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The Effect of an Educational Intervention on Medication Adherence in Persons with Coronary Artery Disease

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Abstract

Title: The Effect of an Educational Intervention on Medication Adherence in persons with Coronary Artery Disease.

Background: The use of evidence-based medications is recommended for the management of stable coronary artery disease (CAD). Non-adherence to prescribed medications is common.

Purpose: To determine the effect of an educational intervention on medication adherence in persons with CAD receiving care in a general cardiology clinic.

Methods: This quality improvement project was conducted to determine the appropriateness of incorporating a brief medication adherence education intervention at a clinic serving patients with CAD. Eligibility criteria included males and females, ages 18 to 65, diagnosed with CAD, non-adherent to medications, on one or more CAD medications, and independent in taking medications. Data were analyzed using descriptive statistics and the Wilcoxon Signed Rank Test. Medication adherence was assessed using the four-item Morisky Green Levine medication adherence scale (MGLS) at the clinic before the intervention and by telephone four weeks later.

Results: A total of 20 participants enrolled in the project. Out of 20 participants, 18 participated in the follow-up. A Wilcoxon Signed Rank Test revealed a statistically significant difference in the mean summary scores for the pre-test (=1.25, SD=.85) and the post-test scores (=.11, SD=.47) Z=-.31[b], p =.001 (two-tailed), with a small effect size (r=.07). The median score on the MGLS scale decreased from pre-intervention (Md=1.5) to post-education (Md=.000).

Keywords: Coronary Artery Disease; Heart Disease, Medication Adherence; Medication non-Adherence, Evidence-Based Practice

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The Effect of an Educational Intervention on Medication Adherence in Persons with Coronary Artery Disease

Heart disease is a significant health issue in the United States. About 655,000 Americans die from heart disease each year (Center for Disease Control and Prevention [CDC], 2019). Coronary artery disease (CAD) is the most common form of heart disease and is one of the leading causes of death and disability worldwide (Hussain et al., 2018). International guidelines highly recommend the management of CAD with evidence-based medications, which requires adherence to achieve optimal benefit (Du et al., 2017). Excellent medication adherence contributes to a decrease in morbidity, mortality, and health care costs (Conn & Ruppar, 2017). Unfortunately, even when there are known benefits of medication therapy, there are still patients who do not adhere to prescribed medication regimens (Chase et al., 2016). Poor medication adherence in the United States is attributed to 125,000 deaths each year and nearly $300 billion spent on healthcare provider visits, emergency department visits, and hospitalization (American Heart Association [AHA], 2020). Non-adherence to CAD medications results in worsening clinical outcomes, repeated hospitalization, recurrent myocardial infarctions (MI), increased healthcare costs, and death (Hussain et al., 2018; Lam & Frensco,2015).

This paper outlines the development, implementation, and evaluation of a Doctor of Nursing Practice (DNP) scholarly project. The paper discusses the problem statement, literature review, conceptual framework, project timeline, methodology, data analysis, results, and discussion of the DNP project.

Background and Significance

According to the CDC, CAD affects approximately 18.2 million adults in the United States (CDC, 2019). CAD is caused by atherosclerosis of coronary arteries, resulting in reduced

blood flow and oxygen supply, causing myocardial ischemic changes, leading to symptoms such as chest pain (AHA, 2019). Risk factors for CAD are high low-density lipoproteins cholesterol (LDL), low high-density lipoproteins cholesterol (HDL), high blood pressure, family history of premature heart disease, diabetes, smoking, being menopausal for women, being older than 45 for men, and obesity (AHA, 2019). To lower the risk of a heart attack and prevent the progression of CAD, individuals diagnosed with CAD must take multiple medications to treat symptoms of CAD and prevent complications from CAD (CDC, 2019; Du et al., 2017). Patients with CAD are typically prescribed secondary prevention medicines (SPMs), such as angiotensin-converting enzyme (ACEs) inhibitors, angiotensin receptor blockers (ARBs), beta-blockers, statins, and oral antiplatelet agents (Khatib et al., 2019).

Problem Statement

According to the Georgia Department of Health [GPH], Georgia's heart disease death rate is 5% higher than the national average and contributes to more than 29% of Georgia's deaths (2016). Medication adherence is the extent to which a person takes medicines prescribed by the health care provider (Conn and Rapper; Lam & Frensco, 2015; Santra, 2015). Studies have shown that medication non-adherence is associated with worse clinical outcomes, including higher hospitalization rates, greater risk of preventable medication-related hospital admissions, and a higher morbidity and mortality rate (Beyhaghi et al., 2016; Santra, 2015; Xi Tan & Jongwha, 2014).

To improve medication adherence, one must acknowledge that adherence is a complex series of behaviors composed of three phases, initiation, implementation, and discontinuation. Initiation is beginning a new medication, implementation is taking medication as prescribed over time, and discontinuation is stopping a medication either when recommended or at the end of a

course of treatment—patients with heart disease experience non-adherence in all phases (Zullig et al., 2017). For example, at the initiation phase, one-in-five Medicare patients fail to fill their prescriptions within seven days of post-percutaneous intervention (PCI) with a drug-eluting stent (Zullig et al., 2017). Regarding implementation, fewer than 50% of patients are persistent with their statins one year after initiation, despite statin being associated with a 45% reduction in mortality risk (Lam & Frensco, 2015; Zullig et al., 2017). Studies have shown adherence to CAD medications to be between 40-80% (Du et al., 2017). About 10% of adult hospitalizations result from medication non-adherence, requiring approximately three extra visits per year, costing about $ 2000 more in treatment (Cutler et al., 2018).

A literature review shows socio-economic factors such as the cost of medications, motivation, and patient's perception of the importance of their quality of life to influence patients' health and health-related behaviors (Aziz et al., 2018). Patient's perception may increase their tendency to become non-adherent to their medications (Aziz et al., 2018). Common barriers to medication adherence are polypharmacy, lack of disease-related knowledge, low health literacy, barriers to obtaining medications, forgetfulness, and cost (Hussain et al., 2018; Zullig et al., 2017). Non-adherence to medicines, including SPMs, is a crucial challenge that limits overall benefits and often leads to poor health outcomes, lower quality of life, and increased demand for healthcare (Khatib et al., 2019). Several studies have reported high non-adherence among patients with CAD, typically in the range of 33%–50% (Khatib et al., 2019). Non-adherence to SPMs is associated with a 10%–40% relative increase in the risk of cardiac hospitalization and a 50%–80% relative increase in mortality (Khatib et al., 2019). Therefore, medication non-adherence is a significant clinical and economic problem, and interventions to improve adherence are warranted (Cutler et al., 2018).

Clinical Question

The PICOT question guiding this DNP project was: For adults ages 18-65 years who receive care in a cardiology clinic for coronary artery disease (population), does participating in an educational intervention (Intervention) improve medication adherence (Outcome) at four weeks (Time)?

Purpose of the Project

Given the significant economic burden of non-adherence to CAD medications, an intervention to improve adherence is essential. The project's purpose was to determine an educational intervention's effect on medication adherence in persons with CAD. Specific aims were to identify facilitators and barriers to medication adherence and test an educational intervention designed to increase medication adherence in patients with CAD.

Literature Review

Search Strategy

The literature search was conducted using Ebscohost, CINAHL, Pubmed, Medline, Government regulatory agencies, and professional organizations. Articles dating 2009-2020 were obtained from CINAHL, Ebscohost, Medline, and PubMed Clinical Queries. Studies and publications included in the search were systematic review or meta-analysis, randomized control trials (RCTs), quantitative research studies, and qualitative research studies. The search keywords used to identify potential articles included coronary artery disease, cardiovascular disease, medical adherence, medication non-adherence, barriers to adherence, interventions, and outcomes of adequate medication adherence, and heart disease. Research articles were selected if they discussed coronary artery disease*, medication adherence*, heart disease*, and adherence*. Other inclusion criteria included articles published in the English language and adults ages 18

years and above. Exclusion criteria included articles older than ten years. The author performed a manual search using the full texts' reference lists to identify potentially relevant studies. See table 1 for an outline of the search strategy.

Search Results

The literature search revealed 150 articles. Twenty-five studies were retained for comprehensive evaluation after screening titles and abstracts for relevance, while 125 studies were discarded for not being relevant for the project. Ten additional studies were identified from the 25 selected studies' reference lists. Thirty-five studies were examined in detail by making use of the selection criteria. Of the 35 studies, 12 studies identified for a critical appraisal because they met the inclusion criteria; they discussed heart disease, CAD, medication adherence, and barriers to adherence, interventions, and outcomes of adequate medication adherence (shown in figure 1). They were also selected because they were within the 2009-2020 range and high level of evidence.

The grades of recommendation, assessment, development, and evaluation *(*GRADE) criteria were used to appraise the 12 articles (Guyatt et al., 2011). The articles ranked according to the seven evidence hierarchy levels (see Table 8) (Dang & Dearholt, 2018). There were four systematic reviews or meta-analyses (level I), three well-designed RCTs articles (Level II), three well-designed controlled trials without randomization (Level III), one cross-sectional study (Level IV), and one analytical study (Level V). Levels of evidence are assigned to studies according to the quality of design, validity, and applicability to patient care (see Table 3).

Review and Synthesis of the Literature

The literature focused on medication adherence among CAD patients and addressed three key areas: Barriers to adherence, interventions to improve medication adherence, and effects of

medication adherence on overall CAD management. This synthesis looks at articles in each of the three areas and how they apply to the current project and clinical practice.

Barriers to Adherence

Barriers are reasons why patients do not take their medications; therefore, recognizing barriers is essential to utilize the appropriate interventions to improve adherence (Xu et al., 2020). Three studies discussing potential barriers to medication adherence were reviewed. Using a cross-sectional postal survey study, the actual and potential modifiable barriers to adherence to be addressed in clinical cardiology practices were identified by Khatib et al. (2019). The study involved sending a survey in the mail to 696 patients, where 503 patients responded. Participants had been on SPMs for greater than three months. The single question (SQ) tool, the eight-item Morisky medication adherence scale (MMAS-8), the adherence estimator (AE), and the beliefs about medicines questionnaire (BMQ), was used on the survey. The study showed that patients share actual and potential modifiable barriers to adherence addressed in clinical practice by using appropriate self-report tools. Barriers identified in this study include forgetfulness, the worry of medicines doing more harm than good, feeling hassled about medications, feeling worse after medications, and not being convinced of medicines' benefit (Khatib et al., 2019).

