SCREENING ASYMPTOMATIC WOMEN FOR CARDIOVASCULAR RISK

by

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EVIDENCE-BASED PRACTICE PROJECT REPORT

Submitted to the College of Nursing

of Valparaiso University,

Valparaiso, Indiana

in partial fulfillment of the requirements

For the degree of

DOCTOR OF NURSING PRACTICE

2014
DEDICATION

I would like to dedicate this EBP project to my family and friends who have provided their unending love and support during this journey. I hope I have instilled upon them the importance of higher education and the belief that we must continually grow and learn on a daily basis.

Success

To laugh often and much,

To win the respect of intelligent people and the affection of children,

To earn the appreciation of honest critics and endure the betrayal of false friends,

To appreciate beauty and find the best in others,

To leave the world a bit better, whether by a healthy child, a garden patch, or a redeemed social condition,

To know even one life has breathed easier because you have lived,

This is to have succeeded!!!

Ralph Waldo Emerson
ACKNOWLEDGMENTS

I would like to thank my professors who have provided a foundational framework on which to build by DNP EBP project. I am thankful for their intelligence and expertise throughout this educational endeavor. I would also like to thank my fellow students for their support and camaraderie as we traveled this journey together. Most importantly, I want to thank Dr. Kristen Mauk, my academic advisor, for her unending support, invaluable guidance, wisdom and expertise throughout this educational quest. She consistently provided encouragement and leadership in a supportive and mentoring manner. She kept me focused and encouraged, for which I thank her with unending gratitude.
PREFACE

Cardiovascular disease is the leading cause of morbidity and mortality in U.S. women. Cardiovascular risk screening is recommended for asymptomatic women by both national and international cardiovascular experts. This EBP project provides compelling evidence that asymptomatic women exhibit a number of modifiable risk factors. Such evidence is crucial to demonstrate the imperativeness of primary prevention initiatives in the clinical practice setting.
TABLE OF CONTENTS

DEDICATION...........................................................................................................iii

ACKNOWLEDGMENTS.......................................................................................... iv

PREFACE.............................................................................................................. v

TABLE OF CONTENTS........................................................................................ vi

LIST OF TABLES....................................................................................................... vii

LIST OF FIGURES................................................................................................... ix

ABSTRACT................................................................................................................ x

CHAPTERS

CHAPTER 1 – Introduction......................................................................................1

CHAPTER 2 – Theoretical Framework and Review of Literature ..................13

CHAPTER 3 – Implementation of Practice Change ........................................52

CHAPTER 4 – Findings............................................................................................65

CHAPTER 5 – Discussion.........................................................................................80

REFERENCES........................................................................................................102

AUTOBIOGRAPHICAL STATEMENT....................................................................113

ACRONYM LIST......................................................................................................114

APPENDICES

APPENDIX A – Data Collection Form ...............................................................116

APPENDIX B – Consent Form..............................................................................117

APPENDIX C – Thank You Letter- Normal Results.........................................118

APPENDIX D—Thank You Letter- Need F/U......................................................119

APPENDIX E—Thank You Letter- Abnormal BMI.............................................120
LIST OF TABLES

Table 1.1 Evidence Table

Table 4.1 Sample Characteristics of Participants Completing Labs

Table 4.2 Sample Characteristics of Participants not Completing Labs

Table 4.3 Correlations Table
LIST OF FIGURES

Figure 4.1 Age Distribution of Sample.........................................................66

Figure 4.2 Modifiable Variables and their Frequencies......................................73

Figure 4.3 Number of Modifiable Risk Factors
   Per Study Participant.................................................................................74
ABSTRACT

Cardiovascular disease (CVD) has long been recognized as a significant health problem in the U.S., and is the leading cause of preventable death in women, collectively causing about one death per minute (Caboral, 2013). A myriad of modifiable risk factors including dyslipidemia, hypertension, smoking, obesity, and type II diabetes are associated with 80-90% of CVD morbidity and mortality. Despite sobering statistics, valid risk prediction screening tools, and national preventive guidelines, adequate screening in clinical practice settings is sadly deficient. An evidence-based practice project was designed and implemented at a large OB/GYN practice in southern Ohio to address this identified gap in clinical practice. Pender’s health promotion model and Stetler’s evidence-based practice model provided the theoretical foundation for the project. A critical appraisal of current evidence was executed to identify best practice recommendations. The literature was salient in articulating that CVD risk assessment in asymptomatic women was imperative to guide primary prevention interventions, improves patient outcomes, and reduce the economic burden of CVD. Synthesis of the literature supported the use of the Framingham risk score (FRS) model as a gold standard recommendation in the clinical practice setting. The FRS model was applied to a convenience sample of asymptomatic women between the ages of 35-50 who presented for their annual gynecologic exam. Statistical analysis using the SPSS 20 statistical software of the gleaned metrics demonstrated 91% of the project participants with at least one modifiable CVD risk factor. 50.5% (n=55) of the EBP project participants had significant CVD risk factors that necessitated a timely follow up appointment. Using Pearson’s r there were 27 statistically significant relational correlations discerned from the data analysis. The findings garnered from the EBP project were commensurate with the findings reported in the scientific literature. The data analysis provided compelling evidence to support the need for CVD risk screening in asymptomatic women. The literature is salient in
elucidating anywhere from 25-46% of women consider their gynecologist as their PCP, therefore, the OB/GYN practice setting is a paramount clinical site for implementation of CVD risk screening.

*Keywords*: cardiovascular disease (CVD), modifiable risk factors, screening, risk prediction models, evidence-based practice, women
CHAPTER 1
INTRODUCTION

Background

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality in the United States (U.S.). A disease that has traditionally been considered a man’s disease is dispelled by statistical data acknowledging that as of 2008, more women in the U.S. died from CVD than from all forms of cancer, respiratory disease, and Alzheimer’s combined, accounting for one of every three deaths but rapidly approaching one of every two deaths (Caboral, 2013). Also, since 1984 the number of CVD deaths for women has consistently exceeded those for men (Moran & Walsh, 2013). In 2007, CVD caused approximately one death per minute among women in the U.S. (Caboral, 2013). More than 60% of women who died suddenly of CVD had no previous symptoms of CVD (Wood & Gordon, 2012).

In asymptomatic women, CVD risk is the additive effect of multiple interacting risk factors. Although data indicate an increased cardiovascular mortality in older women, a disturbing trend is being observed in young women ages 35-54 (Arslanian-Engoren, 2011). CVD mortality in this age group has increased 1.3% annually since 1997 (Arslanian-Engoren, 2011). These sobering statistics reiterate the necessity of primary prevention screening and early intervention in women of all ages.

CVD is an enormous economic burden accounting for 17% of national health expenditures equating to a total of $503 billion in 2010 compared to $228 billion for cancer (Owen & Reid, 2013). Between 2010 and 2030, real total direct costs of CVD are projected to reach $818 billion (Owen & Reid, 2013).

Misperceptions remain pervasive both in the patient population and the medical community regarding the significance of CVD in women. A 2009 cross sectional study of
2,300 women in the U.S., revealed that only 54% of respondents recognized CVD as being the leading cause of death in their gender (Caboral, 2013). This lack of awareness is even more poignant in Central Ohio as elucidated by Gulati and Torkos (2011) whose survey conducted through Ohio State University revealed that only 22% of Ohio women understood the dangers of heart disease. While approximately 75% of the surveyed women had CVD risk factors, only 25% identified themselves at risk for CVD. The American Heart Association (AHA) released its 2020 Impact Goal of improving the cardiovascular health of all American’s by 20% and reducing death from CVD by 20% by the year 2020 (Lloyd-Jones, Hong, Labarthe, Mozaffarian, Appel, Van Horn, Greenlund, et al., 2010). The AHA has a triad of recommendations to meet their objective which includes focusing on prevention at all levels of risk, cognizance that risk factors develop early in life, and providing health promotion and disease prevention at both the population and individual levels (Heidenreich, 2011). Evidence exists that prevention works, specifically that >50% of reduction in CVD mortality is due to changes in risk factors and 40% to improved treatments (Perk, DeBaker, Gohlke, Graham, Reiner, Verschuren, Albus, et al. 2012).

Multiple barriers to assessment of CVD risk factors in women have been identified in the literature. Lack of access to care and lack of knowledge and skill in guideline implementation among internists, family practitioners, and gynecologists are among the barriers identified. For instance, in a study evaluating the impediments in CVD prevention, one half of obstetricians-gynecologists and one third of internists surveyed were unaware that tobacco use is the leading cause of myocardial infarction (MI) in younger women (Mosca, Benjamin, Berra, Bezanson, Dolor, Lloyd-Jones, Newby, et al., 2011).

A myriad of risk factors interact synergistically to increase the level of CVD risk. The majority of these risk factors are modifiable such as dyslipidemia, body mass index
(BMI), blood pressure, smoking, nutrition, and inactivity. Non-modifiable risk factors include age, sex, ethnicity, and family history. CVD risk factor modification targeting lifestyle behaviors (smoking, sedentary lifestyle, poor diet) and comorbid conditions (hypertension, dyslipidemia, diabetes, and obesity) have the propensity to profoundly impact CVD burden.

According to the AHA (2012), 53.8 million women have total blood cholesterol (TC) levels of ≥ 200 mg/dL (Moran & Walsh, 2013). Dyslipidemia as a cardiovascular risk factor affects women differently than men. Elevated triglycerides (TG) (>200 mg/dL) and low levels of high-density lipoprotein (HDL) cholesterol (<40 mg/dL) are more potent independent risk factors for women than for men (Edwards, 2012). A meta-analysis of 17 population based prospective trials demonstrated an 88 mg/dL increase in plasma triglyceride levels was associated with an increase in relative risk of CVD of 75% in women compared to 30% in men (Edwards, 2012).

An ominous trend of rising obesity rates now affects nearly two of every three American women ≥ 20 years of age (Mosca et al., 2011). Overweight or obese as defined as a BMI of ≥ 25.0 kg/m² affects 71.3 million women above the age of 20 (Moran & Walsh, 2013). In the United States, 66% of Americans are now considered overweight or obese (Gleeson & Crabbe, 2009). Obesity, especially central adiposity, is recognized as one of the most important modifiable cardiovascular risk factors. Based on population studies risk estimates indicate at least two thirds of the prevalence of hypertension can be directly attributed to obesity (Chrostowska, Szyndler, Hoffmann, & Narkiewicz, 2013). In men, the attributable risk of hypertension induced by abdominal obesity ranges from 21% to 27% whereas in women the range is 37% to 57% (Chrostowska, Szyndler, Hoffmann, & Narkiewicz, 2013). Among individuals in the Framingham Heart Study, obesity increased the relative risk of CVD by 64% in women (Sharma & Gulati, 2013). In addition to the direct health consequences of obesity, medical expenditures attributed to
adult obesity totaled $147 billion in 2008 and are predicted to be greater than $300 billion by 2018 (Shaw, Caughey, & Edelman, 2012). Obesity and adipose tissue itself have direct and deleterious effects on cardiovascular function and structure. Not only is obesity an independent risk factor for CVD and hypertension but it also contributes to dyslipidemia, and Type II diabetes.

Hypertension is an important causative factor in the lifetime risk for developing heart failure with a reported risk of one in six for women without prior history (Gleeson & Crabbe, 2009). The evidence linking untreated hypertension to increased cardiovascular morbidity and mortality is undisputed. In terms of attributable death, the current leading cause of CVD risk and mortality is elevated blood pressure. A large systematic review of 147 trial reports on the management of hypertension has shown that a mere reduction of 10 mm Hg in systolic blood pressure and 5 mm Hg in diastolic blood pressure was associated with a 20% reduction in CVD and 32% reduction in stroke in one year (Al-Ansary, Tricco, Adi, Bawazeer, Perrier, Al-Ghonaim, AlYousefi, et al., 2013). Elevated blood pressure contributes to 7.6 million worldwide premature deaths annually (Turnbull, Kengne, & MacMahan, 2010).

Smoking has an associative affect in a plethora of diseases and is responsible for 50% of all avoidable deaths in smokers, half of these due to CVD (Perk, DeBacker, Gohlke, Graham, Reiner, Verschuren, Albus, et al., 2012). Smoking is known to cause inflammation and thrombotic activity with epidemiologic evidence supporting a dose relationship between the number of cigarettes smoked and resultant CVD risk. Reports by the U.S. surgeon general conclude that smoking is the single greatest cause of avoidable morbidity and mortality in the U.S. (Filion & Guepker, 2013). In women under the age of 50, cigarette smoking significantly increases the risk for a first MI compared to men (Gleeson & Crabbe, 2009). 23% of women who have an MI in their 40's will die within one year of the cardiovascular event (Johnson & Seibert, 2011). The
The INTERHEART study found that the risk for MI increased by 5.6% for every additional cigarette smoked per day (Owen & Reid, 2013). Smoking also negatively interacts with several other CVD risk factors such as hypertension, dyslipidemia, and diabetes.

A Cochrane systematic review found that smoking cessation was associated with a significant (36%; odds ratio (OR) = 0.64, confidence interval (CI) 95%) reduction in risk of all-cause mortality in patients with CVD (Katskiki, Papadopoulou, Fachantidou, & Mikhailidis, 2013). Smoking cessation is an effective CVD prevention strategy; within three years of quitting, risk of MI in the INTERHEART Study had halved (Owen & Reid, 2013). Despite these pervasive statistics, 18.1% of all women in the U.S. continue to smoke (Wood & Gordon, 2012).

Type II diabetes is another significant risk factor for the development of CVD. According to the Centers for Disease Control and Prevention (CDC), 11.5 million women ages 20 and older have diabetes. CVD death rates are increased three to fourfold in women with diabetes compared to men (Arslanian-Engoren, 2011). Diabetes accelerates the atherosclerotic process which is commensurate with increasing a person’s age by approximately 15 years (Worrall-Carter, Ski, Scruth, Campbell & Page, 2011). Type II diabetes is a completely preventable disease which can be averted through weight management, nutrition, and physical activity.

Physical inactivity is yet another modifiable CVD risk factor. Only about 31% of American women age 18 and older engage in 30 minutes of moderate physical activity five times per week as recommended by the AHA (Arslanian-Engoren, 2011). There is limited randomized data on the independent effects of exercise on the primary prevention of CVD events, however multiple prospective and retrospective observational studies have shown that regular exercise is associated with lower rates of CVD (Hsu, Van-Khue, Ashen, Martin, Gluckman, Kohli, Sisson, et al., 2013). The inverse relationship between physical activity and risk for developing CVD is present in both men
and women but is more pronounced in women. The median CVD risk reduction in women was 40% when most active (30 minutes per day) women were compared to least active women, whereas that in men was 30% (Shiroma & I-Min, 2010).

In summary, each identified cardiovascular risk is significant in and of itself but when multiple risk factors are present, the risk exponentially increases. This further validates the importance of obtaining a complete CVD risk assessment on asymptomatic women in the clinical setting.

**Statement of the problem**

The problem that the evidence-based practice project addressed was CVD risk identification and stratification in asymptomatic women. The rationale for using a risk prediction model is that in the majority of adults, CVD is the product of greater than one risk factor; it is the synergistic effect of multiple risk factors over time. The majority of CVD, (80-90%) is modifiable, but unless women are being screened for CVD risk, interventions on lifestyle modification cannot be initiated. Mosca, Benjamin, Berra, Bezanson, Dolor, Lloyd-Jones, Newby, et al., (2011) found that in the three years after distribution of guideline recommendations for use of the Framingham-based risk scoring, less than 50% of primary care physicians were implementing them. The aim of CVD risk assessment is to be more effective in identifying those at risk and to facilitate evidence-based prevention and treatment based modalities.

Over the past 20 years, studies have shown that women are less likely than men to be evaluated for CVD risk factors. Despite reliable CVD risk screening tools, there is a prevalent disconnect between what is recommended for risk assessment and the reality of what is being done in clinical practice. It is the responsibility of the practicing clinician, in providing comprehensive care, to perform CVD risk assessment on asymptomatic patients.
Data from the literature supporting the need for the project

An amalgamation of numerous large-scale clinical trials and systematic reviews has informed our understanding of cardiovascular risk factors and disease. The “Effectiveness-Based Guidelines for the Prevention of Coronary Artery Disease in Women-2011 Update” recommends risk-stratifying women based on their risk scores into three categories: 1) high risk; 2) at risk; and 3) optimal risk (Sharma & Gulati, 2013). As has been previously articulated, a handful of modifiable risk factors account for 80-90% of CVD. Optimization of these easily measured and potentially modifiable risk factors could result in a 90% reduction in risk for an initial MI (Berger, Jordan, Lloyd-Jones & Blumenthal, 2009).

CVD death rates had been declining between 2000 and 2008 largely due to advancements in secondary prevention (47%) and risk factor reduction (50%) (Perk et al., 2012). These statistics support CVD risk factor modification to be profound in reducing future CVD events in women. However, increasing obesity rates and greater prevalence of diabetes has reversed the downward trend and has demonstrated increasing annual CVD death rates of 8% and 10% respectively (Ehrenthal et al., 2011).

Given the social burden of premature death, disability from CVD, and escalating costs of CVD, there must be a paradigm shift in the approach to cardiac care from treatment of single risk factors in isolation and opportunistic screening to systematic screening and to the management of total cardiovascular risk. Risk assessment through a validated predictive tool and management of CVD risk factors has been recommended both nationally and internationally by experts in the field as a prudent primary prevention strategy.

A recent study was conducted by the Cardiovascular Research Foundation (CRF) in ten OB/GYN offices which assessed 2,234 asymptomatic middle aged women for CVD risk factors. The results were astonishing; 87% of the women had CVD risk
factors while 42% had cardiovascular symptoms (Jancin, 2012). Of the women screened 14% had hypertension, 21% were dyslipidemic, and 7.5% had diabetes. Of the participants assessed, 18% of the participants identified their gynecologist as their primary care provider while 6% identified no primary care provider at all (Jancin, 2012).

In a review authored by Scholle & Kelleher (2003) 38% of the respondents identified their gynecologist as their primary care provider. A screening pilot program conducted by SCAI-Women in Intervention (2012) garnered cardiovascular risk factor data on over 3000 women visiting their OB/GYN office. Over 70 percent of the women screened at 16 study sites had CVD risk factors while 40 percent of them were actually experiencing cardiovascular symptoms. This study also touted the significant percentage of women who cite their OB/GYN as their primary care provider.

Improving cardiovascular health of all Americans is a national priority with a goal of reducing CVD morbidity and mortality and decreasing health care financial expenditures. The OB/GYN as an identified practice setting must embrace the national recommended guidelines for CVD risk assessment in asymptomatic women as an initiative to reduce cardiovascular burden and improve the health of women in the U.S.

A great number of CVD prevention guidelines and tools are reported in the literature and proclaimed by various national and international organizations as being superior to another. However, the ultimate objective of all CVD screening guidelines is identical: to facilitate the prevention of CVD and all its clinical manifestations (De Backer, Catapano, Chapman, Graham, Reiner, Perk, & Wiklund, 2013). Guidelines should be simplistic, straightforward, and credible, applicable to the patient population, and be an aide for informed decision making between the provider and the patient.

The FRS, developed through the Framingham Heart Study (1971-1974), is one of the earliest and best known epidemiological studies in the field of cardiovascular disease. The FRS is the most commonly recommended assessment tool for evaluating
the risk stratification of CVD in the U.S. (Setayeshgar, Whiting, & Vatanparast, 2013). The critically appraised literature repeatedly recommended the FRS as the gold standard for evaluating risk and differentiating high-risk from low-risk women. Key cardiovascular risk factors from the identified Evidence based practice (EBP) project study population was inputted into the web-based FRS prediction equation for numerical probability that the individual will develop CVD over a specific time period, generally a ten year time frame. Additionally, the FRS provided a vascular heart age based on the gleaned metrics for further informing. Further discussion of the FRS will be detailed in the method section of chapter three.

**Data from the clinical setting supporting the need for the project**

It is essential in clinical practice to be able to assess cardiovascular risk precipitously and with sufficient accuracy to allow logical management decisions. Lifestages Center’s for Women is a large multi-site OB/GYN practice located in Southern Ohio and served as the EBP project implementation venue. The mission statement of Lifestages includes a commitment to providing health and wellness services to women of all ages. Lifestages recognizes its responsibility to the community, to not only advocate for, but to develop and implement quality, comprehensive, and cost effective health care programs which educate, inform and support women in making their health care choices and living healthful lives. The provider staff of Lifestages includes OB/GYN physicians, certified nurse midwives (CNM), and a board certified family nurse practitioner (FNP).

The Samaritan north practice site served as the implementation site for the EBP project and sees on average a hundred women per day. Traditionally the OB/GYN practice setting has focused on reproductive and gynecologic health not on cardiovascular health; however as previously elucidated, 25%-46% of women consider their OB/GYN as their primary care provider (PCP). Sadly, as presented by Mosca et al, (2011) only one in five physicians knew that more women than men die each year from
CVD and interestingly, OB/GYN physicians were reported to have substantially less awareness of national risk assessment guidelines compared to other physicians. Based on the reported literature, these statistics are detrimental to a woman’s health and the provider group at Lifestages has collectively agreed to become proactive in reversing this ominous trend.

Effective nurse leaders are essential to play key roles in shaping the health care delivery system and addressing primary prevention measures of risk assessment and intervention modalities for modifiable CVD risk factors. As a family nurse practitioner (FNP), this Doctor of Nursing Practice (DNP) project manager will be instrumental in assessment, education, and treatment of women at risk for CVD.

