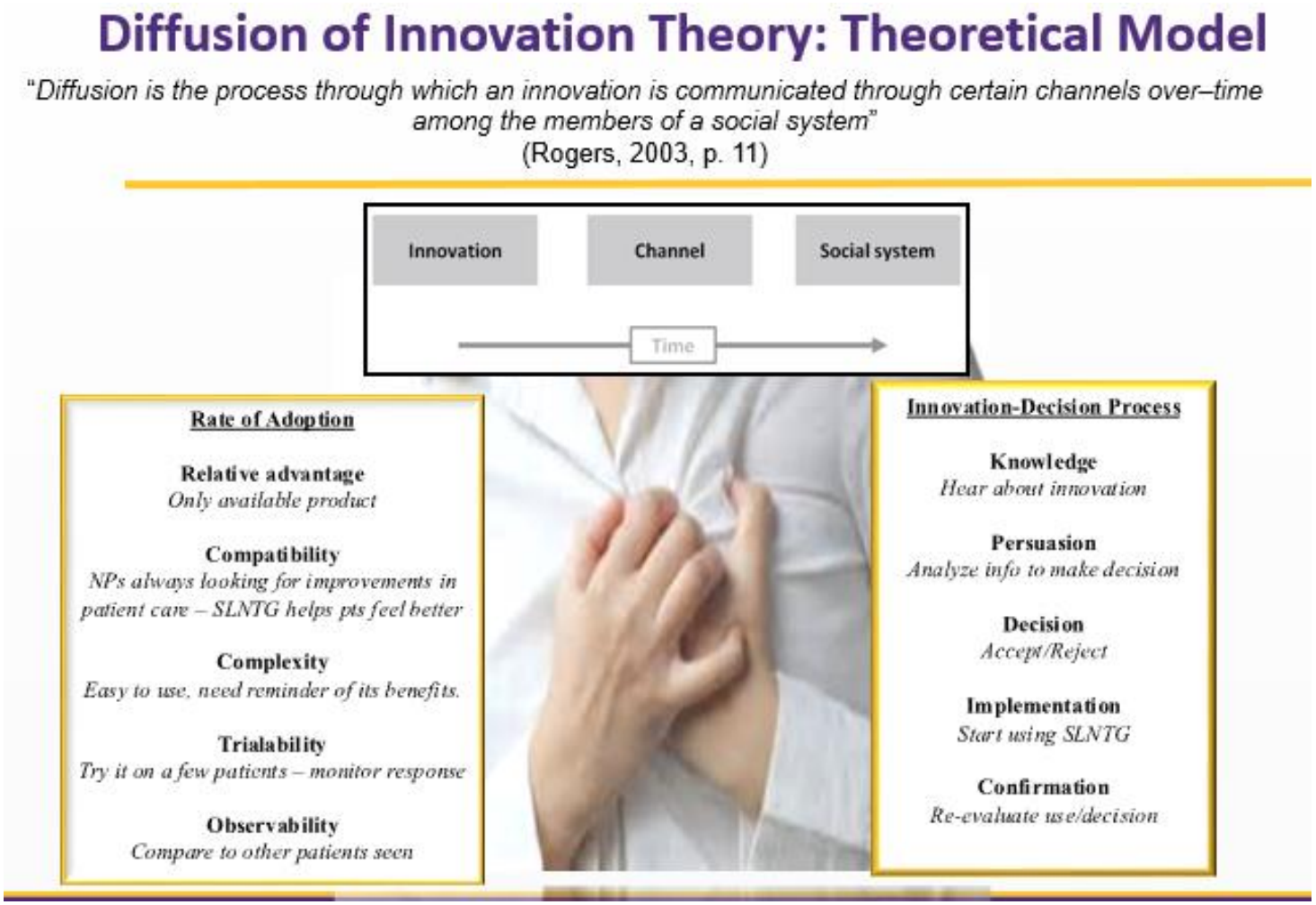


***Figure B*:** Diffusion of Innovation Theory-Theoretical Model

Appendix C

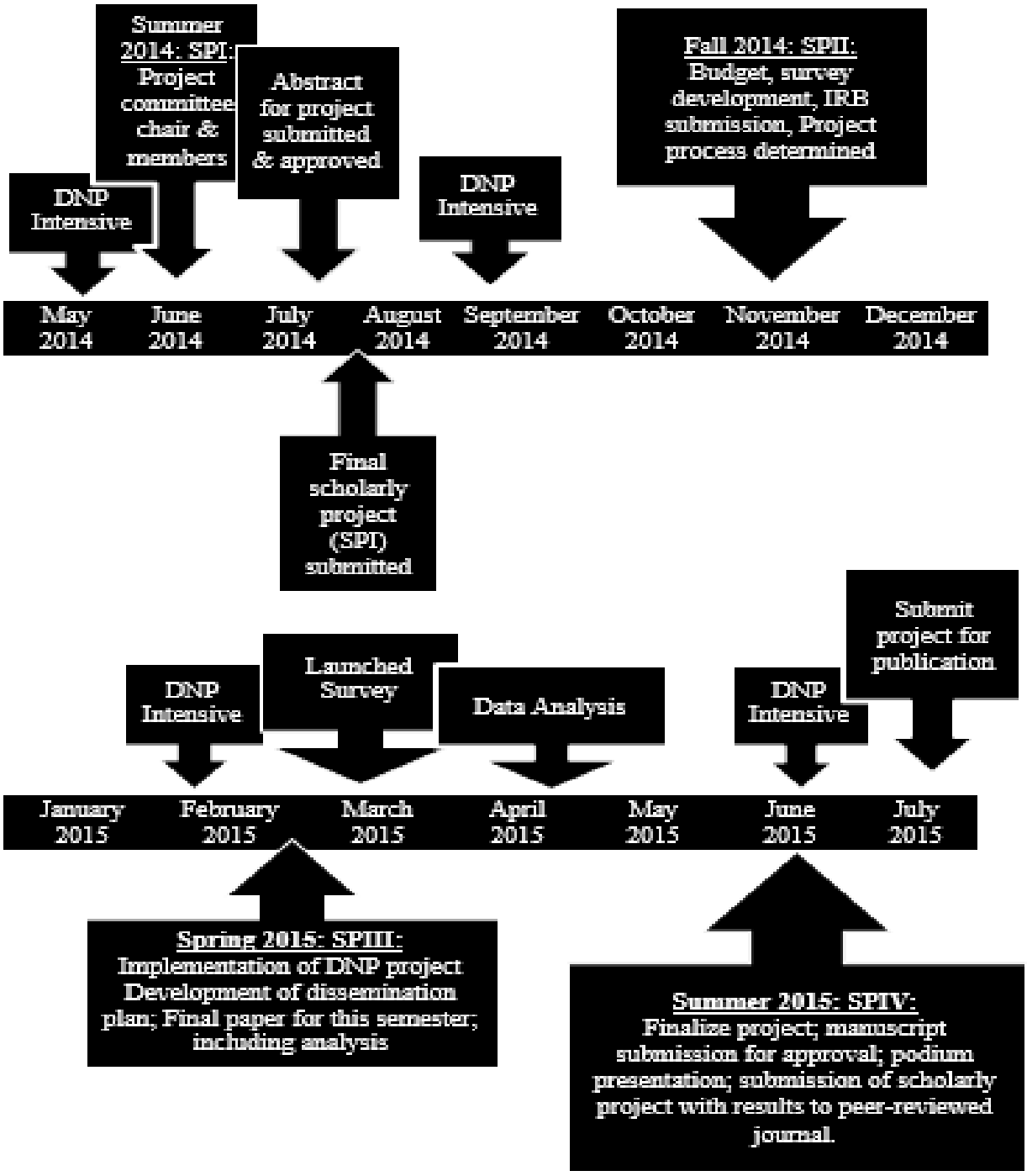


***Figure C*:** Timeline for DNP Project/Course Work

Appendix D

D1: *Word version (as downloaded from Qualtrics) of DNP project Survey*

The Use of Sublingual Nitroglycerin

SURVEY OF NURSE PRACTITIONERS' KNOWLEDGE, BARRIERS, AND CURRENT PRACTICE IN USE OF SUBLINGUAL NITROGLYCERIN IN THE STABLE ISCHEMIC HEART DISEASE PATIENT

You are being invited to participate in an investigative survey, titled "Nurse Practitioners' Knowledge, Barriers, and Current Practice in the Use of Sublingual Nitroglycerin in the Stable Ischemic Heart Disease (SIHD) Patient" being conducted by Melinda Matthews, ANP- BC a DNP Student at East Carolina University, College of Nursing.

The goal is to identify knowledge, barriers, and current practice as reported by nurse practitioners (NPs) practicing in North Carolina in primary care and specialty clinics in the use of sublingual nitroglycerin in the SIHD patient.

The survey will take approximately 10-12 minutes to complete. Participation in this anonymous, voluntary survey implies consent. There is no penalty for not taking part in this investigative survey. Please try and complete the survey in one sitting or if need to stop and return, please return to the same computer to complete.

Please call Melinda Matthews, ANP at 252-316-2067 for any research related questions or the Office of Research Integrity & Compliance (ORIC) at 252-744-2914 for questions about your rights as a research participant.

Q1 What is your highest level of education in nursing?

