Atherosclerotic Cardiovascular Disease Screening in the Primary Care Setting

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Abstract

Problem: Cardiovascular disease (CVD) and associated atherosclerosis cardiovascular disease (ASCVD) is the leading cause of death for all people residing in the United States. Early detection of CVD through formal screenings during primary care visits is lacking despite being one the best ways to decrease associated mortality and morbidity. The purpose of this quality-improvement (QI) project was to implement an evidence-based ASCVD screening tool in a primary care office, to improve use of an ASCVD screening tool to ensure detection and treatment of ASCVD.

Methods: A quantitative design method utilizing a retrospective chart review to evaluate changes in provider documentation of ASCVD screenings and the patient's associated risk scores. A statistical analysis using the Chi-square test was conducted to examine the potential influence of the atherosclerotic cardiovascular disease (ASCVD) tool outcomes on healthcare providers' treatment plans and patient education.

Results: Providers completed ASCVD screenings and documented risk scores on patients who met criteria in 100% of cases after implementation and in 0% of the cases prior to implementation. A Chi-square analysis revealed significant relationships between the patient's risk category and tool usefulness based on a $p < 0.001$. Furthermore, the results revealed statistically significant associations between the usefulness of the ASCVD tool and the extent of patient education provided by healthcare providers, with a p-value of less than 0.001.

Conclusion: The ASCVD program increased the provider's screening and documentation of ASCVD risk. This allows the providers to develop an individualized, data-driven, evidence-based care plan for patients at risk for ASCVD events.

Keywords: *cardiovascular disease; ascvd; primary care; screening tool; heart attack, stroke; provider education; clinical decisions; quality improvement; risk factors; prevention*

Atherosclerotic Cardiovascular Disease Screening in the Primary Care Setting

Cardiovascular disease (CVD) has been identified as a leading cause of death in the US (Naghavi et al., 2017). The U.S. Preventative Services Task Force (USPSTF) recommends primary care providers assess for atherosclerotic cardiovascular disease (ASCVD) risk for patients between the ages of 40-75 (Gerteis & Branch, 2022). Screening for cardiovascular disease is an important part of primary care for adults and can help to identify potential risks of serious health events later in life. Cardiovascular disease screenings will reveal risk factors that need to be addressed by the individual and their healthcare team. Early detection of these risk factors, especially in an asymptomatic person, can help reduce the occurrence of early mortality (Lowres et al., 2013; Saab et al., 2009).

Primary care practitioners should have the tools to provide a thorough assessment of a patient's ASCVD risk as this type of preventative screening is the foundation of primary care. Patients should be encouraged to follow a lifestyle that reduces ASCVD risk. However, as primary care providers combine these personal efforts with the individual's 10-year absolute ASCVD risk, it allows for maximization of possible benefits and minimization of possible harm (Arnett, et al., 2019). The US Preventative Services Task Force recommends primary care screening tools such as the Pooled Cohort Equations or the Framingham Risk Score to detect CVD risk (US Preventative Task Force, 2018). There is little evidence in the literature regarding the adherence and formalized usage of these tools in the primary care setting. Despite having screening tools available, CVD detection and diagnosis are still discovered late and often only after irreversible damage has been done (Zwartkruis, et al., 2020).

Purpose

The primary aim of this project was to enhance the overall count of formal ASCVD screenings conducted in a primary care setting, with the aim of identifying patients who are at a higher risk of developing ASCVD. This was achieved by implementing a permanent ASCVD screening tool at a primary care facility located in the Piedmont Triad region of North Carolina.