**Purpose of the EBP project**

All women are at risk for CVD; therefore, preventive screening based on demographic characteristics, comorbid conditions, lifestyle behavior, and risk factor assessment should be routinely performed in the clinical setting in accordance with national guidelines. The first step in disease prevention is recognizing risks which can only be accomplished through performing screening assessments. Screening involves the routine evaluation of asymptomatic people for detection of risk or disease. Available clinical data suggest that CVD is largely preventable and incremental benefits exist from identification and improved control of modifiable CVD risk factors. The purpose of this EBP project was to screen asymptomatic women between the ages of 35-50 presenting for their annual gynecologic exam for cardiovascular disease risk and stratification. This approach affords a valuable tool for identifying a cohort of women who can benefit from preventive treatments to modify or reverse CVD progression. Ultimately, efforts must focus on expanding the number of women whose level of risk is accurately identified and who are receiving evidence-based interventions for CVD risk reduction.
The clinical question

The burning clinical question is: can asymptomatic women be accurately identified for CVD risk factors and have their level of cardiovascular risk accurately stratified? The advantage of implementing a standardized reliable risk assessment tool is that it should be intuitively easy to initiate, takes into account the multifactorial nature of CVD, assesses the appropriate variables, allows for a consistent measurement of risk over time, and establishes a common language that can easily be understood among practitioners.

PICOT

In women between the ages of 35-50 presenting for their annual gynecologic exam, who are asymptomatic for cardiovascular disease, how does implementation of the Framingham risk assessment model, compared to usual care (no screening), identify the level of CVD risk over a three month period of time?

Significance of the project

In reality, 38.2 million U.S. women are living with some form of CVD while a significantly higher percentage of women are at increased risk for developing CVD (Carey & Gray, 2012). Beneficial reductions in major risk factors such as smoking, blood pressure, and high cholesterol, account for more than half of the decreases in CVD deaths (Perk et al., 2012). It is therefore imperative to implement CVD screening risk assessment to identify and implement interventions to improve clinical outcomes and reduce healthcare costs. Current guidelines emphasize assessing a woman’s CVD risk factors throughout her lifetime. After the age of 50, women with even one risk factor will have a substantially higher lifetime risk of developing CVD (Gleeson & Crabbe, 2009).

The ultimate goal of the EBP project is identifying asymptomatic women for their cardiovascular disease risk within the OB/GYN practice setting. The OB/GYN practice site has not traditionally assessed women for disease not related to the reproductive
system. The reasoning behind this has been multi-factorial and includes lack of awareness, lack of understanding and comfort level of garnering metrics on CVD, feeling that it is the responsibility of the PCP to screen, not being comfortable treating risk factors for CVD, and not having a referral mechanism in place. In the implementation site for the EBP project, some of these barriers were articulated; however assurance was rendered to the clinical provider staff that the FNP would be responsible for patient follow up and referral.
CHAPTER 2

THEORETICAL FRAMEWORK AND REVIEW OF LITERATURE

In this chapter, the DNP project manager will discuss the two theoretical frameworks that were used to guide the EBP project. The strengths and limitations of the framework and its applicability to the project will be discussed. A review and appraisal of the literature that supports the underpinnings of the project will be addressed in detail.

Theoretical framework

The theoretical frameworks chosen for this EBP project were Norla Pender’s Health Promotion Model (HPM) and the Stetler model of EBP. These models were chosen for their applicability to the EBP project. Each of the frameworks will be discussed in detail in the following section.

Description of the theoretical framework

The HPM was developed by Norla Pender as a holistic predictive model of health promoting behavior for application in the clinical practice setting. The model attempts to explain and predict human behavior in regard to individual health choices and behavior. The HPM has its theoretical roots in the expectancy value theory and the social cognitive theory. The expectancy theory purports that individuals engage in actions to achieve goals that are perceived to be possible and that have valued outcomes (Strof & Velsor-Friederich, 2006). The social cognitive theory reveals the interconnectedness of thoughts, behavior, and environment in their effect on behavior (Strof & Velsor-Friederich, 2006). Pender articulates that health promotion, defined as behavior motivated by the desire to increase well-being and actualize human health potential, and disease prevention, defined as behavior motivated by the desire to avoid illness, should be the primary impetus in health care (Pender, Murdaugh, & Parsons, 2011).
The HPM has been validated in numerous clinical studies. With regard to the benefit of action of the model, the test-retest reliability score is 0.86 and Cronbach’s alpha is 0.75-0.88; in the barriers to action component of the model the test-retest reliability is 0.75 and Cronbach’s alpha is 0.75-0.84 respectively (Pender, Murdaugh, & Parsons, 2011).

One of the most challenging roles for the practicing clinician is to identify the motivating factor that will provide the impetus for eliciting health behavior change in the patient. The goal of primary prevention is to focus on being proactive with one’s health versus being reactive when disease occurs. There are eight maxims of the HPM that purport to characterize health behavior. The first maxim is the perceived benefit of the action that must be realized by the patient: the individual must foresee the positive consequences of undertaking a health behavior change. Secondly, the patient must be able to identify the perceived barriers to action, the perception of blocks and personal costs of undertaking a health behavior change. The third maxim is perceived self-efficacy and the judgment of personal capability to organize and execute a particular health behavior and complete it successfully. The fourth maxim is the activity-related affect involving the emotional component of health during and following a specific health behavior. The fifth maxim revolves around the interpersonal influences of family, peers, and healthcare providers. This may be the most tenuous construct to achieve as the interactions and compelling forces of peers and family outside of the clinical practice are typically more persuasive than the advice and recommendations of the healthcare practitioner. The sixth maxim involves situational influences or the perception of the compatibility of life context or environment with engaging in a specific health behavior. The seventh maxim is the commitment to a plan of action with the intention to carry out a particular health behavior including the identification of specific strategies to do so successfully. Lastly, the patient must evaluate the immediate competing demands and
preferences that deter changing health behaviors. It is commonplace in clinical practice to hear a barrage of reasons for not completing or continuing a health behavior change. As a clinician, these excuses must be discussed and a plan formulated to repudiate these barriers so that the patient can actively pursue behavioral change.

Research has shown that an individual will take health-related action when there is “a perceived threat to personal health and when the conviction that the benefits of taking the action to protect health outweigh the barriers that will be encountered” (Pender, Murdaugh, & Parsons, 2011, p. 38). One of the roles of the healthcare provider is to discern what the perceived health threat would be to each individual patient and capitalize on that belief to effect change in health behavior.

**Application of the theoretical framework to the EBP project**

Health promotion and disease prevention should be the primary emphasis within the health care environment. It has been succinctly elucidated that the majority of cardiovascular risk factors are modifiable. After critical assessment of numerous theoretical foundations, it was determined that the Pender model is particularly applicable to this EBP project. The HPM provides an excellent foundation for guiding the identified cohort to become actively involved in health promotion and prevention outcomes. Young and Capezuti (2010) postulated that the health promotion model allows for examining factors associated with improved health promotion and allows focusing on personal and environmental factors that influence health. It is imperative for patients to change their modifiable risk factors in order to prevent or reduce the burden of CVD. The eight maxims of the HPM clearly delineate behavior and cognitive constructs that determine health promoting behaviors. The health promotion model has been validated in research to be beneficial in promoting positive health behavior change in people.
Strengths and limitations of the theoretical framework

The primary concern for health care providers is to promote health and prevent disease for each individual patient. The principal strength of the HPM is the identification of factors that influence health behavior. Evaluation of the eight maxims provides a logical progression to improve health and health behaviors. The definitions of the concepts are clear and unencumbered, making them easily understood by health professionals. Strof and Velsor-Friederich’s (2006) analysis of the HPM indicates that self-efficacy and behavior specific cognitions are supported as a predictive variable in a myriad of studies. Identification of benefits and barriers to positive health behavior plays a role in predicting individual health behavior.

The HPM would ideally empower patients with unhealthy behaviors to make necessary changes to promote and improve their health. The HPM can be a beneficial tool for increasing patient awareness and perception of CVD risk factors and facilitating positive behavioral health change. Bennett, Perry, and Lawrence (2009) believed that health behaviors must be in the control of the patient and possess meaning for the patient in order to be effective. Using the HPM as a framework while interacting collaboratively with the patient, the clinician can identify the barriers that impede patients from achieving optimal health.

One of the limitations to the HPM is that the relationship between the constructs is not clearly identified. Although interrelated, there is not a clear linear relationship between the various constructs. Some constructs are more powerful than others in affecting health care behavior. Peterson & Bredow (2009) articulated: “Although the model identifies foci for nursing interventions, it does not explicitly describe how nurses can effect changes in client perceptions” (p. 296). Practitioners in a busy clinical setting may find evaluation of eight constructs to be cumbersome and untenable as well as time prohibitive.
There are specific assumptions associated with the HPM including the assumption that patients are able to self-reflect, actively seek to regulate behavior, and initiate behaviors that modify their environment (Pender, 1996). This may not be the case with each individual patient.

Time constraints of a routine clinical visit would preclude identification of all tenets of the theoretical model and their level of significance for each individual patient. Assisting patients to address the perceived barriers such a lack of discipline, interference by family and peers, and application of change in daily behavior would be a daunting time intensive task. The interaction of patient and provider regarding health changing behavior and risk modification must be persistent and undeviating to effectively elicit health behavior change. Although Pender removed threat of disease from her original model, Peterson and Bredow (2009) pointed out that this may not always be distinguished in practice; threat of disease may therefore continue to be a motivational factor in promoting changes in health behavior. An additional barrier to implementation of the HPM may be that the clinician doubts the patients’ willingness to change negative behaviors and thus finds health promotion and disease prevention discussions to be a waste of valuable time.

In summary, the HPM does provide a sound theoretical framework for promoting change in health behavior. The HPM identifies individual behavior and factors that restrict positive health promoting behavior. The premise of the model is to concentrate on the barriers that impede individuals from achieving optimal health and preventing disease. This model is persuasive for promoting CVD risk reduction in asymptomatic women by identifying barriers, strengthening potential and capability, and putting the responsibility for one’s health in their own hands making the patient a positive change agent.
Description of the EBP model

The principles of EBP have become the cornerstone strategy for health care providers to translate research into clinical practice (Facchiano & Hoffman-Snyder, 2012). Evidence-based practice is a problem solving approach to clinical care that incorporates the conscientious use of current best evidence from well-designed studies, a clinician’s expertise, and patient values and preferences (Fineout-Overholt, Melnyk, & Schultz, 2005). The ever-changing health care environment compels practitioners to synthesize the highest level of evidence into the decision making process. Although there are a number of definitions used interchangeably for evidence-based medicine and evidence-based practice, one of the most widely accepted definitions is by Sackett, Rosenberg, Gray, Haynes, and Richardson (1996) who defined evidence-based medicine “as the conscientious, judicious, and explicit use of current best evidence in making decisions about the care of the individual patients” (p.71). The intent of EBP is not to conduct new research but rather to synthesize clinical evidence from high levels of previously published research and apply it to the clinical setting and to the individual patient. Facchiano and Hoffman-Snyder (2012) concluded that “EBP is a strategy to keep knowledge up to date, enhance clinical judgment, and lead to cost-effective treatment modalities” (p.581). The Institute of Medicine (IOM, 2001) confirmed that it is germane to base clinical decision making on scientific acumen that is evidence-based. When EBP processes are integrated into our clinical practice settings they augment the existing provider-client relationship and shared decision making process (Facchiano & Hoffman- Snyder, 2012). The IOM (2001) has set forth a recommendation that 90% of all clinical decisions be evidence-based by the year 2020. The EBP model chosen for this project is the Stetler model of evidence based practice.
Application of the model to the EBP project

Cheryl Stetler’s model of research utilization was one of the original models developed for EBP. She originally developed the model in 1994 and then revised it in 2001. The purpose of the model is to formulate a series of critical thinking and decision making steps that are designed to facilitate effective use of research findings (White & Dudley-Brown, 2012). The Stetler model de-emphasizes practice based on tradition and instead focuses on the use of research findings along with other credible sources of data. The model focuses on both internal data (such as quality improvement, operational, evaluation, and practitioner experience) and external data (such as primary research and consensus of national experts) making the model comprehensive in nature (Ciliska, et al., 2011).

The Stetler model is a series of five progressive critical thinking and decision making steps designed to facilitate use of research findings in the clinical setting. Preparation, validation, comparative evaluation/decision making, translation/application, and evaluation represent the five building blocks of the model (Ciliska, et al., 2011).

The preparation phase initiates the EBP process by defining the clinical issue, identifying the purpose, and affirming the priority of the identified clinical question. During the initial phase consideration is given to both internal and external factors which may create barriers to implementation. Potential barriers may include organizational expectations/norms, peer expectations, resource availability, and timelines. The PICOT question is formulated to clarify and organize the patient population, intervention of interest, comparison of interest, outcome of interest, and timeframe of the project (Romp & Kiehl, 2009). It is during the preparation phase that the researcher identifies measurable outcome goals and expectations for the project.

The clinical issue identified by this DNP project manager relates to the lack of or inconsistency of CVD risk screening in the female clients seen at Lifestages Center’s for...
Women. To reiterate the significance of this clinical issue, CVD being the leading cause of death in women, is predominantly precipitated by modifiable risk factors. The clinical conundrum is that unless CVD risk screening is implemented in the clinical setting and risk identified, there cannot be evidence based interventions initiated. It is therefore prudent to implement a primary prevention modality to identify cardiovascular risk in asymptomatic women. This DNP project manager, being an FNP, practices primary care within an OB/GYN office setting. Many women identify their gynecologist as their primary care provider, especially women of childbearing age. The usual CVD risk screening may be opportunistic at best in this clinical setting. Not screening asymptomatic women for cardiovascular risk in the clinical setting is negligently ignoring a disease that can easily be modified to change the trajectory of cardiovascular disease progression. This DNP project manager has been afforded a pristine opportunity to amass data on CVD risk factors and stratification of risk in asymptomatic women presenting for their annual preventive exam. This EBP project is a primary prevention intervention initiative.

Phase two of the Stetler model is the validation phase in which relevant literature is critically appraised and synthesized for its applicability to the PICOT question. The methodological review discerns adequate evidence to support the PICOT question. The evidence is analyzed for its statistical and clinical significance as it relates to the clinical question. The chosen evidence is rated for its level and quality and cataloged in an evidence table for easily accessible visualization. It is during this phase that reflection of the studied variables and their relationships are assessed in terms of their applicability to the clinical practice issue. Although a number of tools would provide CVD risk stratification, the tool must be easily applied to the identified cohort and the practice setting. The review of literature will be succinctly detailed in a following section.

Comparative evaluation/decision making is the third phase of the Stetler model. Rigorous comparison of the cumulated evidence for similarities and differences is
completed and the most applicable evidence for the project is garnered. Many sources
of evidence may be pertinent to the EBP but a myriad of parameters must be taken into
consideration such as feasibility, cost, time constraints, current practice fit, and
organizational buy-in before a final decision is made. Admittedly there are a
multitudinous number of risk prediction models articulated in the literature however, this
DNP project manager chose the Framingham risk prediction model for its reliability,
validity, national clinical guideline recommendations, and ease of use in the clinical
practice setting.

Phase four of the Stetler model is the translation/application phase. Using the
summary statements from phase three, the DNP project manager articulated
implementation methodology of the synthesized findings specific to the EBP project. This
phase specifically delineates the type of research, method of use, level of use, any
variation of use, and the plan for dissemination and change strategies (Stetler, 2001).

A convenience sample of women between the ages of 35-50 who presented to
Lifestages Samaritan North office for their annual gynecology exam, and who were
asymptomatic for CVD, were offered CVD risk assessment. Women were assessed by
the nursing staff for inclusion/exclusion criteria, the nursing staff obtained informed
consent, inputted demographic and measurement values onto the questionnaire, and the
medical practitioner seeing the patient ordered a fasting lipid and metabolic panel if not
previously done within the past 12 months. The questionnaire along with the laboratory
metrics were forwarded to the DNP project manager for input into the web-based risk
prediction tool database.

Implementation of a practice change can be challenging therefore, a myriad of
methods of dissemination of information to key stakeholders must be considered.
Communication was done via provider meetings, staff meetings, individual meetings, e-
mail reminders, personal interaction with providers and staff, use of power point
presentations, as well as active involvement by the marketing director and practice manager. Data collection and coalescing of data took place over a 12 week time period.

Tacit valuing, enthusiasm, and awareness of the EBP project are consequential for its success in the clinical practice setting. Anticipation of potential barriers and methods to circumvent these barriers must be in place prior to the implementation phase. This DNP project manager was available at all times, either physically present in the practice setting or via telecommunication, should obstacles be encountered.

Phase five of the Stetler model is the outcome/evaluation phase. Evaluation of the EBP project was based on expected outcomes relative to the PICOT question. Differentiation of formal and informal evaluation as it relates to applying the findings to clinical practice was rendered. Statistical analysis using the SPSS 20 statistical software was completed on the garnered data for its significance and credibility to the clinical question. Assimilation of the findings was disseminated to the provider and nursing staff through group staff meetings and power point presentations. The final phase of the Stetler model is continuous and ongoing as the practice change is made a permanent change in clinical practice.

The Stetler model is a practitioner-oriented model with a focus on critical thinking and the application of research findings applied by an individual practitioner. The model maintains the core assumptions that research based recommendations are applied at the skilled practitioner level to individual patients or other identified groups (Melnyk & Fineout-Overholt, 2011). Albeit the Stetler model is an individual practitioner oriented model rather than an organizational focused model, it is desirable to have a supportive organizational culture. The organizational culture must propagate leadership support for evidence-based practice foci, have the capacity to engage in EBP, have an effective implementation framework, and have an infrastructure to maintain an EBP milieu. The choice of this model was in part due to a collective acknowledgement within the provider
group identifying the exigency to screen women for cardiovascular disease risk. The leadership culture supports the EBP project and deems it crucial in meeting primary prevention goals and in providing comprehensive healthcare screening to women. Implementation of the EBP was an individual practitioner endeavor with expected outcome and data analysis to support the commitment to continue cardiovascular risk screening as an organization wide endeavor.

**Strengths and limitations of the EBP model in the context of the EBP project**

The Stetler model of EBP provides a conceptual framework to elicit a clinical practice change. The models assumptions and action steps are grounded in research and are interactive in nature. The model emphasizes critical thinking and is intended for the practicing clinician. The model affirms the expertise and experience of the clinician to apply evidence-based guidelines in the clinical practice setting. The logical progression of the various phases of the model provided substantiating evidence to support a needed change in current clinical practice. Critical appraisal of the evidence helped ascertain the best fit for answering the clinical question and aided in identifying the evidence that was most apropos for use in the OB/GYN clinical setting.

A potential limitation to the model is the paucity of change theory discussion within the implementation phase of the model. Change causes angst both individually and collectively within the work environment. Staff may perceive the screening implementation to be more work for them, staff may feel that the traditional way of doing things is fine, and concern arises as to what will be done with the data garnered from implementing a risk assessment screening. Providers have voiced concern regarding their level of comfort in primary prevention screening and their responsibility in relationship to intervention and referrals based on risk prediction scores. These concerns were encompassed as part of the education prior to implementation and were ongoing throughout the EBP project.
The decisions rendered during a clinical practice change and used within the context of practice must be replicable, observable, credible, verifiable, and supportable (Melnyk & Fineout-Overholt, 2011). EBP is a strategy to keep knowledge up to date, enhance clinical judgment, and lead to cost-effective treatment modalities (Facchiano & Hoffman-Snyder, 2012). Adopting EBP in the clinical setting enables the clinician to present EBP recommendations to patients and involve them in the clinical decision making process.

**Literature search**

Using key words from the PICOT question, a cogent number of health care data bases were searched for current relevant evidence related to cardiovascular risk assessment in asymptomatic adults. In alignment with the evidence-based process, rigorous research must be appraised and be included in the clinical practice setting to improve the quality of healthcare and patient outcomes (Melnyk & Fineout-Overholt, 2011). This DNP project manager searched a salient number of word combinations and phrases to compile a body of evidence that best related to the EBP project and the PICOT question. This rigorous search for evidence was labor intensive and difficult to amalgamate into tangible units of useable information. There was a dearth of evidence on CVD risk factors and cardiovascular prediction models to appraise and classify.

**Sources examined for relevant evidence**

The search engines used for ascertaining highly relevant current evidence included: CINAHL, Joanna Briggs Institute (JBI), Cochrane databases, PubMed, Google Scholar, National Guideline Clearinghouse, and MEDLINE via EBSCO. A combination of search terms used in each search engine included: cardiovascular disease, women, cardiovascular risk assessment, screen, tools, interventions, cardiovascular risk factors, and Framingham heart study.
Inclusion criteria consisted of peer reviewed scholarly journals, evidence-based or research articles, English language, and date range of 2008-2013. Exclusion criteria were articles written in a foreign language, research older than 2008, evidence that was not pertinent to the evidence-based project, and sources that were not high levels of evidence.

In the CINAHL database, an initial search using the identified terms yielded a total of 31 articles that matched the search criteria. Of these identified articles, five were pertinent to the evidence-based project. Of these research articles, two were included in the appraisal of evidence due to their applicability to cardiovascular risk factor identification and the pertinence of the Framingham risk score in screening asymptomatic adults. Joanna Briggs Institute (JBI) returned 38 articles matching the search terms that were entered. Analytical analysis of the evidence yielded one evidence summary relevant to the EBP project. This evidence summary demonstrated a high level of quality evidence. Many of the evidence summaries were more applicable to interventions of identified cardiovascular risk factors rather than the role of risk factors in the development of cardiovascular disease. Albeit valuable evidence, this EBP project focus was on identifying cardiovascular risk factors rather than focusing on interventions to change the trajectory of the significance of the risk factor as it relates to CVD development. A search of the Cochrane database returned a total of 82 potentially useful articles of high level evidence. A multitudinous number of these were focused on interventions rather than on risk assessment screening. After critical review of the abstracts and sifting through the research, three high quality evidence articles were included in the appraisal of relevant literature. PubMed resulted in a consequential number of applicable evidence. Using the identified search terms, 139 results were returned. Assessing the evidence culminated in five usable articles. Systematic reviews of risk prediction model comparisons along with systematic review of cardiovascular risk
factors were gleaned and found applicable to the EBP project. Google Scholar yielded a plethora of hits and was very onerous to narrow the search to relevant evidence for the EBP project. This search engine was a source of frustration as attempts at narrowing search terms still apportioned an abundance of potential research, but many did not match the defined criteria for the EBP project. After reviewing the returned abstracts, three articles were found to meet inclusion criteria and deemed appropriate for the EBP project. The National Guideline Clearinghouse search criteria resulted in 87 potentially appropriate articles. Analyzing the guidelines and articles resulted in four germane guidelines and articles appropriate for the EBP project. MEDLINE search terms accrued an initial 4104 results that matched the search parameters. Further narrowing of criteria resulted in a total of 47 articles that were reviewed and evaluated which terminated in two articles for integration into the appraised evidence. Once the evidence was amalgamated, hand searching was completed for any supplementary pertinent research.