- ❍ Diploma RN (1)
- ❍ ADN (2)
- ❍ BSN (4)
- ❍ BS (5)
- ❍ MSN (6)
- ❍ DNP (7)
- ❍ PhD (8)
- ❍ Other (9)

Q2 What is your highest level of education as Nurse Practitioner

- ❑ Certificate (1)
- ❑ Graduate (2)

Q3 Please indicate the title that best describes your current Nurse Practitioner role:

- ❑ Acute Care Nurse Practitioner (ACNP) (1)
- ❑ Adult Nurse Practitioner (ANP) (2)
- ❑ Family Nurse Practitioner (FNP) (3)
- ❑ Gerontology Nurse Practitioner (GNP) (4)
- ❑ Adult/Gerontology Primary Care Nurse Practitioner (AGPCNP) (5)
- ❑ Other (7)

Q4 Please indicate which region in North Carolina (NC) your primary Nurse Practitioner practice is located:

- ❍ **Coastal Plains** (Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Chowan, Columbus, Craven, Cumberland, Currituck, Dare, Duplin, Edgecombe, Gates, Greene, Halifax, Harnett, Hertford, Hoke, Hyde, Johnston, Jones, Lenoir, Martin, Nash, New Hanover, Northampton, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Pitt, Roberson, Sampson, Scotland, Tyrell, Washington, Wayne, Wilson) (1)
- ❍ **Piedmont** (Alamance, Alexander, Anson, Cabarrus, Caswell, Catawba, Chatham, Cleveland, Davidson, Davie, Durham, Forsyth, Franklin, Gaston, Granville, Guilford, Iredell, Lee, Lincoln, Mecklenburg, Montgomery, Moore, Orange, Person, Randolph, Richmond, Rockingham, Rowan, Stanley, Surry, Union, Vance, Wake, Warren, Yadkin) (2)
- ❍ **Mountains** (Alleghany, Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, Wilkes, Yancey) (3)

Q5 Please indicate the practice type where you spend the majority of your time as a Nurse Practitioner:

- ❍ Primary Care Setting/Internal Medicine/Family Practice (1)
- ❍ Nursing Home/Long-term Care Facility/assisted Living or Short-term Rehabilitation (2)
- ❍ Retail Clinic (3)
- ❍ Urgent or Intermediate Care (4)
- ❍ Specialty Clinic: Cardiology (5)
- ❍ Specialty Clinic: Nephrology (6)
- ❍ Hospital (7)
- ❍ Other (10)
- ❍ I do not see patients with stable ischemic heart disease (or chest pain) (11)

If I do not see patients with ... Is Selected, Then Skip To This concludes the survey. Thank you ...

Q6 How many years have you been in clinical practice in your current Nurse Practitioner role? ___ (will be free text answer)

Q7 Do you have prescribing privileges?

- ❍ Yes (9)
- ❍ No (10)

Q8 In your day-to-day practice, how often do you see a patient with the diagnosis of:

	Daily (1)	Weekly (2)	Monthly (3)	Hardly ever (4)	Never (5)
Angina or chest pain (CP) (1)	❍	❍	❍	❍	❍
Coronary artery disease (CAD) (2)	❍	❍	❍	❍	❍
Status post myocardial infarction (S/p MI) (3)	❍	❍	❍	❍	❍
Status post percutaneous coronary intervention (s/p PCI) (4)	❍	❍	❍	❍	❍
Status post coronary artery bypass grafting (s/p CABG) (5)	❍	❍	❍	❍	❍
Hypertrophic obstructive cardiomyopathy (HOCM) (6)	❍	❍	❍	❍	❍
Severe aortic stenosis (AS) (7)	❍	❍	❍	❍	❍

Q9 As a general rule, how likely are you to provide an initial prescription (RX) for sublingual nitroglycerin in the following conditions?

	Always (1)	Very Likely (2)	Very Unlikely (3)	Never (4)
Angina or chest pain (CP) (1)	❍	❍	❍	❍
Coronary artery disease (CAD) (2)	❍	❍	❍	❍
Status post myocardial infarction (S/p MI) (3)	❍	❍	❍	❍
Status post percutaneous coronary intervention (s/p PCI) (4)	❍	❍	❍	❍
Status post coronary artery bypass grafting (s/p CABG) (5)	❍	❍	❍	❍
Hypertrophic obstructive cardiomyopathy (HOCM) (6)	❍	❍	❍	❍
Severe aortic stenosis (AS) (7)	❍	❍	❍	❍

Q10 Are you aware of the guidelines for diagnosis and management of patients with stable ischemic heart disease?

❍ Yes (1)

❍ No (2)

In the following scenarios, please provide your response(s)

Q11 Ms. Jones, a 56 year old white female, enjoys working in her garden. She finds after about 15 minutes of working at moderate pace, she develops chest pain (her typical symptoms of left chest pain that radiates to her jaw). She usually stops working in the garden and goes in the house, rests and after about 5 minutes, the pain resolves on its own. She is on metoprolol (a beta-blocker), Imdur (long-acting nitrate), Lisinopril (ACE-

inhibitor) and Ranolazine (Ranexa) and has a prescription for sublingual nitroglycerin. She also has hypertension. Your recommendations include: (Select yes or no for each statement)

	Yes (18)	No (19)
You inform her she is doing the right thing by going in the house and resting, as one has to be careful and not over do it with heart disease. (1)	❍	❍
You consider increasing her Imdur and/or Ranexa (2)	❍	❍
You advise her to take a sublingual nitroglycerin 5-10 minutes before the planned activity (gardening) and see if that will allow her to work longer in her garden before developing chest pain, possibly up to 30-40 minutes before development of symptoms. (3)	❍	❍
You advise her to immediately call 911 with any chest pain. (4)	❍	❍

Q12 Mr. Thompson is a 70 yo male with coronary artery disease, Erectile Dysfunction, and hypertension. He and his wife report being sexually intimate. His current medications include beta-blocker, ACE-inhibitor, Aspirin, statin and Ranolazine (Ranexa). He requests

a prescription (RX) for both Viagra and Sublingual Nitroglycerin. What instructions MUST you provide? (Select yes or no for each statement)

	Yes (9)	No (10)
None, as he is not on a long-acting nitrate, so use of phosphodiesterase inhibitors, such as Viagra is okay. (1)	❍	❍
Advise him it is okay to have a prescription for Viagra, as he is not on a long-acting nitrate. But withhold the prescription for sublingual nitroglycerin. (2)	❍	❍
Advise him it is okay to have prescription for both Viagra and sublingual nitroglycerin but caution him that he should not use the sublingual nitroglycerin within 24 hours of using the Viagra. (3)	❍	❍
Suggest he should avoid having sex with his wife with his heart disease. (4)	❍	❍

Q13 Ms. Smith, a 68 year old white female with hypertension, diabetes, hyperlipidemia, stage 3 chronic kidney disease as well as coronary heart disease with previous history of myocardial infarction 2 years ago, and now status post myocardial infarction 3 days ago. She did not get a stent at that time, but is being treated medically. She is on the usual medications, including aspirin, statin, Beta-Blocker, ACE-inhibitor and Ranexa. She is

given a RX for sublingual nitroglycerin as well as Instructions for use, which should include: (select yes or no for each statement)

	Yes (10)	No (11)
Once she obtains the RX for sublingual nitroglycerin, be sure and transfer them directly to her pillbox that she keeps in her purse. (1)	❍	❍
Remind her that the pills should be used daily whether she is having CP or not. (2)	❍	❍
Instruct her to place a pill under her tongue if develops chest pain (CP) that does not resolve w/ rest after a few minutes. Instruct her to take 1 tablet every 5 minutes (up to 3 tabs) and if still having CP with the 3rd one, she should call 911. (3)	❍	❍
Advise her to remain standing while taking the sublingual nitroglycerin as it works better that way. (4)	❍	❍
Stop the medication immediately if she experiences a headache or blurred vision, as this suggests an uncommon reaction to the medication. (5)	❍	❍

Q14 A patient should be instructed to replace their bottle of sublingual nitroglycerin: (select yes or no for each statement)

	Yes (9)	No (10)
According to the expiration date on the side of the bottle (as long as the bottle has not been opened) (1)	❍	❍
6-12 months after they have opened the bottle (2)	❍	❍
Only after they have used all their pills, no matter how long they have had them. (3)	❍	❍

Q15 What factors prevent you from prescribing sublingual nitroglycerin when clinically indicated? (select all that apply)

- ❑ I am uncomfortable writing for this medication – afraid it will harm my patient. (1)
- ❑ I have never written a prescription for sublingual nitroglycerin and do not plan to write one. (2)
- ❑ My supervising physician does not believe patients who have had stents or coronary bypass surgery (CABG) need a prescription for sublingual nitroglycerin. (3)
- ❑ I have no problems writing an initial or refill prescription for sublingual nitroglycerin. (4)
- ❑ I have no problems refilling sublingual nitroglycerin once the initial prescription provided by a cardiology provider (5)
- ❑ I do not provide prescription for sublingual nitroglycerin because if patient having chest pain, they should go to the emergency room for further evaluation. (6)
- ❑ I do not write prescriptions in the practice where I work. (7)

Q16 How often do you look up clinical guidelines for a specific problem/disease/ disorder?

- ❍ Never (11)
- ❍ Less than Once a Month (12)
- ❍ Once a Month (13)
- ❍ 2-3 Times a Month (14)
- ❍ Once a Week (15)
- ❍ 2-3 Times a Week (16)
- ❍ Daily (17)

Q17 Please indicate if you have access and if you use the following resources for reviewing clinical guidelines or medication information (select all that apply):

	I have access (1)	I have used (2)
Google/Yahoo/Bing (1)	❑	❑
Google Scholar (2)	❑	❑
UpToDate (3)	❑	❑
National Guideline Clearinghouse (4)	❑	❑
American Heart Association (5)	❑	❑
Medscape (6)	❑	❑
Lexicomp (7)	❑	❑
Micromedex (8)	❑	❑
Epocrates (9)	❑	❑
I have access to a health science library at/through my practice - several resources available. (10)	❑	❑
I usually also confer with my NP colleagues (11)	❑	❑
I ask my supervising physician (12)	❑	❑

Q18 The following are reasons (barriers) to why I may not consistently practice evidence-based healthcare (select all that apply):

- ❑ Lack of familiarity or awareness of available clinical guidelines. (1)
- ❑ Not enough time to stay informed. (2)
- ❑ Lack of access to guidelines. (3)
- ❑ I do not typically agree with guidelines. (4)
- ❑ Guidelines are too "cookbook". (5)
- ❑ I find that the guidelines usually do not provide the expected outcomes. (6)
- ❑ I try to use guidelines, but my patients are not compliant. (7)
- ❑ I do not have time to review the information in guidelines with my patients. (8)
- ❑ The practice with which I work does not endorse the use of clinical guidelines. (9)
- ❑ I have no barriers in practicing evidence-based healthcare. (10)

Demographic Information

Q19 I am

- ❍ Male (1)
- ❍ Female (2)

Q20 Race/Ethnicity:

- ❍ White/Caucasian (1)
- ❍ Black/African American (2)
- ❍ Hispanic/Latino (3)
- ❍ Asian (4)
- ❍ Native American (5)
- ❍ Pacific Islander (6)
- ❍ Other (7)

Q21 Age: ___ (will be free text)

This concludes the survey. Thank you for your participation.