Review of Current Evidence

ASCVD Burden

According to the American Heart Association (AHA), the presence of cardiovascular disease can refer to several conditions such as heart disease, heart attack, stroke, heart failure, arrhythmias, and heart valve problems (Arnett, et al., 2019). In the US, cardiovascular disease has been a leading cause of death for decades, and is attributed to one in four deaths in the US (Moss et al., 2019). Despite advances in technology and research, cardiovascular disease mortality is no longer improving which is creating increased individual, systemic, and national burdens (Roth et al., 2018). Cardiovascular disease is a significant contributor to altered disability-adjusted life years (DALY), defined as the sum of productive years lost due to disability or premature mortality (WHO, 2021). Ischemic heart disease has been identified as a leading cause of CVD DALY nationwide, second only to ischemic stroke (Roth et al., 2018). These major disease processes are driven by cardiovascular disease and compound together to further disable our healthcare system and prevent individuals from living happy, healthy lives.

ASCVD Risk Factors

Research has recognized a variety of risk factors that contribute to the cardiovascular burden in this country. These risk factors include; diet, blood pressure, body mass index, cholesterol level, glucose level, tobacco use, and physical activity (Roth et al., 2018; Banks, et al., 2020; Arnett, et al., 2019; Topel, et al., 2018; US Preventative Task Force, 2018). There are many notable disparities in the burden of CVD among different states in this country, suggesting modifiable risk and identification of this risk as large contributing factors (Roth et al., 2018). Being aware of these risk factors allows providers to not only mitigate the effect of cardiovascular disease but also implement evidence-based tools to detect CVD risk before it develops

ASCVD Screening Tool Use by Provider

Current literature is saturated with evidence regarding the risks of cardiovascular disease, and the cost of these events both to the patient and our healthcare system in the United States as a whole (Cowper, et al., 2019; Girotra et al., 2019). Adequate evidence also exists regarding the recommendations to screen

for ASCVD in the primary care setting (US Preventative Task Force, 2018; Arnett, et al., 2019; Rosenzweig at al, 2019). However, evidence suggests the frequency and regularity of use of these screening tools in primary care clinics across the US is not high (Brown et al., 2017; Shillinglaw et al., 2012; Zwartkruis, et al., 2020). The lack of these tools may be leading to missed diagnoses and preventative medications. Evidence suggests that as much as 50% of people who have a first stroke or transient ischemic attack were not on preventative medications that could have reduced their ASCVD risk dramatically (Turner, et al., 2016). Primary care facilities are tasked with the identification and treatment of acute, chronic, and developing illnesses. Primary prevention of ASCVD should be prioritized in the primary care setting as there is a high rate of fatality, disability, and high expense associated with initial ASCVD events (Zwartkruis, et al., 2020; Toth, et al., 2018; Pearson et al., 2002). Since ASCVD is accepted as being largely preventable when modifiable risk factors are addressed providers must utilize the best tools to help aid in detection (Banks, et al., 2020; Wong, et al., 2020; Zhang, et al., 2017; Yusuf, et al., 2004). Calculating ASCVD risk allows for improved prediction of adverse events and allows the provider to better identify those who may benefit greatly from lifestyle modifications or preventative medications (Patsouras, et al., 2019; Sheridan & Crespo, 2008). Primary care providers that incorporated a cardiovascular disease prevention guideline in their everyday practice reported improved identification of CVD risk and increased guidelines-based prescribing of medications such as statins for high-risk patients (Bonner et al., 2019). Patients who received their personal ASCVD risk information may have better long-term outcomes when combined with education and risk-based counseling (Sheridan, et al., 2010). These patients have been shown to have a better understanding of the preventative medications and have a desire to increase their adherence to taking them after receiving the education and counseling that resulted from the ASCVD screening tools (Sheridan, et al., 2010).

ASCVD Screening Tools

There are a variety of ASCVD screening tools available for medical providers to choose from. One of the most widely recognized tools is recommended by the American Heart Association (AHA) and is based on research conducted jointly by the AHA and the AMerian College of Cardiology (ACC) called

