INCREASING KNOWLEDGE OF ABDOMINAL AORTIC ANEURYSM SCREENING CRITERIA AND INTRODUCTION OF A SCREENING TOOL TO IMPROVE AAA SCREENING IN A FAMILY PRACTICE CLINIC: AN EVIDENCE-BASED PRACTICE PROJECT

A Scholarly Project

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

Jennifer Elizabeth Rank

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Lynchburg, VA

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Scholarly Project Chair Approval:

Dr. Vickie Moore, RN, DNP, FNP-C Date

ABSTRACT

Abdominal aortic aneurysms (AAA) are diagnosed most frequently in male patients of advanced age with a current or past smoking history. Screening for AAA by ultrasonography is effective at detecting clinically significant aneurysms and reduces AAA-associated and all-cause mortality at short-term and long-term follow-up. The criteria for screening include male gender, age 65 to 75, and a current or past smoking status. Additional criteria that may be considered include family history of AAA in a first-degree relative and/or a personal history of hypertension or atherosclerotic cardiovascular disease. Based on review of the evidence, the project leader designed an evidence-based practice project at a primary care clinic using the Iowa Model. The project identified three measurable outcomes: increased knowledge of AAA screening among providers and clinical staff, increased number of documented AAA screening forms filled out, and increased in the number of patients who have completed an AAA screening by ultrasonography. An educational intervention, along with a pretest and posttest, was administered to participants. A screening tool was developed and provided to clinical staff to assist with documentation of eligible patients. Retrospective and prospective chart reviews were conducted one-month pre- and post-educational intervention. The educational intervention resulted in a 54.5% average increase in clinical staff scores on the posttest compared to the pretest. AAA screenings improved during the project from 0% to 54.5% of eligible patients. Screening by ultrasonography did not increase during the project. The scholarly project is informative of the utility of educational interventions along with screening tools for improving adherence to evidence-based guidelines surrounding AAA screening in the primary care setting.

Keywords: Abdominal aortic aneurysm screening, AAA screening, educational interventions, screening tools

Dedication

This manuscript is dedicated to Daniel Harb Rank.

Acknowledgments

I would like to acknowledge my family and Nate, who provided unwavering support throughout the Doctor of Nursing Practice program. I am thankful for their understanding and encouragement during long hours of studying and writing. My family has made it possible for me to fulfill my educational goals.

I would like to extend my gratitude to the Liberty University School of Nursing. I had the privilege of being educated by an exceptionally talented and dedicated group of professors in the Doctor of Nursing Practice program. My education at Liberty has prepared me to be a servant leader and to consider how I may improve outcomes for those I serve.

I would also like to thank my chair, Dr. Vickie Moore, who advised me throughout the process of developing and implementing my evidence-based practice project. I am thankful for her dedication to my project and encouragement along the way. Her support was instrumental in finishing this long and difficult journey.

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List of Abbreviations

Abdominal aortic aneurysm (AAA)

Atherosclerotic cardiovascular disease (ASCVD)

Evidence-based practice project (EBPP)

Institutional Review Board (IRB)

Statistical Package for Social Sciences (SPSS)

United States Preventive Services Task Force (USPSTF)

SECTION ONE: INTRODUCTION

The Centers for Disease Control and Prevention (2018) reports that ruptured abdominal aortic aneurysms (AAAs) represent the 15th leading cause of death in America for male patients age 65 to 74. AAAs are considered a silent killer, as most patients with AAAs remain asymptomatic until rupture occurs. The risk factors most strongly correlated to AAA include male gender, advanced age, current or past history of smoking, family history of AAA, and personal or family history of cardiovascular disease (Claridge, Arnold, Morrison, & van Rij, 2017; Cousins et al., 2018; Howard et al., 2015; Ye, Bailey, Austin, & Kullo, 2016).

The United States Preventive Services Task Force (USPSTF, 2019) provides a Grade B recommendation that clinicians order a one-time screening ultrasound to detect AAA for all male patients age 65 to 75 who have ever smoked. A one-time screening ultrasound for AAA is associated with a reduction in AAA-associated mortality in short and long-term follow-up, emergent repairs, and all-cause mortality up to 13 years after screening (Ali et al., 2016, 2018; Eckstein, Reeps, Zimmermann, & Söllner, 2015; Guirguis-Blake, Beil, Senger, & Whitlock, 2014; Takagi, Ando, & Umemoto, 2018).

An evidence-based practice project (EBPP) was conducted to increase the number of AAA screenings ordered in a family practice clinic. The setting of the project was a family practice clinic with three providers and four medical assistants. The primary population served at the clinic at the time of the project was middle-aged and geriatric adults. The aims and measurable outcomes of the EBPP were to increase provider knowledge of AAA screening, to increase provider documentation of AAA screenings through implementation of a screening tool, and to increase AAA screenings ordered by ultrasonography.

Background

AAAs have an estimated prevalence of 1.3% to 2.7% in men age 50 and older (Claridge et al., 2017; Cousins et al., 2018; Oliver-Williams et al., 2018). The prevalence of AAA for men age 65 and older is estimated to range from 2.7% to as high as 8.7% (Claridge et al., 2017; Cousins et al., 2018; Engelberger et al., 2017). The average growth rate of an AAA is approximately 2 millimeters each year (Claridge et al., 2017).

Ruptured AAAs are responsible for 7.2 deaths per 100,000 men age 65 to 74 (Centers for Disease Control and Prevention, 2018). AAAs are more common in males than females; the ratio of males to females with AAAs is 2.6:1 (Claridge et al., 2017). The USPSTF (2019) recommends providers order a one-time screening ultrasound to detect AAA for all male patients age 65 to 75 who have ever smoked.

Evidence demonstrates that male sex, current or previous history of smoking, and advanced age correlate with AAA development (Aune, Schlesinger, Norat, & Riboli, 2018; Corrado et al., 2016; Howard et al., 2015; Tang et al., 2016; Vänni, Hernesniemi, Turtiainen, Turtiainen, & Hakala, 2015). Additional risk factors include family history of AAA or atherosclerotic cardiovascular disease (ASCVD), as well as a personal history of hypertension or ASCVD (Jahangir et al., 2015; Jones et al., 2016; Tang et al., 2016; van de Lujtgaarden et al., 2017; Ye et al., 2016). Current smoking status has a particularly strong correlation with AAA, and when combined with male gender and advanced age, a high-risk clinical scenario for AAA development is present (Aune et al., 2018; Howard et al., 2015; Tang et al., 2016).

Ultrasonography as a method of screening has been determined to be cost effective and provides high specificity and consistency in detecting an AAA (Chiu, Ling, Tripathi, Ahmed, & Shrivastava, 2014; Engelberger et al., 2017; Liisberge, Diederichsen, & Lindholt, 2017). In

addition to the low initial cost of a screening ultrasound for detection of AAA, cost effectiveness is realized over the long term with total life-years and quality-adjusted life years gained (Glover, Kim, Sweeting, Thompson, & Buxton, 2014). A one-time AAA screening by ultrasonography is covered by insurance for eligible patients. The U.S. Centers for Medicare and Medicaid Services (2019) covers a one-time screening ultrasound to detect AAA in male patients age 65–75 who have smoked a total of 100 cigarettes or more in their lifetime.

Screening for AAA is necessary, as AAAs grow an average of 2 millimeters each year, and only 10% to 11% of patients report symptoms related to the disease process (Chandra et al., 2017; Lederle et al., 2015). The condition may remain undetected until significant and life-threatening sequelae develop, including rupture. Reparative efforts and postsurgical outcomes are complicated by several factors. Advanced age, larger aneurysm size at repair, impaired renal function, low blood pressure, blood transfusions, respiratory complications, and medical comorbidities contribute to increased mortality post-AAA repair (Briggs et al., 2018; Gokani et al., 2015; Healey, Neilson, Clark, Schanzer, & Robinson, 2016; Hicks, O'Kelly, Obeid, Locham, & Malas, 2017; Hye et al., 2019).

When an AAA is emergently repaired for symptomatic patients and patients presenting with a rupture, the 30-day and one-year survival rates are 64% and 53%, respectively (Briggs et al., 2018). An endovascular approach to AAA repair, when compared to an open approach, has reduced mortality associated with ruptured AAA; however, the patient's presenting condition and medical comorbidities compromise survival at 30 days post-repair (Healey et al., 2016). Increased mortality associated with AAA rupture at advanced ages, presenting condition, and medical comorbidities, in addition to high mortality with emergent repair, warrants increased

screening efforts to detect aneurysms at an earlier age so that surveillance and surgical planning may be initiated.

Widespread screening initiatives have demonstrated efficacy in initiating elective repair of large AAAs and reducing AAA-associated mortality (Jacomelli, Summers, Stevenson, Lees, & Earnshaw, 2016; Wanhainen et al., 2016). Despite evidence demonstrating the utility of AAA screenings and recommendations from the USPSTF, Medicare claims have demonstrated low compliance among providers for ordering the one-time screening ultrasound (Olchanski, Winn, Cohen, & Neumann, 2014). Olchanski et al. (2014) found that less than 1% of Medicare beneficiaries were screened for AAA from 2005 to 2009.

Chun et al. (2019) found that the number of AAA screenings increased dramatically from 2007 to 2016 in the Veteran's Affairs Health system. The research by Chun et al. (2019) is encouraging and demonstrates improved adherence to the guidelines. Educational initiatives are necessary to improve adherence to the guidelines regarding AAA screenings across health care systems.

Educational interventions have shown efficacy in improving provider compliance for other screening recommendations. Fallucco, Seago, Cuffe, Kraemer, and Wysocki (2015) demonstrated that an educational intervention increased provider screening, assessment, and treatment of depression in adolescents. Bryan, Estrada, Castiglioni, and Snyder (2015) provided evidence that an educational intervention was successful in improving provider knowledge of, attitude toward, and comfort in counseling women regarding evidence-based recommendations for breast cancer screening. Raz et al. (2018) asserted that primary care providers with increased knowledge of the screening recommendations for low-dose computed tomography (LDCT) have

higher rates of screening using LDCT. It is feasible that an educational intervention would facilitate improved knowledge and competence in screening patients for AAA.

Screening tools have shown efficacy in detecting various conditions commonly encountered in the primary care setting. A study by Bhana et al. (2019) demonstrated that a screening tool for common mental health disorders was effective in identifying patients with alcohol misuse, depression, and anxiety symptoms in the primary care setting. Screening tools have also shown efficacy in identifying dementia and mild cognitive impairment in patients in the primary care setting (Abd Razak et al., 2019). This EBPP relied on evidence demonstrating the effectiveness of the use of screening tools to identify patients at higher risk for AAA in order to initiate formal screening by ultrasonography.

Problem Statement

AAAs have an increased prevalence in male patients age 65–75 with a current or past history of smoking. Current guidelines support a one-time screening ultrasound for AAA in this population. However, evidence suggests that providers underutilize the screening for eligible patients, presenting a potential safety concern. AAAs are usually asymptomatic, and ruptured AAAs are correlated with high mortality rates. Screening programs are effective in detecting AAAs and lead to reduced AAA-associated mortality in short-term and long-term follow-up and reduced all-cause mortality in long-term follow-up. Increasing provider knowledge of the benefits of AAA screenings will improve patient outcomes by facilitating clinical surveillance of AAAs and repair planning to avoid ruptures, emergent repairs, and associated morbidity and mortality.

Purpose of the Project

The purpose of this EBPP was to increase the number of AAA screenings completed by providers in a primary care clinic during annual wellness or routine follow-up office visits. As such, the project had three aims. The first aim was to increase provider knowledge of the screening criteria for AAAs and insurance eligibility by conducting a brief educational intervention utilizing a PowerPoint presentation. The second aim was to increase the number of AAA screenings documented in the medical record by implementation of a clinical screening tool identifying the criteria for AAA screening. The third aim was to increase the number of AAA screenings completed by ultrasonography.

Clinical Question

Among health care providers and clinical staff in a primary care setting, will an educational intervention and introduction of a screening tool increase knowledge of AAA screening and the number of AAA screenings documented and ordered for eligible patient populations when compared to no educational intervention or screening tool?

SECTION TWO: LITERATURE REVIEW

Search Strategy

The literature review was conducted by searching PubMed and Liberty University's Jerry Falwell Library. Terms utilized to generate literature included *screening and abdominal aortic aneurysm, ultrasound and abdominal aortic aneurysm, risk factors and abdominal aortic aneurysm, epidemiology and abdominal aortic aneurysm*, *mortality and abdominal aortic aneurysm,* and *outcomes and abdominal aortic aneurysm repair, educational interventions and screening and primary care, screening tool and providers and primary care.* The search of the Liberty University Jerry Falwell Library was restricted to scholarly and peer-reviewed articles in

the discipline of medicine with human subjects published in the last five years. The number of articles yielded from the search terms was 9,024.

The search of PubMed was restricted to classical articles or clinical studies with human subjects published in the last five years. The PubMed search yielded 1,008 articles. The project leader then conducted a hand search by viewing article titles for applicability to the project. The project leader then reviewed abstracts of articles with applicable titles to ascertain whether the research was original and to determine the type of study and applicability to project implementation. Over 100 articles were reviewed in full, and 40 studies were utilized for the project.

Critical Appraisal of the Evidence

In appraising the evidence located for utilization in this EBPP, the project leader assigned a level of evidence to each article according to Melynk's hierarchy and organized the evidence into a matrix (University of Michigan, 2019). The project leader noted that there were five Level 1 systematic reviews, 31 Level 4 cohort or case control studies, two Level 5 systematic review, and two Level 6 descriptive studies. The literature matrix may be found in Appendix A.

Evidence Synthesis

Through the literature review and critical appraisal of the evidence, five themes emerged as guiding factors for implementation of an EBPP to increase AAA screening in the primary care setting. Themes central to this project included improved patient outcomes resultant from AAA screening, patient criteria for AAA screening, AAA screening method, the effectiveness of educational interventions in increasing provider adherence to evidence-based practice, and screening tools facilitating screening initiatives supportive of evidence-based practice.

Patient outcomes and screening for AAA. The evidence demonstrated that a one-time ultrasound to screen for AAA leads to a reduction in AAA-associated mortality and all-cause mortality at short-term follow-up at three to five years (Ali et al., 2016, 2018; Eckstein et al., 2015). Reduction in AAA-associated mortality and all-cause mortality was observed at long-term follow-up of 13 to 15 years (Ali et al., 2018; Eckstein et al., 2015; Guirguis-Blake et al., 2014; Takagi et al., 2018). AAA screening is further associated with reduced ruptures and emergent repairs as well as an increase in elective surgical interventions, to include endovascular repairs, among screened populations (Eckstein et al., 2015; Guirguis-Blake et al., 2014; Jacomelli et al., 2016; Wanhainen et al., 2016).

Criteria for AAA screening. Risk factors for AAA supported by the literature include male gender, advanced age, and current smoking status or history of smoking (Aune et al., 2018; Claridge et al., 2017; Corrado et al., 2016; Howard et al., 2015; Jahangir et al., 2015; Li, Zhang, Li, & Zhai, 2018; Tang et al., 2016). A history of cardiovascular disease, including hypertension and ASCVD, was also determined to be associated with AAA development (Corrado et al., 2016; Jahangir et al., 2015; Jones et al., 2016).