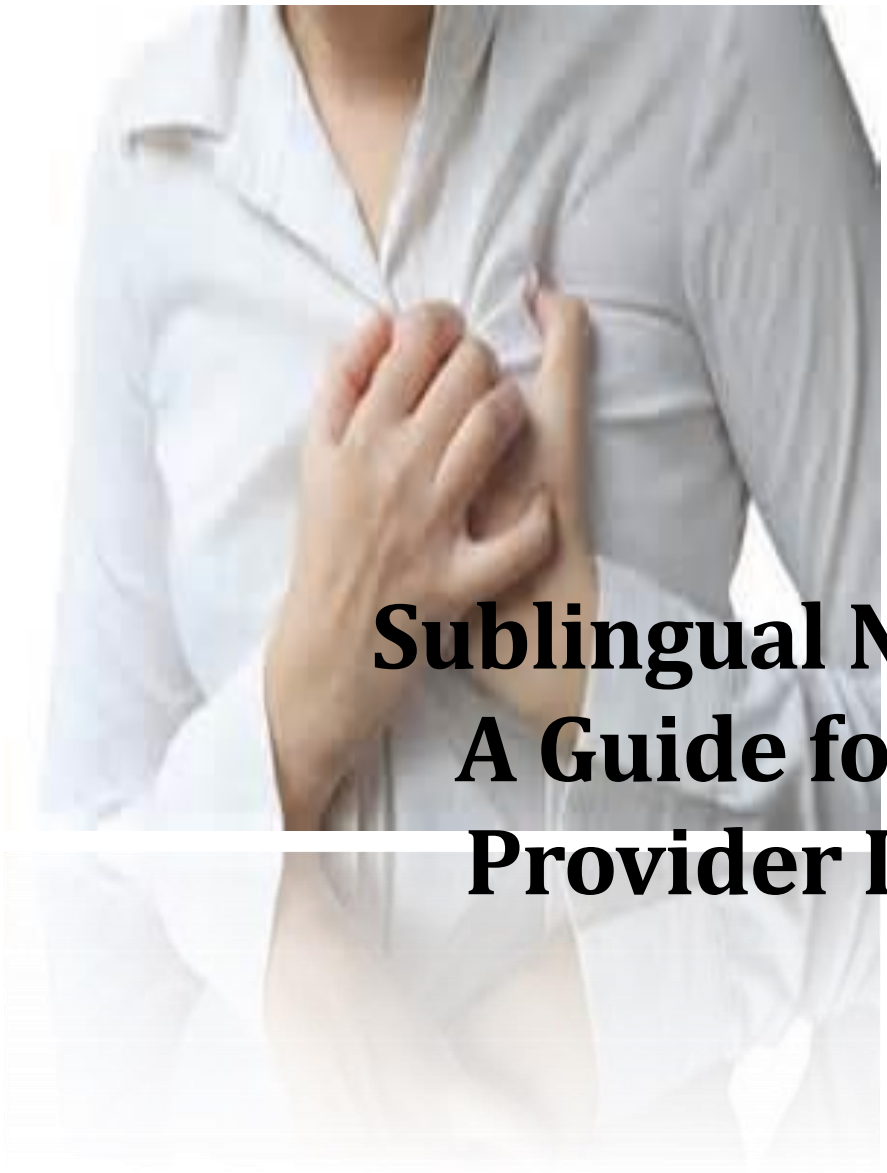
Below is a link to a handout that summarizes the use of Sublingual nitroglycerin (SLNTG) as included in the 2012 Guideline for the Diagnosis and Management of Patients with Stable Ischemic Heart Disease.

The Nitroglycerin handout *(copy of handout below)*

Sincerely,

Melinda Matthews, MSN, APRN, ANP,BC, DNP Student
East Carolina University, College of Nursing

D2: *The Nitroglycerin Handout as embedded in the DNP SLNTG Survey, downloadable to Survey Participants*



Sublingual Nitroglycerin: A Guide for Patient & Provider Instruction

By

Melinda Matthews, RN, MSN, ANP, BC, DNP-Student

Based on the 2012 ACCF/AHA Guideline for Diagnosis and Management of Stable Ischemic Heart Disease.

THE BASICS

- **S**: Stable Ischemic Heart Disease: predictable chest pain, appropriate for prescription of sublingual nitroglycerin (SLNTG). As is diagnosis of angina, coronary artery disease (CAD), post myocardial infarction (MI), post percutaneous coronary intervention (PCI/stents) and/or coronary artery bypass grafting (CABG)

- **L**: Listen: To your patients – Ask at each visit if they are having chest pain and if they need a refill on their SLNTG. Remind them each visit how to use the nitro. Including use of SLNTG as premedication for exercise-induced angina.

- **N**: Nitrates: works to vasodilate the coronary arteries and increases blood flow to the heart muscle → eases chest pain.

- **I**: Instructions for use: Sit down, place tablet under tongue, wait 5 minutes, can repeat x 2. If still having chest pain → Call 911. (Spray works the same, just spray on tongue, not under). Warn of possible (normal) side effects – hypotension, dizziness and/or headache. Should report if has syncope.

- **T**: Take Caution: in use with hypertrophic obstructive cardiomyopathy.

- **R**: Risk: Avoid with severe aortic stenosis.

- **O**: Other meds? Ask if taking phosphodiesterase inhibitors, such as Viagra, Cialis or Levitra. Advise cannot use SLNTG within 24 hours of Viagra. Cannot use within 48 hrs with Cialis. Suitable time for use after Levitra has not been determined. Remind them that is okay to use SLNTG even if wearing nitroglycerin patch.

ADDITIONAL RESOURCES FOR MORE INFORMATION ON THE 2012 GUIDELINE FOR STABLE ISCHEMIC HEART DISEASE

Below are articles and guidelines you may find helpful if interested in reading more about SIHD and use of SLNTG.

Fihn, S. D., Gardin, J. M., Abrams, J., Berra, K., Blandenship, J. C., Dallas, A. P., & ... Williams, S. V. (2012). 2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS guideline for the diagnosis and management of patients with stable ischemic heart disease: A report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines,. *Journal of the American College of Cardiology, 60*(24), e44 -e164.

Fihn, S. D., Gardin, J. M., Abrams, J., Berra, K., Blandenship, J. C., Dallas, A. P., & ... Williams, S. V. (2012). 2012 ACCF/AHA/ACPAATS/PCNA/SCAI/STS guideline for the diagnosis and

management of patients with stable ischemic heart disease: Executive Summary. *Journal of the American College of Cardiology, 60*, 2564-2603. Retrieved from http://content.onlinejacc.org

Lewis, J. M., & Davis, L. L. (2013). Management of stable ischemic heart disease. *The Journal of Nurse Practitioners, 9*(10), 661-668.

Appendix E: IRB Approval Letters

IRB: Study Correspondence Letter
umcirb@ecu.edu
Sent: Friday, November 21, 2014 8:50 AM
To: Matthews, Melinda Workman

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building · Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · www.ecu.edu/irb

Notification of Exempt Certification

From: Social/Behavioral IRB
To: Melinda Matthews
CC: Robin Webb Corbett
Date: 11/21/2014
Re: UMCIRB 14-001641
Use of Sublingual Nitroglycerin

I am pleased to inform you that your research submission has been certified as exempt on 11/21/2014 . This study is eligible for Exempt Certification under category #2 .

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession. This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.
The UMCIRB office will hold your exemption application for a period of five years from the date of this letter. If you wish to continue this protocol beyond this period, you will need to submit an Exemption Certification request at least 30 days before the end of the five year period.
The Chairperson (or designee) does not have a potential for conflict of interest on this study.

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office 252-744-2914 · Fax 252-744-2284 · www.ecu.edu/irb

Notification of Amendment Approval

From: Social/Behavioral IRB
To: Melinda Matthews
CC: Robin Webb Corbett
Date: 2/9/2015
Re: Amel_UMCIRB 14-001641
UMCIRB 14-001641
Use of Sublingual Nitroglycerin

Your Amendment has been reviewed and approved using expedited review on the date of 2/8/2015. It was the determination of the UMCIRB Chairperson (or designee) that this revision does not impact the overall risk/benefit ratio of the study and is appropriate for the population and procedures proposed.