the pooled cohort equations (PCE). The PCE research evolved into a tool used to estimate the 10-year risk of ASCVD in adults aged 40-75 with o prior history of an ASCVD event (Arnett, et al., 2019). The tool has since been updated to improve accuracy among all races and sex subgroups and remains the most recommended screening tool to anticipate and prevent adverse ASCVD events (Nanna, et al., 2020; Durairaj, et. al., 2020; Damen, et al., 2019). The PCE ASCVD tool has an additional benefit over other screening tools as it has been shown to better estimate risk for the African American population, especially making it superior for use in a diverse community (Topel et al., 2018). The PCE ASCVD risk assessment tool (see Appendix 1) consists of ten factors that are predictive of the development of cardiovascular disease. These ten factors are age, sex, race, systolic blood pressure, diastolic blood pressure, total cholesterol, HDL cholesterol, history of diabetes, current or former smoker, and is the patient on hypertension treatment. When these items are added to the tool a 10-year ASCVD risk is produced. The output from the tool categorizes patients into four categories which are: low risk (<5%), borderline risk (5-7.4%), intermediate risk (7.5-19.9%), and high risk (≥20%) (American College of Cardiology, 2022).

Alternative tools that are widely recognized and available for use include the Framingham Risk Score (FRS), and the Systematic Coronary Risk Evaluation Score (SCORE). The FRS is based off the Framingham Heart Study in which data collection began in 1948 but was not developed until 1998 with the intent of assessing the risk of 10-year coronary heart disease for patients with a combination of risk factors. This risk calculator was modified in 2002 by the Third Adult Treatment Panel (ATP-III) which eliminated diabetes from its algorithm. The tool was further revised in 2008 to include what the other two versions were lacking (stroke, transient ischemic attack, claudication, and heart failure) when considering the possible outcomes or endpoints involved in predicting ASCVD risk (D'Agostino, et al., 2008). This screening tool however is less often utilized as the population studied to develop the tool was largely derived from a majority white male population and overestimates risk in most populations (Damen, et al., 2019; Topel et al., 2018).

The SCORE tool is the recommended cardiovascular disease prevention tool in the 2007

European Society of Cardiology guidelines (Graham, et al., 2007). This tool is based on data of over 200,000 patients in 12 European countries and estimates the 10-year risk of any first fatal atherosclerotic event (Graham, et al., 2007). The endpoint to this tool is CVD death and includes factors such as stroke, arrhythmias, heart failure, or ruptured aneurysm and has been utilized and assessed for use in various populations (Graham, et al., 2007; Durairaj, et al., 2020). Although the SCORE tool is reliable and clinically relevant it is still outperformed by the PCE ASCVD tool when assessing the risk of certain populations such as women which many tools underestimate (Motamed, et al., 2021).

All of these screening tools have proven reliability and provide benefits when used in the primary care setting. However, these tools may be limited in scope and not as accurate as the PCE when assessing a wide range of ages and patient demographics such as the patient population in a typical primary care office in the US (Wilson, 2022). Based on the performance, evidence-based updates, lifetime risk assessment, use as a benchmark, and inclusivity the PCE ASCVD screening tool is the best choice for use in the primary care setting and has been chosen for the implementation of this project.

Conceptual Framework

The behavior change that occurs among primary care providers is likely to follow the Transtheoretical Model and the Stages of Change created by James O. Prochaska (Prochaska & Velicer, 1997). This model was introduced in 1997 and has been a prominent model when attempting to describe an individual's readiness to implement steps towards better health. This model is often referred to as the "stages of change" model since there are five major stages a person experiences when health behavior changes occur which are pre-contemplation, contemplation, action, maintenance, and termination (Prochaska, Redding, & Evers, 2015).

The provider is focused on the best outcomes for their patients and may need time to adopt a new screening tool such as the ACSVD PCE tool. Many providers may not be as open to a practice change as others. They may stay in the pre-contemplation stage, as they want to investigate primary literature or evidence-based practice before considering the change. The transtheoretical model will help guide the providers along the stages of change as they seek a systems change in their practice.

Methods

Outcome Measures

The primary outcome measures for this QI project was to increase the number of ASCVD screenings charted in the electronic health record (EHR) for patients identified at risk for ASCVD. The secondary outcome will include changes to the treatment plan as a direct result of utilizing the screening tool, as well as education provided to the patient.