Similarly, using qualitative semi-structured interviews, Aziz et al. (2018) aimed to identify and compare the potential factors for medication adherence and non-adherence among subsided and self-paying patients in Malaysia. The sample consisted of 25 patients, including 13 in the subsidized group and 12 in the self-paying group. The patients were interviewed and asked to provide reasons for their medication adherence or non-adherence. The study showed patients' perceptions of the importance of their quality of life, perceived benefit or value of medications,

and the perceived value of the money spent on medications as the reasons for medication adherence and non-adherence (Aziz et al., 2018).

Likewise, an analytical multihospital survey study was done by Kahkonen et al. (2019) to identify the predictors of adherence in patients with coronary heart disease (CHD) after a PCI. The study included a survey of 416 post PCI patients. The survey used the adherence of people with chronic disease instruments (ACDI) to measure adherence. The instrument consists of 37 items measuring adherence and 18 items comprising sociodemographic, health behavioral, and disease-specific factors. The study showed the predictive factors known to explain adherence to treatment were male gender, close personal relationship, more extensive education, lower LDL cholesterol, and longer CHD duration without previous PCI (Kahkonen et al., 2019).

Identifying barriers to medication adherence is an essential part of improving patient outcomes. Barriers identified from the studies include forgetfulness, the worry of medicines doing more harm than good, feeling hassled about medications, feeling worse after medications, and not being convinced of medicines' benefit. Perceptions of the importance of quality of life, perceived benefit or value of medications, and the perceived value of the money spent on medications are other reasons for medication adherence and non-adherence (Aziz et al., 2018; Kahkonen et al., 2019; Khatib et al., 2019).

Interventions to Improve Medication Adherence

Interventions and strategies to improve medication adherence have been studied for many years and have been shown to improve clinical outcomes (Xu et al., 2020). Five studies were analyzed to identify strategies used to improve adherence. A systematic review and observational study were done by Mamudu et al. (2014) to determine the effects of screening for coronary artery calcium (CAC), a subclinical marker of CAD, behavioral or lifestyle modification, risk

perception, and medication adherence. The study examined 15 studies that met the predetermined inclusion, three were RCTs, and 12 were observational. The study reported that CAC screening improved medication adherence and could encourage individuals for helpful behavioral or lifestyle changes to improve CAD (Mamudu et al., 2014).

Likewise, Conn and Ruppar did a systemic review and meta-analysis (2017). The analysis included reviewing 771 adherence intervention studies to integrate primary research that tested medication adherence interventions. Intervention approaches reported by at least 30 primary studies included written medication instructions, medication adherence problem solving tips, improvement of health care provider skills to enhance medication adherence, and self-monitoring of symptoms/signs influenced by medications. The study showed that interventions focused on behavioral strategies were more effective than those focused on knowledge, beliefs, or attitudes. Meta-analytic moderator analysis suggests that healthcare providers should focus intervention content on behavioral strategies, especially habit-based interventions, over cognitive strategies designed to change knowledge and beliefs. Although interventions can increase adherence**,** much room remains for improvement (Conn & Ruppar, 2017).

Likewise, Zullig et al. (2017) performed RCTs to synthesize research findings from recently published RCTs targeting different medication adherence phases, from initiation to discontinuation among patients with CHD. The study involved appraisal and a summary of 77 articles and identified successful strategies and promising practices for improving medication adherence among patients diagnosed with CHD, such as facilitating patient-provider communication, using mobile (mHealth) technologies with emphasis on two-way communication, providing patient education at the same time with lifestyle and behavioral counseling, and providing psychosocial support (Zullig et al., 2017).

Similarly, a qualitative study was done by Peterson et al. (2014) to describe a three-step approach to develop and evaluate an innovative CAD self-management educational workbook. The study showed a self-management educational workbook developed using qualitative methods can provide relevant disease-specific health information for patients with CAD, which in return improves adherence to medications (Peterson et al., 2014).

Finally, Akhu-Zaheya and Shihab (2017) performed an RCT to assess the effects of short message system **(**SMS**)** reminders on adherence to a healthy diet**,** medication, and cessation of smoking among adult patients with cardiovascular diseases (CVD)**.** The participants were assigned randomly to an experimental group and a placebo group. MMAS-8, Mediterranean diet adherence screener (MEDAS), and readiness to quit ladder were used to assess patients**'** adherence to medication**,** adherence to a Mediterranean diet**,** and smoking cessation. At the beginning of the study, Akhu-Zaheya and Shihab assessed the outcome before and three months later, following completion of the intervention. The study showed recommendations to apply SMS via cellphone services improves the patient's adherence to a healthy diet and medication (Akhu-Zaheya & Shihab, 2017).

Findings from these studies demonstrate various interventional strategies to improve adherence. Behavioral strategies were more effective than those focused on knowledge, beliefs or attitudes, patient-provider communication, and using mHealth technologies (Akhu-Zaheya & Shihab (2017); Conn & Ruppar, 2017; Zullig et al., 2017). An educational workbook was effective in improving medication adherence (Peterson et al., 2014).

Effects of Medication Adherence

Studies have shown overall medication adherence improves patient's clinical outcomes. Four studies discussing the effects of medication adherence on costs and outcomes were

reviewed. A systemic review study was carried out by Bitton et al. (2013) to determine the effect of medication adherence on CAD's costs and outcomes. The study reviewed 25 articles and reported, increased medication adherence is associated with improved outcomes and reduced costs. It also showed a consistent trend toward benefits in reduced CAD-related events, mortality, and readmissions (Bitton et al., 2013).

Likewise, a Meta-analysis was done by Chase et al. (2016) to determine the effectiveness of medication adherence interventions among patients with CAD. The study analyzed 24 primary studies, and measurement involved treatment vs. control design. The study verified interventions to increase medication adherence among CAD patients were modestly effective. It also showed that nurses could be instrumental in improving medication adherence among CAD patients. Future research is needed to investigate nurse-delivered medication adherence interventions across varied clinical settings.

Similarly, Turan and Canli did an RCT to evaluate the effect of education and telephone follow-up intervention based on the Roy adaptation model for improving myocardial infarction patients' self-efficacy, quality of life, and lifestyle adaptation. Patients were randomly assigned to a control group or intervention. The control group received routine care, while the intervention group received routine care plus a telephone follow-up intervention, which consisted of a predischarge education program and three telephone follow-up sessions. In the 12th week after discharge, patients in the intervention group had significant improvements in self-efficacy, quality of life, and coping skills compared with the control group (Turan & Canli, 2020).

Furthermore, a meta-analysis was performed by Du et al. (2017) to evaluate the impact of medication adherence on clinical outcomes in patients with stable CAD. A total of ten studies were included in the analysis, with a total of 106,002 CAD patients. The study showed that good

adherence to evidence-based medication regimens was related to a lower risk of CVD, recurrent hospitalizations, and myocardial infarctions. The study confirmed the significant impact of good medication adherence on clinical outcomes in stable CAD patients (Du et al., 2017).

Studies agree, there are positive impacts on patient's outcomes after adhering to the medication regimen. The effect of medication adherence includes improved outcomes, reduced costs, reduced CAD-related events, mortality, and readmissions (Bitton et al., 2013; Chase et al., 2016; Du et al., 2017). Educational interventions improve patient's self-efficacy, quality of life, and coping skills (Turan & Canli, 2020).

Grading of the literature review using GRADE criteria shows a strong recommendation with high to moderate evidence quality. Most of the studies are well designed, but further research studies should utilize a dynamic and rigorous design, such as high-quality systematic reviews and RCTs. Before reaching a definitive conclusion on the effects of educational intervention on CAD medication adherence, careful thought should be given to studies with larger sample sizes and explored over more extended periods.

Conceptual Framework

General Overview

The framework chosen for this scholarly project was Sister Calista Roy's adaptation model (RAM). RAM has provided an expanded values-based concept of adaptation based on insights related to the person's place in the creation and social group. Roy hoped that the redefinition of adaptation, enhanced philosophical, scientific, and cultural theoretical understanding of life processes of the adaptive modes and processes described for individuals and groups is the basis for improving the knowledge that makes nursing a major social force in this century (Parker & Smith, 2010).

Roy’s theory views humans as bio-psycho-social adaptive systems that cope with change through adaptation (Polit & Beck, 2017). The utilization of Roy's adaptation theory is a valuable framework in executing and evaluating the scholarly project. Roy's adaption theory provides a holistic and comprehensive system-based prospect for nursing practice. The theory provides a valued perspective to recognize essential issues for scholarly questions (Roy, 2013). The RAM framework was first published in 1970, with its primary concept of adaption resting on scientific and philosophic assumptions. The model views persons as having bio-psycho-social characteristics in interaction with both the internal and external environments (Parker & Smith, 2010). The human and environment points of interaction that elicit responses are known as stimuli and categorized as focal, contextual, and residual in the RAM concept. Focal stimuli are internal or external stimuli affecting an individual instantly; contextual stimuli are the surrounding circumstances that may contribute to the focal stimuli' effect, while residual stimuli are the environmental factors that have an undetermined effect on human behavior (Roy, 2011).

Roy's model defines the environment as all the states, conditions, and influences surrounding and affects individuals' development and behavior (Roy, 2013). According to Roy's model, health as a concept is defined as a process, a state of being, and becoming whole and reflects people and the environment's mutuality (Roy, 2013). Evidence-based practice (EBP), according to Roy, allows for three levels of readiness for application in practice, i.e., implementation support, need for review by advanced practice nurse specialists to confirm readiness, and need for replication of studies. EBP is a problem-solving approach to healthcare delivery that integrates the best evidence from well-designed studies and patient care data and combines it with patient preferences, values, and nurse expertise (Roy, 2013). Adaptations are a significant life process that leads to quality health (Parker & Smith, 2010).