A family history of AAA was also found to have a strong correlation to AAA development (van de Luijtgaarden et al., 2017; Vanni et al., 2015). Additionally, a family history of AAA or ASCVD was correlated with AAA development (Ye et al., 2016). The literature demonstrated a prevalence rate for AAA among males to be estimated at 1.3%–8.7%; the prevalence is higher in men of advanced age (Cousins et al., 2018; Claridge et al., 2017; Engelberger et al., 2017).

Complications of AAA, including rupture, are more prevalent in patients of advanced age, are current smokers, or are female (Gokani et al., 2015). Large aneurysm size is also

associated with rupture (Hye et al., 2019). The mortality rate associated with rupture is approximately 50% to 51% and is higher among women (Aber et al., 2018; Kühnl et al., 2017; Reite, Søreide, Ellingsen, Kvaløy, & Vetrhus, 2015). Mortality associated with AAA repair is higher among patients of advanced age and with medical comorbidities (Healey et al., 2016; Hicks et al., 2017). Unfortunately, these circumstances are becoming more common, which prevents vast improvement in mortality for patients requiring emergent repair (Aslam, Fisher, Thoo, Neale, & Thomas, 2017).

Screening using ultrasonography. Screening for AAA using ultrasonography provides high repeatability and reproducibility in addition to high specificity (Chiu et al., 2014; Liisberg et al., 2017). The sensitivity of ultrasonography in screening for AAA is much lower than computed tomography (Liisberg et al., 2017). However, AAA screening by ultrasonography is affordable for widespread use in screening programs and presents long-term, incremental cost effectiveness in terms of total life years gained and quality adjusted life years gained (Engelberger et al., 2017; Glover et al., 2014; Vanni et al., 2015). Unfortunately, provider utilization of the guidelines for screening patients who are Medicare beneficiaries for AAA has been demonstrated to be very low (Olchanski et al., 2014). Guideline adherence has improved in recent years in large health systems such as the VA hospital (Chun et al., 2019).

The literature examining quality of life for patients who have undergone AAA screening is contradictory. One study indicates that patients who undergo AAA screening experience a reduction in quality of life in the first 12 months after screening but that quality of life improves after 12 months post-screening (Bath, Sidloff, Saratzis, Bown, & UK Aneurysm Growth Study Investigators 2018). Another study indicates patients do not experience any reduction in quality of life after AAA screening or during AAA surveillance (Tomee et al., 2018).

Educational interventions to improve adherence to evidence-based practice. Educational interventions are effective at increasing provider and clinical staff knowledge of evidence-based practice guidelines surrounding lung cancer screening, depression screening, and breast cancer screening (Bryan et al., 2015; Fallucco et al., 2015; Raz et al., 2018). This is demonstrated in three studies that illustrate a correlation between increased knowledge following an educational intervention of screening guidelines and subsequent utilization of the guidelines or increased willingness to utilize evidence-based guidelines (Bryan et al., 2015; Fallucco et al., 2015; Raz et al., 2018). While the study topics did not include AAA screening, they involved other evidence-based screening recommendations published by the USPSTF.

Screening tools to improve provider adherence to evidence-based practice. Screening tools facilitate the utilization of evidence-based screening guidelines in the primary care setting. Screening tools have shown efficacy in detecting alcohol misuse, depression, and anxiety, in addition to dementia and mild cognitive impairment, in patients in the primary care setting (Abd Razak et al., 2019; Bhana et al., 2019). Screening tools in the primary care setting may be evaluated by sensitivity and feasibility for high yield and ease of use (Abd Razak et al., 2019).

Conceptual Framework

The conceptual framework used for this EBPP was the Iowa Model of Evidence-Based Practice conceptualized by the Iowa Model Collaborative (2017). The Iowa Model of Evidence-Based Practice is a conceptual framework that encompasses seven steps. The seven steps of the Iowa Model include identifying a clinical trigger, forming a team, gathering relevant research, appraising the evidence, piloting the change in practice, and disseminating the results (Iowa Model Collaborative, 2017). Permission was granted to the project leader to utilize the Iowa Model and is found in Appendix B.

Clinical trigger. In utilizing the Iowa Model, the team leader identified a clinical trigger. The clinical trigger was the inconsistent application of the guidelines for AAA screening. The team leader identified this clinical trigger after comparing the primary care's standard screening procedures with evidence-based screening guidelines provided by the USPSTF (2019). After identifying the clinical trigger, the project leader evaluated whether the trigger was a priority for the organization and found that preventative screenings that promote safety and adherence to evidence-based practice and improved patient outcomes were a priority for the organization.

Forming a team. The next step of the Iowa Model is to form a team. A team was formed and consisted of two nurse practitioners and four medical assistants in addition to the project chair, who collected and appraised relevant literature and planned the project.

Gathering relevant research. A comprehensive literature review was conducted to determine the quantity and quality of the evidence in support of an intervention to increase the number of AAA screenings in the primary care setting. Evidence was gathered in five distinct areas: patient outcomes and screening for AAA, criteria for screening for AAA, ultrasonography as a method to screen for AAA, educational interventions to increase adherence to evidence-based practice, and use of screening tools to increase adherence to evidence-based practice.

Appraising the evidence. The evidence was appraised for use in clinical practice through the use of Melynk's pyramid. Each article was critiqued based on applicability to the project, sample size, generalizability, and level of evidence. A matrix of all articles utilized for the literature review may be found in Appendix A. The evidence provided a strong foundation for implementation of this EBPP.

Piloting the project. The EBPP was piloted in a small family practice clinic located in Central Virginia. The pilot involved participation of the clinical staff, composed of providers and medical assistants, in an educational intervention and pretest and posttest. An AAA clinical screening tool was disseminated, and a retrospective and prospective chart review was conducted to determine project outcomes. The practice change may be adopted by the practice if the clinical staff determine the project outcomes were successful, as evidenced by an increase in knowledge pf AAA screenings and documentation of AAA screens.

Dissemination of results. The results of the EBPP are disseminated in this scholarly project manuscript. The results are displayed in graphical format utilizing descriptive statistics generated by Statistical Package for Social Sciences (SPSS) software. The final manuscript will be submitted for publication in Scholars Crossing, a collection of graduate work by Liberty University students.

Summary

The objective of the literature review was to determine the strength of the evidence in support of an intervention to increase AAA screenings in the primary care setting. The literature review also sought to determine the most effective intervention to increase AAA screenings. In review of the evidence, it was found that a one-time AAA screening in males age 65–75 with a current smoking status or past history of smoking, as well as family history of AAA, is supported by the guidelines and current literature. The literature review also found that educational in-services and use of screening tools facilitate adherence to evidence-based practice.

Review of the literature supported an EBPP to increase the number of AAA screenings in the primary care setting. The Iowa Model was selected to guide implementation of the project. Through implementation of an EBPP utilizing the Iowa Model as a conceptual framework, the

project leader sought to increase provider awareness of the criteria and outcomes related to AAA screening. Additionally, the project leader planned to increase the number of AAA screenings ordered and ultimately improve patient outcomes for those screened for AAA through early detection of existing AAA and initiation of surveillance or surgical planning.

According to the evidence presented, AAA screening provides life-saving benefits in short-term and long-term follow-ups through early detection. Screening initiatives may be utilized by providers to initiate surveillance or elective surgical interventions. The evidence supports screening initiatives directed at men age 65 to 75 with a history of smoking. Ultrasonography is the screening method of choice due to its ability to detect clinically significant AAAs and its cost effectiveness.

AAA screening programs may be effectively implemented in the primary care setting through educational interventions aimed at increasing provider knowledge of evidence-based guidelines regarding the screening. Screening tools have demonstrated efficacy for other disease processes commonly encountered in the primary care setting. The goal of this EBPP was to implement a practice change aimed at increasing the number of AAA screenings performed in the primary care setting through an educational intervention and implementation of a screening tool. The Iowa Model of Evidence-Based Practice guided the project design.

SECTION THREE: METHODOLOGY

Project Design

The quasi-experimental design selected for this EBPP relied on descriptive statistics to demonstrate whether a change in clinical staff knowledge and documented AAA screenings occurred when comparing pre- and post-intervention data. The project leader described pre- and post-data in terms of percentage increase in knowledge and documented AAA screenings. The

goal of the use of descriptive statistics was to demonstrate that the intervention was effective in implementing an evidence-based practice change, rather than to demonstrate statistical significance.

The purpose of the EBPP was to increase the number of AAA screenings in the primary care setting was a pilot based on the Iowa Model (Iowa Model Collaborative, 2017). The project identified a clinical trigger within the practice setting, which was inconsistent screening for AAAs among male patients age 65–75 with a history of smoking or current status of smoking.

The topic has been determined to be a priority for the organization, as the providers have identified the need to increase the number of AAA screenings ordered for eligible patients to improve outcomes and align preventative practice with evidence-based guidelines. A team was formed after the project was determined to be an organizational priority. The team consisted of the project leader and clinical staff. The project leader gathered, appraised, and synthesized evidence related to AAA screening. The evidence was found to be sufficient in demonstrating that AAA screening improves patient outcomes for eligible populations and that the screening method of ultrasonography is effective. Additionally, the evidence demonstrated that educational interventions and screening tools facilitate adherence to evidence-based practice. The next step was to pilot the practice change in the clinical setting.

Measurable Outcomes

1. Increase knowledge of AAA screening among clinical staff. Following an educational in-service on AAA screening and implementation of the AAA screening tool, the clinical staff was expected to demonstrate increased knowledge of AAA screening. This was measured by comparing scores achieved on a pretest and posttest. An increase in the posttest score of at least 20% was sought to demonstrate an increase in knowledge.

2. Increase the number of documented AAA screening forms filled out. After clinical staff attended an educational in-service, an increase in the number of AAA screenings was expected to be documented in the medical record. This was measured by comparing the number of patients screened prior to the intervention and one month following the intervention. The team leader measured the number of screening forms completed in the chart one-month post-intervention.
3. Increase the number of patients who have completed a AAA screening by ultrasonography. Following the educational in-service, the team leader planned to determine how many screenings were ordered and completed by ultrasonography. This was planned to be measured by the completion of an additional chart review 12 weeks post intervention to determine how many ultrasounds were ordered and how many patients had documentation of a completed AAA screening by ultrasonography. The number of completed ultrasounds was planned to be compared to pre-intervention data from the retrospective chart review. This measurable outcome was impacted by COVID-19.

Setting

The setting of this evidence-based project was a family practice clinic in Central Virginia. The rationale for project implementation at this setting was the diverse patient population and provider-acknowledged deficit in AAA screening. The project aligned with the organization's directive to improve patient outcomes and to move toward providing preventative care based on current evidence. The project further aligned with the providers' recent initiatives to improve preventative screenings at the point of care and to utilize screening checklists or tools to facilitate this initiative.

The key stakeholders at the organization included the providers, medical assistants, patients, patients' families, and the community served by the practice in Central Virginia. Additional stakeholders included insurance companies and local health care providers as partners in improving preventative screenings delivered at the practice. The providers and medical assistants expressed organizational support for the project. The administrator of the practice provided a letter of support, which may be found in Appendix D.

Population

The population taking the pretest and posttest were three providers and four medical assistants. The providers have between one and 25 years of experience and range in age from mid-30s to mid-60s. The medical assistants have between one and 10 years of experience and range in age from mid-20s to mid-50s. The providers conduct a wide range of services at the clinic, including wellness exams, follow-up visits for chronic conditions, and illness-focused visits. The sample selection was based on the population identified in the USPSTF's (2019) AAA screening guideline, which is male patients age 65 to 75 with a history of smoking.

Ethical Considerations

The scholarly project leader and project chair completed extensive training regarding participation in research involving human subjects through the Collaborative Institutional Training Initiative to ensure protection of all human subjects involved in this scholarly project. A certificate of successful program completion is provided in Appendix C.

Additional ethical considerations were implemented by the project leader to protect research subjects, to include participant and patient confidentiality. Participant confidentiality was protected by the omission of personal identifiers on the pretests and posttests. The

participants were asked to refrain from placing their name on the pretests and posttests. The pretests and posttests were shredded after the data were recorded into SPSS software.

All patient identifiers were omitted during the retrospective and prospective chart review process. The data was deidentified and coded for use with SPSS software. Additionally, all data were preserved in a manner that protected its integrity during the project. The data were saved on the projects leader's computer and a second desktop computer, which are passcode protected. The project data will be maintained for three years after the project has concluded and will then be deleted.

The project was submitted to Liberty University's Institutional Review Board (IRB) for review prior to implementation. The practice setting did not have an IRB. The project was considered exempt by Liberty University's IRB, as it was an EBPP. A copy of Liberty University's IRB approval letter is provided in Appendix G.

Data Collection

Data collection was completed by the project leader for the pretest and posttest. The project leader delivered a 10-question pretest and posttest in addition to a PowerPoint educational intervention. Participants were asked to complete the pretest, review the educational intervention, and then complete the posttest. The pretest and posttest scores were collected as data. Clinical staff demographic data were also collected, including age, clinical title, and years of experience. The pretest and posttest scores were displayed in graphical form, and statistical analysis was conducted for reporting in the results section of the scholarly project manuscript. Please refer to Appendix F for the pretest and posttest.

The second part of the data collection involved a pre-and post-educational intervention chart review. The project leader worked in collaboration with the clinical staff in utilizing the

schedule from the practice management system to collect data for the sample of male patients age 65–75 presenting to the practice for a routine wellness or follow-up visit one month prior to and one month after the intervention. The patient's charts were reviewed for evidence of smoking status to determine eligibility for screening. Data were collected regarding whether a AAA screening was ordered at the most recent office visit or a previous encounter. Additional data points collected included statistics on the patients screened, including age, current or former smoking status, family history of AAA, completed ultrasounds, and results of the completed ultrasounds (positive or negative for AAA).

All patient identifiers were removed during the data collection process. The patients were coded as eligible or ineligible for screening and yes or no as to whether a documented AAA screening was noted in the chart. The process was repeated one month after the educational intervention and dissemination of the clinical screening tool to determine if there was an increase in documented AAA screenings completed using the screening tool. The process was planned to be completed a second time 12 weeks after the intervention; however, this second review was cancelled due to the COVID-19 pandemic.

Tools

The tools utilized for this EBPP included a pretest and posttest. The pretest and posttest contained 10 questions in multiple-choice format. The test covered population characteristics necessitating AAA screening, method of AAA screening, outcomes resultant from AAA screening, screening intervals, and insurance coverage of the screening. All questions were based on the USPSTF's (2018) guidelines and the literature review presented in this manuscript.

The second tool utilized for the project was a clinical screening tool provided to clinical staff to facilitate the identification of patients eligible for an AAA screening. The tool was

comprised of a yes-or-no checklist with three items: male gender, age 65–75, and current or past smoker (the patient must have smoked at least 100 cigarettes in his lifetime). The tool also contained the criteria of family history of AAA in first-degree relative. The criteria used in the screening tool was based on guidelines from the USPSTF (2018) and the literature review provided in this manuscript. At the bottom of the tool, an advisement was provided that if a patient meets all three criteria, he was eligible for a one-time screening ultrasound to rule out an AAA. The screening tool allowed the provider to circle yes for clinical staff to order the AAA screen or no with stated reason, such as patient declines or other reason to not proceed with screening. The pretest, posttest, and AAA screening tool are provided in Appendices E and F.