Levels of evidence

The evidence was evaluated and categorized based on the hierarchy of evidence pyramid delineated by Melnyk and Fineout-Overholt (2011). These levels of evidence range from I, the highest level of evidence to VII, the lowest level of evidence. These levels of evidence are connoted in the note to Table 1.1 which provides summaries inclusive of author(s), date and type of study, study design, outcomes and relevance to the EBP project and clinical practice.

The levels of evidence from the 20 included research articles ranged from Level I to Level VI. Included in the appraised evidence were 14 Level I systematic reviews or clinical guidelines, four Level IV which included two case control studies and two cohort studies, and two Level VI studies, one which was a single descriptive study and one that was a cross sectional study. Clinical practice guidelines were appraised using the Appraisal of Guidelines for Research & Evaluation (AGREE II) and all other research
was appraised using the Critical Appraisal Skills Programme (CASP). The appraisal of current relevant research yielded a significant number of high levels of evidence.

**Appraisal of relevant evidence**

A total of 20 articles were included in the appraisal of evidence and are summarized in Table 1.1. An examination of this evidence will be discussed in greater detail in the following section.

**Table 1.1 Levels of Evidence**

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Level of evidence</th>
<th>Study design</th>
<th>Outcomes</th>
<th>Implications</th>
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<tr>
<td>Siontis et al. 2012</td>
<td>Level I Systematic Review</td>
<td>Comparative predictive model studies included 56 pairwise comparisons of 8 cardiovascular prediction models. Medline and citation search of studies compared at least 2 major risk models in the general population.</td>
<td>One model was no better than another in cardiovascular disease risk stratification. Limitations included same geographic areas, same study population (European), no language restriction, sample size or duration limits.</td>
<td>Clinical usefulness of the various models is based on their potential for affecting decisions on treatment and prevention and improving health outcomes. The FRS model was compared in 50/56 pairwise comparisons, the reliability and validity of the model had previously been validated.</td>
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<tr>
<td>Matheny et al., 2011</td>
<td>Level I Systematic Review</td>
<td>Comparison of externally and internally validated risk prediction models that included prospective and randomized controlled trials. Study designs were accepted if evaluation was of asymptomatic patients. Medline search from 1999-2009 and reference searching was done.</td>
<td>The objective the USPSTF sought to determine was if a specific model performed better and therefore would be more applicable in a primary care setting. The FRS models performed well in the U.S. population, the newer models being more predictive than older models.</td>
<td>Evidence supports use of the FRS in a primary care setting. It has been compared to global models and has performed successfully in the U.S. population. This tool will be applicable for this DNP project manager to apply to the EBP project study population.</td>
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<td>Hsu, et al., 2013</td>
<td>Level IV Case Control</td>
<td>INTERHEART case control study comparing the FRS model and RRS model</td>
<td>Comparison of the FRS and the RRS model in 9 modifiable risk factors. The RRS demonstrates more</td>
<td>The RRS assessment adds family history and CRP- hs to the FRS which demonstrated more</td>
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<td>RCT’s comparing risk models focusing on rationale for estimating cardiovascular risk, comparison of current models for reliability and validity, and whether evidence exists that cardiovascular risk estimation improves patient outcomes.</td>
<td>Review of RCT’s and prospective cohort studies that included greater than 1000 women. This was a follow-up to the 2007 guideline. PubMed, Embase, and Cochrane were searched using the date ranges of 2006-2010.</td>
<td>The rationale for implementation of risk modeling is that CVD is the result of combined effect of several risk factors. Patients identified with high risk who are randomized to interventions have shown greater reduction in risk factor levels and decreased cardiovascular disease.</td>
<td>There were significant changes from the 2007 guidelines. Effectiveness of prevention therapies was added to the previous guidelines. It was demonstrated that prevention strategies were shown to have sufficient evidence and clinical benefit in regard to CVD outcomes. An algorithm was established for the evaluation of CVD risk.</td>
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<td>Reference</td>
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<td>Perk et al., 2012 European guidelines on cardiovascular disease prevention in clinical practice</td>
<td>Level I Clinical Practice Guidelines</td>
<td>The Joint Taskforce of the European Society of Cardiology along with eight other societies who focus on CVD prevention reviewed current levels of evidence and recommendation from RCT’s and systematic reviews to create current practice guidelines. Evidence was analyzed on the GRADE criteria to establish quality of evidence and strength of recommendation.</td>
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<td>Colagluri et al., 2009 Guidelines for the assessment of absolute cardiovascular risk</td>
<td>Level I National Guideline Clearinghouse</td>
<td>Data base search of Australasian Medical Index, CINAHL, Cochrane database, EMBASE, EBM (OVID), and Medline including systematic reviews and RCT’s that compared the predictive ability of different methods of risk assessment. A total of 20,991 studies were narrowed down to 30 studies that met inclusion criteria. Among the clinical questions to be answered in the guideline was to determine which risk assessment method is most predictive of future CVD events in a mixed adult population without a diagnosis of CVD.</td>
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<td>Dykova, M., Drew, C., Wright, N., Clarke, A., &amp; Rees, K. 2013 Systematic versus opportunistic</td>
<td>Level I Review of RCT’s</td>
<td>The primary objective of this review was to assess the effectiveness, costs, and adverse</td>
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<td>In apparently healthy persons, CVD risk is most frequently the result of multiple interacting factors. Good clinical guidelines are a major mechanism to improving the delivery of healthcare and improving patient outcomes. 50% of reductions seen in CVD mortality are related to changes in risk factors.</td>
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<td>Modeling studies were appraised and it was found that the most cost-effective strategies for preventing CVD are those that direct intervention strategies on CVD risk assessment rather than targeting on individual risk factors in isolation. The highest level recommendation in the guideline is that absolute CVD risk assessment, using the FRS equation to predict risk of a cardiovascular event of the next 5 years should be performed on all adults between the ages of 45-74 who are known to not have CVD.</td>
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<td>Modeling studies provide compelling current evidence that CVD risk assessment in general practice is likely to improve CVD outcomes and direct patient/clinician decision-making on risk reduction strategies. These guidelines recommend the FRS tool as the initial assessment tool to ascertain CVD risk in asymptomatic patients. The FRS assessment tool is the identified tool for use in this DNP EBP project. The FRS model was chosen for its reliability and validity and its ease of use in the clinical practice environment.</td>
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<td>This Cochrane review is most applicable to this DNP EBP project as the methodology for implementation</td>
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<td>risk assessment for the primary prevention of cardiovascular disease. The Cochrane Collaboration</td>
<td>effects of systematic risk assessment compared to opportunistic risk assessment for the primary prevention of CVD. RCT's included individuals without diagnosis of CVD. The two types of interventions appraised included systematic risk assessment for primary prevention of CVD, defined as screening involving a pre-determined selection process where asymptomatic individuals systematically received risk assessment and opportunistic risk assessment screening which occurs sporadically and without identified guidelines.</td>
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<td>Greenland et al., 2010</td>
<td>identifying CVD risk in asymptomatic individuals. Systematic risk assessment was deemed to be more effective in identifying levels of risk and was more cost effective than opportunistic assessment.</td>
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</table>
| ACCF/AHA guideline for assessment of cardiovascular risk in asymptomatic adults | The guidelines are intended to assist health care providers in clinical decision making. The guidelines attempt to define practices that meet the needs of most patients in most situations making them generalizable to a myriad of practice settings. The goal of early assessment of CVD risk is to provide a foundation for targeted preventive efforts based on that individual’s predicted risk. The guideline proves an evidence-based approach to risk assessment. The first recommendation is for the use of global guidelines that are generalizable in a myriad of practice settings provide data that has enhanced reliability and validity. These practice guidelines are entrenched with high levels of evidence. These guidelines are applicable to this DNP EBP project as they focus on an initial assessment of risk in asymptomatic or apparently healthy adults. Another applicable delineation of the guideline is that there is no specific identified age when risk assessment should be completed. The
<p>| Level I Clinical Practice Guidelines | Rigorous search of the evidence was done and guideline recommendations were prioritized based on the type of studies that were done. Level A recommendations were based on data derived from multiple RCT’s or meta-analyses. Level B data was derived from single RCT or nonrandomized studies. Evidence was ranked as C when the primary source was consensus opinion, case studies, or standard of care. These guidelines are specific to populations residing in North America. |</p>
<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Level</th>
<th>Methodology</th>
<th>Findings</th>
<th>Clinical Question</th>
<th>Best Practice Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worrall-Carter, L., Ski, C., Scruth, E., Campbell, M., &amp; Page, K.</td>
<td>Level I Systematic Review</td>
<td>A search of the published literature was done for the time period of January 1999-June 2011. PubMed, CINAHL, Embase, PsychINFO, and Medline were among the search engines. 58 papers were critically appraised. Inclusion criteria were studies using meta-analyses, systematic reviews, and literature reviews.</td>
<td>The FRS assessment was identified as a consistent tool that contributes to understanding CVD risk factors. Modifiable risk factors such as hypertension, dyslipidemia, inactivity, BMI, smoking, and nutrition continue to be consistently identified in the literature. Focus must be on identification of these risk factors so that interventions can be initiated, hopefully changing the course of CVD progression.</td>
<td>What are the significant risk factors related to the prevention or reduction of risk of CVD among adult populations?</td>
<td>Risk factors should be identified and stratified for comprehensive assessment of risk. The FRS model does not recommend that risk identification can be done at any age even beginning in children or adolescents. This is pertinent as some guidelines recommend screening women beginning at age 50 which may be too late to initiate primary prevention practices. The identified age range for this EBP project is 35-50.</td>
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<tr>
<td>Read, S.</td>
<td>Level I Systematic Review</td>
<td>This evidence summary is based on a structured search of the literature using evidence-based health care data bases. Studies included for appraisal consisted of RCT’s, prospective cohort studies, and one nested case-control study.</td>
<td>This systematic review continues to validate the necessity for screening asymptomatic individuals for modifiable CVD risk factors. Risk factors should be identified and stratified for comprehensive assessment of risk. The FRS model does not...</td>
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<td>Murphy, T., Dhangana, R., Pencina, M., Zafar, A., &amp; D’Agostino, R. 2011</td>
<td>Level IV Cohort Design</td>
<td>This study was a retrospective analysis of two prospective cohort studies. The Atherosclerosis Risk in Communities and the Cardiovascular Health Study included 11,436 and 2569 participants respectively. These individuals were without CVD or diabetes at baseline. The FRS variables were analyzed. Receiver Operating Characteristics (ROC) curves, sensitivity, specificity, accuracy, and other test performance characteristics were determined at various 10 year risk thresholds.</td>
<td>The modifiable risk factors articulated included smoking, hypertension, dyslipidemia, inactivity, alcohol consumption, dietary fats, and recommendations on fruit/vegetable intake.</td>
<td>Current guidelines recommend Framingham risk scoring to be used to categorize risk and to plan evidence-based interventions. Identification and intervention can reduce negative outcomes and reduce health care costs. The Cardiovascular Health Study was conducted in an older population which makes it less generalizable to the cohort in the EBP project. The Atherosclerosis Risk in Communities included white and African American men and women between the ages of 45-64 which is more applicable to the age range of the EBP project.</td>
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<td>McGorrian et al., 2011</td>
<td>Level IV Case Control Study</td>
<td>Multiple logistic regressions were used to create the INTERHEART modifiable risk score (IHMRS). Internal and external validation was completed. N=19470 were evaluated from the case control study assessing nine modifiable risk factors with MI being</td>
<td>The FRS was significantly associated with coronary heart disease. 10 year incidence rates for hard coronary heart disease such as MI or stroke strongly correlates with FRS categories. The incidence rates were higher in the Cardiovascular Health Study most likely due to an older population. The authors observed that the limitations in risk prediction were not in the correlation of the risk prediction algorithm with subsequent events, which demonstrated good correlation across risk categories, but in the threshold that is used to dichotomously determine high risk.</td>
<td>Risk stratification is suggested as best practice for the management of individual CVD risk. Risk assessment tools have demonstrated accuracy in determining risk. This tool would be more cumbersome in the clinical practice setting as</td>
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<td>Tattersall, M., Gangnon, R., Karmali, K., &amp; Keevil, J. 2012</td>
<td>Level VI Evidence from a single descriptive or qualitative study</td>
<td>Using the National Health and Nutrition Examination Surveys (NHANES) the FRS and the Reynolds risk score (RRS) was applied to 2,502 individuals who were free from CVD. The RRS has additional risk assessment variables in addition to the variables assessed by the FRS. The RRS includes hemoglobin A1C and CRP-hs which are not included in the FRS.</td>
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Women up, men down: The clinical impact of replacing the Framingham risk score with the Reynolds risk score in the United States population. | the end point. Participants were from 52 different countries. | Compared to the FRS, the RRS assigns a higher risk category to 13.9% of the women and a lower risk score to 2% of the women that were evaluated in the study. In the U.S. population, the RRS assigns a new risk category in one of every six women. |

| psychological factors, dietary factors, physical exercise, and alcohol consumption. The INTERHEART case control study demonstrated that these nine modifiable risk factors account for 90% of the population attributable risk for MI. |

| some of the risk factors are subjective in nature versus objective and it would be time prohibitive to ascertain some of the subjective variables. Degree of second hand smoke exposure, definitions of stress, depression and anxiety would be difficult to measure. Use of the Framingham risk tool provides objective data that is standardized and would lend itself to statistical analysis. A multivariate risk prediction tool gleans data that identifies and stratifies levels of CVD risk. |

Clinician use of CVD risk stratification results in evidence-based interventions and potential reduction in CVD burden. Risk models differ in variables, definition of end points, and the population in which they were developed and validated. Guidelines for best practice recommend routine screening for CVD risk in asymptomatic individuals. This DNP project will implement the FRS in asymptomatic women in an OB/GYN setting. Ease of use of a validated tool is going to be most imperative in initial screening for this cohort and this practice setting. |
<table>
<thead>
<tr>
<th>Reference</th>
<th>Level of Evidence</th>
<th>Search Method</th>
<th>Findings</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Katsiki, N., Papadopoulou, S.K., Fachantidou, A.I., &amp; Mikhailidis, D.P. 2013 Smoking and vascular risk: Are all forms of smoking harmful to all types of vascular disease?</td>
<td>Level I Systematic Review</td>
<td>Medline was searched for relevant publications using keywords related to smoking and CVD, risk, primary and secondary prevention. The most recent evidence was reported. All forms of smoking including cannabis, cigar, pipe, smokeless tobacco, and cigarette smoking were evaluated in the study.</td>
<td>Although all forms of smoking were associated with an increased risk for CVD, cigarette smoking garnered the highest risk and is the variable assessed by the FRS model. Acute active as well as passive smoking increases CVD morbidity and mortality. A Cochrane systematic review found that smoking cessation was associated with a significant reduction in the risk of all-cause mortality related to CVD. Smoking also interacts with several vascular risk factors such as hypertension, diabetes, dyslipidemia, and homeostasis which further amplify CV risk.</td>
<td>Smoking is a significant modifiable risk factor for the development of CVD. In addition to smoking being an independent risk factor, it acts synergistically to amplify risk when combined with other risk factors. The FRS does assess for smoking status. The U.S. surgeon general has articulated smoking as being the single greatest cause of avoidable morbidity and mortality in the U.S. Smoking is dose related but cessation of smoking allows rapid approach to CVD risk of never smokers. As clinicians, it is imperative to evaluate for smoking history and to incorporate interventions for smoking cessation in the practice setting.</td>
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<td>Al-Ansary et al., 2013 A systematic review of recent clinical practice guidelines</td>
<td>Level I Systematic Review</td>
<td>Medline, EMBASE, guideline websites, and Google were searched for clinical practice guidelines</td>
<td>A large systematic review of 147 trial reports on the management of hypertension has</td>
<td>All CPG’s recommend assessing for hypertension in relation to other CVD</td>
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<td>Although the RRS reclassifies many women into a higher risk category, the FRS is a validated reliable tool to use as a primary prevention intervention. Cost consideration must be considered when expecting patients to complete laboratory testing as CRP-hs and Hgb A1C are not considered initial screening labs.</td>
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<td>Mohebi, R., Bozorgmanesh, M., Azizi, F., &amp; Hadaegh, F. 2013</td>
<td>Level IV Prospective Cohort Study</td>
<td>(CPG) written in English between 2006-2011. The search strategy yielded 2168 citations of which 114 were considered and 11 were included. The CPG's were evaluated using the AGREE-II instrument.</td>
<td>shown that a mere reduction in 10 mm Hg in systolic blood pressure and 5 mm Hg in diastolic blood pressure was associated with a 20% reduction in coronary heart disease and a 32% reduction in stroke in one year. The continuous and linear relationship between systolic blood pressure and coronary risk is true for both men and women.</td>
<td>risk factors during patient assessment. Blood pressure measurement is one of the variables assessed with the FRS. Measurement of blood pressure is clinically relevant as population attributable risk methods suggest approximately 54% of all strokes and 47% of all ischemic heart disease is attributable to high blood pressure, resulting in 7.6 million annual premature deaths worldwide. Modest reductions in blood pressure measurements results in significant reductions in CVD risk.</td>
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<td>Effects of obesity on the impact of short-term changes in anthropometric measurements on coronary heart disease in women</td>
<td>This prospective design consisted of a sample of 2468 women over the age of 30 without a diagnosis of CVD. This was sample was followed for a period of 6.6 years (mean). Cox proportional hazard regression was performed to estimate the hazard ratios of anthropometric measures for cardiovascular events.</td>
<td>During the follow up period, 5.1% of the participants exhibited a CV event. There was a significant interaction between BMI and anthropometric changes in prediction of CV events (p&lt; .04).</td>
<td>Obesity, defined as a BMI ≥ 30 kg/m² is a conventional risk factor for CVD. 68% of Americans are now considered to be overweight or obese. According to these authors, obesity is the leading modifiable risk factor for the development of CVD in women. Screening is simple in the clinical setting, especially for practices that use the EMR as BMI is automatically calculated for you. There is a dearth of information on clinicians not addressing this modifiable risk factor in the clinical setting. However, obesity accounted for $147 billion in health...</td>
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<td>Level I Systematic Review</td>
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<td>Collaborative analysis was undertaken of baseline BMI versus mortality in 57 prospective studies in western Europe and North America. The analyses were adjusted for age, gender, smoking, and study design. The first five years of follow up were excluded, using an additional eight years of follow up analysis.</td>
<td>Data sources included Medline, CAB abstracts, and Cochrane central register of controlled trials. Inclusion criteria were longitudinal studies that reported an association between LDL subfractions and cardiovascular outcomes.</td>
<td>Mortality was lowest in patients with BMI levels of 22.5–25 kg/m². Each additional 5 kg/m² BMI was on average associated with an increased 30% overall mortality rate, 40% associated with increased CV mortality. At 30–35 kg/m² median survival is reduced by 2–4 years and at 40–45 kg/m² median survival from a CV event is reduced by 8–10 years.</td>
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**Prospective Studies Collaboration 2009**

Body-mass index and cause-specific mortality in 900,000 adults: Collaborative analysis of 57 prospective studies


Systematic review: Association of low-density lipoprotein subfractions with cardiovascular outcomes

Increased prevalence of BMI ≥25 kg/m² has been consistently increasing over the years. Obesity is now being observed in childhood and adolescence. There have not been studies following childhood obesity into adulthood for its effect on morbidity and mortality. This modifiable risk factor has a strong associative effect on the development of CVD. The Nurse’s Health Study demonstrated that women who gained more than 25 pounds in weight had a five-fold increase for the risk of hypertension. Obesity plays an increased CV risk in multiple variables such as hypertension, dyslipidemia and Type II diabetes.

The ATP-III of the Expert Panel of the National Cholesterol Education Program has identified elevated LDL cholesterol as pervasive CVD risk factor. LDL subfractions are a myriad of additional spending in 2008 and is expected to rise to $244 billion per year by 2018. The FRS model has a separate data base that assesses CVD risk that is based on BMI and other non-laboratory variables.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Study Type</th>
<th>Study Details</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kim, J., Sillah, A., Boucher, J., Sidebottom, A., &amp; Snickelbine, T. 2013</td>
<td>Level VI Cross Sectional Study</td>
<td>Prevalence of the American Heart Association’s “ideal cardiovascular health” metrics in a rural, cross-sectional, community-based study: The heart of New Ulm project</td>
<td>Incidence of CVD. Data was extracted from 24 studies which were homogeneous in terms of specific tests analyzed, analytical methods, participants, and outcome measures. Subfractions add incremental benefit to traditional risk factor assessment. There is limited data from cross-sectional and prospective studies that further analysis of LDL cholesterol is a better discriminator of CVD risk. Only 1% of the participants met the AHA’s definition of ideal CV health in all seven metrics. This cross sectional design had similar results to other published studies and appears to be representative of the U.S. population. Tests what are typically not covered by insurance, especially as initial screening carried out in the primary care setting. The recommended screening continues to be total cholesterol, LDL, HDL, and triglyceride levels. This is the lipid assessment that will be run as part of the EBP project. Future research may find LDL subfractions as having greater specificity for CVD risk but the NCEP guideline recommendation continues to be the standard lipid panel. These seven AHA metrics are significant for evaluation of CV health in the clinical practice setting. It has been reiterated time and again that CVD is multi-factorial in nature. There is an additive negative consequence with multiple risk factors. It is imperative for the practicing clinician to apply a validated CV risk prediction tool in asymptomatic adults to evaluate CVD risk. Achieving ideal CV health lowers risk for CVD, lowers mortality rates, and increased life expectancy. CVD is economically burdensome with CV related costs comprising 17% of the nation’s total health expenditures.</td>
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Note: Level I: Evidence from a systematic review or meta-analysis of all relevant randomized controlled trials (RCT), or evidence-based clinical practice; Level II: Evidence obtained from well-designed RCT’s; Level III: Evidence from well-designed controlled trials without randomization; Level IV: Evidence from well-designed case-control and cohort studies; Level V: Evidence from systematic review of descriptive and qualitative studies; Level VI: Evidence from single descriptive or qualitative studies; Level VII: Evidence from opinion of authorities and/or reports of expert committees (Melnyk & Fineout-Overholt, 2011, p. 12).