Application to the DNP Project

RAM, which explains human responses to chronic illness, focuses on the nurse and patient interaction within the environment and thus will be essential to address this scholarly project on improving adherence to medication among CAD patients. RAM is pertinent to the project because the model sees individuals as an adaptive holistic system that communicates with stressors in the environment. According to RAM, the 'person' with a CAD diagnosis is the individual's environment with CAD. 'Nurse' is the researcher who will evaluate the factors affecting behaviors and adaptation skills and gives the education to improve adherence to CAD medications (Turan and Canli, 2020). The purpose of RAM is to seek knowledge that outlines the coming together, which is the reverse of adversity, also seeks the good of individuals and society (Roy, 2011).

Individuals diagnosed with CAD undergo physiological, psychological, and even financial change and must learn to cope and adapt to a new lifestyle. Roy's nursing model goal is to promote adaptation in the four adaptive modes, contribute to health, quality of life, and die with dignity (Roy, 2011). The nursing action aims to enhance system relationships by protecting, accepting, encouraging interdependence, and promoting personal and environmental change (Roy, 2011). Studies have shown that using education intervention based on RAM increases adaptation and coping and thus increased adherence to the medication regimen among CAD patients (Turan and Canli, 2020). Upon receiving the CAD diagnosis, patients may feel overwhelmed and hopeless and may stop taking prescribed medications. For example, patients with stents may suddenly stop taking antiplatelet or skip the recommended dosages. RAM's main objective is to teach patients "coping" in conditions changed by the disease. The model functions on holism theory, which hypothesizes the person as a valuable human being in whom the body

and spirit are unified. Education is an effective method for risk factor control and adherence in that it increases awareness and responsibility (Turan & Canli, 2020).

RAM's worldview views humans as an adaptive system to the surroundings, health, and nursing goals; individuals are holistic-adaptive systems, complete with coping processes that maintain adaptation and promote persons and environmental transformations (Parker & Smith, 2010). The model implies that all humans have needs that need to be met to keep wholeness. The four modes of adaptation, the physiologic, the self-concept, the role function, and the interdependence, meet these needs (Roy, 2011). The physiologic condition is associated with the way people act as physical beings with the environment (Parker & Smith, 2010). The self-concept addresses psychological and spiritual integrity and focuses on how one perceives one's body and oneself. The role function deals with social integrity by focusing on the performance of activities associated with the various roles. The interdependence mode deals with social integrity and concern for how one gives and receives social support (Roy, 2011). Individuals with CAD deal with the challenges of daily self-management and low self-esteem.

Implementation/Evaluation

Participants and Recruitment

Convenience sampling was used to identify and invite potential participants. Patients were recruited over four weeks after institutional review board (IRB) approval from Georgia State was obtained. Patients were deemed non-adherent if they self-reported not taking their CAD medications as prescribed. Nurses and providers identified patients with a known history of non-adherence to medications and alerted the student investigator (SI). The SI reviewed the patient’s charts to confirm the CAD diagnosis and the number of CAD medications. The target size was 20 participants. The EPI info TM sample size calculator was used to determine the

desired sample size (CDC,2019). The small sample size was chosen to allow for timely collection of data and implementation of the project.

Eligibility criteria included males and females, ages 18 to 65, diagnosed with CAD, non-adherent to medications, on one or more CAD medications, independent in taking medications, and English-speaking who presented to the clinic for a non-acute follow-up appointment. Exclusion criteria included no diagnosis of CAD, non-English speaking patients, adherent to medications, under the age of 18, or over the age of 65 who presented for an acute appointment.

Participants' Protection

Each participant was given a unique identification number (EW1, EW2, EW3...) to link the participant's identifying information and the data rather than their names. The hard copy information was stored in a locked, secure file cabinet in the office. Data was transferred into a password-secured laptop, where only the SI had access. The key (code sheet) to identify the research participants was stored separately from data to protect privacy. Consent forms were stored separately from the research data. All data will be destroyed two years after data collection via a paper shredder, and data stored on the computer will be deleted.

Setting

A cardiology group that serves a county in West Georgia area was chosen for the project due to its diversity and availability. The group has been in operation for over 20 years and offers roughly 18,000 encounters per year. The clinic offers outpatient cardiac services and inpatient services to the local hospital system and consists of two cardiologists, two nurse practitioners, one licensed practical nurse, and three certified medical assistants. The clinic offers general cardiology care, echocardiogram, stress testing, ankle-brachial index testing, direct current cardioversion, external counter pulsation, cardiac pacemaker management, weight management,

and medical massage. The patient population ranges from 18 to 96 years—a very diverse population, including African Americans, Caucasians, Hispanics, and Asians. The clinic consists of nine rooms, seven of which function regularly, and the other two used as needed. The cardiology clinic is very active in the local community by providing health fairs, clinical trials, and sports physicals.

Instrument/Tools

Morisky Green Levine medication adherence scale

The medication adherence assessment tool selected for this project was the four-item Morisky Green Levine medication adherence scale (MGLS) (Beyhaghi et al.,2016). The tool validates the self-report of medication adherence. The original MGLS has four items that have dichotomous response categories with yes or no options. The first two items assess the unintentional non-adherence due to forgetfulness and carelessness, while the other items measure the intentional non-adherence, stopping medications when feeling better or worse (Beyhaghi et al.,2016). Patients score one point for every 'Yes' answer. A score of 0 indicates high adherence; a score of 1 or 2 indicates moderate adherence; a score of 3 or 4 indicates low adherence (Beyhaghi et al., 2016; Xi Tan & Jongwha, 2014). Since its development, its reliability and validity have been tested on many adherence studies on chronic diseases such as hypertension (HTN), diabetes mellitus (DM), and heart disease (Beyhaghi et al.,2016; Lam & Fresco, 2015; Santra, 2015).

MGLS is quick to administer and score; however, it can only identify barriers to adherence due to its length. MGLS has been validated in the broadest range of diseases in patients with low literacy; thus, it is a widely used scale for research (Lam & Fresco, 2015). The original MGLS has a Cronbach’s alpha reliability of 0.61 (Lam & Fresco, 2015; Morisky et al.,

1986; Xi Tan & Jongwha, 2014). MGLS's low reliability and sensitivity are limitations to the project but were the most appropriate for the DNP project. In addition to the four questions, the pre-MGLS had two open-ended questions to assess the barriers and facilitators to medication adherence; (1) what has helped you take CAD medications as instructed? (2) what has prevented you from taking CAD medications as instructed? Similarly, the post-MGLS had two additional questions to assess the level of satisfaction with the pamphlet and the one-on-one education session; (1) how helpful was the CAD educational pamphlet?, and (2) how helpful was the one-on-one education session. The possible responses were (1) not helpful, (2) somewhat helpful, and (3) very helpful. Other adherence questionnaires were considered, for example, MMAS-8, but due to cost and time, MGLS was chosen.

Coronary Artery Disease Education (CADE) Pamphlet

The 'coronary artery disease education' (CADE) pamphlet (Appendix-B) was used for the educational intervention. The SI developed the educational pamphlet using content from the CDC and AHA website (AHA, 2020; CDC, 2019). The pamphlet consisted of information about CAD etiology, risk factors, and management. The pamphlet also had information about medication adherence, non-adherence, and tips to improve adherence. A cardiologist reviewed it to verify the validity of the contents.

Demographic Questionnaire

The participants' demographics included name, age, gender, race, language, education level, telephone number, and the number of CAD medications (see Appendix A). This information was collected from the participants and chart review during the implementation process.

Intervention & Data Collection

The key individuals involved in this DNP scholarly project included the SI, project chair, project co-chair, and mentor. This was a quality improvement project utilizing a quantitative pre-test, post-test design through convenience sampling. Pre-tests and post-tests were administered in paper and pencil format, with the SI collecting all the data. The pre-test was done at the cardiology clinic; the post-test was administered through the phone during the follow-up telephone call four weeks after the intervention. The SI observed restrictions imposed by Georgia State University and relevant government or public health authorities in research activities. To follow the CDC's recommendations for COVID-19, the SI wore a mask, practiced social distancing, and performed proper handwashing.

The SI approached potential participants after the provider saw them. The SI used a recruitment script. A brief synopsis of the project and the role of the investigators was discussed with the potential participants. The potential participant was informed that their care would in no way be impacted by the decision they made. If the participants were willing to proceed, they signed a consent form. The consent form was at the 8th-grade reading level. Feelings of coercion were mitigated by consistently reminding the potential participants of their right to withdraw from the project or limit their participation if they became uncomfortable.

As soon as the participant signed the consent form, they received the pre- MGLS questionnaire form and a demographic form. Once the participants filled out the forms, they received the educational pamphlet. The SI reviewed the pamphlet and provided a one-on-one educational session; counseled the participants on CAD and medication adherence while at the clinic. The educational intervention consisted of CAD etiology and management and information on medication adherence. The one-on-one education session took about 35 minutes and included

reviewing the pamphlet and counseling the patient on CAD and medication adherence. The participants were also allowed to keep the pamphlet and take it home.

After four weeks, each participant was called, and a post-intervention MGLS was administered. The four-week timeline was chosen as this would allow timely collection of data and implementation of the project. The four-week timeline is consistent with the clinic's one-month follow-up policy after initiating medications or medication dosage changes. Overall, the project's participation took 60 minutes; 15 minutes to complete the pre-MGLS and the demographic datasheet, 35 minutes reviewing the pamphlet, providing the one-on-one education session, and 10 minutes for the post-MGLS.