Intervention

The intervention for this EBPP was delivered in two parts. The project leader initiated the project by providing a pretest to clinical staff to determine baseline knowledge of AAA screening. The project leader also provided a 15-minute educational intervention in PowerPoint format to clinical staff concerning the population characteristics warranting an AAA screening, the benefit of conducting AAA screenings, and insurance coverage of the screening. The clinical staff were also provided a posttest to reassess their knowledge of AAA screening after reviewing the educational intervention.

The project leader distributed copies of the AAA screening tool for the clinical staff to utilize during the patient intake process. The tool contained the three qualifying items for a AAA screening based on the USPSTF's (2019) criteria, which were male gender, age 65–75, and current or past smoker. Based on the literature review, the screening tool also included the criterion for family history of AAA. The screening tool accompanied the educational intervention to provide the clinical staff with a simple method of identifying qualifying patients.

The screening tool also provided a method of documenting completion of AAA screening in the medical record.

The second part of the intervention involved pre-and post-educational intervention chart reviews. Approximately 50 charts were reviewed retrospectively. A post-educational intervention chart review was conducted 30 days after the educational intervention to determine the number of AAA screenings ordered. Approximately 50 charts were planned for review, but due to the COVID-19 pandemic, only 25 charts were reviewed. A second post-educational intervention chart review was planned for 90 days after the educational intervention to determine the number of AAA screenings completed by ultrasonography. The second prospective review was cancelled due to COVID-19.

Timeline

Preparation. The preparation phase included identifying a clinical trigger, determining if the topic was a priority for the organization, forming a team, engaging in extensive research and critically appraising the evidence, and preparing a draft of the scholarly project to submit to the project chair and IRB at Liberty University.

The project leader identified a clinical trigger that served as an organizational priority, formed a team, and performed preliminary research and critical appraisal of research from August 15 to October 31, 2019. The edited manuscript was submitted to Dr. Moore on November 3, 2019. The primary defense of the scholarly project was completed from November 4 to 8, 2019. Finally, submission of EBPP to Liberty University's IRB occurred on January 20, 2020.

Implementation. The next phase was the implementation of the EBPP at the clinical site. For the project leader, this included engaging in a retrospective chart review, conducting an

educational intervention, conducting a pretest and posttest, distributing the AAA screening tool, and engaging in a prospective chart review.

The retrospective chart review was completed February 1 and 2, 2020. The educational intervention and clinical staff pretests and posttests were completed by February 6, 2020. Next, the project leader conducted the prospective chart review to determine number of AAA screenings ordered on March 6 and 7, 2020. Finally, the prospective chart review to determine number of AAA screenings completed by ultrasonography was cancelled due to the COVID-19 pandemic.

Evaluation. Evaluation of the project included statistical analysis of data collected, final editing of the manuscript, final defense, and publication. Statistical analysis of data using descriptive statistics with SPSS software was conducted March 15 to April 12, 2020. The completion of the final edit of manuscript by an editor is planned for June 19, 2020. Final defense of scholarly project occurred July 3, 2020, and publication of scholarly project is planned for July 8, 2020.

Feasibility Analysis

A feasibility analysis for the EBPP was conducted. The project required approximately 30 minutes of clinical staff time for the completion of the educational intervention and a pretest and posttest. The educational intervention and pre- and posttest commanded a very small budget for materials, as the project leader used her personal computer to develop the educational intervention PowerPoint. The pretest and posttest and PowerPoint education intervention were supplied by the project leader for the clinical staff.

The educational intervention was delivered through a printed PowerPoint. The pre-educational intervention and post-intervention chart reviews occupied up to 60 hours of the

project leader's time. This cost of the project in terms of time spent on the intervention and chart reviews was absorbed by the project leader, and the company did not provide reimbursement for any part of the project. The total cost to the project leader was minimal at 15 dollars for paper and supplies. The time frame for the project was 12 weeks, with a tentative completion time of June 2020. This time frame was deemed to be feasible in consideration of the expected date of degree completion of August 2020.

Data Analysis

Increase knowledge of AAA screening among clinical staff. Data analysis was conducted by the project leader for the pretest and posttest and the pre-and post-intervention chart reviews. The project leader analyzed data collected for all clinical staff who agreed to participate in the educational intervention, pretest, and posttest. The data were analyzed based on answers selected on the questionnaire and overall scores for the pretest and posttest. Descriptive statistics and multiple bar graphs were generated by SPSS software to compare data collected from the educational intervention pretest and posttest and the retrospective and prospective chart reviews over a 12-week period.

Increase number of documented AAA screening forms filled out. Data analysis was conducted by the project leader based on the pre-and post-intervention chart review. The project leader collected data for all patients who presented to the clinic for a wellness physical or routine follow-up from December 12, 2019, and January 6, 2020. Statistical analysis was performed on the data collected during the retrospective and prospective chart review using SPSS software. The data were coded with a nominal data format. Under the category "eligible for AAA screen," 1 was coded for patients meeting criteria for AAA screening, and 0 was coded for patients not meeting AAA screening criteria. Under the category "screenings completed among eligible

patients," 1 was coded for patients meeting criteria for whom a one-time AAA screening was ordered, and 0 was coded for patients meeting AAA screening criteria but for whom an AAA screening was not ordered. A pie graph was presented to display the change in documented AAA screenings ordered pre- and post-intervention.

Increase the number of patients screened for AAA by ultrasonography. Data analysis was planned to occur at a second prospective chart review 12 weeks after the educational intervention was completed. The project leader planned to collect another 50 fifty charts of patients presenting to the clinic for wellness visits or follow-ups to determine whether a screening by ultrasonography had been completed. The project leader planned to follow the same coding steps described for the retrospective chart review. Under the category "screening completed by ultrasonography," 1 was planned to be coded for ultrasound completed, and 0 was planned to be coded for ultrasound not completed. Data analysis was planned to be conducted using descriptive statistics and SPSS software. This second prospective chart review for further data analysis was unfortunately cancelled due to the COVID-19 pandemic.

SECTION FOUR: RESULTS

There were a total of four clinical staff members who participated in the scholarly project at the primary care clinic. Of the participants, there were three providers and one medical assistant. The four participants completed the pretest, reviewed the educational intervention, and completed the posttest. The completion rate among the four participants was 100%. The purpose of the educational intervention was to increase knowledge of AAA screening among clinical staff. Descriptive statistics were utilized to analyze and compare pre-intervention and post-intervention scores to determine if a change in knowledge occurred. Descriptive statistics were also utilized to analyze the results of a retrospective and prospective chart review to

determine if there was a difference in total AAA screenings ordered and AAA screenings ordered by ultrasonography.

Descriptive Statistics

Demographics. Of the participants, there were three licensed providers and one medical assistant. There were three female participants and one male. Of the three providers who participated in the scholarly project, all three identified their specialty as family practice. Two providers reported having between zero and five years of experience and one provider reported having 16–25 years of experience.

Increase knowledge of AAA screening among clinical staff. Upon completion of the educational intervention, the pretests and posttests were collected, and descriptive statistics were compiled. There was a total of four sets of pretests and posttests. The average of the pretest scores was compared to the average of the posttest scores. The average score for the pretests was 55%. The average score for the posttests was 85%. There was a 54.5% increase in average score upon completion of the educational intervention.

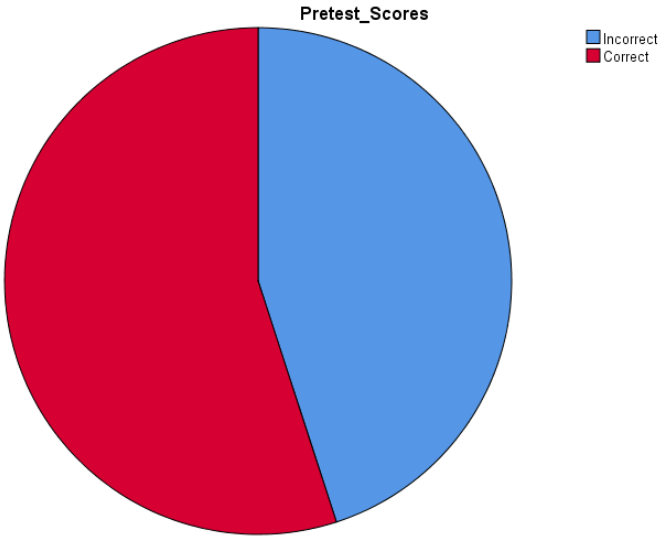

Figure 1. Pretests: Percentage of questions answered correctly versus incorrectly. 55% of questions answered correctly, and 45% of questions answered incorrectly.

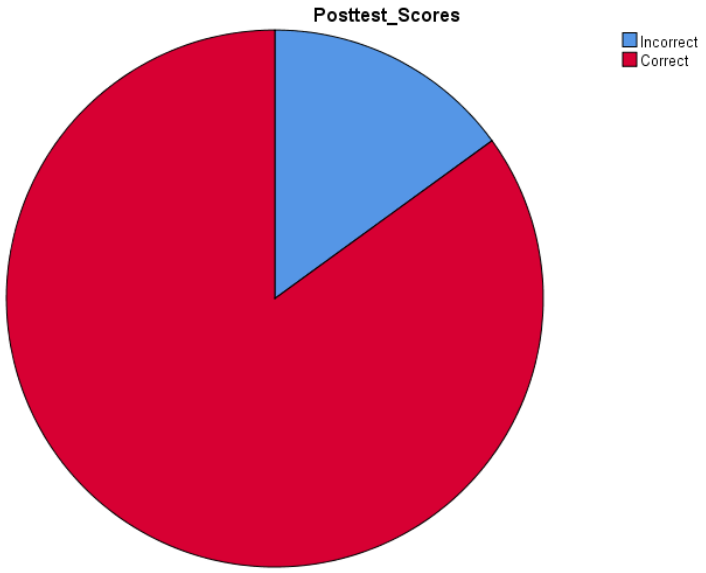

Figure 2. Posttests: percentage of questions answered correctly versus incorrectly. 85% of questions answered correctly and 15% of questions answered incorrectly.

Increase number of documented AAA screening forms filled out. The retrospective chart review was conducted between February 1, 2020, and February 2, 2020, and yielded data for 50 male patients between the age of 65 and 75 who presented to the clinic for a routine follow-up visit or annual wellness physical between December 12, 2019, and January 6, 2020. The data revealed there were 27 patients (54%) who were eligible for an AAA screening. Eligible patients had a notation in their chart that they were either a current or former smoker, forming the third component of eligibility for AAA screening, along with male gender and age of 65 to 75.

For each of the 27 eligible patients, there was no verbiage in the medical record specifically stating that an AAA screening had been conducted during an office encounter. There were no ultrasound results with the verbiage “abdominal aortic aneurysm screening” found among charts reviewed. Therefore, out of 27 eligible patients, 0% of patients had evidence of an AAA screening completed by providers in the primary care clinic.

There were 23 patients (46%) who were found to be ineligible for AAA screening in the retrospective chart review. Twenty-one of the ineligible patients were never smokers or had no documented smoking history. Two patients had documentation of an existing AAA that was under surveillance.

The prospective chart review was conducted between March 19 and March 22, 2020, and included all patients age 65 to 75 presenting to the clinic for a follow-up between March 6, 2020, and March 20, 2020. A total of 25 charts were reviewed. The prospective chart review was reduced to 25 charts as a direct result of the coronavirus pandemic and operational changes within the clinic. The prospective chart review encompassed patients who presented to the clinic from March 6, 2020, to March 13, 2020, for follow-up visits.

In the prospective chart review, 11 patients (44%) were identified as eligible for AAA screening. Eligible patients had documentation in the medical record that they were males between age 65 and 75 with a current or former smoking status. There were 14 patients (56%) who were ineligible for a AAA screening due to lack of documentation of current or former smoking status.

Out of the 11 patients identified as eligible for a AAA screening in the prospective chart review, six patients (54.5%) were screened for AAA. Five patients (45.5%) were not screened for AAA. All six patients who were screened for AAA were screened with the screening tool. Of the six patients screened for AAA using the screening tool, all six patients had documentation that a screening ultrasound was recommended. There was also documentation advising clinical staff to order an ultrasound.

A comparison of the data from the retrospective and prospective chart review revealed that AAA screening among eligible patients increased from 0% in the pre-intervention phase to

54.5% in the post-intervention phase. Additionally, 100% of eligible patients screened for AAA in the post-intervention phase were screened utilizing the AAA screening tool. This was the sole method utilized to document and record use of the AAA screening tool. Several medical records had a notation that screening was completed by providers using the office note in addition to the screening tool; however, the screening tool was utilized to order AAA screening by ultrasonography in all six patients for which ultrasonography was recommended.

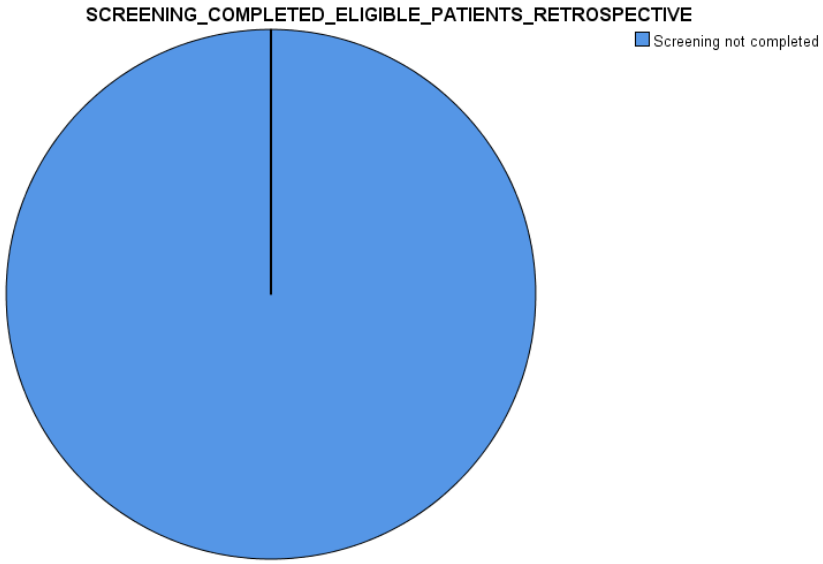

Figure 3. AAA screenings completed among eligible patients in retrospective chart review. 0% of eligible patients were screened in the retrospective chart review.

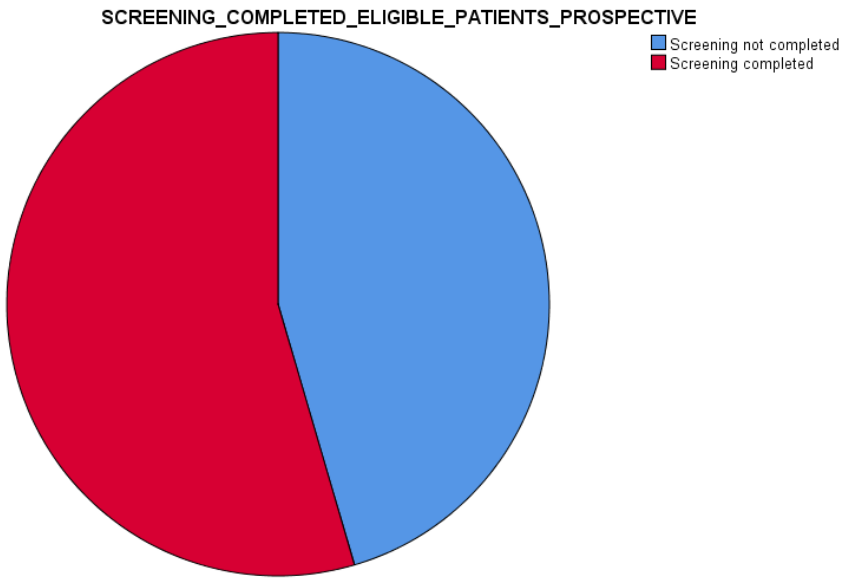

Figure 4. AAA screenings completed among eligible patients in prospective chart review. 54.5% of eligible patients were screened for AAA in the prospective chart review.