Please note that any further changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. A continuing or final review must be submitted to the UMCIRB prior to the date of study expiration.The investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Document	Description
Nitroglycerin Handout - embedded in survey(0.01)	Surveys and Questionnaires
purpose and consent - revised(0.01)	Consent Forms
Revised - INTRO to survey(0.01)	Recruitment Documents/Scripts
REVISED Survey (0.01)	Surveys and Questionnaires

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

Appendix F

Table F1: *Clinical Practice Questions (CPQ), Survey Question that Addresses the CPQ, and Statistical Test Used*

Survey Q# (SQ#):	Question	Statistical Test Used
CPQ 1. Do NPs in NC practicing in primary care and specialty clinics report an understanding of the use of SLNTG for the self-management of angina?		
SQ#9	**As a general rule, how likely are you to provide an initial prescription (RX) for sublingual nitroglycerin in the following conditions?**	Descriptive stats

	Always (1)	Very Likely (2)	Very Unlikely (3)	Never (4)
Angina or chest pain (CP) (1)	○	○	○	○
Coronary artery disease (CAD) (2)	○	○	○	○
Status post myocardial infarction (S/p MI) (3)	○	○	○	○
Status post percutaneous coronary intervention (s/p PCI) (4)	○	○	○	○
Status post coronary artery bypass grafting (s/p CABG) (5)	○	○	○	○
Hypertrophic obstructive cardiomyopathy (HOCM) (6)	○	○	○	○
Severe aortic stenosis (AS) (7)	○	○	○	○

SQ#11	*Scenario Question: seeking to see if NPs know to tell patients to premedicate for effort-induced angina.*	Descriptive stats

Ms. Jones, a 56 year old white female, enjoys working in her garden. She finds after about 15 minutes of working at moderate pace, she develops chest pain (her typical symptoms of left chest pain that radiates to her jaw). She usually stops working in the garden and goes in the house, rests and after about 5 minutes, the pain resolves on its own. She is on metoprolol (a beta-blocker), Imdur (long-acting nitrate), Lisinopril (ACE-inhibitor) and Ranolazine (Ranexa) and has a prescription for sublingual nitroglycerin. She also has hypertension. Your recommendations include: (Select yes or no for each statement)

	Yes (18)	No (19)
You inform her she is doing the right thing by going in the house and resting, as one has to be careful and not over do it with heart disease. (1)	❍	❍
You consider increasing her Imdur and/or Ranexa (2)	❍	❍
You advise her to take a sublingual nitroglycerin 5-10 minutes before the planned activity (gardening) and see if that will allow her to work longer in her garden before developing chest pain, possibly up to 30-40 minutes before	❍	❍

development of symptoms. (3)		
You advise her to immediately call 911 with any chest pain. (4)	❍	❍

SQ#12 *Scenario Question: seeking if NPs know issues around the use of SLNTG and Viagra*. **Mr. Thompson is a 70 yo male with coronary artery disease, Erectile Dysfunction, and hypertension. He and his wife report being sexually intimate. His current medications include beta-blocker, ACE-inhibitor, Aspirin, statin and Ranolazine (Ranexa). He requests a prescription (RX) for both Viagra and Sublingual Nitroglycerin. What instructions MUST you provide? (Select yes or no for each statement)** Descriptive stats

	Yes (9)	No (10)
None, as he is not on a long-acting nitrate, so use of phosphodiesterase inhibitors, such as Viagra is okay. (1)	❍	❍
Advise him it is okay to have a prescription for Viagra, as he is not on a long-acting nitrate. But withhold the prescription for sublingual nitroglycerin. (2)	❍	❍

Advise him it is okay to have prescription for both Viagra and sublingual nitroglycerin but caution him that he should not use the sublingual nitroglycerin within 24 hours of using the Viagra. (3)	❍	❍
Suggest he should avoid having sex with his wife with his heart disease. (4)	❍	❍

SQ#13 *Scenario Question: seeking if NPs know correct dosing sequence for SLNTG based on the 2012 Guideline for SIHD.* Descriptive stats

Ms. Smith, a 68 year old white female with hypertension, diabetes, hyperlipidemia, stage 3 chronic kidney disease as well as coronary heart disease with previous history of myocardial infarction 2 years ago, and now status post myocardial infarction 3 days ago. She did not get a stent at that time, but is being treated medically. She is on the usual medications, including aspirin, statin, Beta-Blocker, ACE-inhibitor and Ranexa. She is given a RX for sublingual nitroglycerin as well as Instructions for use, which should include: (select yes or no for each statement)

	Yes (10)	No (11)
Once she obtains the RX for sublingual nitroglycerin, be sure and transfer them directly to her pillbox that she keeps in her purse. (1)	❍	❍
Remind her that the pills should be used daily whether she is having CP or not. (2)	❍	❍

Instruct her to place a pill under her tongue if develops chest pain (CP) that does not resolve w/ rest after a few minutes. Instruct her to take 1 tablet every 5 minutes (up to 3 tabs) and if still having CP with the 3rd one, she should call 911. (3)	❍	❍
Advise her to remain standing while taking the sublingual nitroglycerin as it works better that way. (4)	❍	❍
Stop the medication immediately if she experiences a headache or blurred vision, as this suggests an uncommon reaction to the medication. (5)	❍	❍

SQ#14 *Scenario Question: seeking if NPs know when to tell patients to replace their bottle of SLNTG.* Descriptive stats

A patient should be instructed to replace their bottle of sublingual nitroglycerin: (select yes or no for each statement)

	Yes (9)	No (10)
According to the expiration date on the side of the bottle (as long as the bottle has not been opened) (1)	❍	❍

6-12 months after they have opened the bottle (2)	❍	❍
Only after they have used all their pills, no matter how long they have had them. (3)	❍	❍

SQ#15 **What factors prevent you from prescribing sublingual nitroglycerin when clinically indicated? (select all that apply)** Descriptive stats

- ❑ I am uncomfortable writing for this medication – afraid it will harm my patient. (1)
- ❑ I have never written a prescription for sublingual nitroglycerin and do not plan to write one. (2)
- ❑ My supervising physician does not believe patients who have had stents or coronary bypass surgery (CABG) need a prescription for sublingual nitroglycerin. (3)
- ❑ I have no problems writing an initial or refill prescription for sublingual nitroglycerin. (4)
- ❑ I have no problems refilling sublingual nitroglycerin once the initial prescription provided by a cardiology provider (5)
- ❑ I do not provide prescription for sublingual nitroglycerin because if patient having chest pain, they should go to the emergency room for further evaluation. (6)
- ❑ I do not write prescriptions in the practice where I work. (7)

CPQ 2. Do NPs report an understanding of contraindications for the use of SLNTG?

SQ#9 **As a general rule, how likely are you to provide an initial prescription (RX) for sublingual nitroglycerin in the following conditions?** Descriptive stats

	Always (1)	Very Likely (2)	Very Unlikely (3)	Never (4)

Angina or chest pain (CP) (1)	❍	❍	❍	❍
Coronary artery disease (CAD) (2)	❍	❍	❍	❍
Status post myocardial infarction (S/p MI) (3)	❍	❍	❍	❍
Status post percutaneous coronary intervention (s/p PCI) (4)	❍	❍	❍	❍
Status post coronary artery bypass grafting (s/p CABG) (5)	❍	❍	❍	❍
Hypertrophic obstructive cardiomyopathy (HOCM) (6)	❍	❍	❍	❍
Severe aortic stenosis (AS) (7)	❍	❍	❍	❍

SQ#12 *Scenario Question: seeking if NPs know issues around the use of SLNTG and Viagra.* Descriptive stats
Mr. Thompson is a 70 yo male with coronary artery disease, Erectile Dysfunction, and hypertension. He and his wife report being sexually intimate. His current medications include beta-blocker, ACE-inhibitor, Aspirin, statin and Ranolazine (Ranexa). He

requests a prescription (RX) for both Viagra and Sublingual Nitroglycerin. What instructions MUST you provide? (Select yes or no for each statement)

	Yes (9)	No (10)
None, as he is not on a long-acting nitrate, so use of phosphodiesterase inhibitors, such as Viagra is okay. (1)	❍	❍
Advise him it is okay to have a prescription for Viagra, as he is not on a long-acting nitrate. But withhold the prescription for sublingual nitroglycerin. (2)	❍	❍
Advise him it is okay to have prescription for both Viagra and sublingual nitroglycerin but caution him that he should not use the sublingual nitroglycerin within 24 hours of using the Viagra. (3)	❍	❍
Suggest he should avoid having sex with his wife with his heart disease. (4)	❍	❍

CPQ 3. Does the understanding and utilization of SLNTG in the SIHD patient differ among practice specialties?

SQ#5 *Practice type (cardiology vs. all others)*

Analysis of relationship between Practice Type and knowledge questions (SQ#s: 11, 12, 13, and 14).

Please indicate the practice type where you spend the majority of your time as a Nurse Practitioner:

Chi Square for independence

- ❍ Primary Care Setting/Internal Medicine/Family Practice (1)
- ❍ Nursing Home/Long-term Care Facility/assisted Living or Short-term Rehabilitation (2)
- ❍ Retail Clinic (3)
- ❍ Urgent or Intermediate Care (4)
- ❍ Specialty Clinic: Cardiology (5)
- ❍ Specialty Clinic: Nephrology (6)
- ❍ Hospital (7)
- ❍ Other (10)
- ❍ I do not see patients with stable ischemic heart disease (or chest pain) (11)

If I do not see patients with ... Is Selected, Then Skip To This concludes the survey. Thank you ...

SQ#11 *Scenario Question: seeking to see if NPs know to tell patients to premedicate for effort-induced angina.*

Analysis of relationship between Practice Type and knowledge questions (SQ#s: 11, 12, 13, and 14).