Siontis, Tzoulaki, Siontis, & Ioannidis, (2012) compared cardiovascular disease risk prediction models on their accuracy for prognostic prediction. Studies were included that compared at least two different prediction models applied to the general population. A total of eight risk prediction models were assessed for validity, reliability, and accurate prognostic performance. The basis for the study was the opinion that practitioners need reliable multivariate CVD risk assessment tools that can easily be utilized in the clinical setting. Albeit limitations to the study were elucidated, the conclusion was that there was no one risk prediction tool that was superior to another. The clinical usefulness of a risk prediction model is its potential for affecting health care decision making and improving health outcomes (Siontis, Tzoulaki, Siontis, & Ioannidis, 2012).

The Agency for Healthcare Research and Quality (Matheny, McPheeters, Glasser, Merca, Weaver, Jerome, Walden et al., 2011) completed a systematic review of current CVD risk assessment tools applied in U.S. populations. The initial search resulted in identification of 102 various risk models, however, 87 of these models lacked validation. Of the remaining models assessed, the Framingham Risk Score (FRS), Prospective Cardiovascular Münster (PROCAM), and the Systematic Coronary Risk Evaluation (SCORE) were the tools most commonly reported in the literature. The objective of the review was to assess risk models for the best prediction of cardiovascular risk. The conclusion was that the FRS models performed well in U.S. populations but concerns were raised regarding generalizability of the tool to diverse populations. It was observed that when the FRS model was applied to a population that was different from the original cohort, the risk prediction scores were not consistent. It
was concluded that the newer models of the FRS performed better than the older models and the gender specific models provided greater reliability. Additionally, all risk prediction models demonstrated good relative and absolute risk prediction in the cohort in which they were developed bringing into question the limitations of every risk prediction model. Overall, the FRS models were deemed to be valid and reliable and a favorable tool to use in clinical practice.

Hsu, Van-Khue, Ashen, Martin, Gluckman, Hohli, Sisson, Blumenthal & Blaha (2013) in conjunction with John’s Hopkins and the American College of Cardiology evaluated a global case control study entitled the INTERHEART Study, evaluating CVD risk factors and creating an easy acronym to assist practitioners in clinical practice. This Level IV evidence evaluated nine modifiable risk factors that are associated with >90% of the risk for a first myocardial infarction (MI). The ABCDE approach which stands for assessment of risk, antiplatelet therapy, blood pressure, cholesterol, cigarette smoking, diet and weight, and exercise provides a guide for a consistent comprehensive approach to cardiovascular risk assessment. This approach and recommendations which are supported by evidence, provides a core framework for addressing CVD risk with the goal of preventing CVD. The authors articulated the FRS model as being the most commonly used global risk assessment tool. The authors did elucidate however, that in some populations risk was underestimated by the FRS model. The authors compared the FRS model with the Reynolds risk prediction tool. The Reynolds risk assessment adds family history and CRP-hs data in its prediction model which are not included in the FRS model. Application of the Reynolds risk score in the female population often reclassifies their risk status to a higher level when compared to the FRS model. Ease of use in the clinical setting and its consistent validation of reliability and validity still make the FRS model an appropriate choice for CVD risk prediction. Cost considerations versus
additional value of biomedical markers must be contemplated when initiating CVD risk screening.

Cooney, Dudina, D’Agostino, & Graham (2010) in their systematic review attempted to determine if CVD risk prediction as a primary prevention measure makes a difference in clinical practice. The authors sought to appraise the evidence for the rationale of estimating cardiovascular risk, compare the current CVD risk models for clinical applicability, seek evidence for estimating CVD risk related to patient outcomes, and determine the direction of CVD risk prediction in the future. According the authors, to be clinically useful a CVD risk estimation model should be methodologically robust and easy to use as well as address clinically relevant risk factors. A noted universal limitation of all risk prediction models is the assumption that the effect of the risk is constant, not taking into consideration age and level of degree of each of the identified risk factors.

The authors assessed various risk prediction models for internal and external validation as well as calibration. Calibration metrics for predicted to observed ratios indicate values closest to one as being the best fit. Values >1 indicate overestimation and values <1 indicative of underestimation. In a number of research studies, the FRS models demonstrated calibration values between 0.76-0.86 (Cooney, Dudina, D’Agostino, & Graham, 2010). The FRS models have been modified over the years and continue to be the most widely accepted and utilized models both nationally and internationally. The FRS model remains the recommended assessment tool in both national and international CVD prevention clinical practice guidelines.

The authors, due to a paucity of evidence, were unable to answer whether identification of CVD risk makes a difference in patient outcomes. It is well agreed upon that CVD is a multivariable disease and it is imperative to assess total risk versus
identification and intervention of only single risk factors but additional research must be rendered to answer the question posed by the authors.

The systematic review by Mosca et al. (2011) focused specifically on guidelines for the prevention of CVD in women. The authors reviewed randomized controlled trials (RCT’s) based on CVD prevention in women. One of the major findings discovered in the review was a discerning escalation in CVD deaths in women between the ages of 35-54. The algorithm for risk stratification recommended three categorical levels of risk: high risk, at risk, and optimal risk as defined by the number of CVD risk factors. Among high risk, at risk, and optimal risk, the rates of MI, CVD deaths or stroke were 19.0%, 5.5% and 2.6% per ten years respectively ($P$ for trend <0.0001) (Mosca et al., 2011).

Because the lifetime risk for cardiovascular death in women is one out every two women, it was determined through critical analysis of the literature, that the effectiveness of prevention therapies did exhibit clinical benefit for improving CVD outcomes. By establishing scientific levels of evidence and desired treatment strategies, guidelines are fundamental in improving CVD preventive care. It was specified that applying evidence-based lifestyle modifications and interventions were the most cost-effective method for CVD prevention.

The European Clinical Practice Guidelines authored by Perk et al. (2012) disseminated recommendations on CVD prevention that should be both individual and population focused. 1900 articles including RCT’s, meta-analyses, and non-randomized control studies on risk assessment and CVD were evaluated using the AGREE instrument. The guideline recommendations were rated based on the GRADE system and are consistent with other reviews and guidelines in regard to modifiable risk factors. Research supports the effectiveness of prevention strategies; 50% of reductions in CVD mortality are related to changes in risk factors whereas, the World Health Organization
WHO purports that greater than three-fourths of CVD mortality could be prevented by lifestyle changes.

The authors analyzed the current literature and compared the FRS model with the SCORE model demonstrating the estimation of risk as being comparable. A 5% SCORE risk equated to a 10-25% Framingham risk corroborating the similarity of outcomes in established risk prediction models (Perk et al., 2012).

It is essential for clinicians to be able to assess risk in a timely manner and with sufficient accuracy to allow for logical management decisions in the practice setting. Research and evidence-based clinical guidelines are an excellent mechanism for improving the delivery of healthcare and improving patient outcomes.

Colagiuri, Tonkin, Harris, Briffa, Huang, Cary-Harzell, Azidi, et al. (2009) published clinical guidelines for the assessment of absolute CVD risk. The objective of the guideline was to assist health care professionals in assessing CVD risk in an accurate manner in order to assist their patients in making well informed decisions about clinical care management of the identified risks. The target population included adults over the age of 18 without known CVD. The guideline authors sought to determine which absolute risk assessment method is most predictive of future CVD events in a mixed adult population not known to have CVD or diabetes. A search of the literature did not specifically analyze the cost effectiveness of one assessment model over another. It was reasonable to conclude, according to the authors, that there would be a realized cost benefit that would result from implementation of an accurate risk prediction tool in asymptomatic adults. The number one recommendation for intervention and practice was to implement the FRS model for all adults ages 45-74 who are not known to have CVD. Modeling studies provide the most compelling evidence that CVD risk assessment in general practice is likely to improve CVD outcomes, compared with assessment and treatment of single risk factors.
Dyakova, Drew, Wright, Clarke & Rees (2013) through the Cochrane Heart Group developed a protocol on CVD risk assessment as a primary prevention intervention. The authors recommended systematic risk assessment versus opportunistic risk assessment. Systematic risk assessment was defined as a screening program that involves a pre-determined process for selection of people who are systematically assessed for CVD risk in a primary care or similar setting. Opportunistic risk assessment was defined as a CVD risk assessment occurring sporadically in a primary setting which could include a primary care office, pharmacy, occupational health department or in a small business. The review focused on the effectiveness of comparing systematic (intervention) to opportunistic risk assessment (control) for primary prevention of CVD. According to the NHS Health Checks program, a standard assessment based on simple questions and measurements to identify the risk of CVD, was deemed to be the most effective.

Greenland, Alpert, Beller, Benjamin, Budof, Fayad, & Foster, et al. (2010) in conjunction with the American College of Cardiology Foundation (ACCF) and the American Heart Association (AHA) published guidelines for the assessment of cardiovascular risk in asymptomatic adults. The guideline objectives were to assist healthcare practitioners in clinical decision making, to assist providers in the initial assessment of risk in apparently healthy adults, and to provide a foundation for targeted preventive efforts based on an individual’s predicted risk. These authors presented a paradigm of care for the standardization for CVD risk assessment in this population. The goal of early risk identification in asymptomatic individuals is to provide targeted interventions to reduce or eliminate the identified risk factors. Cardiovascular disease has a long asymptomatic latent period which provides an opportunity for early and effective preventive interventions. The recommendation by the authors was for use of a
global risk score, such as the FRS, that evaluates multiple traditional cardiovascular risk factors.

Worrall-Carter, Ski, Scruth, Campbell, & Page (2011) authored a systematic review of CVD risk in women, acknowledging the gender differences in CVD risk significance. Risk factor modification is paramount for primary and secondary prevention of CVD. Analysis of the Framingham Heart Study, of which 53% of the participants were female, identified six main risk factors for CVD. The risk factors purported to be most significant were blood pressure, lipids, smoking, diabetes, BMI, and physical inactivity. The authors concluded that most CVD risk in women is modifiable and the key is effective and relevant risk factor identification and early intervention.

The cardiovascular disease risk estimation and prevention summary authored by Read (2012) and published by JBI confirmed the maxim that CVD has multiple risk factors, of which the majority are modifiable. Moderate risk individuals constitute the largest group of screened individuals and this population also has the highest rate of mortality. The best practice recommendations in addition to advocating risk prediction in asymptomatic adults were to focus on research evidence that supports positive improvements in modifiable risk factors.

Murphy, Dhangana, Pencina, Zafar, & D’Agostino (2011) evaluated the FRS model for its risk prediction capabilities. The model was evaluated using Receiver Operating Characteristics (ROC) curves, sensitivity, specificity, and accuracy. There is a strong positive association between the FRS prediction and the incidence of hard coronary heart disease. The current Adult Treatment Panel III (ATP III) guidelines call for intensive medical risk factor reduction in individuals identified at moderate or high risk by the FRS model. There is no known trigger threshold with regard to an individual risk factor; therefore individual risk factor management strategies are less than optimal for
effectively lowering overall risk. It is imperative to implement comprehensive risk lowering reduction in those individuals identified with multiple CVD risk factors.

McGorrian, Yusuf, Islam, Jung, Rangarajan, Avezum, & Prabhakaran et al. (2011) applied the INTERHEART modifiable risk score to a multi-international population. Summating risk factor burden is crucial in assessing CVD risk in apparently healthy persons. As previously elucidated, the INTERHEART risk score assesses nine modifiable risk factors that are estimated to account for more than 90% of the population attributable risk. The benefit of using the INTERHEART risk score, as articulated by the authors, included its applicability to a number of populations and ethnically diverse cultures around the world. The variables assessed through this tool are time consuming, costly and glean a significant amount of subjective data such as stress and depression levels. The tool, albeit valid, would not easily be implemented into a busy clinical practice setting.

Tattersall, Gangnon, Karmali, & Keevil (2012) compared the clinical impact of replacing the FRS with the Reynolds Risk Score (RRS) in U.S. populations. Risk models differ in variables, definitions of endpoints and the population in which they were developed and validated. Both the FRS and the RRS have been validated in the U.S. population. 1440 women who were analyzed with the FRS found 82% to be at low risk, 11.4% at moderate risk and 0.6% at high risk. In contrast, when using the RRS, risk classifications were more severe (p<0.0001) with 76% at low risk, 11% at moderate risk, 9.3% at moderate-high risk, and 3% at high risk (Tattersall, Gangnon, Karmali, & Keevil, 2012). The magnitude and direction of change were more noticeable in women than in men when comparing the models. In an effort to translate the differences in the models to clinical practice, it was found that only a small percentage of individuals who had been reclassified received different clinical recommendations regarding treatment of risk factors.
Clinicians have an increasing number of choices of which cardiovascular risk prediction tool to utilize and how to determine the population effects of various multivariate risk models compared to the well accepted FRS models. A practicing clinician must choose a model that will be advantageous with the patient population and applicable to the clinical practice setting.

As previously elucidated, there are a handful of modifiable risk factors that account for 80-90% of all CVD morbidity and mortality, these modifiable CVD risk factors will be discussed in the following section.

**Smoking**

Smoking both active and passive is a well-established vascular risk factor and one which is prima facie to modify. Katsiki, Papadopoulou, Fachantidou, & Mikhailidis (2013) in a narrative review, weighed the effects of various forms of smoking on CVD risk. Although various forms of smoking all pose a CVD risk, cigarette smoking is compellingly associated with morbidity and mortality. In a meta-analysis review, smoking cessation was shown to significantly reduce CVD mortality (OR=0.54, 95% CI=0.46-0.62). A Cochrane systematic review found that smoking cessation was associated with a significant (36%, OR=0.64, 95% CI=0.58-0.71) reduction in all case mortality. Smoking can cause endothelial dysfunction, enhance platelet aggregation, and impair fibrinolysis, increasing the prevalence and severity of thrombotic CVD events. Smoking interacts with several other cardiovascular risk factors including hypertension, dyslipidemia, and diabetes to significantly augment level of risk.

**Hypertension**

Al-Ansary, Tricco, Adi, Bawazeer, Perrier, Al-Ghanaim, Alyousefi, et al. (2013) completed a systematic review of recent clinical practice guidelines (CPG’s) on the management of hypertension. Eleven CPG’s were evaluated using the AGREE-II assessment tool. There was disparity among the guidelines regarding levels of
hypertension, when to initiate treatment, what treatment to initiate, and what the goal of hypertension management should be. Regardless of the disparate recommendations in the CPG’s, it was consistently recommended that blood pressure be assessed in relationship to other cardiovascular risk factors during patient assessment.

A large systematic review of 147 clinical trials reporting on the management of hypertension; showed that a mere reduction of 10 mm Hg in systolic blood pressure and 5 mm Hg reduction in diastolic blood pressure was associated with a 20% reduction in coronary heart disease and 32% reduction in stroke in one year (Al-Ansary et al., 2013). The FRS has authenticated the associative relationship between blood pressure and cardiovascular risk as continuous and linear and consistent across age groups for development of cardiovascular events. It has been estimated that 54% of all strokes and 47% of all ischemic heart disease is attributable to high blood pressure (Al-Ansary et al., 2013). Despite the availability of CPG’s, optimal hypertension control remains an intangible goal worldwide.

**Obesity**

Mohebi, Bozorgmanesh, Azizi, & Hadaegh (2013) assessed the effects of obesity on coronary heart disease in women and the Prospective Studies Collaboration (2009) analyzed 57 prospective studies on BMI and cause specific mortality. Epidemiologic studies have found obesity (BMI $\geq$30 mg/m²) to be a conventional risk factor for coronary heart disease. Cross-sectional associations between BMI and risk factors were estimated by multiple linear regression or logistic regression with adjustment for study, baseline age, and baseline smoking status. Increased BMI was associated with increased blood pressure and abnormal lipids which are additionally both modifiable risk factors for CVD. Mortality is lowest in in those individuals with an optimum BMI of 22.5-25 kg/m². For every 5 kg/m² higher BMI, there was an associated 30% higher all-cause mortality (Mohebi, Bozorgmanesh, Azizi, & Hadaegh, 2013).
**Cholesterol**

Ip, Lichtenstein, Chung, Lau, & Balk (2009) disseminated findings on a systematic review evaluating the association of low-density lipoprotein with cardiovascular outcomes. There is irrefutable evidence that high levels of total cholesterol, low-density lipoprotein (LDL), and low levels of high-density lipoprotein (HDL) are salient risk factors for cardiovascular disease. According to the authors, LDL cholesterol is influential in enhancing CVD risk. LDL cholesterol is not taken up by the cells, staying in the blood stream and creating foam cells which causes inflammation and increases risk for ischemia and hypertension. It is estimated elevated cholesterol fractions account for greater than 50% of all cardiovascular events. Dyslipidemia is yet another CVD risk factor considered to be a modifiable risk factor.

Kim, Sillah, Boucher, Sidebottom, & Knickelbinc (2013) in a cross-sectional study assessed for ideal cardiovascular risk in a rural community in Minnesota. The delineation of ideal cardiovascular risk as defined by the American Heart Association includes seven modifiable metrics for assessing cardiovascular health. These ideal metrics include blood pressure, cholesterol levels, smoking status, physical activity, BMI, dietary intake, and blood glucose. The researchers gathered data in a cross-sectional cohort over a period of two years. SPSS statistical analysis using a two-sided α considered statistical significance to be 0.05. Pearson χ² tests were used for comparisons of age and sex. Attaining ideal cardiovascular health in this study was extremely low (1%), however achievement of ideal cardiovascular health metrics would notably decrease CVD burden and associated health care costs.

**Synthesis of the critically appraised literature**

Current relevant literature provides a superlative perspective of cardiovascular disease burden both physically and economically as it affects the female population. The literature is consistent in identification of modifiable risk factors that account for >80-90%
of the disease burden. The appraised literature is replete with the recommendation and significance of cardiovascular risk screening in asymptomatic adults as well as the deficiency in screening currently observed in the clinical practice setting. Risk assessment algorithms may be used to identify modifiable risk factors, raise awareness of CVD, educate, prompt risk modification, and predict both short and long term risk of developing CVD.

The goal of early CVD risk identification in asymptomatic adults is to provide targeted interventions to reduce or eliminate the risk and change the trajectory of CVD progression. Summarization of the current evidence, as reported in the literature by experts in the field of cardiovascular disease, deduced that many risk prediction models are reliable and valid but that all models have limitations. All of the validated models assess for a core number of modifiable risk factors including blood pressure, smoking status, blood glucose, lipid analysis, physical activity, and BMI. Many of the models, especially the European models, assess for additional risk factors such as depression, anxiety, socio-economic factors as well as additional biologic markers such as CRP-hs and additional lipoprotein analysis.

The goal in CVD prevention is to produce the largest relative risk reduction, the smallest number needed to treat, and the lowest cost per quality-adjusted life year saved (Ashen, 2010). To be clinically relevant, a risk prediction model must be robust and must be clinically applicable considering the patient population, practice setting, time constraints, cost, and objective for implementing a CVD risk prediction model in the clinical setting. In clinical practice, risk prediction algorithms have been used most directly to identify individuals at risk for developing CVD and institute interventions to reduce morbidity and mortality of the disease. The 16 high level of evidence summaries all substantiated the use of the FRS model as a universally accepted risk prediction model in the U.S. and recommended its use as a primary prevention measure. This DNP
project manager employed the FRS model to the identified study population with resultant findings to be discussed in-depth in chapter three.

**Construction of the EBP project**

Intertwining Pender's health promotion model and Stetler’s evidence-based model with rigorous integration of current evidence provides a cogent foundation for this evidence-based practice project. The detailed implementation process will be discussed throughout the project paper.

**Best practice recommendation**

Risk scores can be useful educational and motivational tools for patients. The best practice model is one that is implemented by practicing clinicians and employs primary prevention performance guidelines for assessment of CVD risk in the asymptomatic patient utilizing a multivariate risk model. This DNP project manager has the knowledge and clinical expertise to implement the risk assessment screening tool in the identified practice setting. The best practice recommendation is one that is valid and reliable and is applicable to the constructs of the PICOT question. The Framingham risk score (FRS) model was chosen for this EBP project for its ability to consistently predict risk assessment in asymptomatic women.

**Answering the clinical question**

The best practice recommendation answered the clinical question: *In women ages 35-50 presenting for their annual gynecologic exam and are asymptomatic for CVD, how does implementation of the FRS compared to usual care (no screening), identify the level of CVD risk over a three month period of time?* The DNP project manager negotiated with the practice manager and CEO regarding the implementation process and the need for provider and staff buy-in. The DNP project manager initiated strategies with the staff regarding the significance of gleaning CVD risk prediction data. In concordance with the Lifestages mission statement which includes advocating for,
development of, and implementation of quality, comprehensive, and cost effective health care programs which educate, inform and support women in making their health care choices and in living healthful lives was repeatedly reiterated to the identified stakeholders. The DNP project manager reinforced the vision of the practice which is to provide comprehensive health care across the lifespan with uniform excellence in quality and service. The DNP project manager educated the clinical staff on the scope of the problem, procuring the informed consent, on garnering the required metrics, and on the process of appropriating the completed data to the DNP project manager. The DNP project manager inputted data into the web based FRS prediction tool and elicited risk stratification for each person in the EBP project. Statistical data analysis was computed using the SPSS 20 statistical analysis program.