Increase the number of patients screened for AAA by ultrasonography. For the 27 eligible patients identified in the retrospective chart review, there was no indication in the medical record that any of the patients received a screening ultrasound to detect AAA. There were no ultrasound results with the verbiage "abdominal aortic aneurysm screening" found among charts reviewed. Therefore, out of 27 eligible patients, 0% of patients had evidence of an AAA screening completed by ultrasonography.

For the 11 patients eligible for AAA screening in the prospective chart review, there was no documentation that an AAA screening was completed by ultrasonography. There were six patients for which AAA screening was ordered by ultrasonography. Unfortunately, the results of these ultrasounds were not in the medical record at the time of the prospective chart review. Therefore, there was no increase in the number of AAA screenings completed by ultrasonography over the course of the scholarly project.

SECTION FIVE: DISCUSSION

The scholarly project to increase the number of AAA screenings in the primary care setting revealed three important implications for practice. First, the scholarly project highlighted the impact of educational interventions on increasing adherence to evidence-based practice guidelines. The educational intervention conducted at the clinic was successful in improving clinical staff knowledge of AAA screening in the primary care setting. Posttest scores improved 54.5% from pretest baseline data.

Second, the scholarly project demonstrated that an educational intervention to improve knowledge of evidence-based screening guidelines resulted in increased numbers of screenings performed. The scholarly project demonstrated an improvement in screenings from 0% of eligible patients in the retrospective chart review to 54.5% of eligible patients in the prospective chart review. This is important, as the goal of the project was to improve screening for AAA in the primary care clinic. Early recognition of an AAA has been demonstrated to reduce all-cause and AAA-associated mortality for up to 15 years post-screening (Ali et al., 2016, 2018; Eckstein et al., 2015; Guirguis-Blake et al., 2014; Takagi et al., 2018). It is essential that the work continue to further improve adherence to the guidelines to impact patient outcomes over the long term.

Third, the scholarly project demonstrated that use of a screening tool is effective in improving adherence to screening guidelines. All patients screened for an AAA in the prospective chart review were screened using the AAA screening tool. Educational interventions and dissemination of screening tools should be considered for community primary care clinics to improve adherence to evidence-based practice and impact patient outcomes.

Limitations

There were several limitations identified during data collection. During the retrospective chart review, it was noted that many patients who were eligible for an AAA screening were being followed by a cardiologist. The patients may have been screened for AAA and other cardiovascular conditions by a cardiologist without the information being updated to the health maintenance record. Additionally, the practitioners at the clinic may have assumed that the cardiologist screened the patient for an AAA and factored this assumption into their decision not to screen at the primary care clinic.

Another limitation is that the medical record may lack documentation of an AAA screening or be incomplete. It is possible that the providers screened the patient but did not document the screening on the AAA screening form or health maintenance record. The provider may have documented the screening in an office visit but failed to update the health maintenance record. There is also the possibility that another specialist or previous primary care provider had screened the patient and these records were not reflected in the current health maintenance record.

Sustainability

The scholarly project to increase AAA screenings in the primary care clinic is sustainable as a practice change. The clinic easily adapted the new AAA screening form into the workflow. The form was placed in a folder among other screening forms in the clinical area. Screening patients in accordance with evidence-based guidelines has become a priority for the clinic. This practice change has been supported by increased utilization of other evidence-based screening, such as screening for depression and obstructive sleep apnea.

The outcome of the scholarly project, an increase the number of AAA screenings in the primary care setting, will provide added initiative for the practice to continue the AAA screenings. The practice had a significant increase in screenings during the scholarly project. The clinic should continue to track the number of AAA screenings completed and consider any impact to long-term outcomes. Additionally, this project may become a catalyst for future educational interventions to improve outcomes across other quality measures.

Dissemination Plan

The dissemination plan for the scholarly project is to publish the final manuscript in Liberty's Scholars Crossing, which is an online collection of graduate work. The manuscript will also be published in a peer-reviewed nursing journal. It may also be helpful to publish portions of the work, such as the guidelines for AAA screening and the screening tool, to a clinically focused peer-reviewed journal. Additionally, the results of the study, including a description of the outcomes, will be delivered to the clinic site in a PowerPoint format.

Conclusion

AAAs are more common in male patients age 65 to 75 with a current or past smoking status. The evidence and guidelines support ordering a one-time screening by ultrasonography for eligible patients. Screening for AAA among eligible patients by ultrasonography has been deemed to be effective and has the potential to reduce mortality and encourage surveillance and/or planned repair.

The EBPP was successful in two out of three aims to improve adherence to the evidence related to AAA screening. The project demonstrated a 54.5% improvement in knowledge among clinical staff when pretest and posttest scores were compared after an educational intervention. The project also resulted in an improvement in the percentage of patients screened for AAA

using a screening tool, as shown by a comparison of the data from the retrospective and prospective chart reviews. In the retrospective chart review, there was no documentation of AAA screening among eligible patients. The prospective chart review showed that six patients were screened for a AAA using the AAA screening tool. This demonstrated a 54.5% increase in AAA screening after the educational intervention and with utilization of the AAA screening tool.

Primary care providers should be cognizant of the evidence supporting AAA screening and improved outcomes resultant from adherence to the evidence-based guideline. The scholarly project identified the benefit of introducing educational initiatives in the practice setting to improve knowledge of evidence-based practice surrounding AAA screening. Providers are encouraged to extend education to their respective practices to promote the initiative to screen eligible males for AAAs. Additionally, providers should consider dissemination of a screening tool to enhance screening efforts, promote participation of all members of the clinical team, improve documentation, and improve communication of the need to screen eligible patients by ultrasonography.

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U.S. Preventive Services Task Force. (2018). *Information for health professionals.* Retrieved from https://www.uspreventiveservicestaskforce.org/Page/Name/tools-and-resources-for-better-preventive-care

van de Luijtgaarden, K. M., Rouwet, E. V., Hoeks, S. E., Stolker, R. J., Verhagen, H. J., & Majoor-Krakauer, D. (2017). Risk of abdominal aortic aneurysm (AAA) among male and female relatives of AAA patients. *Vascular Medicine, 22*(2), 112–118. doi:10.1177/1358863X16686409

Vänni, V., Hernesniemi, J., Turtiainen, M., Turtiainen, J., & Hakala, T. (2015). Screening men with coronary heart disease for abdominal aortic aneurysm: A prospective cohort study. *World Journal of Surgery, 39*(9), 2354–2358. doi:10.1007/s00268-015-3091-8

Wanhainen, A., Hultgren, R., Linné, A., Holst, J., Gottsäter, A., Langenskiöld, M., . . . Swedish Aneurysm Screening Study Group. (2016). Outcome of the Swedish nationwide abdominal aortic aneurysm screening program. *Circulation, 134*(16), 1141–1148. doi:10.1161/CIRCULATIONAHA.116.022305

Ye, Z., Bailey, K. R., Austin, E., & Kullo, I. J. (2016). Family history of atherosclerotic vascular disease is associated with the presence of abdominal aortic aneurysm. *Vascular Medicine, 21*(1), 41–46. doi:10.1177/1358863X15611758

Appendix A: Literature Review Matrix

Article	Study Purpose	Sample Characteristics	Methods	Study Results	Melnyk Level of Evidence	Study Limitations	Evidence to Support a Change
Abd Razak, M. A., Ahmad, N. A., Chan, Y. Y., Mohamad Kasim, N., Yusof, M., Abdul Ghani, M. K. A., . . . Jamaluddin, R. (2019). Validity of screening tools for dementia and mild cognitive impairment among the elderly in primary health care: A systematic review. *Public Health, 169*, 84–92. doi:10.1016/j.puhe.2019.01.001	The purpose of the study is to determine validity and feasibility of screening tools for mild cognitive impairment and dementia for use in primary care.	The sample consists of 30 studies assessing for the validity, specificity, and feasibility of screening tools. The population foci for the studies was patients age 60 and older screened at primary care settings by one of three methods: healthcare provider directed, self-administered screening, or caretaker administered.	The methodology was a meta-analysis and systematic review of all literature with inclusion of validity studies with assistance of sensitivity and specificity screening tools.	The results demonstrated that the ACE-III was found to have the highest sensitivity and specificity in predicting dementia in the primary care setting (Sensitivity = 100%, specificity = 96%). The MoCA was found to exhibit high sensitivity in screening for mild cognitive impairment in the primary care setting (sensitivity = 83–97%).	Level 5: Systematic review of descriptive and qualitative studies. (University of Michigan, 2019)	Limitations of the study include only English language articles, possibly limiting the scope of the review. The authors contend that articles from nontraditional sources may have broadened the scope as well.	The study is supportive of an evidence-based practice project aimed at introducing evidence-based clinical screening tools that are both sensitive and feasible to facilitate screening initiatives in primary care.

Aber, A., Tong, T., Chilcott, J., Maheswaran, R., Thomas, S. M., Nawaz, S., & Michaels, J. (2018). Gender differences in the rates of repair of emergency abdominal aortic aneurysm. *European Journal of Vascular & Endovascular Surgery, 56*(6), e30. doi:10.1016/j.ejvs.2018.08.024	The purpose of the study is to determine whether gender differences exist in the rate and type of repair of intact emergency and ruptured AAA.	The sample consists of 28, 484 patients who presented to the hospital for intact emergent AAA and ruptured AAA.	The researchers performed a retrospective review of hospital data. Hospital episodic statistic (HES) datasets were reviewed from April 2002 to February 2015. The researchers utilized clinical and administrative codes to identify patients who underwent repair for ruptured or intact AAA in addition to patients who presented to the hospital with a AAA and	The results indicated that 15, 717 patients (83% male) received surgical intervention for AAA. Of these patients, 10, 276 patients (81% male) received treatment for intact AAA. A total of 12,767 patients expired in the hospital as a result of a ruptured AAA. The OR for not receiving reparative surgery for emergent AAA was 0.34 for men and 0.9 for women. The adjusted OR (adjusted for age, deprivation, and co-morbidities) was 0.4 for men and 0.53 for women. EVAR rates for ruptured AAA was 22% for women and 28%	Level 4: Cohort study (University of Michigan, 2019)	Study limitations include potential errors in clinical or administrative coding. Additionally, differences may exist in age and co-morbidities of the populations. An attempt to account for age and co-morbidity differences was made in the adjusted odds ratio.	This retrospective cohort study lends to the pool of data in implementing an EBPP. The study helps support an initiative to improve AAA screening to reduce emergent repairs of AAAs and potential ruptured AAA. Additionally, the study supports greater attention to inclusion criteria.

			subsequently expired.	for men. EVAR rates for emergent intact repair was 48% for women and 50% for men.			
Ali, M. U., Fitzpatrick-Lewis, D., Kenny, M., Miller, J., Raina, P., & Sherifali, D. (2018). A systematic review of short-term vs long-term effectiveness of one-time abdominal aortic aneurysm screening in men with ultrasound. *Journal of Vascular Surgery, 68*(2), 612–623. doi:10.1016/j.jvs.2018.03.411	The purpose of this study is to evaluate short term (3-5 years) versus long-term (13-15 years) reduction in mortality resultant from a one-time AAA screening in men.	The sample consists of 4 RCTs. One study had a sample size of 67,800 men age 65-74. The second study had a sample size of 15,775 men and women age 65-80. The third study had a sample size of 12,639 men age 64-73. The last study had a sample size of 41,000 men age 65-83. The pooled sample consists of 137,214 individuals. Only one study	The method is identified as meta-analysis of the studies from the most recent USPSTF review on AAA screening, with an updated search to identify all long-term data. MEDLINE, Embase, Cochrane Central Register of Controlled Trials, and PubMed were searched for any literature updates since the last update	The results from the meta-analysis demonstrated that the effect on all-cause mortality was insignificant (p=0.14) for short-term follow-up. For long term follow-up, the effect on all-cause mortality was significant (RR, 0.99, 95% CI, 0.98-1.00; p=0.03, number needed to screen NNS= 164).	Level 1: Meta-analysis of RCTs (Univerist y of Michigan, 2019)	Limitations include a literature search in English and French, heterogeneity across the RCTs, and lack of information for various demographics and subgroups. There were also too few studies to rule out publication bias.	Yes. This meta-analysis establishes evidentiary backing for screening abdominal aneurysms based on reduction in all-cause and AAA-related mortality in long-term follow-up.

		had both men and women.	of the USPSTF. The time period was April 2015 to April 2017. Inclusion and exclusion criteria are detailed.				
Ali, M. U., Fitzpatrick-Lewis, D., Miller, J., Warren, R., Kenny, M., Sherifali, D., & Raina, P. (2016). Screening for abdominal aortic aneurysm in asymptomatic adults. *Journal of Vascular Surgery, 64*(6), 1855–1868. doi:10.1016/j.jvs.2016.05.101	The purpose of this systematic review is to examine all available evidence related to the benefits and harms of abdominal aortic aneurysm screening.	The sample consists of 10 studies. Four of the 10 studies were randomized controlled trials (RCTs) to determine the benefits of a one-time AAA screen on mortality. Three studies were uncontrolled observational studies to determine if there is a benefit to repeat ultrasonography. An additional three	Systematic review of literature from January 2013 to April 2015 using Medline, EMBASE, Cochrane Central Register of Controlled Trials, PubMed, with the additional of a Peer Review of all literature utilized by the USPSTF to formulate the AAA screening	The results demonstrated that a one-time ultrasound screen for AAA showed a statistically significant reduction in AAA mortality of 43% at 3-5 years (four trials; RR = 0.57; 95% CI; 0.44-0.72, absolute risk reduction ARR = 0.13%, number needed to screen NNS = 796). Analysis of the RCTs demonstrated that screening results were maintained at	Level 1: Systematic Review inclusive of RCTs. (University of Michigan, 2019)	Study limitations include that the search was limited to English and French language articles, uncertainty regarding statistical heterogeneity based on difference in population, sample size, and length of follow-up, lack of evidence to demonstrate the most	This systematic review provides strong evidentiary backing for an evidence-based practice project aimed at increasing AAA screening, as it indicates a substantial reduction in AAA-associated mortality at 13-15 years

		uncontrolled observational studies were used in conjunction with the previous seven studies to determine the benefits of a one-time ultrasound screening for AAA using an ultrasound scan.	guidelines using Electronic Search Strategies. Inclusion criteria	13-15 years, with a 42% reduction in mortality (three trials: RR = 0.58; 95% CI, 0.39-0.88, ARR-47%, NNS = 212).		effective screening modality, and lack of information regarding groups, aortic size, baseline risk of rupture. Additionally, publication bias was not able to be excluded due to the small number of studies with outcomes data.	based on the pooled outcomes of RCTs.
Aslam, A., Fisher, C. M., Thoo, C., Neale, M. L., & Thomas, S. D. (2017). Patients with ruptured abdominal aortic aneurysm have become higher risk. *Annals of*	The purpose of this study is to determine if patients presenting with ruptured AAA have more risk factors associated with	The sample consists of 188 patients who presented with ruptured AAA between January 1985 and December 1993 and 60 patients who presented with ruptured AAA between	The study methodology is a cohort study in which the researchers followed two separate cohorts retrospectivel y. One cohort was the past-era group,	The results demonstrated that that more patients in the past group were prepared for repair of ruptured AAA in comparison to the modern group (154/188 versus 38/60). More patients in the modern group	Level 4: Cohort study (Universit y of Michigan, 2019)	Limitations of the study include the relatively small sample size. Additionally, predictive risk factors need to be evaluated for past era and modern	The study is helpful in informing an EBPP, as it identifies the need to consider comorbiditi es in AAA rupture risk, as well as age. Patient should be

Vascular Surgery, 42, 176–182. doi:10.1016/j.avsg.2016.10.056	mortality and whether these risk factors continue to predict mortality.	January 2007 and December 2011.	who presented for repair of ruptured AAA between January 1985 and December 1993. The second group was the modern group who presented for repair of ruptured AAA between January 2007 and December 2011.	presented with medical comorbidities. The in-hospital mortality rate among the two groups was similar at 39 percent. The main differentiating risk factor in the modern group was age. Patients in the modern group presented for repair of ruptured AAA at more advanced ages than the past era group (81 versus 72, $p < 0.001$). The authors demonstrated reduced mortality associated with repair in the modern group. However, low hemoglobin was the only risk factor associated with higher mortality in the modern group.		patients with a ruptured AAA, considering mortality rates surrounding rupture AAA remain unchanged.	screened at the appropriate age so that an intervention may be planned. Mortality rates remain high at 39% for ruptured AAA, despite improvements in surgical interventions. Early identification of AAA and planning is essential to improve outcomes.