Chi Square for independence

Ms. Jones, a 56-year-old white female, enjoys working in her garden. She finds after about 15 minutes of working at moderate pace, she develops chest pain (her typical symptoms of left chest pain that radiates to her jaw). She usually stops working in the garden and goes in the house, rests and after about 5 minutes, the pain resolves on its own. She is on metoprolol (a beta-blocker), Imdur (long-acting nitrate), Lisinopril (ACE-inhibitor) and Ranolazine (Ranexa) and has a prescription for sublingual nitroglycerin. She also has hypertension. Your recommendations include: (Select yes or no for each statement)

	Yes (18)	No (19)
You inform her she is doing the right thing by going in the house and resting, as one has to be careful and not	❍	❍

over do it with heart disease. (1)		
You consider increasing her Imdur and/or Ranexa (2)	❍	❍
You advise her to take a sublingual nitroglycerin 5-10 minutes before the planned activity (gardening) and see if that will allow her to work longer in her garden before developing chest pain, possibly up to 30-40 minutes before development of symptoms. (3)	❍	❍
You advise her to immediately call 911 with any chest pain. (4)	❍	❍

SQ#12 *Scenario Question: seeking if NPs know issues around the use of SLNTG and Viagra.* **Mr. Thompson is a 70 yo male with coronary artery disease, Erectile Dysfunction, and hypertension. He and his wife report being sexually intimate. His current medications include beta-blocker, ACE-inhibitor, Aspirin, statin and Ranolazine (Ranexa). He requests a prescription (RX) for both Viagra and Sublingual Nitroglycerin. What instructions MUST you provide? (Select yes or no for each statement)**

Analysis of relationship between Practice Type and knowledge questions (SQ#s: 11, 12, 13, and 14).

Chi Square for independence

	Yes (9)	No (10)
None, as he is not on a long-acting nitrate, so use of phosphodiesterase inhibitors, such as Viagra is okay. (1)	❍	❍

Advise him it is okay to have a prescription for Viagra, as he is not on a long-acting nitrate. But withhold the prescription for sublingual nitroglycerin. (2)	❍	❍
Advise him it is okay to have prescription for both Viagra and sublingual nitroglycerin but caution him that he should not use the sublingual nitroglycerin within 24 hours of using the Viagra. (3)	❍	❍
Suggest he should avoid having sex with his wife with his heart disease. (4)	❍	❍

SQ#13 *Scenario Question: seeking if NPs know correct dosing sequence for SLNTG based on the 2012 Guideline for SIHD.*

Ms. Smith, a 68 year old white female with hypertension, diabetes, hyperlipidemia, stage 3 chronic kidney disease as well as coronary heart disease with previous history of myocardial infarction 2 years ago, and now status post myocardial infarction 3 days ago. She did not get a stent at that time, but is being treated medically. She is on the usual medications, including aspirin, statin, Beta-Blocker, ACE-inhibitor and Ranexa. She is given a RX for sublingual nitroglycerin as well as Instructions for use, which should include: (select yes or no for each statement)

Analysis of relationship between Practice Type and knowledge questions SQ#s: 11, 12, 13, and 14).

Chi Square for independence

	Yes (10)	No (11)
Once she obtains the RX for sublingual nitroglycerin, be sure and transfer them	❍	❍

directly to her pillbox that she keeps in her purse. (1)		
Remind her that the pills should be used daily whether she is having CP or not. (2)	❍	❍
Instruct her to place a pill under her tongue if develops chest pain (CP) that does not resolve w/ rest after a few minutes. Instruct her to take 1 tablet every 5 minutes (up to 3 tabs) and if still having CP with the 3rd one, she should call 911. (3)	❍	❍
Advise her to remain standing while taking the sublingual nitroglycerin as it works better that way. (4)	❍	❍
Stop the medication immediately if she experiences a headache or blurred vision, as this suggests an uncommon reaction to the medication. (5)	❍	❍

SQ#14 *Scenario Question: seeking if NPs know when to tell patients to replace their bottle of SLNTG.*

Analysis of relationship between Practice Type and knowledge questions (SQ#s: 11, 12, 13, and 14).

A patient should be instructed to replace their bottle of sublingual nitroglycerin: (select yes or no for each statement) Chi Square for independence

	Yes (9)	No (10)
According to the expiration date on the side of the bottle (as long as the bottle has not been opened) (1)	❍	❍
6-12 months after they have opened the bottle (2)	❍	❍
Only after they have used all their pills, no matter how long they have had them. (3)	❍	❍

Demographic type question

SQ#1 **What is your highest level of education in nursing?** Descriptive stats

- ❍ Diploma RN (1)
- ❍ ADN (2)
- ❍ BSN (4)
- ❍ BS (5)
- ❍ MSN (6)
- ❍ DNP (7)
- ❍ PhD (8)
- ❍ Other (Please comment): (9) _____

SQ#2 **What is your highest level of education as an Advanced Practice Registered Nurse (APRN):** Descriptive stats

- ❍ Certificate (1)
- ❍ Graduate (2)

SQ#3 **Q3 Please indicate the title(s) that best describes your current APRN role:** Descriptive stats

- ❑ Acute Care Nurse Practitioner (ACNP) (1)
- ❑ Adult Nurse Practitioner (ANP) (2)
- ❑ Family Nurse Practitioner (FNP) (3)
- ❑ Gerontology Nurse Practitioner (GNP) (4)
- ❑ Adult/Gerontology Primary Care (AGPCP) (5)
- ❑ Other (please comment): (7) _____

SQ#4 **Please indicate which region in North Carolina (NC) your primary NP practice is located:** Descriptive stats

- ❍ **Coastal Plains** (Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Chowan, Columbus, Craven, Cumberland, Currituck, Dare, Duplin, Edgecombe, Gates, Greene, Halifax, Harnett, Hertford, Hoke, Hyde, Johnston, Jones, Lenoir, Martin, Nash, New Hanover, Northampton, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Pitt, Roberson, Sampson, Scotland, Tyrell, Washington, Wayne, Wilson) (1)
- ❍ **Piedmont** (Alamance, Alexander, Anson, Cabarrus, Caswell, Catawba, Chatham, Cleveland, Davidson, Davie, Durham, Forsyth, Franklin, Gaston, Granville, Guilford, Iredell, Lee, Lincoln, Mecklenburg, Montgomery, Moore, Orange, Person, Randolph, Richmond, Rockingham, Rowan, Stanley, Surry, Union, Vance, Wake, Warren, Yadkin) (2)
- ❍ **Mountains** (Alleghany, Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, Macon, Madison, McDowell, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, Wilkes, Yancey) (3)

SQ#5 **Please indicate the type of practice in which you are employed:** Descriptive stats

- ❍ Primary Care Setting/Internal Medicine/Family Practice (1)
- ❍ Nursing Home/Long-term Care Facility/assisted Living or Short-term Rehabilitation (2)
- ❍ Retail Clinic (3)
- ❍ Urgent or Intermediate Care (4)
- ❍ Specialty Clinic: Cardiology (5)
- ❍ Specialty Clinic: Nephrology (6)
- ❍ Other: (7) _____
- ❍ I do not see patients with stable ischemic heart disease (or chest pain) (8)

If I do not see patients with ... Is Selected, Then Skip To This concludes the survey. Thank you ...

SQ#6 **How many years have you been in clinical practice in your current APRN role? __ (free text)** Mean/standard deviation

SQ#7 **Do you have prescribing privileges?** Descriptive stats

- ❍ Yes (9)
- ❍ No (10)

SQ#8 **In your day-to-day practice, how often do you see a patient with the diagnosis of:** Descriptive stats

	Daily (1)	Weekly (2)	Monthly (3)	Hardly ever (4)	Never (5)
Angina or chest pain (CP) (1)	❍	❍	❍	❍	❍
Coronary artery disease (CAD) (2)	❍	❍	❍	❍	❍
Status post myocardial	❍	❍	❍	❍	❍

infarction (S/p MI) (3)					
Status post percutaneous coronary intervention (s/p PCI) (4)	❍	❍	❍	❍	❍
Status post coronary artery bypass grafting (s/p CABG) (5)	❍	❍	❍	❍	❍
Hypertrophic obstructive cardiomyopathy (HOCM) (6)	❍	❍	❍	❍	❍
Severe aortic stenosis (AS) (7)	❍	❍	❍	❍	❍

SQ#10 **Are you aware of the guidelines for diagnosis and management of patients with stable ischemic heart disease?** Descriptive stats

❍ Yes (1)

❍ No (2)

SQ#19 **I am** Descriptive stats

❍ Male (1)

❍ Female (2)

SQ#20 **Race/Ethnicity:** Descriptive stats

- ❍ White/Caucasian (1)
- ❍ Black/African American (2)
- ❍ Hispanic/Latino (3)
- ❍ Asian (4)
- ❍ Native American (5)
- ❍ Pacific Islander (6)
- ❍ Other (7)

SQ#21 **Age: ___ (free text)** Mean/standard deviation

General question

SQ#16 **How often do you look up clinical guidelines for a specific problem/disease/ disorder?** Descriptive stats

- ❍ Never (11)
- ❍ Less than Once a Month (12)
- ❍ Once a Month (13)
- ❍ 2-3 Times a Month (14)
- ❍ Once a Week (15)
- ❍ 2-3 Times a Week (16)

Daily (17)

SQ#17 **Please indicate if you have access and if you use the following resources for reviewing clinical guidelines or medication information (select all that apply):** Descriptive stats

	I have access (1)	I have used (2)
Google/Yahoo/Bing (1)	❑	❑
Google Scholar (2)	❑	❑
UpToDate (3)	❑	❑
National Guideline Clearinghouse (4)	❑	❑
American Heart Association (5)	❑	❑

Medscape (6)	❑	❑
Lexicomp (7)	❑	❑
Micromedex (8)	❑	❑
Epocrates (9)	❑	❑
I have access to a health science library at/through my practice - several resources available. (10)	❑	❑
I usually also confer with my NP colleagues (11)	❑	❑
I ask my supervising physician (12)	❑	❑

SQ#18 **The following are reasons (barriers) to why I may not consistently practice evidence-based healthcare (select all that apply):** Descriptive stats

- ❑ Lack of familiarity or awareness of available clinical guidelines. (1)
- ❑ Not enough time to stay informed. (2)
- ❑ Lack of access to guidelines. (3)
- ❑ I do not typically agree with guidelines. (4)
- ❑ Guidelines are too "cookbook". (5)
- ❑ I find that the guidelines usually do not provide the expected outcomes. (6)
- ❑ I try to use guidelines, but my patients are not compliant. (7)
- ❑ I do not have time to review the information in guidelines with my patients. (8)
- ❑ The practice with which I work does not endorse the use of clinical guidelines. (9)
- ❑ I have no barriers in practicing evidence-based healthcare. (10)