Inclusion of the clinical staff in study purpose and significance, data gathering and education promotes team work and a sense of accomplishment. Staff realization that they were being influential in the potential improvement in health outcomes of the patients they serve provided a sense of worth and a feeling of making a difference versus only performing a job.

Dissemination of study results were shared with the clinical staff as well as with individual patients on follow up appointment. Enhanced collegiality among the provider staff was procured through diffusion of the EBP project findings. Further dissemination of clinically relevant data was accomplished through scholarly publication, community educational presentations, and through local and national professional organizations.
Evidence based practice is the salient commitment to the implementation of theory-derived and research-based evidence in making critical thinking decisions regarding provision of health care. It is not enough to have knowledge of the best evidence to guide clinical practice; that knowledge must be translated into clinical practice to improve patient care and outcomes (Hockenberry, Brown, & Melnyk, 2011). The method used for the design and implementation of the EBP project will be discussed in detail in this chapter. Amalgamation and management of data as well as protection of human subjects will also be discussed.

Sample/Setting

The EBP project participants originated from a convenience sample of women who met inclusion criteria and provided informed consent to participate. In a convenience sample the inclusion criteria is identified prior to selection of project participants and all persons who meet the inclusion criteria are welcomed to participate (White, 2012). Because the sample is selected for ease of data collection, this sample may not be representative of the target population. This may well be the case in the instance of this EBP project as the office setting chosen, again due to ease of project implementation, is only one of five office settings for this OB/GYN practice. The probability for bias is high in a convenience sample as again it may not be representative of the target population. Strategies to control for bias were utilized such as comparing demographic data from individuals in the EBP project to general population demographics to determine if the project sample is representative of the general population.
Lifestage’s Centers for Women has five practice settings located in southern Ohio. The provider staff of Lifestage’s consists of eight OB/GYN physicians, four certified nurse midwives (CNM), and one board certified family nurse practitioner (FNP). On any given work day, there can be anywhere from two to four medical providers working in the EBP project implementation clinical practice site. Lifestage’s offices are diverse in both their location and the populations they serve. Of the five practice sites, one is located in an affluent upper class area of the region, two are located in inner city lower income areas, another in a low to middle class environment and the fifth practice setting is located in a middle to upper class area of the city.

The practice setting that was utilized for this EBP project is located in an upper middle class neighborhood which is easily accessible via a major highway, has ease of parking, and is also adjacent to a city bus route. The clinical practice site is located within a large multi-faceted outpatient facility. Many patients take advantage of this location for its accessibility and functionality. Because of the myriad of services available in this outpatient facility, many patients take advantage of this setting because they can consolidate other testing such as mammography and laboratory testing in conjunction with their medical appointment. This location is an encashment area for several smaller communities that surround the facility therefore providing a wide diversity of population demographics. Among the smaller communities that predominantly employ this outpatient setting are small farming communities, a large German Baptist community, and small communities that extend toward the Richmond Indiana area.

**Design**

The purpose of the EBP project was to implement cardiovascular disease risk assessment screening using the Framingham Risk Score (FRS) model in asymptomatic women to identify and stratify their level of CVD risk. The EBP project is designed as a primary prevention intervention. The tacit goal of primary prevention is the attempt to
prevent disease from occurring. Primary prevention therefore reduces both the incidence and prevalence of a disease. CVD is particularly suited for application of primary prevention because it is common, occurs at a high incidence, can be modified by behavior, has a long latency period, incurs high financial costs, and has a high societal burden (Ashen, 2010). The health care arena has traditionally focused on secondary and tertiary levels of prevention, the foci being on treating disease once it has occurred rather than preventing it from occurring. Compelling evidence exists garnering the importance of primary disease prevention as it relates to CVD in women. Cardiovascular disease risk assessment and stratification can theoretically raise population and individual awareness of disease and motivate changes in behavior to improve health and health outcomes as well as decrease the economic burden of CVD.

Strategies for education and dissemination of information regarding the EBP project included PowerPoint presentations, e-mail communication, role playing, and a scripted module for the medical assistant to employ while explaining the EBP project to a potential project participant. The DNP project manager developed two PowerPoint presentations, one that was specific to the provider staff and practice administrators and one specific for the medical assistant and R.N. staff. The PowerPoint presentations were presented to and approved by the CEO and the office practice manager prior to dissemination to the staff.

The PowerPoint presentation for the medical provider staff was presented at the monthly provider meeting and included CVD background and significance, evidence and research related to CVD risk prediction, practice mission and vision statements, EBP project objectives, and implementation process. Time was allotted for feedback, critique and questions regarding the project and its implementation.

The PowerPoint presentation was presented to the office staff, including MA’s, RN’s, practice manager and office manager, at their monthly meeting which included
CVD significance and background as well as an outlined step by step methodology for the MA role in the project implementation. A script was prepared for the MA’s which presented a dialogue to incorporate into the patient interview process, therefore providing a consistent procedural methodology in which to communicate and interact with potential EBP project participants. Role playing was incorporated into the presentation agenda in which the MA’s simulated an interaction with a potential project participant. The role playing module addressed various scenarios and potential questions that an EBP project participant may have. During the role playing activity, brainstorming and suggestions were made by those observing the role play interaction. Additional presentations were scheduled over lunch hours and before and after office hours to capture those absent from the aforementioned meetings.

A bulleted laminated step by step protocol was provided to the MA’s and was also made available in the work station and provider offices, to quickly ascertain inclusion criteria and applicability for participation in the EBP project. The DNP project manager sent frequent email reminders regarding the EBP project and encouragement to be participative in recruiting applicable project participants. Access to the DNP manager included in-basket computer communication as well as phone communication. When the DNP project manager was working at the implementation site, she was available for face-to-face questions or concerns and would make contact with the medical assistant several times throughout the work day.

The DNP project manager identified inclusion criteria for potential EBP project participants to include a convenience sample of women between the ages of 35-50 who did not have a diagnosis of cardiovascular disease, in other words, were not being treated for dyslipidemia, hypertension, or type II diabetes. The sample consisted of women who presented to the Samaritan North office of Lifestage’s Centers for Women for their annual preventive gynecologic exam.
The screening process was delineated in a step by step process for the medical assistant staff as well as the provider staff. When the MA arrived for the day, she printed out the schedule of the provider that she would be working with that day. The MA then looked at the ages of the patients and identified those who fell into the 35-50 year old age range. She then looked at the visit type and identified those women who were scheduled for their annual preventive exam versus an acute problem or a pre-op patient. The MA then notated next to the patient name, with an asterisk, that this patient met initial inclusion criteria. Before the patient arrived, the MA checked the patient chart for diagnosis of hypertension, dyslipidemia, or type II diabetes that would exclude them from participating in the EBP project. If the patient met all of the inclusion criteria the MA offered CVD risk screening to the patient during the interview process using the scripted dialogue that was presented during the role playing portion of the staff meeting. Using a standardized script, the MA explained briefly the significance of CVD in women, goals and objectives of the EBP project and if the patient consented, what the process would entail for the patient. If the patient desired to participate, the MA obtained a signed informed consent form. The informed consent form contained the elements of the title of the project, aim/purpose of the project, the DNP project manager information, risk/benefit to the patient, assurance that all patient information would be held in strict confidentiality, and that participation in the EBP project was voluntary and without monetary compensation. It was also articulated to the patient that she would be responsible for any laboratory co-pays or fees. Ascertainment of understanding was elucidated and any questions were answered, after which the patient signed the consent form. Once the patient signed the informed consent form, the MA apprized the medical practitioner of the patients’ consent to participate in the EBP project. During the patient exam, the medical practitioner reinforced the significance of CVD risk assessment in women and the objective of the EBP project, answered any questions that they may have had, and
ordered the fasting laboratory testing consisting of a comprehensive metabolic panel (CMP) and a lipid panel. The laboratory testing was ordered for the patients' laboratory of choice or laboratory that was deemed appropriate by the insurance carrier. The MA completed the data entry form and attached it to the consent form and placed them in a folder in the nurses work station for the DNP project manager to collect (Appendix A&B). The DNP project manager collected the forms on a daily basis and procured them in a secure location to maintain patient privacy and confidentiality.

The DNP project manager frequently queried lab results for patients who had consented to project participation. Once the laboratory testing was complete, the DNP project manager entered the data into the FRS model database and obtained risk score results which were printed out in duplicate. One set of the results were scanned into the electronic medical record (EMR) and the other was maintained by the DNP project manager to input into the SPSS-20 statistical program.

Once the data had been collected and inputted into the FRS model and risk identification has been gleaned, the DNP project manager made the determination whether or not the patient required a follow up appointment. Those individuals who had identified CVD risk were notified by the R.N. to make a follow up appointment with the FNP, the patient’s primary care provider, or for cardiology referral to review the FRS results and adjudicate a plan of care.

In tandem with the clinical practice marketing director a thank you letter was drafted and approval by the CEO and practice manager which was then mailed out to each EBP project participant. The letter thanked the participant for being proactive in her CVD health and included a red dress pin, a hallmark identifier for CVD awareness, as well as a print out of her FRS model data with interpretation. A total of three letters were drafted, one for normal risk factors, another for abnormal risk factors requiring a follow up appointment, and a third letter informing the patient that the laboratory testing was
normal but that BMI is elevated and offering suggestions that may assist the patient in reducing BMI (Appendix C, D, & E).

The marketing director interviewed the EBP project manager for an article in the quarterly Lifestage's newsletter that is available on the practice web site, available in the office, as well as a direct mass mailing to the community. The marketing director is also responsible for setting up health talks within the community and has involved the DNP project manager as a speaker on CVD as it relates to women in a variety of community venues.

A strong commitment exists within the practice and with the medical practitioners to have ongoing assessment of CVD risk in women. The outcome data from the EBP project provided compulsory evidence supporting the need to screen asymptomatic women for CVD risk and rendered credence to the need for a permanent clinical practice change. It is imperative to continue to provide credible data, education on the significance of CVD risk as it pertains to the female population, and emerging trends in CVD risk prevention to improve the health of women.

**Instrument**

Accurate and timely risk estimation and identification of individuals at increased risk for CVD is the cornerstone of CVD prevention. Clearly, risk prediction models must be based on statistically sound methods and should accurately estimate risk in the sample population. The ability to accurately assign individuals to categories of risk where the observed rate of disease correlates to the risk prediction is evidence of a valid risk prediction model. Clinical risk profiling is recommended by clinical practice guidelines as a foundational beginning for the evaluation of asymptomatic individuals in identification of CVD risk level.

The Framingham risk assessment model was the instrument utilized to prognosticate CVD risk in this EBP project. The concept of risk factors for CVD
identification, introduced by the Framingham Heart Study, serves as the gold standard for CVD risk assessment. The Framingham risk score is a multivariable mathematical risk equation that predicts a 10-year risk of developing CVD events. In addition to determination of 10 year risk levels, the FRS model also delineates vascular heart health age based on risk factor stratification as it compares to chronological age. For example, based on risk factors, a 59 year old female may have the heart health age of a 48 year old or vice versa. This delineation may provide a greater significance and understanding for the individual patient versus a 10 year risk percentage number.

The Framingham Heart Study remains the most famous and influential investigation in CVD epidemiology, and since its inception in 1947, has garnered over 2000 peer reviewed articles (Oppenheimer, 2010). The Framingham Study has provided insights into the prevalence, incidence, prognosis, predisposing factors, and determinants of CVD. The scientists involved with the Framingham Heart Study were instrumental in changing the concept of chronic disease into discernment of probability and disease prevention. Through population based randomized controlled trials and observational cohort studies in diverse population samples, the researchers associated with the Framingham Heart Study were able to effect change in how clinicians approached CVD as well as the efficacious applicability of primary prevention.

The metrics assessing the parameters of a risk prediction model must evaluate its ability to discriminate future cases from non-cases, determine the ability of the model to inform regarding the outcome of interest, and the calibration of the model related to its validity and reliability (Llyod-Jones, 2010). The most widely reported measure of model discrimination for CVD risk prediction models is the C statistic. The C statistic is a function of both the sensitivity and specificity of the model across all of its values, and it represents the ability of the score to discriminate cases from non-cases (Llyod-Jones, 2010). In simplistic terms, the C statistic indicates the probability that a randomly
selected individual who develops disease would have a higher risk score than a randomly selected individual without disease. The C statistic can vary from 1.0, which is perfect discrimination, to 0.5 which is equivalent to random chance. C statistics between 0.70 and 0.80 are considered to be acceptable and those that fall between 0.80 and 0.90 are considered to be excellent (Lloyd-Jones, 2010). A combination of multiple independent risk markers, as in the Framingham risk score model, provides magnitude of relative risk and C statistics that typically range from 0.75 to 0.80. The Framingham risk score model discriminates risk better for women than men with C statistics that are generally >0.80 for women (Lloyd-Jones, 2010). Measures of calibration assess the ability of a risk prediction model to predict accurately the absolute level of risk that is subsequently observed. For example, if a risk prediction model is well calibrated an observed event rate would be similar to the level of risk identified by the model, so if an individual has a 7% risk of a CVD event over 10 years, the observed event rate should also be close to 7%. Other measures such as likelihood ratio tests and the Bayes information criterion are commonly used to assess the utility of risk prediction models. These tests when statistically significant can indicate whether a risk model is predicting disease incidence better than by chance alone (Lloyd-Jones, 2010).

The literature review has been succinct in identification of significance and variance of risk factors as they pertain to gender differences in CVD risk. Although the classic risk factors are the same for women and men, there are gender differences in the prevalence and significance of the various risk factors. The clustering and interrelationship of multivariate risk factors exhibit different risk levels based on gender. The Framingham risk score model has a gender specific score model which enhanced its applicability in the identified EBP project population.
Measurement

The Framingham Heart Study generated seminal findings such as the effects of tobacco use, unhealthy diet, physical inactivity, obesity, hypertension, dyslipidemia, and diabetes on the development and progression of CVD (Mendis, 2010). The Framingham Risk score model, using a sex specific multivariate risk factor algorithm, was used to assess CVD risk for each individual EBP project participant. Electronic calculator web based data analysis was completed on each EBP project participant. The data was inputted into both of the gender specific FRS models, which included the laboratory data base and the body mass index (BMI) data base (Appendix F & G). The FRS spreadsheet provides a rapid visualization of the gleaned data including percentage of risk over a 10 year period of time as well as each individuals estimated vascular or heart age. Each data spreadsheet was printed and scanned into the patient EMR where is can easily be accessed by the patient’s team of medical providers.

Outcomes

Data analysis is “the process of breaking down, examining, comparing, conceptualizing, and categorizing data” (Mauk, 2012). Once the intervention has been implemented it will be imperative to evaluate the effectiveness of the intervention. Rigorous analysis of the project outcomes must be corroborated with the EBP project goals and objectives as well as the PICOT question. Questions must be propagated regarding outcome achievement and analysis of all possible factors that may have impeded the desired outcome if the EBP project objectives were not met. Initiatory outcomes demonstrated a significant percentage of women who had identified CVD risk factors and required additional follow up. A meticulous analysis of the data will be articulated in detail in Chapter four.
Implementation of practice change

It is imperative to be cognizant of and anticipate potential barriers to changing clinical practice, among these conceivable barriers are organizational culture, belief systems, and research related barriers (Young, 2012). The word change evokes a myriad of defining characteristics which can be quite disparate from one individual to another. Some individuals view change as positive and challenging where others may view change as negative and a divergence from the status quo. Identifying strategies to implement change in a positive manner will be the catalyst to making a smooth transition to a new clinical practice paradigm. Applying a simplistic change model such as Kotter’s eight change phase’s model in conjunction with the Stetler model of EBP will promote a venue for a positive change transition. The eight change phases include creating a sense of urgency; creating a guiding coalition; developing a change vision; communicating the vision; empowering broad-based action; generating short-term wins; don’t let up; and make it stick (Kotter, 1996). To lead change successfully Kotter and Schlesinger (2008) recommend analyzing situational factors, determining the optimal speed of change, develop methods to manage resistance, educate, communicate, encourage participation, negotiate, facilitate and support. The reader may refer back to chapter two for in depth detailing of the foundational models.

When evaluating the outcomes of an EBP implementation, it is important to realize that EBP fosters common goals such as improved patient care and best practice through interdisciplinary collaboration (Fineout-Overholt, Melnyk, & Schultz, 2005). Providing EBP project outcome data to the practitioners and staff in the clinical setting will garner collegiality and support among the entire staff and modulate a clinical practice change. The goal of implementation of the EBP project is to generate outcomes that will support the need for a best practice clinical practice change. By sharing knowledge, evidence, research, and outcomes, EBP guidelines can influence consistency and best
practice in the clinical practice setting. Demonstration of significance will support the need to make CVD risk prediction screening a clinical practice change to both align with the mission and vision of the practice as well as a commitment to improve the health of the women we care for.

Not only does an EBP clinical practice change affect the clinician’s practice behavior but it also unequivocally affects the patient. Dissemination of risk findings must be communicated in a manner that will make an impact with the patient. Evidence-based practice is based on the three components of research-based knowledge, clinical expertise, and patient preference and needs. Patient preference is perhaps the most challenging component of the EBP process. As a clinician, developing a partnership with the patient is prima facie to the success of sharing information and being instrumental in partnering with the patient to mitigate positive health behavior changes.

Applying Pender’s Health Promotion Model as a foundation for the EBP project facilitates identification of the motivation in individuals that will promote a behavioral change as well as potential barriers that inhibit adapting positive health practices. When Pender’s HPM is implemented in clinical practice, it can be an efficacious tool in increasing patient awareness of their risk factors and facilitating movement toward positive health practices and improved health outcomes. As previously elucidated, the FRS model will determine 10 year risk of developing a cardiovascular event but will also report a person’s heart age based on obtained metrics. This knowledge may be more tangible and motivating for an individual to make healthy lifestyle changes than a 10 year risk percentage number that may be difficult for the patient to conceptualize. Aggressive primary prevention in asymptomatic women is crucial in reversing the ominous trend of CVD morbidity and mortality.
Management of data

Continuous variable dichotomization is a popular technique used in estimation of the effect of risk factors on health outcomes in multivariate regression settings. The validity and reliability related to the prognostication of the FRS model has previously been discussed. Measurement of the impact of the EBP project primary prevention intervention was analyzed by descriptive and inferential statistics using the SPSS 20 statistical program. Descriptive statistics and frequencies were used to describe the demographic data of the project sample. Correlational relationships between variables further delineated significance of modifiable risk factors. One of the initial identified deterrents to completing the screening was the need for laboratory testing to be done with the patient fasting. The FRS model has two gender specific databases, both which are inclusive of age, smoking status, and blood pressure. In addition to the above mentioned variables, one database uses laboratory testing and the other uses BMI instead of laboratory testing. This BMI version of the FRS model may be easily implemented in the clinical practice setting where there may be logistical constraints such as lack of readily available laboratory settings or where compliance may be an issue. Further discussion related to EBP project implementation weaknesses and strengths will be considered in Chapter five.

Protection of human rights

Institutional review board approval was received by Valparaiso University and approval for the EBP project was obtained from the clinical practice site administration prior to implementation of the EBP project. Expedited review was obtained based on minimal risk to the patient and significant potential for positive benefit gleaned from the EBP project.

Strict confidentiality was maintained throughout the EBP project. Personal data and demographics were maintained in a secure locked file in the practice setting and
once data was inputted into the FRS model data base, the identifying data was shredded.
CHAPTER 4

FINDINGS

The purpose of the EBP project was to screen asymptomatic women between the ages of 35-50 to identify modifiable CVD risk factors as well as their level of CVD risk. This EBP project was implemented in the clinical practice setting of a large women's health practice in Southern Ohio. The clinical question in PICOT format was: *In women between the ages of 35-50 presenting for their annual gynecologic preventive exam, who are asymptomatic for CVD, how does implementation of the Framingham Risk Score (FRS) model, compared to usual care (no screening), identify the level of CVD risk over a 3 month period of time?* The intended outcome of this primary prevention EBP project was to identify and stratify CVD risk factors in asymptomatic women, in other words women who are not being treated for hypertension, dyslipidemia or type II diabetes. Identification of CVD risk in asymptomatic women allows for early intervention to reverse risk factors and change the trajectory of CVD development. The outcomes and data analysis of this primary prevention EBP project, which addresses the clinical question, will be promulgated in this chapter.

Demographic data was collected on 148 participants who agreed to participate in the EBP project and signed the consent form. The descriptive demographic metrics that were gleaned included age, race, marital status, employment status, insurance status, smoking status, and family history of CVD in a first degree relative at or before the age of 55. These variables were obtained by the medical assistant (MA) at the time of the patient appointment and were recorded on the patient data form.

**Sample characteristics**

All of the EBP project participants were female \( n=148 \) between the ages of 35-50. The mean age was 42.93 \((SD = 4.73)\). Age distribution is visually depicted below in...
Figure 4.1. Age frequencies were fairly well distributed across the age range with the exception of age 39 which consisted of only two participants.

Of the 148 women who signed consent forms to participate in the EBP project, 109 completed the laboratory testing, accounting for 73.6% of the original cohort. Table 4.1 visually depicts the characteristics of the sample who completed the laboratory testing (n=109). Ethnic demography was comprised of 79.8% Caucasian, 18.3% African American, and 1.8% Asian women. Among marital status 66.1% were married, 10.1% divorced, and 23.9% were single. Of those who identified themselves as single, it was not ascertained if they were single never married or defined themselves as single due to divorce. The majority of the women were employed, 85.3% while 14.7% were unemployed. The status of employment was undeterminable in regard to employment status being full time, part-time, or prn status. Insurance status included 80.7% of study participants who had commercial insurance, such as United Healthcare, Aetna, or Anthem, 14.7% were on Medicaid and 4.6% were uninsured. None of the study participants were on Medicare insurance.
In the sample completing the laboratory testing, 14.7% were smokers, 75.2% were non-smokers, and 10.1% were former smokers. Unfortunately there is neither data available regarding the amount of cigarettes smoked per day or the duration of smoking history.