Aune, D., Schlesinger, S., Norat, T., & Riboli, E. (2018). Tobacco smoking and the risk of abdominal aortic aneurysm: A systematic review and meta-analysis of prospective studies. *Scientific Reports*, *8*(1), 14786. doi:10.1038/s41598-018-32100-2	The purpose of this systematic review and meta-analysis is to determine the strength of the association between smoking and increased risk of abdominal aortic aneurysm.	The sample consists of 23 prospective studies. Of the studies included, 13 were from Europe, 8 were from the United States of America, and 2 were from Asia. Regarding smoking status, 20 studies included current smokers, 15 studies included former smokers, and 8 studies included ever-smokers.	The methodology used was a systematic review and meta-analysis of prospective studies. The authors searched for published retrospective and prospective cohort studies and nested-cased control studies within cohort studies with the topic of smoking and abdominal aortic aneurysm risk.	The results demonstrated that current smokers had a relative risk RR of 4.87 compared to never smokers (95% CI, 3.93-6.02, I^2=92%, *N* = 20). Former smokers had a RR OF 2.10 compared to never smokers (95% CI, 1.76-2.50, I^2=71%, N=15). Ever smokers had a RR of 3.28 compared to never smokers (95% CI, 2.60-4.15, I^2=96%, *N* = 18). The RR for 10 cigarettes per day was 1.87 (95% CI, 1.45-2.40, I^2=97%). The RR for 10-pack years was 1.78 (95% CI, 1.54-2.06, I^2=83%) and the RR for 10 years after smoking cessation was 0.45	Level 5: Systematic review of qualitative and descriptive studies. (University of Michigan, 2019)	Limitations include the fact that all studies included in the systematic review and meta-analysis found an increased risk of AAA in smokers. This limited heterogeneity to size of the risk differences among studies. Additionally, the authors suggest that smokers tend to have more unhealthy lifestyles compared to other groups. The effect of this unknown, but the authors do suggest that	The study is supportive of an EBPP in that it adds to data identifying risk factors that may be utilized by clinicians to screen for AAA in the clinical setting. This study supports inclusion of current or past history of smoking as a screening measure.

				(95% CI, 0.32-0.63, I^2=92.3%).		studies linking risk to diet alone are weak.	
Bath, M. F., Sidloff, D., Saratzis, A., Bown, M. J., & UK Aneurysm Growth Study Investigators. (2018). Impact of abdominal aortic aneurysm screening on quality of life. *British Journal of Surgery, 105*(3), 203–208. doi:10.1002/bjs.10721	The purpose of the study is to examine the impact of AAA diagnosis on quality of life.	The sample consists of 5,011 men recruited as part of the United Kingdom Aneurysm Growth Study UKAGS. The UKAGS recruits men with AAA and well as without AAA (control group) who have attended regular ultrasound screening through the English NHS AAA screening program (NAAASP) and the Welsh AAA screening program (WAAASP).	Prospective observational cohort study. All men recruited by UKAGS are sent an annual self-completion postal questionnaire to collect longitudinal data and data related to quality of life QOL.	The results demonstrated that the AAA group had significantly reduced QOL scores screening than the control group ($p < 0.001$). Determinants of QOL returned to normal after 12 months. However, physical QOL remained lower among the AAA cohort.	Level 4: Cohort Study (University of Michigan, 2019)	Limitations of the study include lack of data regarding QOL prior to the screening. There is also reduced compliance with follow-in the control group.	This study provides evidence in support of a practice change. The study provides unique insight into the QOL post-AAA screening, which may serve as a consideration in a EBPP. However, it is helpful to know that QOL returns to baseline after 12 months.

Bhana, A., Mntambo, N., Gigaba, S. G., Luvuno, Z. P. B., Grant, M., Ackerman, D., . . . Petersen, I. (2019). Validation of a brief mental health screening tool for common mental disorders in primary healthcare. *South African Medical Journal, 109*(4), 278–283. doi:10.7196/SAMJ.2019.v109i4.13664	The purpose of the study is to determine the validity of a seven-item Brief Mental Health screening tool for screening for common mental health disorders in the primary care setting.	The sample include 1, 214 participants age ≥ 18 treated at 10 primary care clinics in Newcastle subdistrict of Amajuba District in KwaZulu-Natal Province, South Africa, over a 2-week period.	The method was a case control study in which the validity of the Brief Mental Health screening tool was compared to the gold standard nurse-initiated assessment using the Adult Primary Care (APC) guidelines as the gold standard by administering both screenings to patients in the primary care setting.	The results indicated that the AUD-C, PHQ-2, and GAD-2 performed well with at 0.91 (95% CI, 0.88-0.95; 0.72; 95% CI, 0.65-0.78; 0.69, 95% CI, 0.58-0.80). Using the Brief Mental Health screening tool, 26% of patients were identified as having symptoms consistent with CMD compared to 8% using the Adult Primary Care Guidelines. Specificity was established preferred in this screening to identity patients with symptoms consistent with a CMD, but also identify true negatives.	Level 4: Case control or cohort study.	Limitations include a relatively homogenous sample. It would be beneficial to determine how this study would translate to other populations.	This study is supportive of an evidence-based practice change, as it demonstrates the utility of screening tools to conduct evidence-based screening for common conditions encountered in the primary care setting.

Bryan, T. J., Estrada, C. A., Castiglioni, A., & Snyder, E. D. (2015). Impact of an educational intervention on provider knowledge, attitudes, and comfort level regarding counseling women ages 40–49 about breast cancer screening. *Journal of Multidisciplinary Healthcare, 8*, 209–216. doi:10.2147/JMDH.S80337	The purpose of the study is to determine whether an educational intervention increases provider knowledge regarding mammogram screening recommendations, as well as improve provider counseling practices and comfort with counseling patients regarding the recommendations, and	The sample consists of 87 nurses and physicians in 13 community-based primary care VA clinics.	The method employed was a quasi-experimental design utilizing pre- and post-educational intervention surveys.	The results demonstrated that that the was a significant change in attitudes surrounding breast cancer screening, including increased number of clinicians who indicated they would wait until age 50 to screen (12% pre-intervention, 38% post-intervention). There was an increase in the number of respondents who felt comfortable discussing patient preferences (5% pre-intervention vs. 53% post-intervention, benefits and risks of screening (94% to 99%, $p = 0.076$; 34% to 90%, $p < 0.001$),	Level 6: Single descriptive or qualitative study	Limitations of the study include lack of a comparison group (physician versus non-physician providers) or among different clinics. Additionally, opinions and attitudes were assessed, but there was no measurement indicating if the intervention impacted clinical practice or if the change will be sustained.	The study is supportive of an EBPP to implement an educational intervention to increase provider knowledge of an evidence-based screening recommendation in a primary care clinic.

Chiu, K. W. H., Ling, L., Tripathi, V., Ahmed, M., & Shrivastava, V. (2014). Ultrasound measurement for abdominal aortic aneurysm screening: A direct comparison of the three leading methods. *European Journal of Vascular & Endovascular Surgery, 47*(4), 367–373. doi:10.1016/j.ejvs.2013.12.026	The purpose of this study is to examine the three methods of abdominal ultrasound imaging, inner to inner (ITI), leading-to-leading edge (LTL), and outer-to-outer (OTO) and determine the accuracy, repeatability, and reproducibility of the three methods. Additionally, the authors sought to determine whether aneurysm size or	A convenience sample of fifty static ultrasound images taken at Hull and East Yorkshore Hospitals NHS Trust between January 2010 and June 2012 were used. The images were standard digital images and communication in medicine (DICOM) format.	Fifty static images were measured using ITI, LTL, and OTO, as agreed upon from the panel of six assessors (two experienced sonographers, two interventional radiology fellows, and two consultant vascular IR radiologists). All three measurements were taken in the same images in the AP axis and compared to CT measurements, as the gold standard. Interclass correlation	The results demonstrated that all three methods of ultrasound imaging have high repeatability and reproducibility for static imaging. The inter-observer coefficients for reproducibility between assessors were 0.48 cm, 0.35 cm, and 0.34 cm. The intra-observer repeatability coefficients among the assessors were 0.30 cm, 0.20 cm, and 0.19 for ITL, LTL, and OTO.	Level 4: Cohort study (University of Michigan, 2019)	Study limitations include the fact that the study was underpowered, presenting a concern for a type 2 error. The static images were from a third party, leading to intra and inter-observer variability when compared to live images. Operator technique and their perception of aortic size is a confounding. Additionally, images did not take into account the cardiac cycle, which can cause a change in	This cohort study highly supports a change in practice, as it demonstrates that AAA screening via ultrasonography provides high consistency, including repeatability and reproducibility. However, the two most effective methods of screening are OTO and LTL.

	grade of operator impacted intra or inter-observer variability.		coefficient, inter-observer reproducibility, and intra-observer repeatability were measured. Accuracy, repeatability, and reproducibility were also measured between three groups of aortic sizes and different grades of assessors.			measurement between systole and diastole of up to 2 mm.	
Chun, K. C., Dolan, K. J., Smothers, H. C., Irwin, Z. T., Anderson, R. C., Gonzalves, A. L., & Lee, E. S. (2019). The 10-year outcomes of a regional abdominal	The purpose of this study is to measure diagnosis rates and compliance with the abdominal aortic aneurysm (AAA) screening	The sample consists of all patients screened for AAA from January 1, 2007 to December 31, 2016 through the Veterans Affairs health care system. A total of 19,649	A retrospective chart review was conducted on all patients screened for AAA between the years 2007 to 2016 at the Veterans Affairs health care system.	The results demonstrated that a total of 19,649 patients were screened from 2007 to 2016. A total of 9,916 new patients were screened from 2012-2016. The diagnosis rate was 7.2% in the first 5 years of the	Level 4: Cohort study (University of Michigan, 2019)	Study limitations include the study design as a retrospective review of data, allowing researchers to draw correlations without any information	This systematic review provides support for a practice change, as it demonstrates the utility of initiating a AAA screening program to

aortic aneurysm screening program. *Journal of Vascular Surgery, 170*(4), 1123–1129. doi:10.1016/j.jvs.2019.01.053	recommendation from 2007-2016 since the AAA aneurysm guideline was published in 2007.	patients were screened as part of this sample.	The screening criteria used was male gender, age 65-75, and a history of smoking 100 cigarettes total. AAA diagnosis rates and clinical adherence to screening was compared between the first 5 years and the total number of years to evaluate a change.	screening period. This declined to 6.3% during the entire 10 year period of the study (13.5% decrease, p <0.1). A diagnosis of AAA with a diameter ≥ 5.5cm (5.3% of all AAAs) was noted for 66 patients, and 54 of these patients underwent successful elective repair. Inappropriate screening of AAA declined from 28.2% in the first 5 years to 18.7% in the entire 10 year period (33.7% decrease; $p < 0.1$). Compliance of AAA screening improved from 61.7% in 2007 to 92.4% in 2016 ($p < 0.1$).		related to causation. The patient population is a second limitation, as the sample consisted mainly of male veterans from a large institution in Northern California. Additionally, many radiologists, technologists, and clinicians were involved in the care of these patients, lending to possible coding errors.	detect AAA in time for patients to make an informed decision regarding elective repair. The study also demonstrates the need for proper education of providers to ensure appropriate patients are screened and resources are not expended for inappropriate screenings.

Claridge, R., Arnold, S., Morrison, N., & van Rij, A. M. (2017). Measuring abdominal aortic diameters in routine abdominal computed tomography scans and implications for abdominal aortic aneurysm screening. *Journal of Vascular Surgery, 65*(6), 1637–1642. doi:10.1016/j.jvs.2016.11.044	The purpose of the study is to determine the prevalence and relevance of incidental AAA finding on routine CT scan and to determine accuracy of radiologists in identifying and reporting AAAs.	The sample includes 3,332 CTs scans performed on men and women age ≥ 50 at Dunedin Public Hospital between January 2013 and September 2014. Scans for the follow-up or treatment of AAAs were excluded.	The study is a retrospective cohort study.	The results indicated that out of 3,332 scans performed, 187 incidental AAAs were identified. The prevalence was 5.8%. The prevalence of AAA was found to be 8.7% in men and 3.1% in women. The male to female AAA ratio was 2.6:1. The prevalence increased with age. Patients with AAA had an average age of 78.5 ± 8.8 years (men, 77.8 ± 9.2; women, 80.3 ± 7.7); however, the prevalence number under age 65 was significant at 1.5% overall and 2.7% for men. In analyzing the performance of radiologists, it was found that AAAs ≥ 50 mm had a	Level 4: Cohort study (University of Michigan, 2019)	Limitations include the fact that the prevalence of AAA is higher in all subgroups than in other studies, which may be explained by unknown increased risk factors in patients requiring CTs.	The study is helpful for informing an EBPP. The study helps to establish the prevalence of AAA among men and women and age groups. Additionally, the study provides information regarding diagnostic accuracy for various AAAs sizes. This may help inform screening modalities utilized in the clinical setting.