Project Completion Timeline

The project was divided into four phases; the first phase was the designing phase, which involved identifying the phenomenon of interest, the formulation of the PICOT clinical question, literature review, synthesizing and appraising the literature, identifying and securing the project site, and pinpointing the project team members. This phase lasted from July 2019-December 2019. The second phase was the planning phase, comprised of collaborative institutional training initiative (CITI) training, application, and approval of the IRB, and completion of the project proposal. This phase ran from January 2020-July 2020. After IRB approval, the project was implemented including, selecting participants, administering medication adherence questionnaires, implementing educational materials, and follow-up telephone calls. This phase lasted from August 2020-November 2020. The final phase is the project dissemination, which will run from January 2021-April 2021, and will involve data analysis, transcription, and project defense.

Component of Analysis/ Statistical Tests

Data was transferred from paper to Microsoft Excel and analyzed using IBM statistical package for the social sciences (SPSS), version 27 by the SI with a statistician's assistance. Data were analyzed using descriptive statistics (counts, percentages, means, and standard deviation) and Wilcoxon Signed Ranks Test. The Wilcoxon Signed Ranks Test was used to determine changes in medication adherence from pre-test to post-test. Statistical significance was set at $p < .05$. The mean scores for the missing data of the two participants who were lost to follow up were not accounted for at the post-test.

Results

Participants Characteristics

Participants (N=20) had a mean age of 53.7 (standard deviation =7.75 years). Over half of the participants self-identified as male (55%), 75% self-reported as Caucasian/White, and 25% self-identified as African American/Black. Many of the participants (70%) were high school graduates. Ten participants (50%) reported taking three CAD medications, five (25%) were taking four, and another five (25%) were taking two CAD medications. (see shown in table 4).

Pretest and posttest scores

A total of 20 participants completed the pre-test MGLS, while 18 completed the post-test MGLS. At the pre-test, 65% of the participants forgot to take their medication in the last week, 60% had problems remembering to take their medications, 10 % felt better and sometimes stopped taking their medications, and 10 % sometimes felt worse and stopped taking their medications. At post-test, the number of participants responding yes to the questions above were 5.6 %, 5.6%, 0%, and 0%, respectively (see table 5). Non-adherence was more often associated with remembering to take medications than how patients felt because of taking medications. The

mean summary for pre-test scores was 1.25 (SD=.85), while the mean summary for post-test scores was.11 (SD=.47), as shown in figure 2. Lower scores indicate better medication adherence. The Wilcoxon Signed-Rank Test revealed a statistically significant difference in the mean summary scores for the pre-test (1.25, SD=.85) and the post-test scores (.11, SD=.47) Z=-.31[b], p =.001 (two-tailed), with a small effect size (r=.07). The median score on the MGLS scale at pre-intervention (Md=1.5) decreased to (Md=.000) at post-intervention.

Medication Adherence

Before the intervention, 25% of the participants were identified as having high adherence with MGLS scores of 0, while 75% were identified as having moderate adherence with 1-2. After the intervention, 94.4% scored high adherence, while 5.6 % had moderate adherence. There were no participants in the low adherence category (3-4) at pre-intervention or post-intervention. For the two open-ended questions added to the MGLS by the SI, descriptive statistics were used to summarize the responses. Before the intervention, barriers to medication adherence identified were forgetfulness (65%) and side effects (5%). At post-test, 5% reported forgetfulness as a barrier to medication adherence. At pre-test, regarding tips to help with adherence, 40% reported following a fixed routine to help with adherence, 25% used a phone alarm reminder, 25% used a medication pack, while 10% reported depending on a family member. At post-test, 35% reported following a fixed routine, 25% used a phone alarm, 20% used a med-pack, while 10% depended on a family member to remind them to take their medications. At post-intervention, the percentage of participants who indicated the educational pamphlet and one-on-one session was very helpful was 83.3% and 77.8%, respectively.

Discussion

The DNP project's overall goal was to determine the effect of an educational intervention on medication adherence in persons taking medications for coronary artery disease. The findings from this project suggest that improvements in medication adherence may be possible with the administration of an educational pamphlet and one-on-one counseling by a nurse practitioner in a clinic setting. The project answered the clinical question; for adults ages 18-65 years who receive care in a cardiology clinic for coronary artery disease, does participating in an educational intervention improve medication adherence at four weeks? In this project, participants were taking at least two medications for CAD and were either moderately (75%) or highly adherence (25%) to their CAD medications within the prior week. Four weeks after the intervention, all but 5.6% of participants ranked as highly adherence to CAD medications. Medication non-adherence remains a complicated issue for patients, providers, healthcare systems, and the community (Xu et al.,2020). Studies have shown adherence to CAD medications to be between 40-80% (Du et al., 2017).

In this project, most participants reported forgetfulness as a barrier to adherence with the first two questions on the MGLS and the open-ended questions about what prevented participants from taking their CAD medications. The educational intervention provided tips to help patients remember to take medications, including taking medications simultaneously every day, family members, and pill containers (AHA, 2020). In this study, patients reported following a routine phone alarm, while others used medication packs. Some patients relied on family members as a reminder.

Barriers are the essential explanations why patients are unable to adhere to medication regimens (Xu et al.,2020). The world health organization (WHO) classifies social and economic

factors, healthcare teams and system-related factors, and patient-related factors as common causes of non-adherence (Xu et al.,2020). Common barriers to medication adherence are polypharmacy, lack of disease-related knowledge, low health literacy, barriers to obtaining medications, forgetfulness, and cost (Hussain et al., 2018; Zullig et al., 2017). Targeting barriers may be instrumental in identifying medication adherence interventions (Xu et al.,2020). This project demonstrated that providing patients with tips to remember taking medications may improve adherence. Interventions such as CAC, patient education, using mobile (mHealth), self-management educational workbooks have been reported to improve medication adherence (Akhu-Zaheya & Shihab (2017); Conn & Ruppar, 2017; Turan & Canli, 2020; Zullig et al., 2017). The findings from this project suggest that improvements in medication adherence may be possible with the administration of an educational pamphlet and one-on-one counseling by a nurse practitioner in a clinical setting. These project's findings echo the conclusions from other studies on using education as an intervention to improve medication adherence.

Patient satisfaction is associated with better health-related outcomes (Veghel et al., 2020). In addition to improvements in medication adherence, most participants found the pamphlet and one-on-one education by a nurse practitioner to be "very helpful. No participants scored a 3-4 (low adherence), but this project suggests that even persons with moderate adherence can improve. The unexpected findings were that there were no Hispanics or Asians with CAD who attended the clinic during recruitment. Typically, the clinic serves patients of all ethnic groups, but only Whites and African Americans met the inclusion criteria for participation during the recruitment period. It is unclear if this was due to the COVID-19 pandemic; due to the pandemic, patients of other ethnicities may have limited their outpatient visits to avoid exposure to the virus.

Limitations

This project had limitations that should be considered when thinking about the results and planning for future projects. Limitations include limited time to conduct the project and small sample size. There were no participants with low adherence; therefore, the window for improvement in medication adherence was small. Despite this, improvements in self-reported adherence were observed in those with moderate to high adherence. Another limitation is self-report; participants could have overestimated their report of adherence, particularly in the presence of a healthcare provider. The SI administered the pre-test and the post-test; participants could have responded to please the investigator. Due to time limitations and recall, adherence was only assessed over one week. Using MGLS is also a limitation given its low specificity and reliability. Using a medication adherence tool with higher reliability and specificity would yield better data. Regardless of these limitations, the improvement in medication adherence scores should motivate healthcare providers to explore the benefits of this project and utilize it to improve patient outcomes.

Practice Implications

Non-adherence to CAD medications continues to be a significant issue in the United States (Du et al.,2017). Educational intervention is essential to improve medication adherence. This project shows that an educational intervention has the potential to improve medication adherence significantly. This project's results can be used to strengthen the benefits of an educational intervention in adults with CAD. Physicians, registered nurses (RNs), and advanced registered nurses (APRNs) can be instrumental in improving medication adherence among CAD patients since they are the prominent individuals addressing medications with patients.

Physicians and APRNs are the ones who prescribe medications, and thus it should be their responsibility to identify and intervene in non-adherence in clinical practice.

Clinicians should be aware of common barriers to medication adherence to use tailored interventions to improve adherence. Educating patients on tips to improve medication adherence can improve clinical outcomes. Policy changes such as implementing education programs on all CAD patients during routine office visits would help improve cardiology clinics' adherence. Effective CAD education programs may be essential in improving medication adherence, improving overall health outcomes, and lowering healthcare expenditures. Based on the project's findings, providers and organizational leaders should prioritize patient education as an approach to improve adherence. Future research should give careful thought to studies with larger sample sizes, explored over more extended periods before reaching a firm conclusion.

Ethical Issues

An approval from the IRB at Georgia State University was obtained before project initiation. Each participant was given a unique identification number to protect participant's identity.

Conclusion

CAD is one of the most predominant cardiovascular diseases and contributes to the leading cause of death worldwide (Salari et al.,2018). The project's findings suggest an educational pamphlet coupled with a nurse practitioner-led counseling session on medication adherence may be beneficial for improving medication adherence in patients with CAD. The ability to recognize barriers to medication adherence will help health care providers educate their patients on tips to improve adherence. The ability to recognize barriers to medication adherence

will help healthcare providers educate their patients on tips to improve adherence. Targeted education programs for CAD patients to improve medication adherence are needed.