There is strong epidemiologic evidence for the familial aggregation of CVD and the researchers from the Framingham Heart Study reported that having CVD in at least one first degree relative increased the risk of CVD in women by 70% (Imes & Lewis, 2013). A positive family history of CVD in a first degree relative prior to the age of 55 included 36.7% of women while 63.3% of the project participants did not have family history of early CVD. This subjective data may be biased as some participants may be unclear as to what defines CVD and may not be fully apprised of the extent of their family history.

A comparison of demographic characteristics was effectuated with those who did not complete the laboratory testing (n=39) and these results are depicted in Table 4.2. The demographic comparison was generated to determine if those who did not complete the laboratory testing were similar in characteristics to the cohort sample that did complete testing. Of the n=39 who did not complete testing, 82.1% were Caucasian, 15.4% African American and 2.6% Asian. The majority were married, 66.7% with 10.3% divorced and 23.1% single. 76.9% of this sample were employed with 23.1% being unemployed. The majority of these women had commercial insurance, 79.5% while 15.4% had Medicaid and 5.1% were uninsured. None of this cohort of women had Medicare insurance. Non-smokers constituted 82.1% of this group, 15.4% were smokers, and 2.6% identified themselves as former smokers. A positive family history of CVD in a first degree relative at or before the age of 55 was depicted in 28.2% of this population while 71.8% did not have this history.
The demographics of the cohort sample that followed through with the CVD screening were similar to those who did not complete the testing. These similarities are germane in providing strength to the generalizability of the EBP project findings to the general population. One comparison of interest to note was that more women who completed the testing were employed (85.3%) compared to those women who didn’t complete the testing (76.9% employed) demonstrating the largest variance in demographic data.

Table 4.1

*Sample characteristics of women completing the laboratory testing n=109*

<table>
<thead>
<tr>
<th>Trait</th>
<th>Frequency (n) results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>100% female (n=109)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>79.8% Caucasian (n=87)</td>
</tr>
<tr>
<td></td>
<td>18.4% African American (n=20)</td>
</tr>
<tr>
<td></td>
<td>1.8% Asian (n=2)</td>
</tr>
<tr>
<td>Marital Status</td>
<td>66.1% married (n=72)</td>
</tr>
<tr>
<td></td>
<td>10.1% divorced (n=11)</td>
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<tr>
<td></td>
<td>23.8% single (n=26)</td>
</tr>
<tr>
<td>Employment Status</td>
<td>85.3% employed (n=93)</td>
</tr>
<tr>
<td></td>
<td>14.7% unemployed (n=16)</td>
</tr>
<tr>
<td>Insurance</td>
<td>80.7% commercial (n=88)</td>
</tr>
<tr>
<td></td>
<td>14.7% Medicaid (n=16)</td>
</tr>
<tr>
<td></td>
<td>4.6% uninsured (n=5)</td>
</tr>
<tr>
<td>Family History of CVD before age 55</td>
<td>36.7% yes (n=40)</td>
</tr>
<tr>
<td></td>
<td>63.3% no (n=69)</td>
</tr>
<tr>
<td>Smoking Status</td>
<td>14.7% smoker (n=16)</td>
</tr>
</tbody>
</table>
Table 4.2

Sample characteristics of the women not completing laboratory testing n=39

<table>
<thead>
<tr>
<th>Trait</th>
<th>Frequency (n) results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>100% female (n=39)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Caucasian 82.0% (n=32)</td>
</tr>
<tr>
<td></td>
<td>African American 15.4% (n=6)</td>
</tr>
<tr>
<td></td>
<td>Asian 2.6% (n=1)</td>
</tr>
<tr>
<td>Marital status</td>
<td>Married 66.7% (n=26)</td>
</tr>
<tr>
<td></td>
<td>Divorced 10.3% (n=4)</td>
</tr>
<tr>
<td></td>
<td>Single 23.0% (n=9)</td>
</tr>
<tr>
<td>Employment status</td>
<td>Employed 76.9% (n=30)</td>
</tr>
<tr>
<td></td>
<td>Unemployed 23.1% (n=9)</td>
</tr>
<tr>
<td>Insurance status</td>
<td>Commercial 79.5% (n=31)</td>
</tr>
<tr>
<td></td>
<td>Medicaid 15.4% (n=6)</td>
</tr>
<tr>
<td></td>
<td>Uninsured 5.1% (n=2)</td>
</tr>
<tr>
<td>Family history of CVD before age 55</td>
<td>Yes 28.2% (n=11)</td>
</tr>
<tr>
<td></td>
<td>No 71.8% (n=28)</td>
</tr>
<tr>
<td>Smoking status</td>
<td>Smoker 15.4% (n=6)</td>
</tr>
<tr>
<td></td>
<td>Former smoker 2.6% (n=1)</td>
</tr>
<tr>
<td></td>
<td>Non-smoker 82.0% (n=32)</td>
</tr>
</tbody>
</table>
Changes in outcomes: statistical testing and significance

The interval variables assessed included systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglycerides (TG), LDL cholesterol, HDL cholesterol, blood sugar, and BMI. These variables with their frequencies are delineated in Table 4.3. Although the aforementioned variables were assessed and are considered individually and collectively as CVD risk factors, only systolic blood pressure (SBP), total cholesterol (TC), HDL cholesterol, blood sugar, smoking and age are considered in the laboratory FRS prediction model. Age, smoking, SBP, and BMI are considered in the BMI arm of the FRS model. The FRS models are gender specific. The measures of central tendency will be articulated in the following section.

Systolic blood pressure is considered normal if ≤140 mg/Hg. The spectrum of systolic blood pressure readings ranged from 98 to 152 with a mean of 121.68 (SD=11.32). Of the 109 EBP project participants 6% exhibited systolic blood pressure readings above the normal. Normal diastolic blood pressure is considered to be ≤90 mm/Hg. The array of readings ranged from 60 to 110 with a mean of 77.76 (SD=8.16) with a resultant 16% of the EBP project participants having reading ≥90.

Normal total cholesterol level recommendation is ≤200. The range notated in the study was 121-281 with a mean total cholesterol of 188.44 (SD=33.42). Of the 109 project participants, 38% had total cholesterol scores of ≥200. Triglycerides (TG) guidelines recommend the level to be ≤150. The readings of TG’s ranged from 32-373 with a mean of 103.56 (SD=64.16). 20% of the project participants had TG levels that were ≥150. HDL cholesterol is the cholesterol that exerts a cardio-protective effect if the levels are ≥40. The range in the EBP project participants ranged from a low of 36 to a high of 118 with a mean of 59.42 (SD=16.24). Of the 109 project participants 12% exhibited levels of HDL that were ≤40. LDL cholesterol plays a major role in the development and progression of CVD. The accepted range for LDL cholesterol is ≤100.
unless a patient has co-morbidities such as hypertension or type II diabetes, which then LDL cholesterol is recommended to be less than 70. The range in the EBP study population was 40-204 with a mean of 108.46 (SD=32.03). Data analysis demonstrated 58% of the project participants garnering LDL levels ≥100. Normal fasting blood sugar should be ≤100, the EBP project range for blood sugar was 77-169 with a mean of 92.34 (SD=12.46). 20% of the participants demonstrated a blood sugar that was ≥100.

A normal BMI is considered to be ≤24.9, overweight 25-29.9, obese 30-34.9 and morbid obesity ≥35. The range observed with the EBP project participants ranged from 19.69-54.03 with a mean of 30.06 (SD=7.00). 23.9% of the study population had a normal BMI of ≤24.9; 30% of the cohort had BMI’s that fell between 25-29.9; 22.2% had BMI’s between 30-34.9; and 23.9% demonstrated a BMI of > 35.

Prognostication of CV risk has historically been disparate among leaders in CV health and risk assessment. The most current recommendation as acceded to by the American College of Cardiology, the American Heart Association, and the researchers from the Framingham Heart Study categorizes women as being at ideal CV risk, at risk, or being at high risk for the development of CVD. The most current FRS model scores delineate percentage of risk estimation as low risk (< 6%), moderate risk (≥ 6% and < 10%), moderate-high risk (≥ 10 and < 20%), and high risk (≥20%) (Tattersall, Gangnon, Karmali, & Keevil, 2012). These percentages estimate the risk of developing a CV event over the course of the next ten years.

FRS percentages ranged from 0.8% to 15.7% with a mean of 3.2991 (SD=2.53). Utilizing the percentages delineated above, 100 of the EBP project participants or 92% were identified as being at low risk, 5 (5%) were considered to be at moderate risk, and 3 (3%) were identified as being at moderate/high risk.

In addition to delineating a risk percentage score for development of a CV event over the duration of a ten year period of time, the FRS also reports a vascular heart age.
The vascular heart age compares one’s chronologic age to the age of the heart muscle taking into consideration various identified risk factors. For example, a 40 year old woman with multiple CVD risk factors may have a heart age that is equivalent to that of a 65 year old woman without risk factors. The FRS informing of the vascular heart age compared to the person’s chronologic age provides a tacit mechanism in which to convey the significance of CVD risk factors to the patient as they relate to the health of the heart muscle.

Using the laboratory metrics (TC, HDL cholesterol and blood sugar) and gleaned assessment data (age, smoking, and SBP), the variables were inputted into the FRS model and heart age was determined. Of the n=109 who completed the laboratory testing 42% (n=45) had a heart age that exceeded their chronologic age; 1% (n=2) had a vascular heart age that was equivalent to chronologic age; and 57% (n=62) had a vascular heart age that was less than their chronologic age. Using BMI instead of laboratory testing, the variables of age, smoking, SBP, and BMI were entered into the FRS prediction tool. Of the n=109 EBP project participants, 58% (n=63) had a vascular age that was greater than their chronologic age; 8% (n=9) had a vascular heart age equivalent to their chronologic age; and 34% (n=37) had a vascular heart age that was less than their chronologic age.

If basing clinical decisions on risk level alone, many women would not receive primary prevention intervention education and strategies to reduce identified modifiable risk factors. As will be elucidated in the following section, the majority of women did exhibit modifiable CVD risk factors which were identified through the risk assessment screening.

Systolic blood pressure, diastolic blood pressure, BMI, smoking, TC, TG, LDL cholesterol, HDL cholesterol, and blood sugar were the nine modifiable risk factors that were assessed with the EBP project. Graph 4.2 visually depicts the identified risk factors
along with the frequency distribution. Graph 4.3 visually correlates each study participant (n=109) with the number of modifiable risk factors each participant possessed. Only 9% of the project participants didn’t have identified risk factors and would be considered to be at ideal CV health as defined by the AHA. 13% had only one identified risk factor; 27% had two identified risk factors; 16% had three identified factors; 16% had four risk factors; 9% had five risk factors; 7% had six risk factors; 2% had seven risk factors and only one person (1%) had eight identified risk factors. The significance of the identified CVD risk factors will be discussed in detail in chapter 5.

Figure 4.2

Modifiable variables and their frequencies
Correlation is a statistical technique that is used to measure and describe the degree and direction of the linear relationship between two variables (Gravetter & Wallnau, 2008). In the data analysis that was performed using Pearson’s Correlation Coefficient (Pearson r) it can be determined if there is a direct correlation between two or more specific variables. Correlations can be used for a number of applications including prediction, validity, reliability, and theory verification (Gravetter & Wallnau, 2008). The correlation coefficient will be between -1.0 and +1.0. Correlations that are above +0.7 or below -0.7 represent a strong correlation between the tested variables (Cronk, 2010). A positive correlation indicates that as one variable gets larger, the other variable will also get larger. Conversely, a negative correlation indicates that as one variable gets larger the other variable will get smaller (Cronk, 2010). Correlations are reported numerically as the correlation, the significance, and the n, with degrees of freedom being n -2 (Cronk, 2010). The significant correlations that were gleaned will be delineated below.
Table 4.3 Correlation Table

<table>
<thead>
<tr>
<th>Variable Correlation</th>
<th>Result</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP/DBP</td>
<td>( r(107) = 0.735, p &lt; 0.000 )</td>
<td>Represents a strong positive correlation indicating that a significant positive linear relationship between the two variables exist; indicating that as SBP increases so does DBP or vice versa</td>
</tr>
<tr>
<td>Age/FRS</td>
<td>( r(107) = 0.446, p &lt; 0.000 )</td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as age increases the FRS increases or vice versa</td>
</tr>
<tr>
<td>SBP/FRS</td>
<td>( r(107) = 0.516, p &lt; 0.000 )</td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as the SBP increases the FRS increases or vice versa</td>
</tr>
<tr>
<td>Age/BMI heart age</td>
<td>( r(107) = 0.539, p &lt; 0.000 )</td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as age increases so does BMI heart age or vice versa</td>
</tr>
<tr>
<td>SBP/BMI</td>
<td>( r(107) = 0.340, p &lt; 0.000 )</td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as SBP increases so does BMI or vice versa</td>
</tr>
<tr>
<td>LDL/TC</td>
<td>( r(107) = 0.892, p &lt; 0.000 )</td>
<td>Represents a strong positive correlation indicating a significant positive linear relationship between the two variables; indicating that as LDL cholesterol increases so does TC or vice versa</td>
</tr>
<tr>
<td>LDL/HDL</td>
<td>( r(107) = -0.307, p &lt; 0.001 )</td>
<td>Represents a moderate negative correlation indicating a significant negative linear relationship...</td>
</tr>
<tr>
<td>Variable Pair</td>
<td>Coefficient $r$</td>
<td>p-value</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------</td>
<td>---------</td>
</tr>
<tr>
<td>DBP/HDL</td>
<td>$r (107) = -0.346$, $p &lt; 0.000$</td>
<td>Represents a moderate negative correlation indicating a significant negative linear relationship between the two variables; as LDL increases HDL decreases or vice versa.</td>
</tr>
<tr>
<td>TG/DBP</td>
<td>$r (107) = 0.309$, $p &lt; 0.001$</td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as DBP increases, HDL decreases or vice versa.</td>
</tr>
<tr>
<td>TG/TC</td>
<td>$r (107) = 0.357$, $p &lt; 0.000$</td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as TG increases so does TC or vice versa.</td>
</tr>
<tr>
<td>TG/HDL</td>
<td>$r (107) = -0.474$, $p &lt; 0.000$</td>
<td>Represents a moderate negative correlation indicating a significant negative linear relationship between the two variables; as TG increases HDL decreases or vice versa.</td>
</tr>
<tr>
<td>FRS/DBP</td>
<td>$r (107) = 0.486$, $p &lt; 0.000$</td>
<td>Represents a moderate positive correlation indicating a significant linear relationship between the two variables; as FRS increases so does DBP or vice versa.</td>
</tr>
<tr>
<td>FRS/TC</td>
<td>$r (107) = 0.473$, $p &lt; 0.000$</td>
<td>Represents a moderate positive correlation indicating a significant positive linear correlation between the two variables; as FRS increases so does TC or vice versa.</td>
</tr>
<tr>
<td>FRS/HDL</td>
<td>$r (107) = -0.305$, $p &lt; 0.000$</td>
<td>Represents a moderate negative correlation indicating a significant negative linear relationship between the two variables; as FRS increases HDL decreases or vice versa.</td>
</tr>
<tr>
<td>BMI/SBP</td>
<td>$r (107) = 0.340$, $p &lt; 0.000$</td>
<td>Represents a moderate</td>
</tr>
<tr>
<td>Variable Pair</td>
<td>Correlation Coefficient</td>
<td>p Value</td>
</tr>
<tr>
<td>-------------------</td>
<td>--------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>BMI/DBP</td>
<td>$r (107) = 0.334$, $p &lt; 0.000$</td>
<td></td>
</tr>
<tr>
<td>BMI/HDL</td>
<td>$r (107) = -0.398$, $p &lt; 0.000$</td>
<td></td>
</tr>
<tr>
<td>DBP/FRS</td>
<td>$r (107) = 0.486$, $p &lt; 0.000$</td>
<td></td>
</tr>
<tr>
<td>LDL/FRS</td>
<td>$r (107) = 0.513$, $p &lt; 0.000$</td>
<td></td>
</tr>
<tr>
<td>TG/FRS</td>
<td>$r (107) = 0.377$, $p &lt; 0.000$</td>
<td></td>
</tr>
<tr>
<td>Blood sugar/FRS</td>
<td>$r (107) = 0.547$, $p &lt; 0.000$</td>
<td></td>
</tr>
</tbody>
</table>
| BMI/TG            | $r (107) = 0.321$, $p < 0.001$ |         | Positive correlation indicating a significant positive linear relationship between the two variables; as BMI increases so
<table>
<thead>
<tr>
<th>Metric</th>
<th>Correlation</th>
<th>p-value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI/blood sugar</td>
<td>$r(107) = 0.379$, $p &lt; 0.000$</td>
<td></td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as BMI increases so does blood sugar or vice versa.</td>
</tr>
<tr>
<td>BMI heart age/blood sugar</td>
<td>$r(107) = 0.501$, $p &lt; 0.000$</td>
<td></td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as BMI heart age increases so does blood sugar or vice versa.</td>
</tr>
<tr>
<td>BMI heart age/FRS</td>
<td>$r(107) = 0.895$, $p &lt; 0.000$</td>
<td></td>
<td>Represents a strong positive correlation indicating a significant positive linear relationship between the two variables; as BMI heart age increases so does FR or vice versa.</td>
</tr>
<tr>
<td>BMI/BMI heart age</td>
<td>$r(107) = 0.301$, $p &lt; 0.001$</td>
<td></td>
<td>Represents a moderate positive correlation indicating a significant positive linear relationship between the two variables; as BMI increases so does the BMI heart age.</td>
</tr>
</tbody>
</table>

Statistical analysis of the metrics acquired during the implementation of the EBP project have identified a cogent number of women who manifest modifiable risk factors and are therefore at increased risk for the development of CVD. The conundrum exists for practitioners regarding the interpretation of the data. The FRS has traditionally based CVD risk on the score percentage which, even with a multiple number of risk factors, still puts the percentage of having a CV event over the next ten years as being low, especially in younger women. The most current recommendation of identifying women as being at optimal risk, at risk, or at high risk may more accurately identify women who may benefit from lifestyle modification or early intervention. Identifying women as being
at risk or at high risk will hopefully cause practitioners to be more circumspect in screening and interpreting CVD risk in women.

The descriptive data analysis and correlation data comparisons provide tangible conclusions that support the need for a clinical practice change. The PICOT question: In women ages 35-50 presenting for their annual gynecologic exam, who are asymptomatic for cardiovascular disease, how does implementation of the FRS model, compared to usual care (no screening), identify the level of CVD risk over a three month period of time? was saliently answered with the data analysis. The EBP project identified 91% of the study participants as having at least one modifiable risk factor for the development of CVD. The significance of each identified risk factor will be discussed in depth in chapter 5. The standard of care in this clinical practice setting is opportunistic at best, meaning that a patient may be counseled on an elevated blood pressure, or history of smoking but all risk factors are not realized or inputted into a risk prediction model such as the FRS model. Dissemination of the EBP project findings to the administrative practice staff and medical providers will hopefully modulate a clinical practice change.
CHAPTER 5

DISCUSSION

Despite progressive advances in our understanding of the determinants of atherosclerosis, cardiovascular disease (CVD) remains the leading cause of morbidity and mortality worldwide (Von-Khue, Martin, Blumenthal, & Blaha, 2012). The purpose of the evidence-based practice (EBP) project was to determine if applying the Framingham risk score (FRS) model to asymptomatic women would appropriately identify modifiable risk factors as well as their CVD risk percentage related to the probability of a CV event over the course of the next ten years. The clinical question to be answered was: In women ages 35-50 presenting for their annual gynecologic exam, who are asymptomatic for CVD, how does implementation of the FRS model compared to usual care (no screening) identify CVD risk over a three month period of time? The major goal of this primary prevention EBP project was to screen women without disease to identify and quantify their modifiable CVD risk factors. One of the cornerstones of health is to identify individuals who have an increased risk of developing an adverse outcome over a specific period of time so that they can be targeted for early preventive strategies (Ahmed, Debray, Moons & Riley, 2014). The EBP project implementation site was a large OB/GYN practice that while espousing to providing comprehensive women’s health care, was not implementing the recommended ACC/AHA preventive CV screening in their patient population. The outcomes of the EBP project demonstrate that application of the FRS model in asymptomatic women succinctly identifies modifiable risk factors and stratifies level of CVD risk into ideal CV risk, at risk, or at high risk for developing CVD. This chapter will articulate the EBP project findings from Chapter 4 and discuss the implications of the findings as they pertain to evidence-based APN clinical practice. Evaluation of the theoretical frameworks in relationship to this EBP project will be
conveyed as well as strengths and weaknesses of the EBP project, and implications for the future.

**Explanation of findings**

Clinical trials have demonstrated that when CVD modifiable risk factors are treated and corrected, the chances of developing CVD are significantly reduced (D’Agostino, Pencina, Massaro, & Coady, 2013). The literature purports that CVD risk is multifactorial and synergistic over time for development of actualized disease. In order to potentially prevent CVD, risk factors in individuals without disease must be identified and quantified. Estimating risk plays an important role in understanding the underlying mechanisms involved in the etiology and progression of chronic disease and guides prevention and treatment (Kariuki, Stuart-Shor, & Hayman, 2013). As elucidated in the literature there are a myriad of risk prediction tools available to assess an asymptomatic woman’s risk of CVD. The ACC/AHA recommends a Framingham type global risk score that incorporates multiple traditional CV risk factors for all adult women without a history of CVD. The most current guidelines promulgated in the literature ascertain that for patients 20 to 79 years of age who are free from CVD, the first step is to assess for CVD risk factors (Goff, et al., 2013). CVD risk scores have the potential to educate and inform patients, motivate them to change their level of risk, and reinforce the importance of compliance with a plan of care.