Note. CPQ: clinical project question; SQ: survey question; NPs: nurse practitioners; NC: North Carolina; SLNTG: sublingual nitroglycerin; RX: prescription; SIHD: stable ischemic heart disease; DX: diagnosis; CP: chest pain;

Appendix G

Checklist for Reporting Results of Internet E-Surveys (CHERRIES) Tools

ITEM CATEGORY	CHECKLIST ITEM	EXPLANATION
Design	Describe survey design p. 30	Type of design – nonexperimental, cross-sectional, quantitative, descriptive 21-item survey; target pop – NPs in NC in primary care/internal medicine/family practice, nursing home/long-term care/assisted-living/short-term rehabilitation, retail clinics, urgent care/intermediate care clinics, cardiology, nephrology or other.
IRB	IRB approval p.33	Yes - IRB approval obtained
	Informed consent p. 33	Informed consent implied in the introduction of survey tool (if participates in survey, consent implied); participants were told length of time for survey (approximately 10-12 minutes to complete); data stored on password protected computer x 3 years.
	Data protection p. 33	Password protected computer, Qualtrics ® program (password protected as well)
Development & Pre-Testing	Development & testing p. 31-33	Described development of this 21-item survey tool developed for DNP capstone project. That 21-item survey item was pilot tested, and face validity and content validity obtained.
Recruitment Process & Description of the Sample Having Access	Open survey vs. closed survey p. 34	Considered "closed survey" – anonymous survey link sent only to NPs from NC BON e-mail listserv. Not "open" in the sense of participants visiting a particular open website.

to the Questionnaire.	Contact mode	NA – as this was not a web-based survey. Was sent directly via e-mail
	Advertising the survey	NA – no pre-advertising was done for this survey.
	Web/email p. 34	Survey was e-mail survey
	Context p. 30	Participants were NPs in NC in above practice areas.
	Mandatory/ Voluntary p. 34	Voluntary participation
	Incentives p. 34	No incentives were offered
	Time/date p. 34	Survey administered on 2/17/15 with 2 additional reminders 2/24/15 and 3/3/15
Survey Administration	Randomization of items or questionnaires	NA – items were not randomized.
	Adaptive questioning p.38	Skip-logic function was used to allow those who do not see patients with stable ischemic heart disease (or chest pain) as looking at NPs caring for these type pts.
	# of items p. 31-34	21 items on survey – 11 demographic type questions with 2 matrix questions (1 frequency of seeing patient type, 1 knowledge question), 4 scenarios (to look at knowledge) and 4 general questions re: barriers to prescribing SLNTG and use of clinical practice guidelines (CPG).
	# of screens (pages)	3 screens when administered online (not mentioned in write up)

	Completeness check p. 33	The survey was previewed/practice multiple times during development. Was sent for pilot testing by fellow students/NP colleagues. There was not a "non-response" option given, many (all but age, gender and race/ethnicity) for forced responses.
	Review step	Not able to go back and change answers. Not mentioned in write up
Response Rates	p. 34 & 39	Given this was an e-mailed survey, and not a web-based survey – many of the descriptors listed under this checklist item are NA for emailed survey. Only the response rate was discussed. Sent out 2238 surveys, 226 were used for analysis.
Preventing Multiple Entries from the Same Individual	p. 34	Author acknowledges use of Qualtrics ® function to avoid ballot box stuffing and responses were anonymized.
	Handing of incompletes questionnaires p. 34	Author did mentioned that analysis done on only the 226 completed surveys. Incomplete or partial surveys were not used.
Analysis	Questionnaires submitted with an atypical timestamp	NA – no mention of this.
	Statistical corrections p. 36	Statistical testing consisted mainly of descriptive statistics, and chi-square.

Source: Checklist for Reporting Results of internet E-Surveys (CHERRIES). (2004). *Journal of Medical Internet Research, 6*(3): e34. doi: 10.2196/jmir.6.3.e34

Appendix H

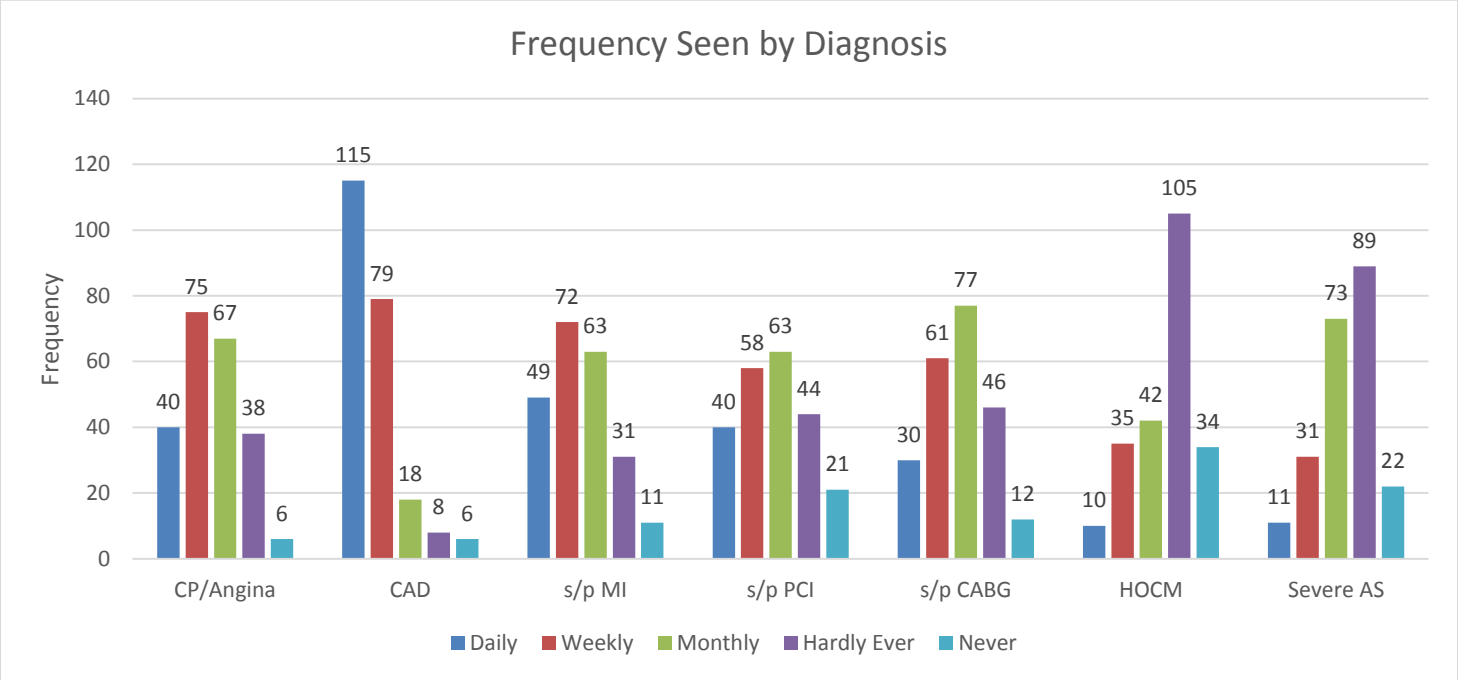
Respondent Characteristics (*n*=226)

Demographics	***n***	**%**
Highest Education (nursing)		
Diploma Registered Nurse (RN)	1	0.4
Associate's Degree in Nursing (ADN)	2	0.9
Bachelors of Science in Nursing (BSN)	0	0
Bachelors of Science (BS)	-	-
Masters of Science in Nursing (MSN)	197	87.2
Doctor of Nursing Practice (DNP)	16	7.1
Doctor of Philosophy (PhD)	5	2.2
Other	5	2.2
Highest Education (NP) – *could choose more than one*		
Certification	45	19.9
Graduate	195	80.1
Current Title/Role		
Acute Care Nurse Practitioner (ACNP)	5	2.2
Adult NP (ANP)	41	18.1
Family NP (FNP)	158	69.9
Gerontology NP (GNP)	7	3.1
Adult/Gerontology Primary Care NP (AGPCNP)	14	6.2
Other	1	0.4
Region in NC		
Coastal Plains	68	30.0
Piedmont	133	58.6
Mountains	25	11.0
Practice setting		
Primary care/Internal Medicine/Family Practice	118	52.2
Nursing home/Long-Term Care/Assisted Living/Short-term rehabilitation	22	9.7
Retail Clinic	8	3.5
Urgent care/Intermediate Care	11	4.9
Cardiology	32	14.2
Nephrology	7	3.1
Other	28	12.4
Experience (in years), *M (SD)*	9.65 years	7.64
Prescribing Privileges (yes)	225	99.1
Aware of SIHD guideline (yes)	137	60.6

Gender		
Male	15	6.6
Female	211	93.0
	1 missing	0.4
Race/Ethnicity		
White/Caucasian	190	83.7
Black/African American	20	8.9
Hispanic/Latino	2	.9
Asian	3	1.3
Native American	6	2.7
Pacific Islander	-	-
Other	3	1.3
Age (in years), *M (SD)*	47.10 years	10.3