Population and Setting

The primary population for intervention was a nonrandom sample of one primary care practitioner who was designated to receive the project intervention strategies. This practitioner was located in a primary care office in the Piedmont Triad area of North Carolina. The inclusion criteria for the intervention were being a medical practitioner employed in a primary care office providing direct patient care to patients in the office. The exclusion criteria included practitioners who were not in a primary care office serving as primary care practitioners. Inclusion criteria for the ASCVD tool to be used were patients must not have an existing diagnosis of ASCVD. This includes diagnoses of stroke, transient ischemic attack (TIA), documented coronary artery disease (CAD) with stable angina, acute coronary syndromes (ACS), coronary or other arterial revascularization, peripheral vascular disease with or without claudication, and aortic aneurysm (American College of Cardiology, 2022). Exlcusion criteria for use of ASCVD on patients included a documented history of any the previously mentioned inclusion criteria.

Design

This was a 3-month quasi-experimental quality improvement (QI) project that implemented a the PCE cardiovascular disease screening tool in a primary care office within the Piedmont Triad of North Carolina to evaluate for the primary and secondary outcomes.

Ethical Considerations

Approval from the Institutional Review Board (IRB) of Lenoir-Rhyne University in Hickory, NC was obtained prior to project implementation. No patient identifying information was obtained and strict

adherence to the Health Insurance Portability and Accountability (HIPAA) guidelines were met in order to protect patient privacy.

Intervention and Data Collection

An in-person meeting was held with primary care providers who met the inclusion criteria. This meeting included an in-depth explanation of the 10 risk factors included in the screening tool (Appendix A). The provider was given a personal copy of the screening tool to use for further discussion. A demonstration on how to utilize the associated mobile app on their personal devices and how to view and utilize the advice section were also provided. The provider was asked to use the mobile app while screening the patient and to copy the results onto the paper tool and file it away using a locked safety box. The paper tool consisted of basic patient demographics and did not identify the patient in any way. The paper tool also provided two additional questions at the end that asks the provider if the suggestions in the app persuaded their care plan for the patient (tool impactful? Yes or No) and if it was used to help educate the patient regarding their ASCVD risk (patient education? Yes or No).

To provide a comparative baseline, a retrospective chart review of patients seen at the primary care practice for three months before the project implementation was obtained. Since the ASCVD screening tool includes cholesterol levels the patients must have had a fasting lipid panel completed to be included in the retrospective analysis. These patients met the inclusion criteria, had no previous history of ASCVD, and were 40-79 years old. Data gathered for this retrospective review are if an ASCVD risk score was charted for the patient (ASCVD score present? Yes or No)

Data Analysis

A retrospective chart review was conducted to determine the amount of formal ASCVD screenings performed at the clinic prior to project implementation. Results of this chart review revealed no formal screenings completed or documented within patient charts who would have met the criteria for ASCVD risk assessment. After project implementation, data analysis revealed all patients who met the criteria for an ASCVD risk assessment had documented risk scores in their EHR. This satisfies the primary outcome measure and indicates that provider adherence to completing a formal ASCVD

screening tool after project implementation was 100%.

Demographics

Descriptive statistics for the patients who received the ASCVD screening tool were described by the following factors included in the screening tool. The population consisted of a total of 56 patients with 51.8% male and 48.2% female with an average age of 55 years. This population consisted of a sample that was majority African American (83.9%) and minority Caucasian (16.1%). This population was closely split among patients who had diabetes (48.2%) and those who did not (51.8%). The tool also provided information regarding current medication therapy for these patients. Descriptive statistics revealed that the majority of the population was not currently on statin therapy (66.1%), or aspirin therapy (80.4%). However, the majority were already on hypertension treatment (60.7%) (Table 1). Table 2 below describes the population with regards to the ASCVD risk score.