Of the 109 women who completed their laboratory testing and who’s data was evaluated using the FRS model, 91% (n=99) had at least one identified modifiable risk factor, 27% had two identified risk factors, 16% had three risk factors, 16% had four risk factors, 9% had five risk factors, 7% had six risk factors, 2% had seven risk factors and 1% of the study participants had eight identified CVD risk factors. As a practicing clinician, each provider must critically evaluate the risk factors for their significance to the health of the patient. For example, having a single risk factor of elevated BMI may not
hold the same health consequence as an individual risk factor of a blood sugar of 300. Using one’s medical acumen and experience will guide the clinician in determining which patient needs immediate follow up and which ones can have their identified risk reviewed and discussed at the next appointment. It was determined from the critical valuation of the data that 50.5% (n=55) of the study cohort required timely follow up appointments for statistically significant identified risk factors. Clearly those individuals with significantly elevated blood sugar, blood pressure and cholesterol levels needed timely intervention with either lifestyle modification or lifestyle and medication modalities.

The outcomes of the EBP project were correlative to those communicated in the CV literature using similar OB/GYN practice settings. The American College of Cardiology Foundation (ACCF) revealed results from a pilot study done in the OB/GYN setting which identified 69% of the study participants exhibiting significant CV risk (SCAI, 2012). Another study that was implemented in ten different OB/GYN practice sites over a 2 year period of time identified 87% of the study participants with significant CVD risk factors (Mehran & Yu, 2012).

Correlational statistics using Pearson’s r exhibited twenty seven statistically significant relational correlations (p<0.001). The two variables being assessed occur naturally and are not manipulated or controlled by the project manager (Gravetter & Wallnau, 2008). These correlations were logically anticipated as they related to modifiable risk factors and how they interact to increase heart age, FRS percentages, and need for follow up. The results of the data analysis were statistically significant in both identification of risk factors and correlations between interval data variables.

The single most identified CVD risk factor was BMI, with 76% (n=83) of the EBP project participants exhibiting a BMI ≥25 kg/m². These statistics from the EBP project are equivalent to those communicated in the literature. Statistics reported in both general scientific literature and CV literature confirm that two out of every three adults in the U.S.
are overweight or obese. There is a linear relationship between increasing BMI and all-cause mortality, especially CVD related death (Von-Khue, Martin, Blumenthal, & Blaha, 2012). Each five unit increase in BMI was associated with a 29% increase in mortality in women (Dudina et al., 2011). This risk factor in isolation may not necessitate an immediate follow up appointment but it assuredly needs to be addressed at each subsequent patient appointment. BMI is a formidable risk factor that is also associated with an increased risk for the development of Type II diabetes, hypertension, and dyslipidemia, all of which are significant risk factors for CVD.

To reiterate the findings reported in chapter four, the modifiable risk factors appraised included systolic blood pressure, diastolic blood pressure, total cholesterol, triglycerides, LDL cholesterol, HDL cholesterol, smoking, and BMI. Diastolic blood pressure was more significantly elevated than systolic blood pressure with 16% (n=17) of the study participants having elevated diastolic blood pressures and 6% (n=7) having elevated systolic blood pressures. All fractions of the lipid panel demonstrated significant abnormalities, with LDL cholesterol elevation being seen in the greatest number of study participants. As previously articulated LDL cholesterol has a deleterious effect on CVD health and is more discerning in the female population. 38% (n=41) of the participants had elevated total cholesterol, 20% (n=22) had elevated triglycerides, and 58% (n=63) had elevated LDL cholesterol. According to the study conducted by Ip (2009) greater than 50% of CV events are due to elevated cholesterol fractions. Elevated blood sugar of ≥100 was reported in 20% (n=22) of the project participants. Smokers constituted 14.7% (n=16) of the EBP project participants. It was not ascertained the amount of cigarettes smoked or the duration of smoking history. Cigarette smoking is dose related and does significantly increase CVD risk in the female population.

The percentage of women who exhibited ideal CV health, as previously outlined by the AHA, was 9% (n=10) of the EBP project study participants. This is a higher
percentage than has been reported in the literature. A cohort study of 14515 adults revealed less than 1% of the participants possessed ideal CV health (Himmelbarb & Hayman, 2012). The remaining 91% of the EBP project participants were at risk for development of CVD. The most current recommendations outlined by the American Heart Association and the American College of Cardiology are to stratify women as being at ideal CV risk, at risk or at high risk versus reliance on the ten year risk percentage reported by the older FRS models. As has previously been discussed, women can exhibit a myriad of risk factors and still remain at a low risk percentage according to risk prediction models.

Using the laboratory arm of the FRS prediction model, 42% (n=45) of the EBP project participants had a vascular heart age that was greater than their chronologic age and using the BMI arm of the FRS model 58% (n=63) of the project participants had a vascular heart age that was greater than their chronologic age. The rationale behind the two arms of the prediction model was the belief that many clinical practice settings were not implementing the laboratory screening but they could at least ascertain a level of risk from metrics obtained at the time of the patient visit. The vascular heart age is a persuasive metric to share with patients that seems to really make an impact on their understanding of how their heart is actually aging while not exhibiting overt symptoms of CVD.

Descriptive demographics were completed on the n=109 who completed the laboratory testing as well as the n=39 who consented to participate but did not follow through with laboratory testing. The two groups were similar in all areas assessed including age, race, marital status, insurance status, smoking status, and family history of CVD. These similarities make the results generalizable to the target population.
Implications for clinical practice

CVD is well suited for application of primary prevention interventions due to it being common, occurring at a high incidence, that it can be modified by behavior, has a long latency period, and has a high economic and societal burden (Ashen, 2010). A practice grounded in evidence-based practice which integrates clinical expertise, patient history and values, and the best clinical evidence is an essential component of APN practice (Facchiano & Snyder, 2013). Implementation of EBP promotes high-value health care including enhancing quality and reliability, improving health outcomes, and reducing variations in care and cost (Melnyk, Gallagher-Ford, Long and Fineout-Overholt, 2014). Utilization of EBP guidelines will ensure current knowledge is being used to guide cost-effective evidence based treatment options. The role of risk factors in the causal pathway to CVD provides a strong rationale for assessment and appropriate risk factor modification (Pearson, 2002).

The most current clinical guidelines provide evidence for control of modifiable risk factors and use of primary prevention strategies in the clinical practice setting. Reducing the burden of CVD must be a shared responsibility among all health care providers. No longer can there be turf war or a non-committal ideology that it is not within the scope of practice to screen all women for heart disease risk. Screening must be initiated whenever and wherever the patient presents and the opportunity emerges. This clinical practice site purports to provide comprehensive care to women, in order to meet that tenet, it must assess and evaluate for the disease that is the leading cause of death in women. Clinical practice settings must also adhere to national guidelines that are authored by leading experts in the field of cardiology.

Based on the achieved EBP project outcomes it is recommended to implement routine CV risk screening. The significant outcomes of this EBP project may result in like practices adopting CVD risk screening as part of their routine provision of women’s
health care. As previously elucidated, a cogent number of women consider their OB/GYN as their PCP, especially women of childbearing age. Unique to this OB/GYN practice is that a family nurse practitioner is a member of the medical provider team and possesses expertise in primary care and management of chronic medical conditions. It is a logical transition of care for patients with identified CVD risk to be referred to the FNP within the practice setting for treatment.

Each patient encounter provides a fortuitous opportunity to educate women on the role of risk factors related to the development of CVD as well as broaden the patients understanding and knowledge of CV health. After initial assessment of risk, CVD risk must be reassessed throughout the lifespan. Applying principles of prevention with each patient encounter will improve health outcomes and reduce health care costs.

Implications for the APN role

The principles of EBP are the cornerstone for APN’s to translate research findings into clinical practice and provide patients with the best available evidence to guide their healthcare decisions (Facchiano & Hoffman-Snyder, 2012). In a health care environment that has expectations of providing expedited care to a more complex patient population while remaining cognizant of cost containment, APN’s possess the competence, knowledge, and expertise to empower patients in understanding and incorporating EBP into their plan of care. As an APN, the ultimate goal of healthcare is to provide the best care possible to our patients, care that is grounded in research and is evidence-based. Implementation of EBP strategies may increase patient compliance in health promoting behaviors and decrease disease burden.

Advance practice nurses play a pivotal role in the primary prevention of CVD in women. Exhibiting a leadership role in CV health, APN’s may need to challenge the status quo, lobby for health system reform, motivate and inspire other health professionals to engage in a shared vision for improving health and well-being in women
(Lanuza, Davidson, Dunbar, Hughes, & Geest, 2011). According to a study which surveyed women regarding CVD, only 21% of women reported that their health care provider had ever discussed their risk for CVD, reinforcing previous findings that health care providers underestimate CVD risk in women and underuse preventive therapies (Roberts & Davis, 2013).

Office based CVD risk assessments are essential and cost effective in identifying modifiable risk factors and should be implemented as a routine part of the armamentarium of clinical practice. The aim of CVD risk assessment is to be more effective in identifying those at risk and to facilitate more efficient use of treatment and prevention resources (Owen & Reid, 2013). This EBP project reinforced evidence elucidated in the literature that CVD risk screening in women without disease is crucial in identifying CV risk. A substantially lower lifetime risk of developing CVD occurs among individuals with optimally controlled risk factors. It is noteworthy that individuals who reach middle age with optimal levels of all major risk factors have only a 6-8% remaining lifetime risk of developing CVD (Heidenreich et al., 2011).

The APN must sharpen his/her CVD acumen, infuse evidence into the clinical practice setting, be able to effectively understand and communicate CVD risk, accurately administer and interpret risk prediction scores and its implications for the patient, and be actively involved with the patient in formulating a plan of care that incorporates evidence-based risk prevention strategies. Once screening and risk has been ascertained, discussion of identified CVD risk factors is prima facie in reversing this devastating disease. Assisting the patient to understand their risk and facilitate a plan of care, the APN must utilize a number of educational tools and communication techniques. This is where the APN can effectively utilize the tenets of the health promotion model (HPM) to assist the patient in understanding their risk and identify methodologies to reserve that risk. In conjunction with their patients, APN’s can be instrumental in empowering their
patients to become proactive with health promotion and disease prevention, inclusive of CVD. APN’s as transformational leaders influence and engage individuals in a shared vision and provide innovative methods in which problems are viewed and solved (Lanuza et al., 2011).

Clinical practice guidelines provide a foundational framework for the APN to screen their patients for CVD risk. The APN must familiarize herself with the guidelines and be fastidious in ongoing CVD risk assessment through the lifespan of their female patients. Using EBP constructs, APN’s can provide evidence and research regarding the symbiotic interaction of modifiable CVD risk factors and provide evidence based interventions to change CVD outcomes. According to Roberts and Davis (2013), 44-50% of the decrease in CVD mortality is related to risk factor reduction related to lifestyle and environmental changes such as blood pressure, blood sugar, cholesterol, BMI, and physical activity. APN’s can meld the triad of EBP tenets of evidence, such as clinical practice guidelines, clinical experience and knowledge, and patient preference to improve the CV health of women.

Another germane tenet to APN practice is in fostering collegiality among their peers. The APN is continually being provided a fortuitous opportunity to share knowledge and expertise. APN’s must remain vigilant in remaining abreast of the most current evidence and research and must take advantage of every opportunity to be a conduit to share CV evidence at the professional, individual patient, and population level.

**Evaluation of applicability of the theoretical frameworks**

The EBP step wise approach assists the practicing APN in identification of a clinical question precipitating the APN to search for the most current relevant scholarly evidence as it relates to an identified clinical issue. Critical appraisal of the evidence for validity, reliability, and applicability to practice is essential for integration of the evidence into clinical practice (Melnyk, Gallagher-Ford, Long, Fineout-Overholt, 2014). If a
practice change is implemented based on the EBP process, it will be incumbent to disseminate the evidence and foster an environment that is conducive for change. In order for the EBP project to become a permanent paradigm shift in clinical practice there must be continuous monitoring and ongoing evaluation of the EBP change.

The five phases of the Stetler model for EBP were used as the underpinning to facilitate progression of the EBP project. The model outlines a number of critical thinking and decision making steps to assist the DNP student in effectively implementing an EBP project. Stetler’s model de-emphasizes practice based on tradition and instead stresses use of research findings as well as other sources of credible information (Stetler, 2001). This foundational framework was inclusive of: a) preparation; b) validation; c) comparative evaluation and decision making; d) translation and application; and e) evaluation (Ciliska et al., 2011). This framework was an appropriate fit and was used successfully to promote, design, implement, and evaluate the EBP project.

In the preparatory phase of the model, the clinical question is identified and formulated for its potential influence in clinical practice. Affirmation of the clinical question as a clinical priority was ascertained. Women’s cardiovascular health has been touted as a health priority in this practice setting for many years but implementation of risk prediction screening had never come to fruition. It was imperative during this phase of the process to examine both external and internal factors that may exert influence in the EBP project. A critical and exhaustive search of the evidence reinforced the necessity for screening asymptomatic women for CVD risk. The relevant literature provided credence to the significance of the EBP project and mitigated the development of expected outcomes and goals. The PICOT question was formulated and defined.

Phase two of the Stetler model assisted the EBP project manager in critical appraisal and grading of the evidence that was garnered during the first phase. The appraised literature revealed an appropriate number of high level evidence studies.
Several appraisal tools were utilized in the evaluation of the evidence including the AGREE II, CASP, and Melnyk & Fineout-Overholt’s (2011) rapid appraisal checklist. Assimilation of the evidence resulted in 20 articles that were included in the evidence table. The evidence was inclusive of 14 Level I evidence studies, four Level IV evidence studies, and two Level VI evidence studies.

Phase three of the EBP model had the project manager analyzing and coalescing the evidence for the best clinical practice fit. Involvement of the management staff, CEO, and marketing director as influential stakeholders were included in the dissemination of evidence supporting the need for and expected outcomes of the EBP project. A decision regarding the risk prediction tool, format for implementation, as well as expected outcomes were based on the appraisal of the evidence.

In phase four of the model, implementation; the project manager designed the 12 week primary prevention intervention based on the significance of the clinical issue and the identified need for a clinical practice change. IRB approval was obtained from Valparaiso University and the process for the EBP project implementation was presented to and approved by the CEO and management team of the clinical practice site. Education was completed with the medical office staff, the nursing staff, and the administrative staff at the implementation site. Education was rendered via power point presentations, scripted modules, role playing, and question and answer time.

The fifth and final phase of the Stetler model was to amalgamate the statistical data and promulgate the findings. Change strategies were evaluated and implemented in preparation for a clinical practice change. Critical evaluation of the entire EBP process was completed by the EBP project manager including strengths and weaknesses of the project, use of the theoretical frameworks, and implications for clinical practice. These tenets will be expounded upon in the following sections.
According to the 2012 AHA National Survey by Mosca and colleagues, women engaged in preventive behaviors to improve their health and feel better, not to live longer (Roberts & Davis, 2013). Thirty five percent of the women surveyed by Mosca and colleagues reported that they had no barriers to engaging in preventive behaviors and felt they lived a heart healthy lifestyle. In the remaining sixty five percent, lack of time, family obligations, lack of financial resources, and lack of confidence in their ability to achieve behavior change were cited as barriers to a heart healthy lifestyle (Roberts & Davis, 2013). Once risk is estimated, understanding and communicating risk is acknowledged as being a daunting task. Practitioners must be cognizant of a myriad of interpretations as to what constitutes health and health promoting behaviors and what influences affect each individual patient. Practitioners must be mindful that self-esteem, societal support, social status, family values and views, as well as one’s own personal control over their health all interact in health promotion. Acknowledgement by women that CVD is the leading cause of death in their gender will support the impetus for primary prevention and identification of modifiable risk factors and ultimately empower women to become proactive in their health. The APN ideally wants to instill CVD prevention strategies in patients with the ultimate intent of preventing negative health outcomes.

Pender’s health promotion model (HPM) served as an excellent foundational nursing model for this EBP project cohort to actively participate in health promoting behaviors. The components of the model lead to a logical progression of the concepts needed to improve health and health behaviors and support the belief that health behaviors must be in control of the patient and have meaning to the patient in order to be effective (Bennett, Perry & Lawrence, 2009). The HPM can be used to increase perception of CVD risk and facilitate conversation regarding health beliefs and behaviors. Implementing the HPM can serve as a conduit to change health from a
paradigm of disease management to one of health promotion and disease prevention. APN’s must be creative and innovative in developing strategies that will break down identified barriers and allow patients to participate and be proactive in a heart healthy lifestyle. The HPM adequately pulls together the factors that can motivate and engage the patient in establishing and monitoring goals and increase adherence to positive health behaviors.

**Strengths of the EBP project**

The fundamental tenet to successful implementation of EBP resides in an organizational culture that finds value in EBP and is supportive of EBP implementation. The main strength of this EBP project was a practice environment that supported the EBP project and a supportive provider and administrative staff who collaborated with the EBP project manager in navigating the project implementation. The DNP project manager provided credibility for the EBP through extensive research and critical appraisal of the CVD literature. The project manager articulated the significance and background of the project, the scientific evidence to support the EBP, the tool to be implemented, and the expected outcomes of the EBP project to the key stakeholders. The relevance of the health issue as a health priority, the amount of evidence supporting the health priority, and the ease with which the EBP project can be replicated enhanced the strength of the project. Critically evaluating the EBP throughout the implementation phase supported the implications that the EBP project had to practice issues, research, theory, and education. The EBP project goals and objectives were in alignment with the vision and mission of the clinical practice setting. The foundational basis of the EBP project using the Stetler model and the HBM provided a sound theoretical framework from which to develop, implement, and evaluate the EBP project.

Ease of implementation of the EBP project into the clinical practice site was an identified strength. There was minimal interruption of normal work flow by the clinical or
provider staff. The clinical staff felt well educated on the implementation process and was enthusiastic and comfortable in identifying potential study participants, educating them, and obtaining informed consent. There were no overtime hours needed for implementation of the EBP project and the associated costs were miniscule, mainly consisting of nominal office supplies.

The literature is saturated with studies validating the reliability and usefulness of the FRS model as a gold standard CVD risk prediction tool. The tool was easily implemented into the clinical practice site and inputting of metrics into the web-based program provided a quick analysis of the variables and rapid reporting of the findings. The ability of being able to scan the reports into the patients EMR provided accessibility for all providers to view the FRS results at any point along the continuum of care. As part of this EBP project, the project participants were sent thank you letters, applauding them for being proactive in their heart health, and were provided with copies of their FRS results along with an explanation of the findings. Providing the patient with a tangible visual result reinforced the findings and provided a mechanism for the patient to evaluate their results without the time constraints of an office appointment. Another identified strength of the FRS tool is its reporting and explanation of heart age which provided in layman terms how the individuals’ heart was aging. Vascular heart age is intuitively an easily understood way of illustrating the likely reduction in life expectancy if risk factors are not reduced.

Utilizing the EMR to calculate risk automatically will become the mainstream of current and future risk algorithms (Goff et al., 2013). Using the EMR as a method for all members of the health care team to review the results of the risk screening and to alert the practitioner of when screening needs to be redone will aide in the ongoing diligence of continued implementation of this EBP practice change and well as pervasive awareness to CV health.
Limitations of the EBP project

Implementation in only one of five clinical practice settings was a limitation that was identified with the EBP project. Since this OB/GYN practice has several locations around the geographical area, the demographics will vary to a certain extent. For example, the demographic of the EBP project implementation site consisted of approximately 65% commercially insured patients, 25% Medicaid, 6% Medicare and 4% uninsured while our inner city clinical practice site is composed of approximately 60% Medicaid patients, 20% commercially insured, 5% Medicare, and 15% uninsured. Once the EBP project becomes a permanent clinical practice change, women at all clinical sites will be offered and screened for CVD risk.

The EBP project sample was a convenience sample of women and therefore may exhibit participation bias. Many studies have demonstrated that those who volunteer for screening may be healthier than the general population (Gordis, 2009). Another potential bias may be identification of those in the pre-clinical phase versus those close to exhibiting overt disease. Because CVD has a long prodromal phase, younger patients may be healthier than those who are older and possibly closer to exhibiting overt disease therefore exhibiting various degrees of risk. The longer the preclinical phase, the more likely the screening program is to detect the case while it is still preclinical (Gordis, 2009). Attrition is a concern while implementing any type of research or EBP. Originally 148 women signed the consent form to participate in the EBP but 109 actually completed the laboratory portion of the project for a participation rate of 73.6%. Demographics were compared between the two groups and demonstrated that they were comparable in all areas of demographics.

There are limitations to any of the risk prediction models, namely that they are most effective within the population from which they were derived and the outcomes/end- points that they attempt to address. The literature identifies over one
hundred CVD risk prediction models. No one model assesses all of the variables that have been associated with CVD risk. The question can be posed if a different tool would yield a different result within the same sample population. However, as has been previously articulated, the risk prediction tool must effectively assess multivariate CVD risk but be cost-effective and be easily implemented in the clinical practice setting. Regardless of the tool, the general principal remains the same, namely to accurately predict the risk of future occurrence of an outcome in an individual utilizing the values of multiple characteristics (Ahmed, Debray, Moons, & Riley, 2014). One of the major limitations of the FRS model articulated in the literature is its potential for under-estimating risk, especially in younger populations. However the FRS remains a gold standard tool for use in the clinical setting to identify and stratify CVD risk. Implementation of the Framingham risk predictive tool identifies CVD risk and allows the practicing clinician to implement further EBP prevention guidelines or refer the patient to another clinician for further assessment and/or treatment.

Another limitation of risk prediction models is that many of them are neither gender nor ethnically specific and therefore may not be representative of the general population. This is especially poignant in minority populations who historically have a disproportionate risk for CVD. Fortunately the FRS model does predict gender specific levels of risk but is not ethnicity specific scores. CVD risk and health outcomes are influenced by environmental, social, economic, and biologic factors (Lanuza et al., 2011) which are not reflected in our current risk predictive tools.