				100% reporting rate, AAAs ≥40-49 mm had a 87% reporting rate, and AAAs ≥ 30-39 mm had a 52% reporting rate. Of the AAAs detected, 72% were considered to be clinically relevant, leading to a 4.1% prevalence of AAAs that will benefit from the imaging.			
Corrado, G., Durante, A., Genchi, V., Trabattoni, L., Beretta, S., Rovelli, E., . . . Ferrari, G. (2016). Prevalence of previously undiagnosed abdominal aortic aneurysms in the area of Como: The ComoCuore	The purpose of the study is to determine the prevalence of previously undiagnosed abdominal aortic aneurysms among men and women age 60-85 in	The sample consists of 1,555 men and women age 60-85 living in Como, Italy, who previously had not been diagnosed with a AAA.	Prospective observational cohort. From September 2010 to November 2013 a non-profit organization ComoCuore provided AAA screenings via ultrasonography free of charge. Participants	The results demonstrated that previously undiagnosed AAA were found in 2.5% of males and 0.4% of females (p=0.005). Independent risk factors for AAA were identified as age (OR 1.14, 1.06-1.22, $p < 0.0001$), male gender (OR 8.23, 1.79-37.91; $p = 0.007$), current	Level 4: Cohort Study (University of Michigan, 2019)	Limitations include the fact that individuals with known AAA were excluded from the study, preventing an accurate prevalence rate.	Yes. This study is supportive of an evidence-based practice change, as it identifies screening criteria based on higher risk populations, including males, advanced

"looking for AAA" ultrasonography screening. *The International Journal of Cardiovascular Imaging*, *32*(8), 1213–1217. doi:10.1007/s10554-016-0911-3	Comon, Italy.		were found through ComoCuore and several preventative disease programs. Volunteers provided gender, demographics, and past medical history.	smoker (OR 4.98, 1.57-15.79; p=0.007), and previous smoker (OR 2.76, 1.12-8.94; p = 0.03). Additionally, ardiovascular risk factors were higher in patients with AAA versus without AAA (mean 2.9± 3.0 versus 1.4±1.0 respectively, p < 0.0001).			age, and previous or current smoker. This may be utilized to develop a screening tool for clinical practice.
Cousins, L., O'Donnell, M., Dornan, S. L., Stewart, D., Ellis, P., & Blair, P. (2018). Six-year experience of the Northern Ireland AAA screening program. *European Journal of Vascular & Endovascular*	The purpose of the study is to review data for the past 6 six years from the Northern Ireland AAA Screening Program. The NI AAA Screening Program was established	The sample consists of 56,631 male patients invited for ultrasound screenings, with the addition of 3,178 men who participated based on self-referral.	This is a prospective cohort study, in which data was analyzed from the NI AAA Screening Program from 2012 to 2017.	The results of the NI AAA Screening Program demonstrated an annual prevalence rate of 1.3-1.7% for recruited patients and 2.3% for self-referred patients.	Level 4: Cohort Study (Univerist y of Michigan, 2019)	Limitations of the study include how participants were obtained. There was both invitation and self-referral. Additionally, only 84.2% of male patients invited for screening followed through.	Yes. This study may be used to support an EBPP as it provides data regarding the prevalence of AAA among male populations. It is well supported that AAA among men

Surgery, 56(5), e25. doi:10.1016/j.ejvs.2018.06.026	in 2012 to provide screening ultrasounds for AAA and reduce the risk of rupture through early detection and intervention.					Lastly, women were not included.	is not an uncommon condition and should be considered for population screening.
Eckstein, H., Reeps, C., Zimmermann, A., & Söllner, H. (2015). Ultrasound screening for abdominal aortic aneurysms: Evidence from randomized controlled trials. English Version. *Gefässchirurgie, 20*(S1), 1–12. doi:10.1007/s0	The purpose of this meta-analysis is to determine if there is adequate evidence from RCTs and other evidence sources for an ultrasound-based AAA screening.	The sample consists of RCTs on AAA screenings, systematic reviews, meta-analyses, health technology assessments, and medical guidelines up to June 2014.	This is a meta-analysis of RCTs, RCTs on AAA screenings, systematic reviews, meta-analyses, health technology assessments, and medical guidelines up to June 2014. MEDLINE, PubMed, and SCOPUS were utilized	The meta-analysis found that RCTs demonstrate that a single ultrasound screening for AAA is significantly associated with a reduction in AAA-associated mortality, as well as in the number of ruptured AAAs, and emergency surgeries.	Level 1: Meta-analysis of RCTs (University of Michigan, 2019)	Limitations of the study include the fact that 30 percent of participants across all RCTS failed to show up for screening. This may lead to an underestimation in the screening potential. Additionally, newer surgical approaches	Yes. This study is highly supportive of an EBPP due to the level of evidence and results demonstrating the association between a one-time ultrasound screening for AAA and

0772-014-1398-7			to locate the literature.			such as EVAR may reduce associated long-term mortality and may need to be factored in.	reduction in mortality.
Engelberger, S., Rosso, R., Sarti, M., Del Grande, F., Canevascini, R., van den Berg, J. C, . . . Giovannacci, L. (2017). Ultrasound screening for abdominal aortic aneurysms. *Swiss Medical Weekly, 147*(910), w14412. doi:10.4414/smw.2017.14412	The purpose of this study is to determine the feasibility, acceptance, and cost of a AAA screening program in Canton, Ticino, Switzerland, in order to determine whether this could be implemented at a national level.	The sample consists of 1,800 males age 65-80 treated at the outpatient clinics associated with the Regional Hospital of Lugano.	The method is identified as a prospective cohort study. All men age 65-80 who presented for care at the outpatient clinics were included as part of the initial sample pool. Inclusion criteria narrowed the sample to include men who have never had a screening ultrasound for AAA or aortic surgery.	The results from the study indicated that 1,634 patients received the screening information leaflet, and 745 (45.6%) underwent the screening ultrasound. Eligible patients totaled 1,091, of which 68.3% accepted the optional screening. An AAA was diagnosed in 31 patients (4.2%, 95% CI, 2.8-5.9%). The age and location of residence was statistically significant in acceptance of the	Level 4: Cohort Study (University of Michigan, 2019)	Limitations of this study include dissemination of screening recommendations using the educational pamphlet versus a personal conversation, invitation using a single call, and lack of involvement of the general practitioners.	Yes. This cohort study contributes to the pool of data identifying large scale screening initiatives as useful in identifying patients with undiagnosed AAA. The study further demonstrates the need to involve general practitioners in screening initiatives to

			Appointments for ultrasounds were scheduled by phone. A diagnosis of aortic aneurysm was applied if the men had an abdominal aorta with saggital or axial diameter greater than or equal to 30 mm.	screen ($p < 0.05$). CHF 88 was the mean cost per screening ultrasound.			enhance success.
Fallucco, E. M., Seago, R. D., Cuffe, S. P., Kraemer, D. F., & Wysocki, T. (2015). Primary care provider training in screening, assessment, and treatment of adolescent depression.	The purpose of the study is to determine whether a training program will have an impact on provider screening, assessment, and treatment of	The sample consists of 31 primary care providers from 4 group practices in Jacksonville Florida.	The method is a cohort study of primary care providers.	The results indicated that primary care provider screening for depression among adolescents increased from 49 percent pre-intervention to 68% at 2-8 months post-intervention (OR 2.78, 95% CI, 2.10-3.68, $p <$ 0.0001) and 74% at 18-24 months	Level 4: Cohort study	Limitations include use of a single source of data to extrapolate data and unknown accuracy of PCP diagnoses of depression.	The study is helpful in developing an EBPP in support of provider-based intervention s to improve adherence to evidence-based screening guidelines.

Academic Pediatrics, 15(3), 326–332. doi:10.1016/j.acap.2014.12.004	adolescent depression.			post-intervention (OR 3.17, 95% CI, 2.16-4.67, $p <$ 0.0001).			
Glover, M. J., Kim, L. G., Sweeting, M. J., Thompson, S. G., & Buxton, M. J. (2014). Cost-effectiveness of the national health service abdominal aortic aneurysm screening programme in England. *British Journal of Surgery, 101*(8), 976–982. doi:10.1002/bjs.9528	The purpose of this study is to determine the cost-effectiveness of the National Health Service abdominal aortic aneurysm (AAA) screening programme.	The sample consists the 10-year follow-up data of the U.K. Multicentre Aneurysm Screening Study (MASS).	The method is identified as a prospective cohort study. The long-term cost effectiveness of offering AAA was re-estimated utilizing the detection, growth, and treatment of AAAs for the population of the MASS trial. The Markov model structure was re-validated to predict longer-term data. Recalibration	The results from the study demonstrated that there is a long-term incremental cost effectiveness of 5758 (95% confidence interval 4285-7410) per year of life gained, and 7370 (5467-9443) for each quality adjusted year of life gained.	Level 4: Cohort Study (University of Michigan, 2019)	A limitation of this study is the unanticipated factor that cost effectiveness estimates are sensitive to individual differences resultant from re-calibration of costs and outcomes individually.	Yes. This cohort study confirms that AAA screenings are cost effective to healthcare systems in the long-term.

			of parameter estimates was conducted to provide 10-year data probabilities.				
Gokani, V. J., Sidloff, D., Bath, M. F., Bown, M. J., Sayers, R. D., & Choke, E. (2015). A retrospective study: Factors associated with the risk of abdominal aortic aneurysm rupture. *Vascular Pharmacology*, *65*, 13–16. doi:10.1016/j.vph.2014.11.006	The purpose of the study is to identify risk factors that impact the risk of AAA rupture.	The sample consists of 983 patients, 315 of which were admitted to the hospital for AAA rupture, and 668 were referred for elective repair of a large AAA.	The study methodology was retrospective cohort study, in which patient data was reviewed in a tertiary referral center.	The results indicated that female gender (OR 2.49, 95% CI, 1.63-3.80), history of hypertension (OR 3.5, 95% CI, 1.6-3.8), renal failure (OR 8.08, 95% CI, 4.15-15.4), advanced age over 80 (OR 2.77, 95% CI, 1.79-4.27), and current smoking status (OR 1.80, 95% CI, 1.09-2.96) were associated with increased risk for AAA rupture. A history of statin use was correlated fewer AAA ruptures (OR 0.50,	Level 4: Cohort Study (University of Michigan, 2019)	Limitations of the study include the relatively small sample size from one location.	The study is helpful in the implementation of an EBPP as it identifies risk factors for AAA rupture. These risk factors may assist in screening initiatives in the outpatient primary care clinic.

				95% CI, 0.32-0.77)			
Guirguis-Blake, J. M., Beil, T. L., Senger, C. A., & Whitlock, E. P. (2014). Ultrasonography screening for abdominal aortic aneurysms: A systematic evidence review for the U.S. Preventive Services Task Force. *Annuals of Internal Medicine, 160*(5), 321–329.	The purpose of this systematic review by the USPSTF is to include new literature and all previous trials to provide updated evidence on the benefit of a one-time and repeated screening ultrasound for AAA.	The sample includes population based RCTs through September 2013. The review of four RCTS provided a sample size of 137,214 participants. RCTS examined outcomes for men and women at age 65 and older.	The method employed is meta-analysis of RCTs through September 2013 obtained from MEDLINE, the Database of Abstracts of Reviews of Effects, the Cochrane Central Register of Controlled Trials, clinical trial registries, references, experts, and targeted searches for randomized controlled trials.	The study results demonstrated that a one-time screening ultrasound for AAA in men age 65 and older reduced AAA rupture and mortality rates for 10-15 years. There was no statistically significant effect on all-cause mortality up to 15 years. The screening resulted in more elective surgical repairs and reduced emergent management for up to 10-15 years. There was no statistically significant benefit in AAA-related mortality or all-cause mortality in screening women.	Level 1: Meta-analysis of RCTs (Univerist y of Michigan, 2019)	Limitations include that the trials consist primarily of white males outside of the United States, and there is little information about subgroups and the benefit of re-screening.	Yes. This meta-analysis provides high level support for the benefit of offering a one-time screening ultrasound for AAA in high-risk male populations. Reduction in emergent surgical repair of ruptured AAAs and reduced mortality rates for 10-15 years is compelling for a practice change.

Healey, C. T., Neilson, M., Clark, D., Schanzer, A., & Robinson, W. (2016). Predicting mortality of ruptured abdominal aortic aneurysms in the era of endovascular repair. *Annals of Vascular Surgery, 38,* 59–63. doi:10.1016/j.avsg.2016.09.006	The purpose of the study is to validate a risk-prediction tool using preoperative variables in patients with ruptured AAA who are being considered for endovascular repair.	The sample includes 649 patients who underwent repair of ruptured AAA as part of the Vascular Study Group of New England database.	The study is a case control study, in which the authors identify characteristics associated with individuals undergoing EVAR or open repair for ruptured AAA.	The results demonstrate that 247 patients underwent EVAR and 402 patients underwent open repair. The mortality associated with ruptured AAA was 30% when open repair was performed and 26.2% when EVAR was performed. Determinants of 30-day mortality were advanced age (age >76 versus ≤ 76, OR = 2.91, CI:2.0-4.24), elevated creatinine (>1.5 mg/dl versus <1.5 mg/dl, OR = 1.57, CI: 1.05-2.34), and lowest systolic blood pressure <70 mm Hg versus ≥ 70 mm Hg, OR = 2.65 and CI: 1.79-3.92).	Level 4: Case control study (University of Michigan, 2019)	Limitations include possible risk factors not identified by the authors. The sample size is relatively small in the small in the study, as well.	The study provides support for an EBPP as it demonstrates the importance if early identification of AAA through widespread screening initiatives. Late identification of AAA, and of course ruptured AAA, is associated with higher 30-day mortality for EVAR and open repair.