References

American Heart Association. (2019). Heart disease and stroke statistics-2019 at-a-glance. Retrieved from https://healthmetrics.heart.org/wp-content/uploads/2019/02at-a-glance-heart-disease-and -stroke-statistics-2019.pdf

American Heart Association. (2020). Medication adherence - Taking your meds as directed. Retrieved from https://www.heart.org/en/health-topics/consumerhealthcare/medication-information/medication-adherence-taking-your-meds-as-directed

Akhu-Zaheya, L. M., & Shiyab, W. Y. (2017). The effect of short message system (SMS) reminder on adherence to a healthy diet, medication, and cessation of smoking among adult patients with cardiovascular diseases. *International Journal of Medical Informatics*, *98*, 65–75. https://doi.org/10.1016/j.ijmedinf.2016.12.003

Aziz, H., Hatah, E., Makmor-Bakry, M., Islahudin, F., Ahmad Hamdi, N., & Mok Pok Wan, I. (2018). A qualitative exploration of the modifiable factors for medication adherence among subsidized and self-paying patients in Malaysia. *BMC Health Services Research*, *18*(1), 605. https://doi.org/10.1186/s12913-018-3417-y

Beyhaghi, H., Reeve, B. B., Rodgers, J. E., & Stearns, S. C. (2016). Psychometric properties of the four-item Morisky Green Levine medication adherence scale among atherosclerosis risk in communities (ARIC) study participants. *Value in health: the journal of the International Society for Pharmacoeconomics and Outcomes Research*, *19*(8), 996–1001. https://doi.org/10.1016/j.jval.2016.07.001

Bitton, A., Choudhry, N. K., Matlin, O. S., Swanton, K., & Shrank, W. H. (2013). The impact of medication adherence on coronary artery disease costs and outcomes: A systematic review. *The American Journal of Medicine*, *126*(4), 357.

https://doi.org/10.1016/j.amjmed.2012.09.004

Centers for Disease Control. (2019). Coronary artery disease. Retrieved from https://www.cdc.gov/heartdisease/coronary_ad.htm

Chase, J.-A. D., Bogener, J. L., Ruppar, T. M., & Conn, V. S. (2016). The effectiveness of medication adherence interventions among patients with coronary artery disease. *Journal of Cardiovascular Nursing*, *31*(4), 357–366.https://doi.org/10.1097/JCN.0000000000000259.

Conn, V. S., & Ruppar, T. M. (2017). Medication adherence outcomes of 771 intervention trials: Systematic review and meta-analysis. *Preventive medicine, 99,* 269–276. doi: 10.1016/j.ypmed.2017.03.008

Cutler, R. L., Fernandez-Llimos, F., Frommer, M., Benrimoj, C., & Garcia-Cardenas, V. (2018). Economic impact of medication non-adherence by disease groups: a systematic review. *BMJ open*, *8*(1), e016982. https://doi.org/10.1136/bmjopen-2017-016982

Dang, D., & Dearholt, S. (2018). *Johns Hopkins nursing evidence-based practice: model & guidelines*. Sigma Theta Tau International. Retrieved from https://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,shib&db=cat06552a&AN=gsu.9934446242602952&site=eds-live&scope=site

Du L, Cheng Z, Zhang Y, Li Y, Mei D. (2017). The impact of medication adherence on clinical outcomes of coronary artery disease: A meta-analysis. *Eur J Prev Cardiol*, 24(9):962-970. doi:10.1177/2047487317695628

Georgia Department of Public Health. (2016). Heart disease. Retrieved from https://dph.georgia.gov/heart-disease

Guyatt, G. H., Oxman, A. D., Schünemann, H. J., Tugwell, P., & Knottnerus, A. (2011).

GRADE guidelines: A new series of articles in the Journal of Clinical Epidemiology. *Journal of Clinical Epidemiology*, *64*(4), 380–382. https://doi.org/10.1016/j.jclinepi.2010.09.011

Hussain, S., Jamal, S.Z., & Qadir, F. (2018). Medication adherence in post myocardial infarction patient. Journal of Aub Medical College, Abbottabad: JAMC, 30 (4), 552-557.

Kahkonen, O., Saaranen, T., Kankkunen, P., Miettinen, H., & Kyngas, H. (2019). Adherence to the treatment of female patients with coronary heart disease after percutaneous coronary intervention. *Journal of Cardiovascular Nursing*, *34*(5), 410–417.

Khatib, R., Marshall, K., Silcock, J., Forrest, C., & Hall, A. S. (2019). Adherence to coronary artery disease secondary prevention medicines: exploring modifiable barriers. *Open heart*, *6*(2), e000997. doi:10.1136/openhrt-2018-000997

Lam, W. Y., & Fresco, P. (2015). Medication adherence measures: An overview. *BioMed research international*, *2015*, 217047. https://doi.org/10.1155/2015/217047

Mamudu, H. M., Paul, T. K., Veeranki, S. P., & Budoff, M. (2014). The effects of coronary artery calcium screening on behavioral modification, risk perception, and medication adherence among asymptomatic adults: A systematic review. *Atherosclerosis*, *236*(2), 338–350. https://doi.org/10.1016/j.atherosclerosis.2014.07.022

Morisky, D., Green, L., & Levine, D. (1986). Concurrent and predictive validity of a self-reported measure of medication adherence. *Medical care*, *24*(1), 67-74. Retrieved March 24, 2020, from www.jstor.org/stable/3764638

Parker, M. E., & Smith, M. C. (2010). *Nursing theories & nursing practice* (pp. 167-180). Retrieved from https://ebookcentral.proquest.com

Peterson, J. C., Link, A. R., Jobe, J. B., Winston, G. J., Marina Klimasiewfski, E., & Allegrante,

J. P. (2014). Developing self-management education in coronary artery disease. *Heart & Lung - The Journal of Acute and Critical Care*, *43*(2), 133–139. https://doi.org/10.1016/j.hrtlng.2013.11.006

Polit-Ohara, D., & Beck, C. T. (2017). *Nursing research: generating and assessing evidence for nursing practice (8th ed.)*. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Roy, C. (2011). Extending the Roy adaptation model to meet changing global needs. Nursing Science Quarterly, 24(4), 345–351. https://doi.org/10.1177/0894318411419210

Roy, C. (2013). Generating middle-range theory: From evidence to practice. Retrieved from https://ebookcentral.proquest.com

Salari, A., Rouhi Balasi, L., Ashouri, A., Moaddab, F., Zaersabet, F., & Nourisaeed, A. (2018). Medication adherence and its related factors in patients undergoing coronary artery angioplasty. *Journal of caring sciences*, *7*(4), 213–218. https://doi.org/10.15171/jcs.2018.032

Santra G. (2015). Assessment of adherence to cardiovascular medicines in rural population: An observational study in patients attending a tertiary care hospital. *Indian journal of pharmacology*, *47*(6), 600–604. https://doi.org/10.4103/0253-7613.169573

Turan K S, Canli Ö.Z. (2020) The effect of education and telephone follow-up intervention based on the Roy adaptation model after myocardial infarction: Randomized controlled trial. *Scand J Caring Sci*.;34(1):247-260. doi:10.1111/scs.12793

van Veghel, D., Soliman-Hamad, M., Schulz, D. N., Cost, B., Simmers, T. A., & Dekker, L. R. C. (2020). Improving clinical outcomes and patient satisfaction among patients with coronary artery disease: an example of enhancing regional integration between a cardiac

center and a referring hospital. *BMC Health Services Research*, *20*(1), 1–8. https://doi.org/10.1186/s12913-020-05352-w

Zullig, L.L., Ramos, K., & Bosworth, H.B. (2017). Improving medication adherence in coronary heart disease. *Current cardiology report*s, 19(11), 113. Https://doi.org/10.1007/s11886-017-0918-y

Xi Tan, Isha Patel, & Jongwha Chang. (2014). Review of the four item Morisky medication adherence scale (MMAS-4) and eight item Morisky medication adherence scale (MMAS-8). *INNOVATIONS in Pharmacy*, *3*. https://doi.org/10.24926/iip.v5i3.347

Xu, H. Y., Yu, Y. J., Zhang, Q. H., Hu, H. Y., & Li, M. (2020). Tailored interventions to improve medication adherence for cardiovascular diseases. *Frontiers in pharmacology*, *11*, 510339. https://doi.org/10.3389/fphar.2020.510339

Table 1

Search Strategy

Key Search Terms Used	• Medical subject headings (MeSH) terms used were acquired from PubMed resulting in these keywords: heart disease (**HD***), coronary artery disease (**CAD***), medication adherence (**MA***), adherence (**AD**) • Other keywords put together during the search process include: Medication non-adherence, cardiovascular disease (**CVD**), Lifestyle Modifications (**LM**) See table 4 for the use of bolded abbreviations
Years/Language	Ten years/English
Age of Subjects	>18 years
Search Engines	Google Scholar
Databases	PubMed, Medline, CINAHL, Ebscohost
Professional Organizations	American Heart Association
Government & Regulatory Agencies	Agency for Healthcare Research and Quality (http://www.ahrq.gov) Georgia Department of Public Health, Centers for Disease Control
other	Bibliographies

Table 2
Data Search

Database	Search terms	Results (Number & Type of studies located	Dates searched
CINAHL	CAD*+MA*=100	Four articles accepted Level I: 1 Level II: 3	09/10/2019-11/14/2019
Pubmed	CAD[MeSH] =25 HD[MeSH]=25 AD [MeSH]=54 HD+MA=2385 CAD* +AD=1337 CAD*+MA*=77 CAD*+MA*+LM=45	Four articles Level I:1 Level III:2 Level IV:1	10/16/2019-11/14/2019
Ebscohost	CAD*+AD+MA=77 CAD*+MA*+HA=12 CAD*+AD+LM=0	Two articles accepted Level I:1 Level III:1	10/11/2019-10/13/2019
MEDLINE	MA*+HD=1162	1 article accepted Level 1: 1	10/16/2019-10/20/2019
Government & Regulatory Agencies	CAD*+MA*=0	No articles accepted	09/10/2019-09/11/2019
Professional Organizations	CAD*/MA*=0	No articles accepted	09/10/2019-09/11/2019
Other	By citation Link=15	1 article accepted Level V: 1	10/16/2019-10/20/2019

Note: The bolded abbreviations on table 1 should be used to interpret the combination search terms on table 2