Another limitation to the risk prediction models is in their definition of risk level. It is discerning the magnitude of risk factors exhibited by women, especially those under the age of 50, who still do not reach a high percentage of CVD risk as defined by some risk prediction models. It is certainly more prudent to follow the tenets as outlined by the ACC/AHA, which is to define women as being at ideal risk, at risk, or at high risk for
development of CVD. The various delineations of risk levels can be confounding for the practicing clinician and is often a cited reason for not implementing risk screening in the clinical setting. A standardization of values and tools would allow for greater ease of implementation.

Barriers to implementation of EBP in the clinical setting are many and may include time constraints, organizational culture and philosophy, inadequate EBP knowledge, lack of access to databases for evidence searching, leader resistance, work load, and limited access to resources that facilitate EBP (Melnyk, Gallagher-Ford, Long, & Fineout-Overholt, 2014). Other barriers may include lack of reimbursement for preventive care, lack of incentives to practice primary prevention, lack of understanding and skill at implementing the various risk prediction models, and lack of understanding in interpreting and communicating the findings. Barriers to implementation may also come from the patients themselves who may be reticent to screening or implementing lifestyle changes. Change strategies must be implemented within the clinical setting to eradicate barriers to EBP.

**Implications for the future**

**Practice.** Strategies for implementation and sustainability of EBP need to be multi-faceted to include education and knowledge enhancement, cultivation of an organizational culture of EBP, development of EBP leaders and mentors, resource availability, expectation of initiating an EBP environment, and recognition for engagement in EBP (Melnyk, Gallagher-Ford, Long, & Fineout-Overholt, 2014). The intended effect of EBP is to standardize healthcare practices to science and best evidence and to reduce illogical variation in care, which is known to produce unpredictable health outcomes (Quigley, Huston, & Covell, 2013). Aligning with the recommendations from the Institute of Medicine and providing quality of care, EBP unifies research evidence with clinical expertise and encourages individualization of care.
through inclusion of patient preferences (Quigley, Huston, & Covell, 2013). Combining national guideline recommendations or pathways backed by current research, APN’s will consistently be providing comprehensive evidence-based care to their patients.

Since the first screening guidelines for screening women for CVD risk were published in 1999, there continues to be a pervasive disconnect between nationally recommended CVD risk screening and implementation of guidelines in clinical practice. According to Perk (2012), 62% of physicians used subjective assessments to gauge CV risk rather than employ a risk calculator. Approximately 60% of PCP’s and OB/GYN’s state that they were aware of the ACC/AHA evidence-based CVD screening guidelines yet only 39% of PCP’s and 21% of OB/GYN’s reported incorporating the guidelines into clinical practice (Wells & Kalman, 2011). This is reflected within the EBP project implementation site, no consistent CVD risk screening was being done. Debate continues as to who is responsibility to initiate screening, is the responsibility of only the PCP or should anyone who interacts with the patient take the initiative to institute CVD risk screening? Death rates for women 35 to 54 years of age are trending upward, compared with the previous four decades (Carey & Gray, 2012). Unless the determinants of CVD risk are identified and reversed, CVD rates in women will continue to trend upward. Unfortunately, OB/GYN practitioners were reported to substantially have less awareness of national CVD screening guidelines than other medical practitioners (Carey & Gray, 2012). The commonly held belief that OB/GYN practices focus only on reproductive and breast health must be reversed and this clinical specialty must place emphasis on comprehensive women’s health care including screening for CVD risk.

The outcomes of the EBP project demonstrated its effectiveness in identifying CVD risk in asymptomatic women. Implementing CVD risk assessment screening in this clinical practice setting requires an educational protocol and a referral process for
patients with identified high levels of risk. The clinical practice site used for implementation of this EBP project is in the process of looking to partner with an internal medicine or cardiology practice in an effort to provide a seamless system for the patient and improve transitions in care. Utilizing the EMR provides a straightforward method to view CVD risk screening results, track risk screening dates, and to alert the practitioner as to when CVD risk screening needs to be redone.

**Theory.** The theoretical frameworks that served as a guide for this EBP were applicable and effective throughout the EBP process. An interesting article published in the NEJM (2014) found that women often viewed their risk or development of CVD as the consequence of having done something bad; that it was essentially their fault whereas cancer was something bad that happened to them but not caused by them. Future theory development or application of current theory should focus on this perception of risk and work to expand knowledge regarding CVD and its associated risk factors.

As the first estimation of risk for CVD, calculating the FRS is clinically helpful in identification of individuals at high or low risk, however those at intermediate risk may need further risk stratification with additional testing. If risk is identified, additional testing could be performed such as lipoprotein subfractions, CRP-hs, or imaging modalities.

There are a myriad of theoretical models that can be applied by the APN in clinical practice. Nursing theories must be continually applied to future research endeavors to assess their validity and applicability to practice issues. Use of the HPM is applicable to this EBP project and population because once risk is identified, it is imperative to find the impetus for the patient to make changes in their health behavior to reverse the identified risk.

**Research.** For risk prediction models to become common place in clinical practice, research needs to show that they consistently have a positive impact on health
outcomes (Ahmed, Debray, Moons, & Riley, 2014). Additional research needs to be rendered to determine the role and inter-relatedness of all associated CVD risk factors. Research needs to demonstrate that identified level of risk is indeed associated with development of disease and if the level of risk is decreased, that there a commensurate decrease in disease development. Additional research needs to be executed regarding significance of identified risk factors as they relate to a younger population. This EBP project assessed women 35-50 for early identification of CV risk; however the literature is unmistakable regarding increased rates of obesity and type II diabetes manifesting in younger individuals, even children. This discerning data trend will cause an increase in CVD among younger individuals and research must focus on assessment and interventions for this younger age group.

Although there are over one hundred CVD risk prediction models reported in the literature, there is currently not one tool that evaluates all identified CVD risk factors as they relate to women. As articulated in chapter two, evidence is informed in the literature on risk factors such as family history, LDL cholesterol, diet, and physical activity which are not reflected in the FRS model, yet are consequential in the development of CVD. Future research endeavors must focus on the role of all identified CVD risk factors and focus on identification of which variables are the most important for risk prediction.

Although the FRS model is gender specific, is validated and reliable in the U.S. population, and is a recommendation in clinical practice guidelines, is does not encompass all risk factors that play a pivotal role in the development of CVD in women nor is it ethnically diverse. Research is ongoing with new risk prediction models that will add additional variables as well as genetic markers which may enhance the determination of risk prediction outcomes. Addressing risk factors suspected as being more significant in the female gender may also be ponderous for future research endeavors. For example, CPR-hs may add prognostic information for a woman’s
development of CVD. Sharma and Gulati (2013) report on a study where women with elevated CRP-hs had almost twice the risk of future CV events than those with normal CRP-hs. Women with history of pre-eclampsia have double the risk of subsequent ischemic heart disease, stroke, and venous thrombotic events (Sharma & Gulati, 2013) making this a crucial component of comprehensive patient history taking and an area for continued research.

Additionally, research must continue on the cost effectiveness of early screening and intervention. Targeted research must include assessment across ethnic and culturally diverse groups. It is elucidated in the literature that African American women and Hispanic women have a disproportionately higher rate of CVD than Caucasian women, with Hispanic women exhibiting overt CVD ten years earlier than Caucasian women (Ahmed, Debray, Moons, & Riley, 2014). Healthcare that is designed to prevent illness and minimize progression of disease is imperative to improve quality of life and decrease healthcare costs.

**Education.** The prevalence of CVD will increase by approximately 10% in the next 20 years under status quo CVD prevention while treatment trends and direct costs related to CVD will increase three fold (Himmelfarb & Hayman, 2012). Cardiovascular disease education must be approached from a myriad of perspectives. Continuing to update the medical providers and office staff on the most current CV literature and research will keep them apprised of the most up to date information regarding CV health and trending. Remaining active in professional organizations and sharing expertise and knowledge with colleagues is imperative to increase awareness of CVD. CV education must also be approached from both an individual and population or community level. Each patient encounter provides an opportunity to assess lifestyle behaviors and allows meaningful interaction on the consequences of poor lifestyle choices. Primary prevention education must be succinct and continuous to educate the individual and effect change
in behavior. Being actively involved in population awareness endeavors will expand the knowledge of CVD within the community. Being active politically with professional organizations and in policy reform will expand awareness of primary prevention strategies. Prevention initiatives at the population level such as lifestyle education, stress reduction, physical activity education, school lunch program changes, senior education, and smoking cessation will aid in the reversal of CVD. Participating in community health fairs and community educational forums and health talks allows the practitioner to share their cardiovascular knowledge and expertise.

The results of this DNP EBP project identified a significant number of women with undiagnosed CVD risk factors. Having a penchant for prevention, had this project not been implemented, these women would not have been identified as being at risk for the development of CVD. Only through early identification of risk can the trajectory of CVD be reversed. The correlational relationships were expected, if there was a significantly elevated blood sugar, blood pressure, or lipid panel, there was a commensurate increase in risk percentage and vascular heart age. The vascular heart age was the strongest motivating factor for women to verbalize a desire to make lifestyle changes. Risk percentages had little effect on the patient understanding of their risk, but a visual depiction of how their heart was aging was eye opening for many of the patients. Even the other medical practitioners in the practice found the vascular heart age an interesting tenet and something the patient could understand and relate to. My fellow colleagues have found the results of the EBP project extremely informative and concur that this practice setting is an ideal clinical site for early screening and identification of CVD risk factors and has the potential to appropriately prognosticate and to increase awareness, education and prevention related to CV health. Implementation of CVD risk screening in this OB/GYN setting sets us apart from the practice of other OB/GYN settings and strengthens our commitment to our mission and vision statements. The
results of the EBP project provide compelling evidence for making CVD risk screening a permanent practice change.

Conclusion

For a woman to reduce her CV risk, she first has to believe it exists (Rosenbaum, 2014). It is well recognized in the cardiovascular literature that a need exists for a risk assessment approach that can easily be utilized by medical providers in the clinical practice setting. Cardiovascular disease has a long latency period therefore the greatest benefit would be achieved by effective early primary prevention. The deleterious impact of CVD in women is largely related to modifiable CVD risk factors. Risk factor modification is tightly linked to knowledge of heart disease and use of preventive actions by women who are at risk (Roberts & Davis, 2013).

Despite progressive advances in our understanding of the determinants of CVD, it remains the leading cause of morbidity and mortality worldwide (Van-Khue, Martin, Blumenthal, & Blaha, 2012). By 2030, it is predicted that more than 40% of Americans will have some form of heart disease with associated economic costs increasing from $273 billion in 2008 to $818 billion in 2030 (Facchiano & Hoffman-Snyder, 2012). As has been repeatedly elucidated throughout this paper, the literature is salient in identifying 80-90% of CVD risk as being preventable. The statistical findings from this EBP project support the findings reported in the literature, 91% of the study participants exhibited at least one CVD risk factor with 50.5% exhibiting three or more risk factors necessitating a timely follow up appointment. The most poignant outcome of the EBP project is the salient number of women who were previously undiagnosed with CVD risk but now have had their CV risk identified.

The reality exists that CVD is expected to escalate because of the aging population, obesity, metabolic syndrome, and diabetes which are all health issues that affect women disproportionately (Carey & Gray, 2012). Many U.S. women consider their
gynecologist as their PCP and as such, practitioners in this clinical setting must strive to provide screening to their patient population.

Implementing the methodology of the EBP process, this EBP project succinctly identified a clinical issue, critically appraised the literature, identified best practice recommendation and in a logical methodological approach applied the steps of the EBP to the clinical question. The resultant analysis of the data provided tacit evidence that supported the significance of the identified clinical question and provided outcomes that support the need for CVD risk screening to become a permanent clinical practice change.
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BIOGRAPHICAL MATERIAL

Kathryn Nelson-Murphy

Kathryn received a MSN from the University of Cincinnati and is board certified through the ANCC as a family nurse practitioner. She is currently completing her Doctor of Nursing Practice (DNP) from Valparaiso University and will graduate in May 2014. Her evidence-based practice (EBP) project is screening asymptomatic women for identification of cardiovascular disease (CVD) risk. Heart disease is the leading cause of death in women and 80-90% of CVD risk is related to modifiable risk factors such as hypertension, dyslipidemia, smoking, and obesity. Her scholarly interest in women’s health issues and prevention is to elicit a clinical practice change and make screening asymptomatic women for heart disease risk a standard of care in her work environment. Kathryn has nearly 40 years of experience in the field of nursing and is a member of American College of Nurse Practitioners, American Association of Nurse Practitioners, the Ohio Association of Advance Practice Nurses, and is a member of Sigma Theta Tau International. She is recognized as a national, state, and local speaker on a variety of health related topics. In addition to full time clinical practice, Kathryn is adjunct faculty for Indiana Wesleyan University and serves as a clinical preceptor for nurse practitioner students.
ACRONYM LIST

ACCF: American College of Cardiology Foundation
AGREE: appraisal of guidelines for research and evaluation
AHA: American Heart Association
APN: advanced practice nurse
ATP: adult treatment panel
BMI: body mass index
CASP: critical appraisal skills programme
CDC: Centers for Disease Control
CI: confidence interval
CMP: comprehensive metabolic panel
CNM: certified nurse midwife
CPG: clinical practice guidelines
CRF: Cardiovascular Research Foundation
CV: cardiovascular
CVD: cardiovascular disease
DBP: diastolic blood pressure
DNP: doctor of nursing practice
EBP: evidence-based practice
EMR: electronic medical record
FNP: family nurse practitioner
FRS: Framingham risk score
HDL: high density lipoprotein
HPM: health promotion model
IOM: Institute of Medicine
JBI: Joanna Briggs Institute
Appendix A: Data Collection Form

Screening Cardiovascular Risk

Name __________________________

Age __________________________

Race __________________________

Family history of heart disease in first degree relative before the age of 55  Yes or No

Smoker  Yes or No

Blood pressure ______________________

BMI ______________________________

Blood glucose ______________________

Total cholesterol ____________________

LDL ______________________________

Triglycerides _______________________ 

HDL ______________________________

FRS level of risk ____________________

Heart age __________________________

Follow up appointment  Yes or No
Appendix B: Consent form

Consent Form

Project Title: Screening Asymptomatic Women for Cardiovascular Disease Risk Factors

Evidence-based practice (EBP) project manager: Kathryn Nelson, Board Certified Family Nurse Practitioner, Lifestyles Centers for Women, DNP student Valparaiso University

Procedure: The purpose of the EBP project is early identification of cardiovascular risk factors in asymptomatic women. The EBP project manager/DNP student will obtain demographic data, lifestyle history, clinical measurements of blood pressure, height and weight, BMI, and laboratory measurements for blood glucose and cholesterol panel. The obtained data will be analyzed using the Framingham Risk Score model for stratification of cardiovascular disease risk. Data collection will take place over a 12 week period. Women who have identified risk will be notified to make a follow up appointment with their healthcare provider to discuss the results of the screening.

Risks: A physical potential risk may be related to the venipuncture for laboratory testing. Potential risks may include discomfort at the puncture site, bleeding, or bruising. Potential psychological risks may include psychological distress with cardiovascular risk identification.

Benefits: Participants in the project will be assessed for their individual risk for cardiovascular disease. By early risk identification and stratification, women can focus on modifiable risk factors that may prevent or delay progression to cardiovascular disease. Preventing cardiovascular disease will maintain health and decrease health care costs. The objective is to improve health and health outcomes.

Voluntary participation: I understand that participating in this EBP project is my choice and I am free to withdraw at any time.

Questions: If I have any questions about participating in this EBP project now or in the future, Kathryn Nelson, FNP can be contacted at 937-277-8588. If I have any questions or concerns regarding my rights as a participant, Dr. Brandt, Chair of the Institutional Review Board at Valparaiso University can be contacted at 219-464-5289 or my academic advisor Dr. Kristen Mauk at 219-464-5289.

Confidentiality: Although the answers I provide and the testing I consent to may be used and reported by the EBP project manager, my name and other identifiable information will be kept strictly confidential.

Consent to participate: I have read or have had read to me all of the above information about this project, the procedure, possible risks, potential benefits to me, and I understand them. All of my questions have been answered and I freely give my consent and agree to participate in this project.

Participant signature ___________________________ Date _____________

EBP project manager signature ___________________________ Date _____________
Appendix C: Thank you letter for normal results

Dear Jane Doe,

Heart disease is the number 1 killer among women. There, we said it and we’ll continue to say it because women need to know their risk factors.

You’ve taken a very important step. Thank you for participating in our Heart Health Risk Screening – heart disease doesn’t play favorites. You are being proactive with your heart health – and when it comes to preventing and treating heart disease, it’s all about early detection.

Enclosed you will find two risk result explanations – both based on the Framingham Heart Model. The first looks at your risk factors through the combination of blood pressure and lab results, the second looks at your risk factors through the combination of blood pressure and BMI (Body Mass Index).

Note that the results will indicate your ten year risk of having a heart attack as well as your heart age based on your results.

We are really happy to tell you everything looks great! Please continue doing what you are doing to maintain a healthy heart. Eating healthy and exercising are the keystones of a healthy heart – take care of your heart and your heart will take care of you for years to come.

Enclosed you will find an American Heart Association’s Go Red Dress Lapel Pin. Adorn any outfit with this pin so you make it your mission every day to fight heart disease in women.

Feel free to call 937-277-8988, ext. 4112, and speak to our nurse with any questions. We’ll see you next year at your yearly appointment.

Stay Healthy,

Kathryn A. Nelson, MSN, FNP-BC
Appendix D: Thank you letter for abnormal results requiring follow up appointment

Dear Jane Doe,

Heart disease is the number 1 killer among women. There, we said it and we’ll continue to say it because women need to know their risk factors.

You’ve taken a very important step. Thank you for participating in our Heart Health Risk Screening – heart disease doesn’t play favorites. You are being proactive with your heart health – and when it comes to preventing and treating heart disease, it’s all about early detection.

Enclosed you will find two risk result explanations – both based on the Framingham Heart Model. The first looks at your risk factors through the combination of blood pressure and lab results, the second looks at your risk factors through the combination of blood pressure and BMI (Body Mass Index).

Note that the results will indicate your ten year risk of having a heart attack as well as your heart age based on your results.

Now that you’ve taken this step, there are a few things we feel should be discussed further regarding your screening. Please make a follow up appointment with your primary care physician or feel free to make your appointment with me. As mentioned you are being proactive, now there are further steps you can take to protect your heart health.

Enclosed you will find an American Heart Association’s Go Red Dress Lapel Pin. Adorn any outfit with this pin so you make it your mission every day to fight heart disease in women.

Feel free to call 937-277-8988, ext. 4112, and speak to our nurse with any questions and to make your follow up appointment. I look forward to seeing you soon.

Stay Healthy,

Kathryn A. Nelson, MSN, FNP-BC
Appendix E: Thank you letter, abnormal BMI

Dear Jane Doe,

Heart disease is the number 1 killer among women. There, we said it and we’ll continue to say it because women need to know their risk factors.

You’ve taken a very important step. Thank you for participating in our Heart Health Risk Screening – heart disease doesn’t play favorites. You are being proactive with your heart health – and when it comes to preventing and treating heart disease, it’s all about early detection.

Enclosed you will find two risk result explanations – both based on the Framingham Heart Model. The first looks at your risk factors through the combination of blood pressure and lab results, the second looks at your risk factors through the combination of blood pressure and BMI (Body Mass Index).

Note that the results will indicate your ten year risk of having a heart attack as well as your heart age based on your results.

We are happy to tell you your lab results are normal. However, based on your Body Mass Index (body weight) you have an increased heart age and are at an increased risk of heart disease. Eating healthy and exercising are the keystones of a healthy heart. We recommend you address this issue and have a couple suggestions. Perhaps you could see a dietician or enroll in a comprehensive type of program such as the Premier HeartWorks program at Miami Valley Hospital (937-438-5483). You may want to schedule an appointment with your Primary Care physician or with Lifestyle for further discussion on healthy eating.

Enclosed you will find an American Heart Association’s Go Red Dress Lapel Pin. Adorn any outfit with this pin so you make it your mission every day to fight heart disease in women.

Feel free to call 937-277-8988, ext. 4112, and speak to our nurse with any questions. We’ll see you next year at your yearly appointment.

Stay Healthy,

Kathryn A. Nelson, MSN, FNP-BC
Appendix F: Framingham risk score results based on laboratory testing

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>male (m) or female (f)</td>
<td>f</td>
</tr>
<tr>
<td>Age</td>
<td>years</td>
<td>38</td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td>mmHg</td>
<td>148.0</td>
</tr>
<tr>
<td>Treatment for Hypertension</td>
<td>yes (y) or no (n)</td>
<td>n</td>
</tr>
<tr>
<td>Smoking</td>
<td>yes (y) or no (n)</td>
<td>y</td>
</tr>
<tr>
<td>Diabetes</td>
<td>yes (y) or no (n)</td>
<td>n</td>
</tr>
<tr>
<td>HDL</td>
<td>mg/dL</td>
<td>36</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>mg/dL</td>
<td>212</td>
</tr>
</tbody>
</table>

**Your 10-Year Risk**

(Other print products, use a point-based system to calculate a risk score that approximates the equation-based one.)

Your 10-Year Risk: 8.4%

**Your Heart/Vascular Age**

68
### General CVD Risk Prediction

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>male (m) or female/female (f)</td>
</tr>
<tr>
<td>Age</td>
<td>years 38</td>
</tr>
<tr>
<td>Systolic Blood Pressure</td>
<td>mmHg 148.0</td>
</tr>
<tr>
<td>Treatment for Hypertension</td>
<td>yes (y) or no (n) n</td>
</tr>
<tr>
<td>Smoking</td>
<td>yes (y) or no (n) y</td>
</tr>
<tr>
<td>Diabetes</td>
<td>yes (y) or no (n) n</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>kg/m² 38.86</td>
</tr>
</tbody>
</table>

#### Your 10-Year Risk
(The risk score shown is derived on the basis of an equation. Other print products, use a point-based system to calculate a risk score that approximates the equation-based one.)

7.8%

#### Your Heart/Vascular Age

63