				A linear model has been developed by the researchers to estimate 30-day mortality associated with repair =14+22*(age > 76) +9*(creatinine > 1.5)+20*(bp < 70). 30-day mortality ranges from 14% to 65% in high-risk groups.			
Hicks, C. W., O'Kelly, A., Obeid, T., Locham, S., & Malas, M. B. (2017). Predicting failure to rescue after abdominal aortic aneurysm repair in elderly patients. *Journal of Surgical Research, 217,*	The purpose of the study is to the determine whether trends exist among failure to rescue cases in elderly patients with a history of elective open aortic aneurysm repair or endovascula	The sample is comprised of 975 patients age ≥ 80 years with a history of elective open aortic aneurysm repair or endovascular aortic aneurysm repair, as recorded in the Vascular Quality Initiative database.	The methodology for the study is a cohort study of all patients age ≥ 80 years with a history of elective open aortic aneurysm repair or endovascular aortic aneurysm repair. The researchers utilized	The results demonstrated that failure to rescue, or postoperative complications 30-days post-surgical intervention, most commonly included acute kidney injury (62%), and respiratory failure (53%). Female gender (OR 1.95), multiple comorbidities (OR 1.98), renal insufficiency (OR	Level 4: Cohort study (University of Michigan, 2019)	Limitations of the study include the selection of age 80 as the cut-off. It is possible that a different age cut-off may be more appropriate. There may be incomplete, missing, or inaccurate data regarding mortality outcomes.	The study is helpful in informing an EBPP as it demonstrates increased mortality associated with advanced age and comorbidities. The study supports screening initiatives

265–270. doi:10.1016/j.jss.2017.06.025	r aortic aneurysm repair. Failure to rescue is defined as postoperative complications within 30 days of surgery.		multivariate logistic regression analysis to identify independent risk factors associated with failure to rescue.	1.97), peripheral vascular presented		Additionally, failure to rescue may be associated with an anatomic or technical difference not accounted for in the study.	for patients at younger ages and in high-risk groups.
Howard, D. P. J., Banerjee, A., Fairhead, J. F., Handa, A., Silver, L. E., Rothwell, P. M., & the Oxford Vascular Study. (2015). Age-specific incidence, risk factors and outcome of acute abdominal aortic aneurysms in a defined population. *British Journal*	The purpose of this study is to identify population-based data on age-specific incidence and associated outcomes from AAA events to inform AAA screening policy.	The sample consists of the demographic and health data of 92,728 men and women in Oxfordshire, England, as part of the general practice registry.	The method is a prospective population-based non-experimental descriptive study.	The results demonstrated that AAA incidence in men for the age bracket 65-74 is 55/100,000 population. For the age bracket 75-84, the incidence among males is 112/100,000. At age 85 and older the incidence among males is 298/100,000. The incidence in the 65-74 age bracket was highest in male smokers (274 per 100,000	Level 4: Cohort Study (University of Michigan, 2019)	Study limitations include the study's demographics, which consists mostly of white Caucasians. The estimation of AAA-related deaths at advanced ages may be conservative due to lack of autopsy. Additionally, analyses were	Yes. This study provides useful data to implement an EBPP by developing a screening tool based on patient populations at increased for AAA rupture and associated mortality. The study also identifies the

of Surgery, *102*(8), 907–915. doi:10.1002/bjs.9838				population per year); 96 percent of events occurred in men who currently smoke or have a history of smoking. Overall, two-thirds of AAA events occurred at age 75 or older, and 25 percent were in women. Smoking and HTN were identified as strong risk factors.		based on 103 acute AAA events, limiting rates and risk factor correlations.	changing demographics of high-risk AAA groups, particularly the change from 65 to 75 years of age in males. This information is helpful in considering a practice change.
Hye, R. J., Janarious, A. U., Chan, P. H., Cafri, G., Chang, R. W., Rehring, T. F., . . . Hill, B. B. (2019). Survival and reintervention risk by patient age and preoperative abdominal aortic aneurysm diameter after	The purpose of the study is to evaluate survival and reoperation rates after EVAR AAA repair in consideration of age and preoperative AAA diameter.	The sample consists of 1,967 patients undergoing EVAR from 2010 to 2014.	The methodology was a cohort study.	The results indicated that patient age lead to a 2.53-fold increase in mortality risk (HR = 2.53; 95% CO, 1.73-3.70; $p < 0.001$). AAA size >5.5 cm was associated with a 1.75-fold increased mortality risk (HR = 1.75; 95% CI, 1.26-2.45; $p = 0.001$). Reintervention risk	Level 4: Cohort study (University of Michigan, 2019)	Potential limitations include the presence of confounders, such as gender, race, BMI, concurrent surgery for iliac aneurysm, implant type, renal insufficiency, peripheral vascular	The study supports an EBPP aimed at increasing screening for AAA in patients at younger ages, and in patients with risk factors. AAA size. The study further provides

endovascular aneurysm repair. *Annals of Vascular Surgery, 54*, 215–225. doi:10.1016/j.avsg.2018.05.053				did not increase for age or AAA diameter. There was a lack of evidence showing an interaction between age and AAA size.		disease, and atherosclerotic cardiovascular disease.	evidentiary backing for screening patients before AAAs grow past 5.5 cm.
Jacomelli, J., Summers, L., Stevenson, A., Lees, T., & Earnshaw, J. J. (2016). Impact of the first 5 years of a national abdominal aortic aneurysm screening programme. *British Journal of Surgery, 103*(9), 1125–1131. doi:10.1002/bjs.10173	The purpose of the study is to examine compliance and early outcomes of the first five years of the Abdominal Aortic Aneurysm Screening Programme introduced by the National Health Service in England in 2009.	The sample consists of 700,000 men screened in the beginning of the program.	This study is a cohort study. All men age 65 years of age enrolled in the NHS were invited to attend a one-time screening ultrasound for AAA. Data from completed screens was compiled into a central bespoke database (AAA SMaRT) for analysis after the first 5 years of the	The results of the study indicated that AAA has a prevalence of 1.34 percent in the population identified as part of this study. Uptake of the screening program varied across the country from 61.7 to 85.8 percent. The mean uptake was 78.1 percent. Of the men screened, 870 were referred for elective AAA repair. There was a false-positive rate of 3.2 percent in the first 1,000 men referred for	Level 4: Cohort Study (University of Michigan, 2019)	Limitations of the study include lack of data on the 21.9 percent of men fitting the inclusion criteria who did not attend a screening. The authors indicate that the cohort has a higher than average rate for AAA. The authors further report that the false-negative rate is unknown. This may be further explored	This study provides evidence in support of a practice change, as the study identifies the utility of organized healthcare system wide AAA screening initiatives in identifying patients who may benefit from elective surgical repair.

			national program.	possible treatment of large AAA (greater than 5.4 cm).		through mortality data reports. However, coding inaccuracies may obscure this data.	
Jahangir, E., Lipworth, L., Edwards, T. L., Kabagambe, E. K., Mumma, M. T., Mensah, G. A., . . . Sampson, U. K. A. (2015). Smoking, sex, risk factors and abdominal aortic aneurysms: A prospective study of 18,782 persons aged above 65 years in the Southern Community Cohort Study. *Journal of Epidemiology*	The objective of this study is to determine the incidence and predictors of AAA.	The sample consists of 18, 782 participants age ≥ 65 years as part of the Southern Community Cohort Study and who received with Medicare from 1999-2012.	This study is a prospective cohort study.	The results of the study demonstrated that the annual age-adjusted incidence rate was 153/100,000 for blacks, 401/100,000 for whites, 354/100,000 for men, and 175/100,000 for women. The risk for AAA was lower among women (HR 0.48, 95% CI 0.36-0.65) and blacks (HR 0.51, 95% CI, 0.37-0.69). Smoking presented the strongest risk factor for AAA (former: HR 1.91,	Level 4: Cohort Study (University of Michigan, 2019)	Limitations of the study lack of complete information regarding history of AAA. First-time diagnosis from Medicare claims was present, but access to data for prior diagnoses was absent. Additionally, participants listed as controls may have had prior AAA screenings. Again, data may be	This study provides useful information in the implementation of an EBPP, as it identifies risk factors correlated with AAA. These risk factors may be utilized by clinicians in the screening process.

and Community Health, *69*(5), 481–488. doi:10.1136/jech-2014-204920				95% CI, 1.27-2.87; current: HR 5.55, 95% CI, 3.67-8.40), and was more pronounced in women (former HR: 3.4, 95% CI, 1.83-6.31; current: HR: 9.17, 95% CI, 4.95-17). Hypertension and history of MI or CABG was associated with AAA (HR: 1.44, 95% CI, 1.04-2.01; HR: 1.9, 95% CI 1.37-2.63). College education and black race were protective factors (HR: 0.6, 95% CI, 0.37-0.97; HR: 0.44, 95% CI, 0.28-0.67).		missing regarding prior screenings for all participants.	
Jones, G. T., Hill, B. G., Curtis, N., Kabir, T. D., Wong, L. E., Tilyard, M. W., . . . van Rij, A. M.	The purpose of the study is to examine three potential screening strategies	The sample consists of 3, 142 individuals over age 50 from the Otago region of New Zealand undergoing	The study is a cohort study of individuals age 50 and older from one location.	The results indicated that the prevalence of AAA was 4.4 percent in the three groups (those undergoing coronary	Level 4: Cohort Study (Universit y of	Limitations of the study include potential selection bias of the matched group, which	The study is helpful in informing an EBPP, as it identifies screening strategies that may

(2016). Comparison of three targeted approaches to screening for abdominal aortic aneurysm based on cardiovascular risk. *British Journal of Surgery, 103*(9), 1139–1146. doi:10.1002/bjs.10224	for AAA based on cardiovascular risk.	coronary angiography, PAD assessment, or community based cardiovascular disease risk assessment. A fourth group of individuals with no signs or symptoms of cardiovascular disease was used as a comparison group.		angiography, PAD assessment, or community based cardiovascular disease risk assessment). The incidence of AAA was 1 percent in the cardiovascular disease-free comparison group.	Michigan, 2019)	may be problematic in comparing this group to the general population.	assist clinicians in identifying individuals at high risk for AAA.
Kühnl, A., Erk, A., Trenner, M., Salvermoser, M., Schmid, V., & Eckstein, H. (2017). Incidence, treatment and mortality in patients with abdominal aortic aneurysms: An analysis of	The purpose of this study is to examine the incidence, treatments employed, and hospital mortality rates of patients diagnosed with an abdominal aortic	The sample consists of all patients admitted to a German hospital that is reimbursed according to the DRG remuneration system between the 2005 and 2014.	The method was a retrospective cohort study with inclusion of DRG datasets from German hospitals. Data was further categorized for stricter inclusion criteria, with	The results demonstrated that the hospital incidence of AAA was 27.9 per 100,000 for men and 3.3 cases per 100,000 for women. From 2005 to 2014, the incidence of ruptured AAA fell by 30% for both men and women. Non-ruptured	Level 4: Cohort study (University of Michigan, 2019)	Limitations of the study include potential case bias due to miscoding or changes in procedural coding, underreporting of secondary diagnoses not associated with the	The study is supportive of an EBPP as it provides evidence of high mortality rate associated with ruptured AAA, even with surgical

hospital discharge data from 2005–2014. *Deutsches Aerzteblatt Online*, *114*(22–23), 391–398. doi:10.3238/arztebl.2017.0391	aneurysm in Germany from 2005 to 2014.		the results pooled from 12,994 patients with a ruptured AAA who resided in Germany and were treated operatively and 9,716 patients with a ruptured AAA who resided in Germany and were treated conservatively.	AAA increased by 16% for men and 42% for women. Endovascular treatment increased during the study period from 29% to 75% in patients with non-ruptured AAA and 8% to 36% in patients with ruptured AAA. In-hospital mortality associated with non-ruptured AAA was found to be 3.3% for men and 5.3% for women. Surgically treated ruptured AAAs were found to have a 39% mortality rate in men and 48 percent mortality rate in women.		DRG, lack of data regarding diameter of aneurysms and technical level of expertise, lack of data related to deaths after hospital discharge, and lack of data related to quality of life or patient reported outcomes.	intervention. The study did demonstrate a reduction in AAA ruptures during the study period. However, non-ruptured AAAs increased for women over the study period, indicating a need to carefully consider screening criteria.
Li, K., Zhang, K., Li, T., & Zhai, S. (2018). Primary results of abdominal aortic	The purpose of the study is to provide epidemiological and risk factor data regarding	The sample consists of 6,925 at-risk residents age 40 and older in three urban and two rural	The methodology used was a cross sectional cohort study conducted of	The results included data from 5,402 participants, with a mean age of 61.2 ±10.4 years. Of the total sample, 2,847	Level 4: Cohort study (University of	Limitations of the study include that fact that the study was comprised of participants	This study is supportive of an EBPP change, as it adds to the literature

aneurysm screening in the at-risk residents in middle China. *BMC Cardiovascular Disorders, 18*(1), 60. doi:10.1186/s12872-018-0793-5	AAA in middle China.	communities in middle China between March 2014 and October 2015.	all residents of three urban and two rural communities randomly selected. A population-based sample of residents age 40 and older was enrolled in the study and invited to complete a risk-factor questionnaire and subsequent screening for AAA.	women and 2,555 men were included. The average age of women was 62.5 ±10.4 years and the average age of men was 59.7 ± 10.2 years. The mean maximum infrarenal aorta diameter was 15.0 ± 2.7 mm. During the screening process, 18 participants (age 68 ± 10.4 years) were found to have a AAA. The total prevalence was 0.33%. The prevalence for males was 0.55%, while the prevalence for females was 0.14% (p = 0.009). Subjects age 55 to 75 years had a higher prevalence of AAA compared to other age groups	Michigan, 2019)	with established risk factors, including cardiovascular disease. The study also lacked long-term follow-up, limiting data of the benefits of screening.	identifying risk factors for increased for of AAA, including advanced age and male gender. This information provides assistance in educating providers regarding risk factors and developing screening parameters.

				(0.51%, versus 0.11%, $p = 0.016$).			
Liisberg, M., Diederichsen, A. C., & Lindholt, J. S. (2017). Abdominal ultrasound-scanning versus non-contrast computed tomography as screening method for abdominal aortic aneurysm - A validation study from the randomized DANCAVAS study. *BMC Medical Imaging, 17*(1), 14. doi:10.1186/s12880-017-0186-8	The purpose of the study is to determine whether non-contrast enhanced CT is equal to or superior to ultrasonography in screening for AAA.	The sample consists of 538 men enrolled as part of the randomized Danish Cardiovascular Screening Trial. A total of 533 men age 65-74 underwent both non-contrast enhanced CT scans and ultrasounds for AAA screening	This was a population based cross-sectional study performed within a population-based randomized screening trial. One-third of the 45,000 participants were invited for a AAA screening. Ultrasound and non-contrast enhanced CT AAA screenings were performed consecutively. Individuals conducting the ultrasound screenings	The results demonstrated that the sensitivity of ultrasonography to detect abdominal aortic aneurysms ranged from 57.1-70.4%. The specificity ranged from 99.2-99.6%. The sensitivity of non-contrast enhanced CT to detect abdominal aortic aneurysms ranged from 82.6-88.9%, with a specificity of 97.7-98.4%.	Level 4: Case control or cohort Study (University of Michigan, 2019)	Limitations include lack of an accurate reference standard, which would be a 3D contrast enhanced CT, the presence of only men in the study, and inability to conclude that non-contrast enhanced CT should be considered a reference standard.	Yes. This study is supportive of an evidence-based practice change as it practice change to recommend ultrasonography as a the screening method for AAA detection. Ultrasonography demonstrates high specificity and is less expensive than non-contrast enhanced CT. While non-contrast enhanced CT

			were blinded from the non-contrast enhanced CT scan results.				demonstrates greater sensitivity, it has not been established as a true reference standard.
Olchanski, N., Winn, A., Cohen, J. T., & Neumann, P. J. (2014). Abdominal aortic aneurysm screening: How many life years lost from underuse of the Medicare screening benefit? *Journal of General Internal Medicine, 29*(8), 1155–1161. doi:10.1007/s11606-014-2831-z	The purpose of the study is to examine utilization of the AAA screening benefit and estimate how increased utilization may influence population life through life years gained. Additionally, the study sought to examine the benefit of extending	The sample consists of new Medicare beneficiaries age 64 or 65 from the year 2005 to 2009.	Retrospective observational cohort study. Medicare claims data was analyzed to determine Welcome to Medicare examination utilization. The researchers examined claims for the following G-code G0344 prior to 2009 and G0402 and utilization of the AAA screening	The results demonstrated that there was low utilization of AAA screening. Of all claims reviewed, under 1% of Medicare beneficiaries were screened. The authors estimated that screening could increase life expectancy by 0.11 years for men with a history of smoking, 0.17 years for men with a family history of AAA, and 0.08 years for women with a family history of AAA.	Level 4: Cohort Study (University of Michigan, 2019)	Limitations include the fact that assumptions were used for AAA prevalence, treatment, and outcomes based on previously published U.S. research and surveys. There was limited data published with women as the sample.	This study is supportive of an evidence-based practice change, as it identifies the need to increase the number of eligible Medicare beneficiaries screened for AAA. The study illustrates a need for enhanced provider education that

	the screening to women with a history of smoking.		benefit code G0389. Medicare claim analysis was conducted for all new Medicare beneficiaries age 64 or 65 from the year 2005 to 2009.				Medicare provides the one-time screening benefit at no charge to patients with utilization of the G0389 CPT code.
Raz, D. J., Wu, G. X., Consunji, M., Nelson, R. A., Kim, H., Kim, J. Y., . . . Sun, C. (2018). The effect of primary care physician knowledge of lung cancer screening guidelines on perceptions and utilization of low-dose computed tomography. *Clinical Lung*	The purpose of the study is to determine whether knowledge of USPSTF guidelines among primary care providers increases utilization of LDCT to screen for lung cancer.	The sample consists of 1,384 randomly selected primary care providers in Los Angeles between January and October 2015.	The method is a cohort study utilizing random assignment.	The results indicated that 117 primary care providers (47 percent) were aware of current USPSTF guidelines regarding lung cancer screening. A higher percentage of PCPs reported that screening reduced lung cancer mortality among those eligible for screening when they were aware of the USPSTF	Level 4: cohort study	Limitations of the study include low response rate, inconsistency between Centers for Medicare and Medicaid Services and USPSTF guidelines regarding LDCT screening may lend to confusion among providers in answering	The study is highly supportive of an EBPP, as it demonstrates that an educational intervention to improve provider knowledge of evidence-based practice may result in improved adherence to evidence-based