Table 3

Evidence Table Matrix

Akhu-Zaheya, L. M., & Shiyab, W. Y. (2017). The effect of short message system (SMS) reminder on adherence to a healthy diet, medication, and cessation of smoking among adult patients with cardiovascular diseases. *International Journal of Medical Informatics*, *98*, 65–75. https://doi.org/10.1016/j.ijmedinf.2016.12.003				Strong recommendation; high- quality evidence level II
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
Aimed to assess the effects of the short message system **(**SMS**)** reminders on adherence to a healthy diet**,** medication, and cessation of smoking among adult patients with Cardiovascular Diseases**.**	Randomized controlled trial design	160 patients	The participants were assigned randomly to an experimental group and a placebo group. Morisky 8-Item medication adherence scale (MMAS), Mediterranean diet adherence screener (MEDAS), and readiness to quit ladder were used to assess patients' adherence to medication**,** adherence to Mediterranean diet**,** and smoking cessation**,** respectively. The outcomes were assessed at the beginning of the study, and three months later, following completion of the intervention.	It is recommended to apply SMS via cellphone services to improve patient's adherence to a healthy diet and medication**.**

Aziz, H., Hatah, E., Makmor-Bakry, M., Islahudin, F., Ahmad Hamdi, N., & Mok Pok Wan, I. (2018). A qualitative exploration of the modifiable factors for medication adherence among subsidized and self-paying patients in Malaysia. *BMC Health Services Research, 18*(1), 605. https://doi.org/10.1186/s12913-018-3417-y				Strong recommendation; high- quality evidence level III
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To identify and compare the modifiable factors for medication adherence among subsidized and self-paying patients in Malaysia.	Qualitative semi-structured interviews of patients with medication subsidies and self-paying patients	25 patients, including 13 in the subsidized group and 12 in the self-paying group (N=25)	Data were analyzed using thematic analysis with NVivo 11 software Medication Event Monitoring System (MEMS)	Patients' perceptions of the importance of their quality of life influence medication adherence among subsidized patients. Limitation: study only included patients who could afford to purchase their medications

Bitton, A., Choudhry, N. K., Matlin, O. S., Swanton, K., & Shrank, W. H. (2013). The impact of medication adherence on coronary artery disease costs and outcomes: A systematic review. *The American Journal of Medicine*, *126*(4), 357. https://doi.org/10.1016/j.amjmed.2012.09.004				Strong recommendation; high- quality evidence (I)
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To determine the impact of medication adherence on coronary artery disease costs and outcomes.	Systemic review of RTCs	25 articles critically summarized and appraised (N=25)	Five studies measured the impact of medication adherence on primary prevention of coronary artery disease, and 20 articles focused on the relationship between medication adherence to costs and outcomes related to secondary prevention of coronary artery disease.	Increased medication adherence is associated with improved outcomes and reduced costs, Also showed a consistent trend toward benefits in reduced coronary artery disease-related events, mortality, readmissions, and variety of adherence measures and medication classes Limitation: most studies, the author did not consider the healthy adherer effect.

Chase, J.-A. D., Bogener, J. L., Ruppar, T. M., & Conn, V. S. (2016). The effectiveness of medication adherence interventions among patients with coronary artery disease. *Journal of Cardiovascular Nursing*, *31*(4), 357–366. https://doi.org/10.1097/JCN.0000000000000259				Strong recommendation; high- quality evidence level II
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To determine the overall effectiveness of interventions designed to improve MA among adults with coronary artery disease	Meta-Analysis	Twenty-four primary studies (N=24)	Treatment-versus-control-design studies testing MA interventions among patients with CAD	Interventions to increase MA among patients with CAD were modestly effective. Nurses can be instrumental in improving MA among these patients. Future research is needed to investigate nurse-delivered MA interventions across varied clinical settings. Besides, more research testing MA interventions among younger populations and more racially diverse groups is needed.

Conn, V. S., & Ruppar, T. M. (2017). Medication adherence outcomes of 771 intervention trials: Systematic review and meta-analysis. *Preventive medicine, 99*, 269–276. doi: 10.1016/j.ypmed.2017.03.00				Strong recommendation; high- quality evidence (I)
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To integrate primary research that tested medication adherence interventions.	Systematic review and meta-analysis	771 published and unpublished interventions studies with adherence behavior outcomes	Review of 771 adherence intervention studies (N=77)	Interventions that focused on behavioral strategies were more effective than those that focused on knowledge, beliefs, or attitudes Meta-analytic moderator analysis suggests that healthcare providers should focus intervention content on behavioral strategies, especially habit-based interventions, over cognitive strategies designed to change knowledge and beliefs.

Du L, Cheng Z, Zhang Y, Li Y, Mei D. The impact of medication adherence on clinical outcomes of coronary artery disease: A meta-analysis. *Eur J Prev Cardiol*. 2017;24(9):962-970. doi:10.1177/2047487317695628				Strong recommendation; high- quality evidence level II
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implication**
To evaluate the impact of medication adherence on clinical outcomes in patients with stable coronary artery disease	Meta-Analysis	Articles from January 1960-December 2015 were retrieved from the MEDLINE and EMBASE databases	Ten studies were included in the analysis with 106,002 coronary artery patients Meta-analysis was performed using R Version 3.1.0 software.	The results showed that good adherence to evidence-based medication regimens was related to a lower risk of all-cause mortality, cardiovascular mortality, and cardiovascular hospitalization/myocardial infarction This meta-analysis confirms the significant impact of good medication adherence on clinical outcomes in patients with stable coronary artery disease. More strategy and planning are needed to improve medication adherence

Kahkonen, O., Saaranen, T., Kankkunen, P., Miettinen, H., & Kyngas, H. (2019). Adherence to the treatment of female patients with coronary heart disease after percutaneous coronary intervention. Journal of Cardiovascular Nursing, 34(5), 410–417.				Strong recommendation; moderate- quality evidence level V
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To identify the predictors of adherence in patients with coronary heart disease after a percutaneous coronary intervention.	Analytical multihospital survey study	Survey of 416 post percutaneous coronary intervention patients (N=416)	Adherence of people with chronic disease instrument The instrument consists of 37 items measuring adherence and 18 items comprising sociodemographic, health behavioral and disease-specific factors	Patients reported good adherence. However, there was an inconsistency between adherence to a healthy lifestyle and health behaviors. The predictive factors known to explain adherence to treatment were male gender, close personal relationship, more extensive education, lower LDL cholesterol, and longer duration of coronary heart disease without previous percutaneous coronary intervention.

Khatib, R., Marshall, K., Silcock, J., Forrest, C., & Hall, A. S. (2019). Adherence to coronary artery disease, secondary prevention medicines: exploring modifiable barriers. *Open heart*, *6*(2), e000997. doi:10.1136/openhrt-2018-000997				Level of Evidence Strong recommendation; moderate-quality evidence (1V)
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To identify actual and potential modifiable barriers to adherence to be addressed in cardiology clinical practice.	Cross-sectional postal survey-based	696 patients were sent a survey in the mail, and 503 responded	Participants had been on secondary prevention medication (SPM) for ≥three months. The single question (SQ) tool, 20 the eight-item, Morisky Medication Adherence Scale (MMAS-8),21 the Adherence Estimator (AE)22, and the Beliefs about Medicines Questionnaire (BMQ) used on a survey. Of the 696 patients who were sent the survey in the mail, 503 (72.3%) returned the completed questionnaire.	By using appropriate self-report tools, patients share actual and potential modifiable barriers to adherence addressed in clinical practice. Barriers included forgetfulness, worry that medicines do more harm than good, feeling hassled about medicines taking, feeling worse when taking medicines, and not being convinced of the benefit of medicines.

Mamudu, H. M., Paul, T. K., Veeranki, S. P., & Budoff, M. (2014). The effects of coronary artery calcium screening on behavioral modification, risk perception, and medication adherence among asymptomatic adults: A systematic review. *Atherosclerosis*, *236*(2), 338–350. https://doi.org/10.1016/j.atherosclerosis.2014.07.022				Strong recommendation; high- quality evidence (III)
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To perform a systematic review of the effects of screening for coronary artery calcium (CAC), a subclinical marker of coronary artery disease (CAD), on behavioral or lifestyle modification, risk perception, and medication adherence.	A systematic review and observational studies	15 studies identified that met the predetermined inclusion criteria (N=15)	Searched through CINAHL, Psych Info, Web of Science, Cochrane Central Register of Control Trials, and PubMed (Medline) 15 retrieved studies, three were randomized control trials, and 12 were observational studies	CAC screening improved medication adherence and could likely motivate individuals for beneficial behavioral or lifestyle changes to improve CAD. The mixed results suggest the need for further research because screening for sub-clinical atherosclerosis has significant implications for early detection and prevention of future cardiovascular events by aggressive risk factors modification.

Peterson, J. C., Link, A. R., Jobe, J. B., Winston, G. J., Marina Klimasiewfski, E., & Allegrante, J. P. (2014). Developing self-management education in coronary artery disease. *Heart & Lung - The Journal of Acute and Critical Care*, *43*(2), 133–139. ttps://doi.org/10.1016/j.hrtlng.2013.11.006	Strong recommendation; high- quality evidence level III

Hypothesis/Questions	Design	Sample	Measurement	Results/Implications
To describe a three-step approach to develop and evaluate an innovative CAD self-management educational workbook.	Qualitative study	61 post-angioplasty patients were interviewed	First, interviews were conducted using grounded theory methods with a diverse CAD cohort (n = 61) to identify needs and perceptions. Second, a workbook was developed, incorporating themes that emerged from the qualitative interviews. Finally, 225 people with CAD used the workbook in a longitudinal study and their use of and experience with the workbook at 12 months was evaluated	A self-management educational workbook developed using qualitative methods can provide relevant, disease-specific health information for patients with CAD. Limitations, the qualitative information gathered may not be generalizable beyond New York City, only sampled Black, Hispanic, and Caucasian participants who were English speaking; other groups may not find this workbook as relevant. Also, the evaluation cohort was not as diverse as the qualitative cohort, and the study was unable to evaluate differences between ethnic/racial groups in the evaluation cohort. Other limitations were in the evaluation phase, physical activity data were provided via self-report, patient education materials should be developed for the populations and disease group for whom they are intended.