Table 1

Patient Population Demographics

Variable	*n*	*%*
Sex		
F	29	51.79
M	27	48.21
Race		
W	9	16.07
AA	47	83.93
Smoker		
Current	8	14.29
Former	7	12.50
Never	41	73.21
HTN treatment		
Y	34	60.71
N	22	39.29
Statin		
Y	19	33.93
N	37	66.07
Aspirin		
Y	11	19.64
N	45	80.36
Diabetes		

N	29	51.79
Y	27	48.21

Note. Due to rounding errors, percentages may not equal 100%.

Table 2

Frequency of Risk Category

Variable	*n*	*%*
Risk_Category		
Borderline	9	16.07
Low	18	32.14
Intermediate	14	25.00
High	15	26.79

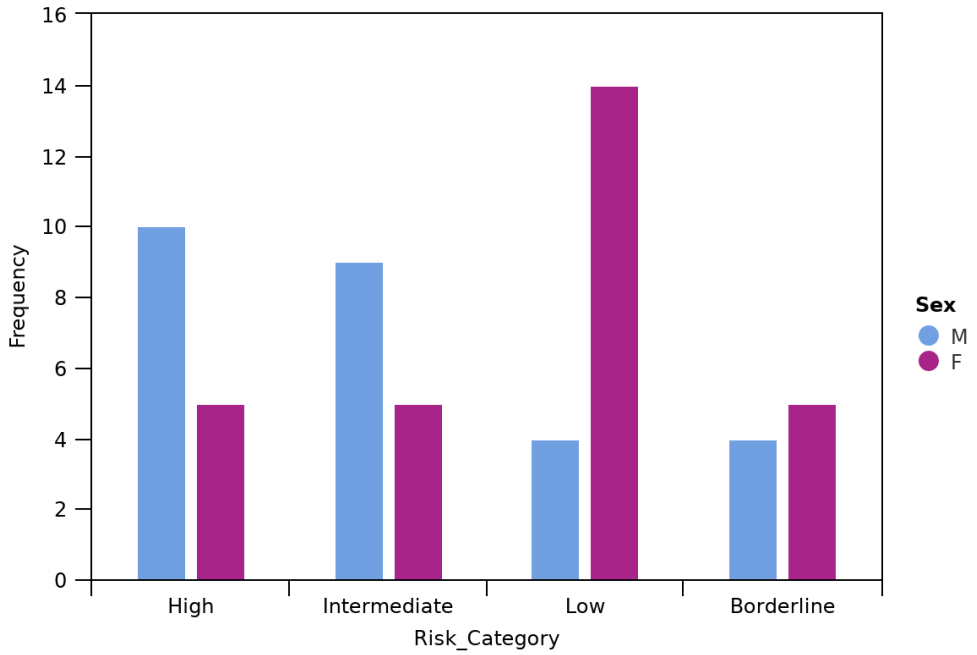
Note. Due to rounding errors, percentages may not equal 100%.

Risk Score Analysis

An additional analysis was conducted to further describe the population in relation to the risk scores. Among men in this population the most common risk score was ‘High’ at 37% but among women the most common risk score was ‘Low’ at 48.3% (Figure 1). Among patients with diabetes, the most common risk score was ‘High’ at 44.4%. For those patients already being treated with an anti-hypertensive or a statin, results varied regarding risk category. For those on hypertension treatment, the most frequently observed risk category was ‘High.’ However, for those on statin therapy the most frequently observed risk category was ‘Low.’

Figure 2

Barplot of Risk Category by Sex



Secondary Outcomes

A Chi-square Test of Independence and Fisher's exact test was conducted to analyze secondary outcomes. The Chi-square test was conducted to determine whether the ASCVD risk category and the tool's impactfulness to the patient's care plan were independent. The results of this Chi-square analysis were significant based on an alpha value of .05, $\chi^2(3) = 27.38$, $p < .001$, suggesting that risk category and tool impactful to treatment plan are related (see table 3).