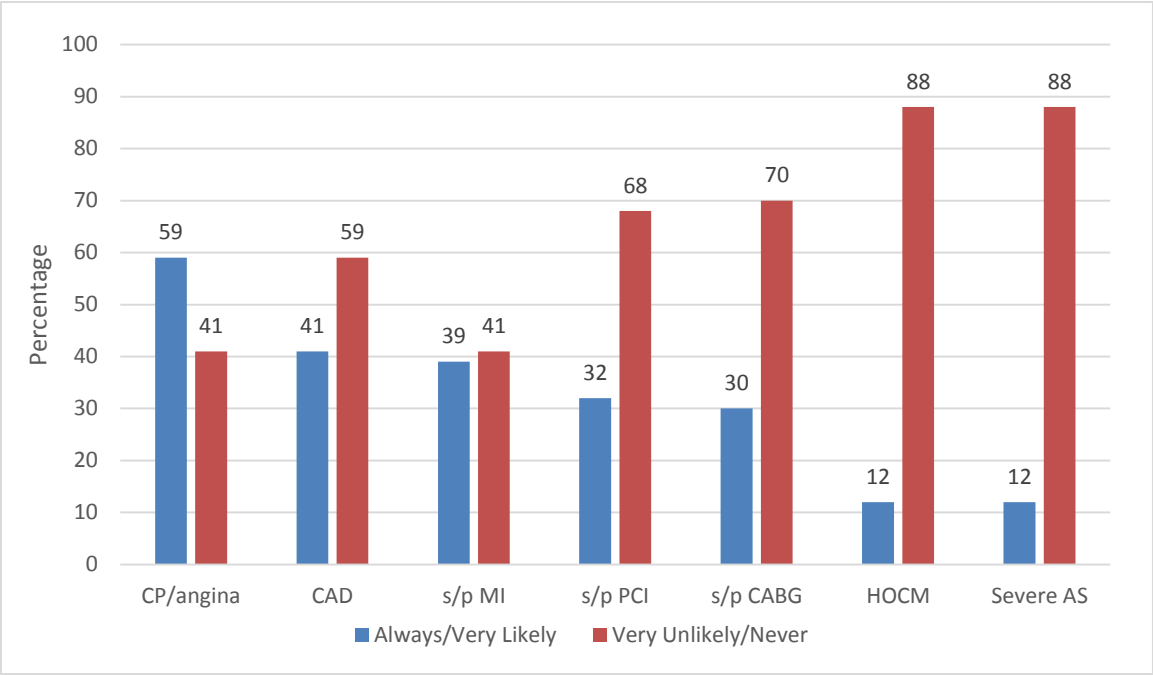
Note. NP: nurse practitioner; NC: North Carolina; M: mean; SD: standard deviation

Appendix I



Note. CP: chest pain; CAD: coronary artery disease; s/p MI: status post myocardial infarction; CABG: coronary artery bypass grafting, HOCM: hypertrophic obstructive cardiomyopathy; AS: aortic stenosis

Figure 1: Frequency Seen by Diagnosis in Clinic (*n*=226)



Note. CP: chest pain; CAD: coronary artery disease; s/p MI: status post myocardial infarction; CABG: coronary artery bypass grafting, HOCM: hypertrophic obstructive cardiomyopathy; AS: aortic stenosis.

*Figure I2**:*** Percentage of NPs that report would likely (or not) give an initial prescription (as appropriate) for SLNTG (Question 9; *n*=226)

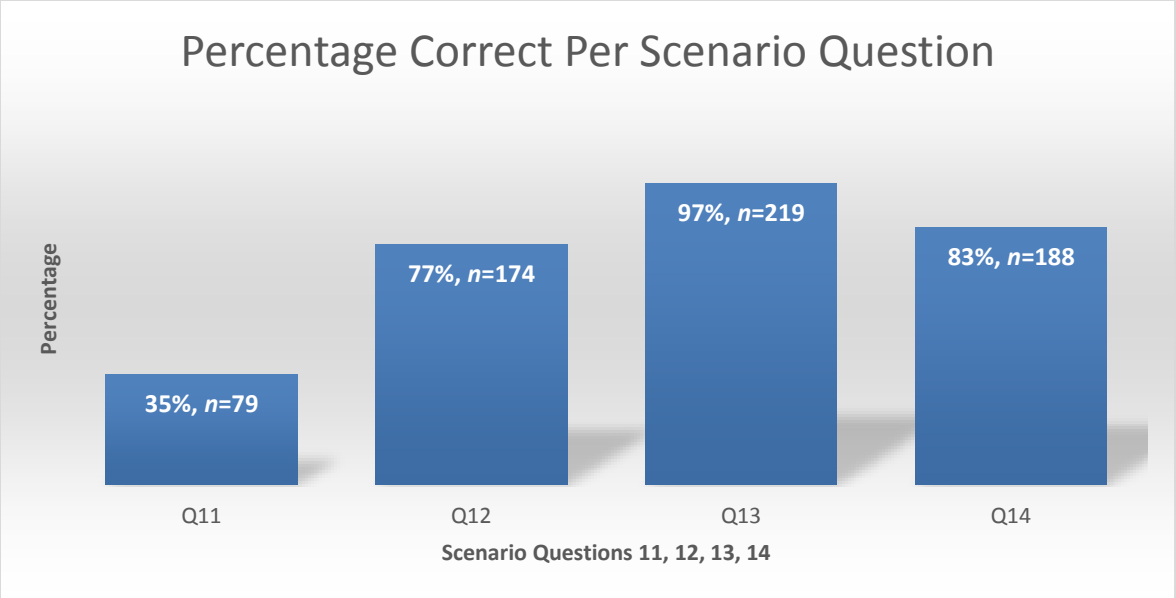


Figure I3: Percentage Correct per Scenario Question (Questions 11, 12, 13, 14, *n*=226)

Table I1: Percentage correct by NP Title and Practice Type: Summary Table

	Question 11		**Question 12**		**Question 13**		**Question 14**	
	n	**% Correct**	***n***	**% Correct**	***n***	**% Correct**	***n***	**% Correct**
Acute Care Nurse Practitioner (ACNP) (1)	3	60.00	5	100.00%	5	100.00%	5	100.00%
Adult Nurse Practitioner (ANP) (2)	18	43.90	32	78.05%	39	95.12%	39	95.12%
Family Nurse Practitioner (FNP) (3)	51	32.28	123	77.85%	153	96.84%	153	96.84%
Gerontology Nurse Practitioner (GNP) (4)	2	28.57	5	71.43%	7	100.00%	7	100.00%
Adult/Gerontology Primary Care Nurse Practitioner (AGPCNP) (5)	5	35.71	9	64.29%	14	100.00%	14	100.00%
Other (7)	1	100.00	1	100.00%	1	100.00%	1	100.00%

	Question 11		**Question 12**		**Question 13**		**Question 14**	
	n	**% Correct**	***n***	**% Correct**	***n***	**% Correct**	***n***	**% Correct**
Primary Care Setting/Internal Medicine/Family Practice (1)	39	33.05	93	78.81%	114	96.61%	99	83.90%
Nursing Home/Long-term Care Facility/assisted Living or Short-term Rehabilitation (2)	8	36.36	16	72.73%	22	100.00%	19	86.36%
Retail Clinic (3)	3	37.50	6	75.00%	8	100.00%	5	62.50%
Urgent or Intermediate Care (4)	2	18.18	8	72.73%	11	100.00%	11	100.00%
Specialty Clinic: Cardiology (5)	15	46.88	30	93.75%	30	93.75%	27	84.38%
Specialty Clinic: Nephrology (6)	3	42.86	4	57.14%	7	100.00%	6	85.71%
Other (10)	10	35.71	18	64.29%	27	96.43%	20	71.43%

Table: I2: Percentage Correct of Scenario Questions Measuring Knowledge of the 2012 SIHD Guideline

Question	**Cardiac Specialty**		**Non-Cardiac Specialty**		
	%	***n***	**%**	***n***	***p*-value**
11_3	47%	15	34%	66	.64
12_3	94%	30	75%	145	.03
13_3	94%	30	97%	188	.57
14_2	84%	27	82%	159	.99

Appendix J

Table J1: Barriers for Writing SLNTG, Frequency Look Up Clinical Practice Guidelines (CPG), Access/Use of Resources to Look Up CPG; Barriers to Practicing Evidence Based Healthcare (Question 15, 16, 17, 18 Results)

Questions (Q)	*n*	%		
Q15:Factors that prevent NP from RX SLNTG when appropriate				
Uncomfortable	8	3.5		
Never wrote one and do not plan to	14	6.2		
Pts with CABG/PCI – should NOT get RX	2	0.9		
No problems – initial or refill	142	62.6		
No problems – refill	131	57.7		
Believe all patients with CP should go to hospital	17	7.5		
I do not write RX	12	5.3		
Q16: Frequency look up clinical practice guidelines				
Never	1	0.4		
Less than once monthly	31	13.7		
Once a month	22	9.7		
2-3 times a month	37	16.4		
Once a week	29	12.8		
2-3 times a week	56	24.8		
Daily	50	22.1		
Q17:Access/Use of Following Resources	*n*	%	*n*	%
Google/Bing/Yahoo	187	82.7	128	56.6
Google Scholar	76	33.6	55	24.3
Up-to-Date	169	74.8	137	60.6
National Guideline Clearinghouse	97	42.9	66	29.2
American Heart Association	163	72.1	111	49.1
Medscape	161	71.1	123	54.4
Lexicomp	50	22.1	45	19.9
Micromedex	56	24.8	50	22.1
Epocrates	160	70.8	128	56.6
Health Science Library	80	35.4	70	31.0
NP Colleague	146	64.6	102	45.1
Ask supervising Physician	190	84.1	137	60.6
Q18: Barriers to EBP with CPG				
Lack of awareness	48	21.2		
Not enough time to stay informed	50	22.1		
Lack of access	12	5.3		
Do not agree	0	0		
Too cookbook	12	5.3		

CPG do not provide expected outcome	5	2.2
Patients not compliant	53	23.5
No time to review with patients	15	6.6
Practice does not endorse use of CPG	3	1.3
No barriers	127	60.6

Note. SLNTG: sublingual nitroglycerin; NP: nurse practitioner; RX: prescription; CABG/PCI: coronary bypass grafting/percutaneous coronary intervention; EBP: evidence based practice