Turan K S, Canli Ö.Z. (2020). The effect of education and telephone follow-up intervention based on the Roy adaptation model after myocardial infarction: Randomized controlled trial. *Scand J Caring Sci*.;34(1):247-260. doi:10.1111/scs.12793				Strong recommendation; high-quality evidence (1**)**
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
The aim of this study was to evaluate the effect of education and telephone follow-up intervention based on the Roy adaptation model for improving myocardial infarction patients' self-efficacy, quality of life and lifestyle adaptation	Randomized controlled study	Patients were randomly allocated to a control group or intervention. (n=33/group)	The control group received routine care, while the intervention group received routine care plus a telephone follow-up intervention, which consisted of a predischarge education program and three telephone follow-up sessions. Data were collected before discharge, in the 12th week after discharge between April 2016 and August 2017.	In the 12th week after discharge, patients in the intervention group had significant improvements in self-efficacy, quality of life and coping adaptation process compared with the control group. The intervention group also had more adaptation lifestyle changes concerning patient's nutrition and physical activity in the 12-week follow-up.

Zullig, L. L., Ramos, K., & Bosworth, H. B. (2017). Improving medication adherence in Coronary heart disease. *Current Cardiology Reports, 19*(11), 113. https://doi.org/10.1007/s11886-017-0918-y				Strong recommendation; high- quality evidence (I)
Hypothesis/Questions	**Design**	**Sample**	**Measurement**	**Results/Implications**
To synthesize research findings from recently published (RCTs) targeting any phase of medication adherence, from initiation to discontinuation, among patients with coronary heart disease.	Randomized controlled trials (RCTs)	77 articles	77 articles critically summarized and appraised Articles' titles and abstracts were reviewed to remove articles for which CHD was not a primary focus (*n* = 16), those that were primarily clinical in nature (*n* = 3), commentaries and editorials (*n* = 4), and articles that described a relevant protocol but only presented baseline data or did not report study results (*n* = 9). In a secondary review process, articles that were observational or cross-sectional (*n* = 25), literature reviews (*n* = 6), and non-randomized interventions (*n* = 3) were removed	This review addressed available data for promising practices for improving CHD medication adherence. Future studies are needed to examine intervention effectiveness, scalability, and durability of observed outcome effects.

Table 4.
Demographic Characteristics

Demographic Characteristics	
Characteristics	M(SD)/n (%)
Age in years	53.7 (7.5)
No. of CAD medications	3.0 (.73)
Male	11 (55)
White	15 (75)
Had less than high school education	13 (60)

Gender, Age, Race, Educational Level, and No. CAD of medications

Table 5.

MGLS Medication Adherence Questions

MGLS Medication Adherence Questions	Pre-Intervention (N=20) Yes n %	Post-Intervention (N=18) Yes n %
In the last week did you forget to take your CAD medications?	13 (65)	1 (5.6)
In the last week did you ever have problems remembering to take your CAD medications?	12 (60)	1 (5.6)
In the last week did you ever feel better and sometimes stopped taking your CAD medications?	2 (10)	0 (0)
In the last week, sometimes if you felt worse when you took your medications, did you stop taking it?	2 (10)	0 (0)

Table 6
Levels of Evidence

Level of Evidence	Description
Level I	Evidence from a systematic review or meta-analysis of all relevant RCTs (randomized controlled trial)
Level II	Evidence obtained from at least one well-designed RCT
Level III	Evidence obtained from well-designed controlled trials without randomization
Level IV	Evidence from well-designed case-control or cohort studies
Level V	Evidence from systematic reviews of descriptive and qualitative studies
Level VI	Evidence from a single descriptive or qualitative study
Level VII	Evidence from the opinion of authorities and/or reports of expert committees.

This level of evidence rating scheme is based on the following:
Dang, D., & Dearholt, S. (2018). *Johns Hopkins nursing evidence-based practice: model & guidelines*. Sigma Theta Tau

Figure 1.
Literature Review
Flowchart

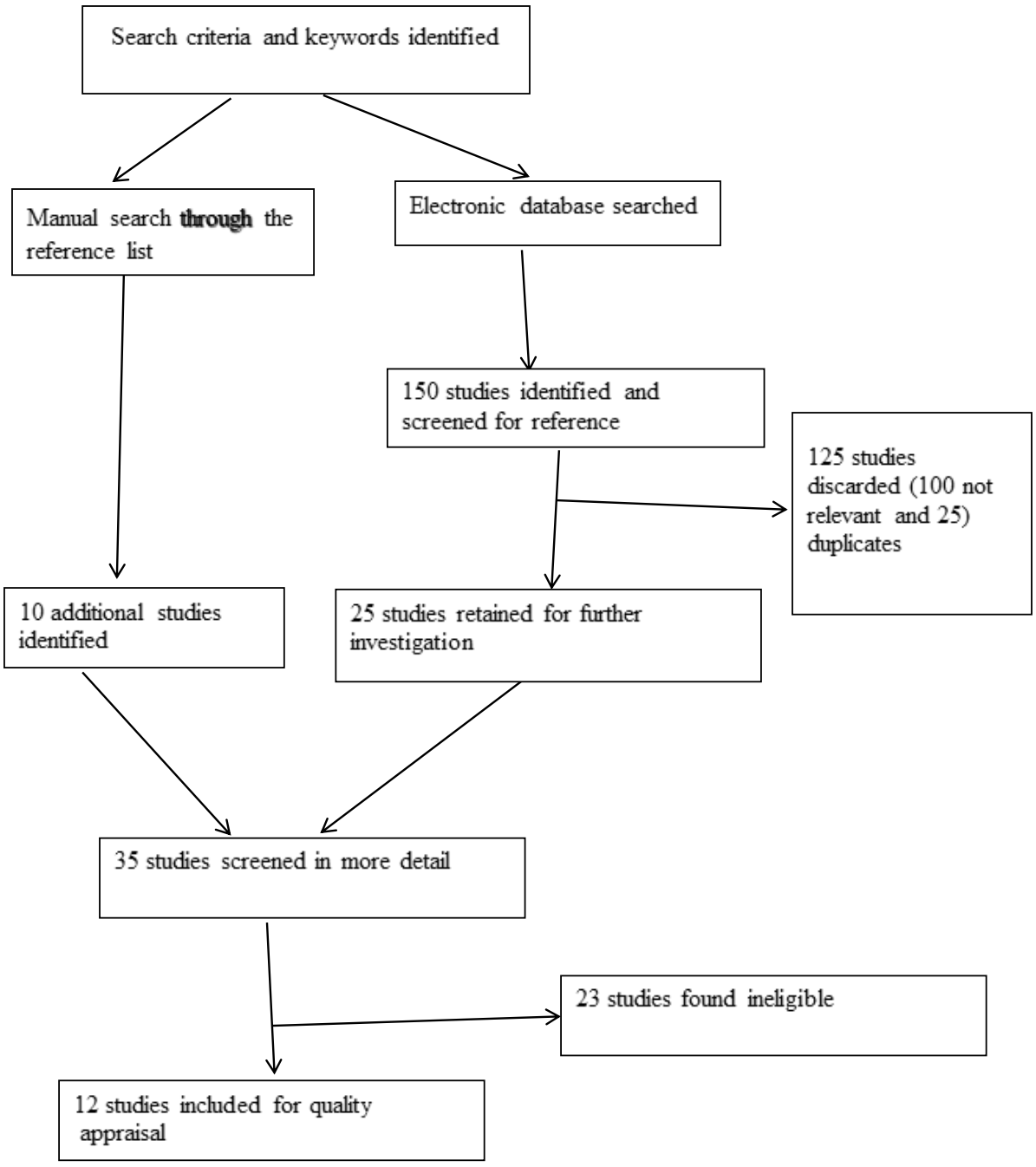


Figure 1. Literature Review of Flowchart

Figure 2.

Mean Scores

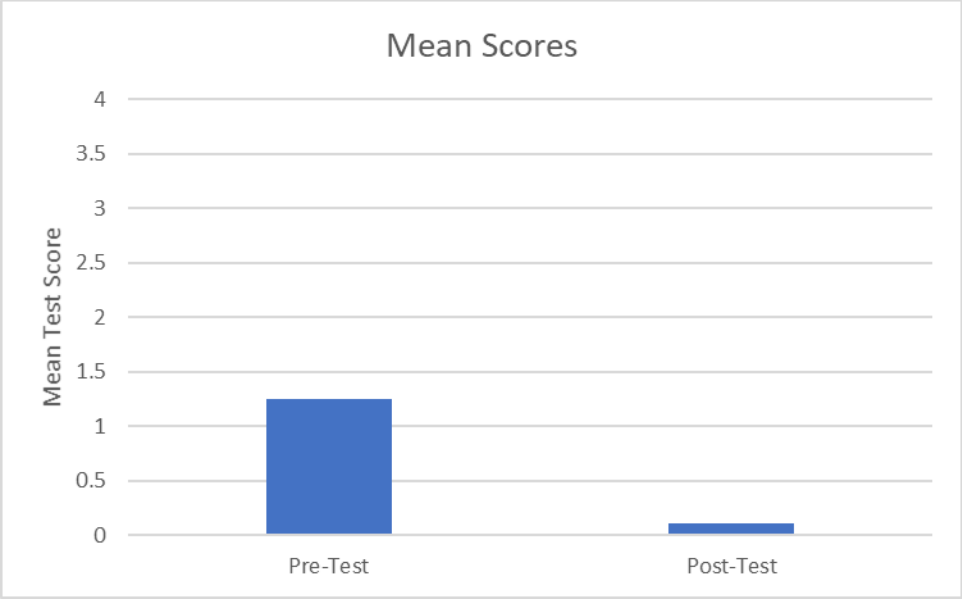


Figure 3.