Table 3

Screening tool impact by risk category

	Tool Impactful				
Risk Category	Y	N	χ^2	*df*	*p*
High	15[9.11]	0[5.89]	27.38	3	< .001
Intermediate	12[8.50]	2[5.50]			
Low	4[10.93]	14[7.07]			
Borderline	3[5.46]	6[3.54]			

Note. Values formatted as Observed[Expected].

A Fisher's exact test was conducted to determine whether the ASCVD risk category and education provided to the patient were independent.. The results of the Fisher's exact analysis were also significant based on an alpha value of .05, $p < .001$, suggesting that 'Tool impactful' and 'Education to patient' are related to one another. Table 4 below provides the results of the Fisher's exact analysis.

Table 4

Screening tool impact on patient education

	Tool_impactful		
Education_to_patient	Y	N	*p*
Y	34[29.75]	15[19.25]	< .001
N	0[4.25]	7[2.75]	

Note. Values formatted as Observed[Expected].

Discussion

The implementation of a cardiovascular disease screening tool was successful in meeting the project's primary outcome of increased ASCVD screenings and documentation of results within the family care practice. All patients (n=56; 100%) who met the criteria for screening had a risk assessment and associated risk score determined by the provider. All of these patients had their risk scores documented in the clinic's EHR for reference at future visits and among other medical teams following the patient.

The PCE ASCVD screening tool (American College of Cardiology, 2022) provides recommendations to the provider that ultimately decreased their patient's ASCVD risk score. The utility of this feature was analyzed as secondary outcomes for this project and was found to be useful and impactful for the patient's care. For those patients who scored in the high risk category the provider utilized the tools recommendations 100% of the time. Furthermore, as the patient's care plans were impacted by the use of this tool the provider also educated the patient's 100% of the time about the new changes to their medication regimin or lifestyle change needed based on the recommendations. Higher amounts of education and knowledge retention among patients at risk of cardiovascular disease has been shown to increase mortality and hospital admissions (Kanejima et al., 2022).

Limitations

One limitation of this project was the small sample size for the primary outcome. There was only one provider within the practice who implemented the PCE screening tool, as one provider left before the implementation phase. Another limitation was how the sample population was also limited in size.

Conclusions

Cardiovascular disease often goes undetected for many years without a patient or their medical provider knowing. As the risks associated with cardiovascular disease are great, the medical community can be doing more to help detect and diagnose cardiovascular disease early while the symptoms aren't evident or are mild. Early CVD screenings performed in a primary care setting improves detection and early treatment of leading cause of death in the US (Zwartkruis, et al., 2020). One of the heart disease and stroke objectives in Healthy People 2030 is to increase the proportion of adults whose risk for atherosclerotic cardiovascular disease was assessed (Healthy People, 2023). At this projet site, since the implementation of the ASCVD screening tool, all patients identified as eiligible for cardiovascular risk screening were screened, assigned a risk score, and treated using the best evidence-based recommendations. This allowed the provider to feel empowered when making decisions for their patients, and to develop a successful plan of care to decrease the risk of having poor health outcomes from CVD.

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Appendix A

ASCVD Screening Tool

1. **Current Age (must be 40-79)**

   _____
2. **Sex**

   ☐ Male ☐ Female
3. **Race**

   ☐ White ☐ African American ☐ American Indian/Alaska Native ☐ Asian ☐ Hispanic/Latino ☐ Native Hawaiian/Other Pacific Islander ☐ Not Listed

   _____
4. **Blood Pressure**

   _____
5. **Total Cholesterol _____HDL Cholesterol _____LDL Cholesterol_____**
6. **History of Diabetes**

   ☐ Yes ☐ No
7. **Smoker?**

   ☐ Current ☐ Former ☐ Never
8. **On Hypertension Treatment?**

   ☐ Yes ☐ No
9. **On a Statin?**

   ☐ Yes ☐ No
10. **On Aspirin Therapy?**

    ☐ Yes ☐ No

Patient Risk Category ☐ Low ☐ Borderline ☐ Intermediate ☐ High
Did this tool influence the patient's treatment plan? ☐ Yes ☐ No
What therapy intervention was chosen?