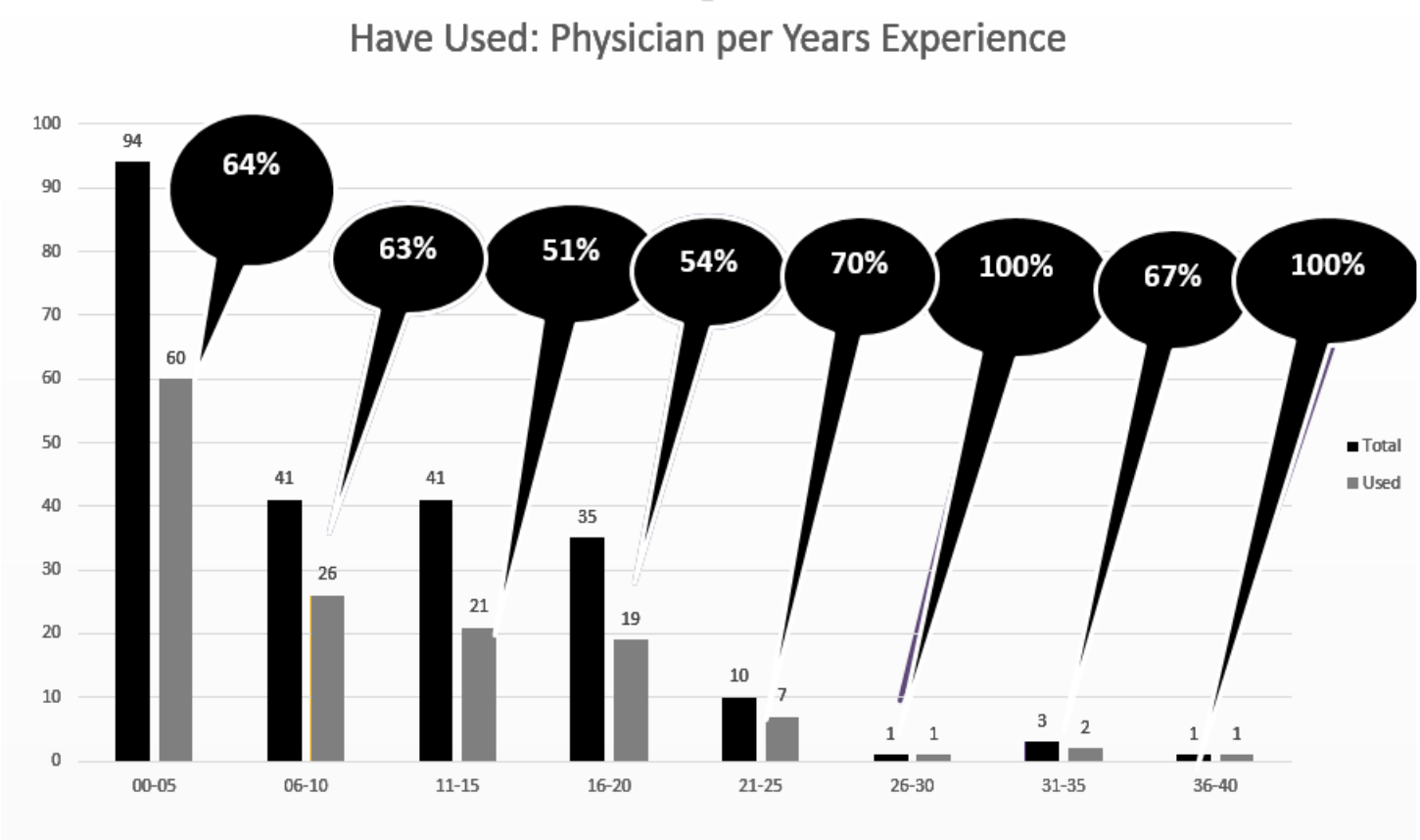


Figure J1: Years of Experience and NP Who Report Having Asked Supervising Physician Regarding Clinical Practice Guidelines and/or Medication Information.

Appendix K

AACN DNP Essentials

Essential I: Scientific Underpinnings for Practice:

- Evaluated current practice of nurse practitioners (NPs) in their use of sublingual nitroglycerin (SLNTG) and plan to provide additional education, through dissemination of my findings to enhance the quality of care provided to patients with stable ischemic heart disease (SIHD).
- Explored many theories, but settled on the use of Diffusion of Innovation to undergird this project. With the innovation being the use of SLNTG as described in the 2012 SIHD Guideline.

Essential II: Organization and System Leadership for Quality Improvement and Systems Thinking:

- Determined a clinical interest related to my current practice – topic in the care of cardiac patients - decided on the use of SLNTG in the SIHD patient.
- Evaluated current literature on the topic – available literature primarily from patient perspective, therefore, gap in knowledge related to NP providers.
- Having found no formal evaluation of NPs and their use of SLNTG in the SIHD patient, elected to begin inquiry into this clinical topic, in hopes of improving the quality of care to patients with SIHD.
- Plan to disseminate findings, first in required submission of journal article, then other available venues – one-on-one interprofessional interactions with colleagues (precepting advanced practice nurses); presentation of information in poster presentation at conference as available.

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

- Determined this student's interest in evaluating NP knowledge, barriers and use of SLNTG in the SIHD patient.
- Reviewed literature related to this subject. As above, no articles found on NPs knowledge of SLNTG in the SIHD patient.
- Used information technology and review of survey research to develop tool (survey) to assess NP knowledge, barriers and current use of SLNTG in the SIHD patient.
- Survey and this author's findings are the initial stages in understanding this clinical issue.
- This author obtained face and content validity for the new tool. Reliability / Factor analysis was felt to be beyond the scope of this course.
- Utilized the 2012 ACCF/AHA Guideline for Diagnosis and Management of the Stable Ischemic Heart Disease Patient (aka, 2012 SIHD Guideline); reviewed the 2014 ACC/AHA Focused Update on the Diagnosis and Management of the SIHD patient.
- This author's scholarly project paper and subsequent journal article submission will disseminate survey findings and areas for further educational opportunities.

Essential IV: Information systems/Technology and patient Care Technology for the Improvement and Transformation of Health Care:

- Various forms of technology used for this DNP project.

- Review of literature using Medline via PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Database of Systematic Review.
- Used Qualtrics ® for the design and launching of survey to NPs in North Carolina (NC).
- Used of Excel for the List serv from NC Board of Nursing – data file, had to convert from excel file to comma-separated values (csv) file.
- Used of Excel for some of the statistical analysis of data from the survey.
- Used the Statistical Package for Social Sciences (SPSS) version 22 program for additional statistical analysis for data from the survey.
- Used PowerPoint for presentation of findings.
- General and frequent use of Internet for access to Institutional Review Board (IRB) site; general searches; submission of journal article.
- Frequent use of e-mail for communication between committee chair and members.

Essential V: Health Care Policy for Advocacy in Health Care:

- One goal of this project is that the information gathered will be used to improve the care of patients with SIHD.
- Nurse practitioners will be educated related to the findings that will enhance their care they provide the patients with SIHD.
- Improvement in the care, will hopefully minimize anginal episodes which in turn will improve quality of life for these patients, decrease utilization of healthcare resources (ED visits, office visits, PCI, etc.).
- These are all goals of the Institute of Health's Triple Aim.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes:

- Collaborated with committee chair and members throughout the project process from formation of topic, survey development to analysis of results.
- Collaborated with health science librarian related to literature review techniques.
- Collaborated with IRB team during the initiation of the IRB application.
- Collaborated with Qualtrics specialist at CON.
- Collaborated with Statistician both at CON and privately (professional statistician).
- Communicated with Dr. Robyn Gallagher (in Australia) author of two of the studies used as guide for my project through e-mail communication.
- Collaborated with fellow NPs in development of the survey – peer reviewers, classmates, one-on-one responses from a few of the NPs who took the survey, and one individual NP who provider constructive feedback on the survey and nitroglycerin handout.

Essential VII: Clinical Prevention and Population health for Improving the Nation's Health:

- Established through literature review that millions of American's are affected by angina. Healthy people 2020 include five of its 24 objectives related to cardiovascular health and risk factor reduction – which includes improvement of quality of life.
- Review of literature also suggests that often patients are uninformed in the use of SLNTG and have many deficits around the use of SLNTG.

- Elected to evaluate NP knowledge, barriers and use of SLNTG in the SIHD patient using the 2012 SIHD Guideline.
- As above, one goal of this DNP project is to improve the care NPs are providing to the patients with SIHD to improve their quality of life through equipping them with a tool (SLNTG) that will provide a means for self-managing their angina, which in turn will lessen their use of healthcare resources.

Essential VIII: Advanced Nursing Practice:

- Utilized findings during research aspect of this scholarly project to enhance the care this author providers to her own patients in a busy outpatient cardiology clinic.
- Anticipate the findings from the study, once shared will enhance the care many other NP providers provide to their patients with SIHD.
- Developed a handout for NP providers to use to educate their patients about the use of SLNTG.
- Additional educational opportunities to be provided through the dissemination of the information found during this descriptive clinical survey project.

Source: AACN. (2006). *The essentials of doctoral education for advance nursing practice.* Washington, DC: American Association of Colleges of Nursing.

East Carolina University
College of Nursing
Doctor of Nursing Practice
Final Scholarly Project Approval

Student Name: Melinda Workman Matthews
Project Title: Nurse Practitioner Use of Sublingual Nitroglycerin in the Stable Ischemic Heart Disease Patient: Knowledge, Barriers, and Current Practice

Private Defense Completed on Thursday, June 11, 2015

Public Defense Completedon Wednesday, June 17, 2015

Final Project/Final Paper Approval:

As the Chair of this student's Doctor of Nursing Practice Scholarly Project Committee, I have reviewed and approved this student's project and final paper and agree that he/she has met the project expectations, including the DNP Essentials, and has completed the project.

DNP Committee Chair Signature: Robin Dellh Orth, FNP-C Date 7-6-2015