Barriers to Adherence

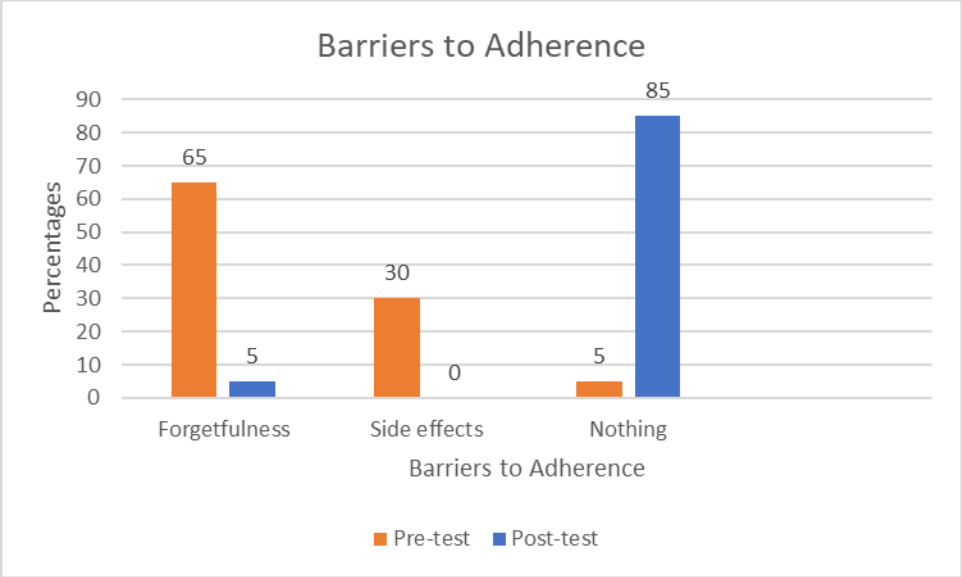


Figure 4.

Tips to help take medications

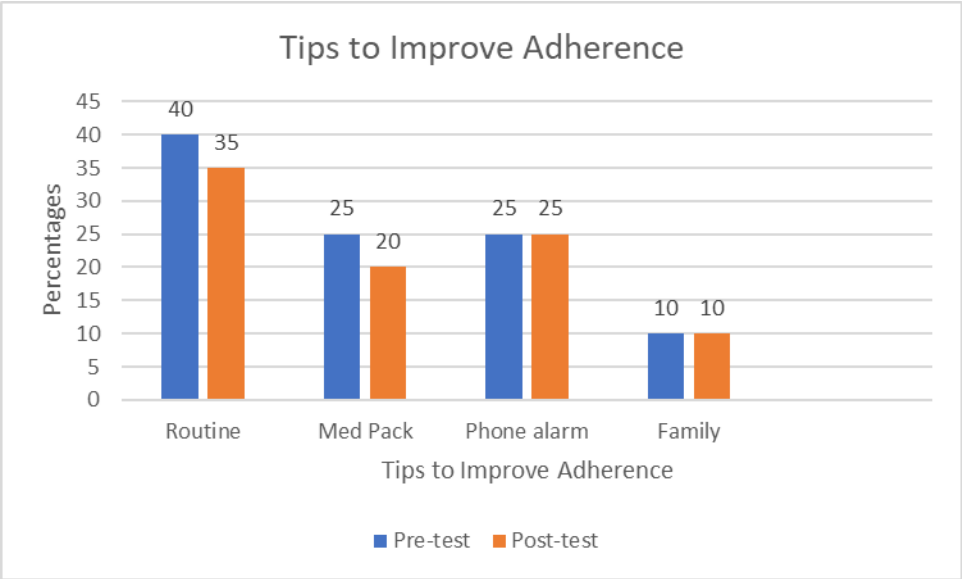
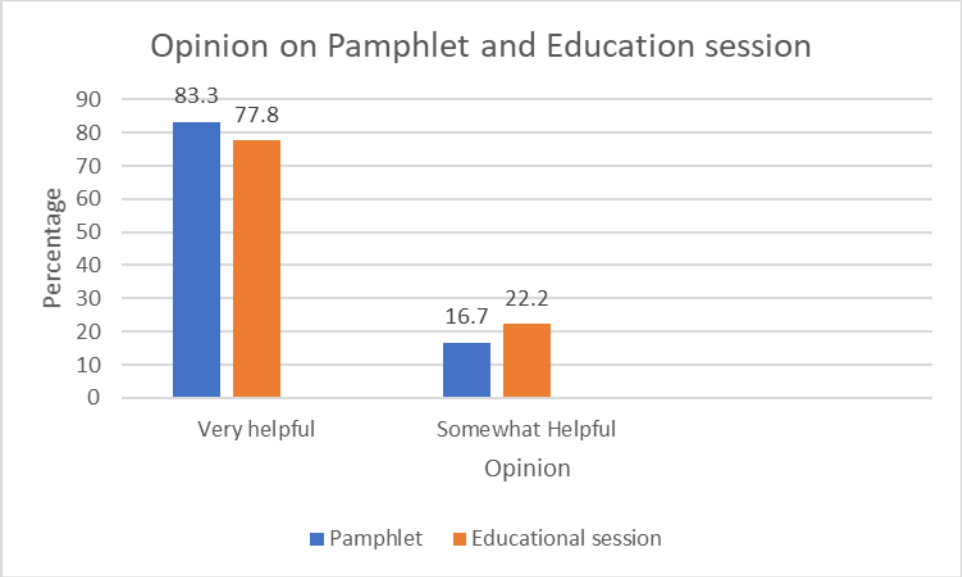


Figure 5.

Opinion on Educational Pamphlet and Education



APPENDIX D

Demographic Sheet

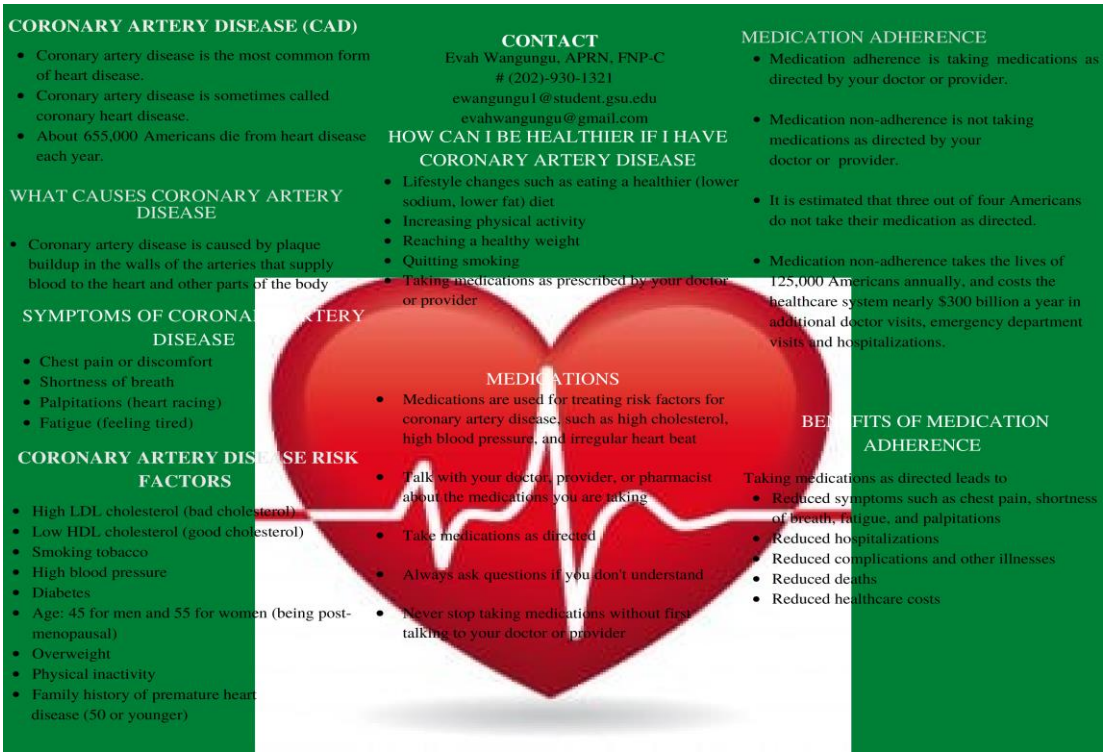
Assigned Code: _____

Name	
Age	
Gender	
Race/ethnicity	
Language	
Level of education	
Phone Number	
Number of CAD medications	

APPENDIX E

Coronary Artery Disease Education (CADE)

Assigned Code: _____



RESULTS OF MEDICATION NON-ADHERENCE

Taking medications as directed leads to

- Reduced symptoms such as chest pain, shortness of breath, fatigue, and palpitations
- Reduced hospitalizations
- Reduced complications and other illnesses
- Reduced deaths
- Reduced healthcare costs

REASONS PEOPLE DO NOT TAKE MEDICATIONS AS DIRECTED	TIPS TO HELP YOU TAKE MEDICATIONS AS DIRECTED
• They may forget	• Put daily alarm reminders • Take your medications at the same time everyday • Ask people close to you to help remind you • If you're using a commercial pill dispenser, set a regular time each week to refill it • If you're away from home, make sure you carry enough of your medication with you to take the prescribed doses while you're out
• They may fear the side effects	• Tell your doctor or provider if you have any side effects
• Affordability/cost of prescriptions	• If your medications are too expensive, ask your physician, provider, or pharmacist about finding financial assistance • Your doctor, or provider may be able to prescribe another medication that works just as well but costs less
• They may not be convinced of the medication's effectiveness or nor sure thatt it is working	• Tell your doctor or provider if you don't think your medication is making a difference

REFERENCES

American Heart Association. (2015). Coronary artery disease-coronary heart disease. Retrieved from https://www.heart.org/en/health-topics/consumer-healthcare/what-is-cardiovascular-disease/coronary-artery-disease

American Heart Association. (2018). Taking control of your medicines. Retrieved from https://www.heart.org/en/health-topics/cardiac-rehab/managing-your-medicines/taking-control-of-your-medicines

American Heart Association. (2020). Medication adherence-Taking your meds as directed. Retrieved from https: heart.org/en/health- topics/consumer-healthcare/medication-information/medication adherence-taking-your-meds-as directed

Centers for Disease Control and Prevention (2019). Coronary artery disease. Retrieved from https://www. cdc. gov/heart disease/coronary ad. htm