Cancer, 19(1), 51–57. doi:10.1016/j.cllc.2017.05.013				guidelines (97% versus 90%, p = 0.2). A higher percentage of PCPs aware of the USPSTF guidelines ordered screening LDCT and provided patient counseling regarding screening (71% vs. 38%, $p < 0.001$; 86% vs. 62%, $p <$ 0.001).		survey questions, and population limited to Los Angeles.	screening recommendations.
Reite, A., Søreide, K., Ellingsen, C. L., Kvaløy, J. T., & Vetrhus, M. (2015). Epidemiology of ruptured abdominal aortic aneurysms in a well-defined Norwegian population with trends in incidence, intervention rate,	The purpose of the study is to determine the epidemiology of ruptured AAA in a population in Norway.	The sample consists of 282, 000 to 339, 000 residents in the catchment area of Stavanger University Hospital.	The method employed is a population-based cohort study, with inclusion of all data related to ruptured AAA in the area of Stavanger University Hospital between January 2000 and December 2012. Data was	The study identified 216 patients with a ruptured aortic aneurysm. The incidence rate during the study period was 11.0 per 100,000 per year (95% CI, 9.6-12.5). Of these patients, 20 expired out of the hospital and 144 of the 196 (73%) admitted to the hospital received surgical	Level 4: Cohort study (University of Michigan, 2019)	Study limitations include possible underestimation of AAA-associated mortality outside of the hospital. There is an overall decline in the number of autopsies being performed compared to	The study is highly supportive of an EBPP to screen eligible patients for AAA, as it provides evidence of high mortality rates associated with ruptured AAA.

and mortality. *Journal of Vascular Surgery, 61*(5), 1168–1174. doi:10.1016/j.jvs.2014.12.054			extrapolated by searching for patient records using ICD-10 codes (I71.1-I71.9).	intervention. The adjusted mortality rate was 7.5 per 100,000 per year (95% CI, 6.3-8.8). The 90-day standardized mortality rate was 37.2 (95% CI, 31.6-43.7) and the overall 90-day mortality rate was 68%, with a 51% mortality rate among those treated for ruptured AAA.		previous decades, potentially limiting reliable data regarding ruptured AAA.	
Takagi, H., Ando, T., & Umemoto, T. (2018). Abdominal aortic aneurysm screening reduces all-cause mortality: Make screening great again. *Angiology, 69*(3), 205–	The purpose of the study is to determine whether AAA screening reduces mortality by performing an updated meta-analysis of the longest follow-up	The sample consists of RCTs of AAA screening in men.	The method employed is meta-analysis of RCTs using MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials, and a manual search of secondary sources	The results demonstrated that, at greater than 13 years of follow-up, invitation for AAA screening reduced all-cause mortality in analyzing time to event data (Hazard Ratio: 0.98, 95% CI, 0.96-0.99, p = 0.003). There was no reduction in dichotomous data (OR: 0.99, 95%	Level 1: Meta-analysis of RCTs (University of Michigan, 2019)	Limitations include that fact that summary statistics were obtained from the RCTs and individual data were not provided from all RCTs. Second, participants who did not undergo the screening	Yes. This meta-analysis provides statistically significant evidence that providing AAA screening to patients promotes a reduction in all-cause and AAA-

211. doi:10.1177/0003319717693107	results from RCTs.		through October 2016.	CI, 0.96-1.01, p = 0.23). A statistically significant reduction in AAA-related mortality was seen in patients invited for AAA screening (OR: 0.66; 95% CI, 0.47-0.93, p = 0.02). Non-AAA mortality was not reduced (OR:1.00, 95% CI, 0.98-1.02, p = 0.96). A statistically significant reduction in all-cause, AAA-related, and non-AAA-related mortality was seen in patients invited for AAA screening. All-cause and non-AAA mortality were higher among non-attenders (OR:1.41; 95% CI, 1.23-1.63, p < 0.00001; OR: 1.39,		presents a problem for assessing non-AAA mortality. Finally, all-cause and non- AAA mortality was higher in participants who did not follow through with the screening and in non-invitees.	associated mortality at greater than 13 years of follow-up. This is highly support of a practice change.

				95% CI, 1.18-1.64, $p < 0.0001$).			
Tang, W., Yao, L., Roetker, N. S., Alonso, A., Lutsey, P. L., Steenson, C. C., . . . Folsom, A. R. (2016). Lifetime risk and risk factors for abdominal aortic aneurysm in a 24-year prospective study: The ARIC study (atherosclerosis risk in communities). *Arteriosclerosis, Thrombosis, and Vascular Biology, 36*(12), 2468–2477. doi:10.1161/ATVBAHA.116.308147	The purpose of the study is to examine the lifetime risk of AAA and association between cardiovascular risk factors present in mid-life and AAA.	The sample consists of 15, 792 participants followed from 1987 to 1989 up until 2013 as part of the ARIC cohort.	The method was a prospective cohort study, in which 15, 792 participants were followed for a median of 22.5 years to determine the clinical AAA events.	The results demonstrated that the lifetime risk for AAA is 5.6% at age 45 (95% CI, 4.8-6.1). The risk lifetime risk for AAA was higher in men (8.2%) and current smokers (10.5%). Participants who quit smoking between visit 1 and 4 had a 29% reduction in lifetime AAA risk compared to those who continued to smoke. The lifetime risk of AAA rupture or medical intervention was 1.6% (95% CI, 1.2-1.8).	Level 4: Prospective cohort study. (University of Michigan, 2019)	Limitations include the potential for underestimation of incidence due to participants who were lost to follow-up and the approximation of AAA incidence through 85 years old. Additionally, health status may serve as a confounding factor, as well as level of control of hypertension and diabetes.	This study is supportive of an EBPP, as it identifies the inclusion criteria for AAA screening in the outpatient setting and provides evidentiary backing from a long-term prospective cohort study.
Tomee, S. M., Gebhardt, W. A., de Vries, J.	The purpose of the study is to	The sample is 10 male patients with an AAA	The methodology was a	The results indicated that the patients did not	Level 6: Single	Limitations of the study include the	The study is supportive an EBPP, in

P., Hamelinck, V. C., Hamming, J. F., & Lindeman, J. H. (2018). Patients' perceptions of conservative treatment for a small abdominal aortic aneurysm. *Patient Preference and Adherence, 12*, 119–128. doi:10.2147/PPA.S149822	determine patient satisfaction of conservative treatment for small size AAA.	between 35 and 49 mm at two hospitals.	descriptive study consisting of questionnaires and interviews conducted on patients being surveilled for an aneurysm between 35 and 49 mm.	experience a negative impact on social life of emotional well-being as a result of being under surveillance for AAA. None of the patients reported fear of AAA rupture. The patients reported contentment with frequency of surveillance screening. The patients did, however, possess a knowledge deficit regarding AAA disease and screening options.	descriptive study (University of Michigan, 2019)	fact that all participants are Dutch, which could present a cultural bias. Additionally, there were no females in the study. Finally, selection bias is a possibility due to the qualitative study methodology.	that it provides useful information to providers that patients under surveillance for AAA may not experience a reduced quality of life. Additionally, the study highlights the need to provide improved patient education regarding the nature of AAAs and treatment options.
van de Luijtgaarden, K. M., Rouwet, E. V., Hoeks, S. E., Stolker, R. J.,	The purpose of the study is to determine if there is a difference	The sample consists of 780 male and female patients diagnosed with a AAA at an	The study methodology is a cross-sectional, observational, single-center	The results demonstrated that out of the initial 780 patients diagnosed with AAA during the	Level 4: Cohort study (University of	Limitations of the study include patient-reported family history	The study is supportive of an EBPP, as it adds to the evidence in

Verhagen, H. J., & Majoor-Krakauer, D. (2017). Risk of abdominal aortic aneurysm (AAA) among male and female relatives of AAA patients. *Vascular Medicine*, *22*(2), 112–118. doi:10.1177/1358863X16686409	among male and female patients in the risk of developing a AAA when a family history of AAA is present. The study also sought to determine if there is a familial clustering in AAA among female relatives versus male relatives.	outpatient clinic between 2009 and 2012.	cohort study utilizing patient data from all patients diagnosed with AAA at the Erasmus University Medical Center between 2004 and 2012. Patients were provided a family questionnaire to provide a family history analysis.	study period 2004 to 2012, 600 patients were alive between 2009 and 2012. Of the 600 patients, 482 returned the questionnaire (80.3%). Family history of AAA was reported by 128 of the 568 index AAA patients (22.5% prevalence). Female relatives of patients with a AAA had a 2.8 times greater risk of AAA development than the sex-specific general population, while male relatives had a 1.7 times greater risk. Relatives of female patients had a 5.5 -fold higher risk of aneurysm development (9.0 versus 5.9%, *p* =	Michigan, 2019).	data as opposed to aortic imaging. Data validation was conducted for over half of the relatives of study participants. Additionally, there is no nation-wide screening program in the Netherlands, potentially leading to underestimation of AAA prevalence. Additionally, there may general underreporting of AAA in women due to smaller body size and similar diagnostic parameters	development of criteria for screening, including assessing for family history of AAA in the outpatient clinic.

				0.022), while relatives of male patients had a 2.0-fold greater risk.		used for men and women.	
Vänni, V., Hernesniemi, J., Turtiainen, M., Turtiainen, J., & Hakala, T. (2015). Screening men with coronary heart disease for abdominal aortic aneurysm: A prospective cohort study. *World Journal of Surgery*, *39*(9), 2354–2358. doi:10.1007/s00268-015-3091-8	The purpose of this study is to determing the prevalence of non-diagnosed abdominal aortic aneurysm in men with coronary heart disease. The authors sought to determine whether screening for AAA in higher risk populations is both feasible and efficacious.	The sample consists of 600 male patients with diagnosed coronary heart disease. The sample was extrapolated from a pool of 176,000 patients in the North Karelia Central Hospital system in Joensuu.	The researchers utilized hospital data to identify male patients with coronary heart disease from the pool of AAA 176,000 patients. Invitations for screening were sent to all 600 patients. Of those invited for the screening, 483 (73%) patients attended the AAA screening.	The incidence of AAA was found to be 5.7% among patients screened. A total of 25 AAAs were found. Independent risk factors were identified to be advanced age, family history of AAA, and current or previous history of smoking. The cost of the screening was approximately 18.50 $ per patient or 325.00 $ per AAA identified.	Level 4: Prospective cohort study (University of Michigan, 2019)	Study limitations include a small population, which prevents prediction of a number needed to screen value. Additionally, the small sample size limits generalizability.	This prospective cohort study is helpful in implementing an EBPP, as it strengthens the pool of evidence indicating specific risk factors for AAA. Advanced age, family history, past or current history of smoking are identified as important risk factors to relay in provider education to promote a

							screening program.
Wanhainen, A., Hultgren, R., Linné, A., Holst, J., Gottsäter, A., Langenskiöld, M., . . . Swedish Aneurysm Screening Study Group. (2016). Outcome of the Swedish nationwide abdominal aortic aneurysm screening program. *Circulation, 134*(16), 1141–1148. doi:10.1161/CIRCULATIONAHA.116.022305	The purpose of the study is to report the outcomes of the Swedish AAA screening program.	The sample consists of all men age 65 identified through the National Population-based Registry in Sweden. This population totaled 302,957 men.	This cohort study was conducted by inviting all men age 65, as identified through the National Population-Based Registry for a AAA screening via ultrasound. The registry is updated every 3 months.	The results of the study determined that of the 302, 957 men invited for screening ultrasounds, 84 percent attended. The prevalence of AAA detected by screening was 1.5 percent. After a mean of 4.5 years, 29 percent of patients diagnosed with AAA received surgical repair. There was a 30-day mortality rate of 0.9 percent among those who underwent repair (1.3 % after open repair and 0.3% after endovascular repair, P<0.001). Screening resulted in a statistically significant reduction in AAA-associated mortality (mean,	Level 4: Cohort Study (Univeristy of Michigan, 2019)	Limitations of the study include potential confounding factors responsible for the improvement in AAA-associated mortality. This includes a falling prevalence of the disease, increased use of endovascular repair, improved perioperative outcomes, and longer life expectancy.	This study may be used to support an EBPP, as the study demonstrates the importance of enhanced efforts to screen all men at age 65. Clinicians should be educated about the population-wide benefits of enhanced screening programs, and the number needed to screen concept.

				4% per year of screening, p = 0.020). The number needed to screen to prevent one premature death was 667. The number needed to operate on to prevent one premature death was 1.5. Sweden has a population of 9.5, yielding a reduction in 90 and a gain of 577 quality-adjusted years annually.			
Ye, Z., Bailey, K. R., Austin, E., & Kullo, I. J. (2016). Family history of atherosclerotic vascular disease is associated with the presence of abdominal aortic aneurysm. *Vascular*	The purpose of the study is to determine whether a family history of ASCVD is associated with the presence of AAA. A secondary purpose of the study is	The sample consists of 11, 814 patients who underwent noninvasive vascular evaluation or stress electrocardiogram testing at the Mayo Clinic.	The study is a cohort study comprised of 696 patients with AAA and 2,686 control subjects recruited from the non-invasive vascular and stress electrocardiogram	The results demonstrated that AAA was associated with family history of AAA or ASCVD after adjustment for age, sex, HTN, BMI, diabetes, smoking, hyperlipidemia, and ASCVD: (adjusted OR; 95% CI, 2.17 (1.66-2.83, p < 0.01) and	Level 4: Cohort study (University of Michigan, 2019)	Limitations of the study include the fact that all study participants were referred to the Mayo Clinic, possibly limiting generalizability, a mostly white population	The study supports the implementation of an EBPP as it enables one to develop a screening tool based on risk factors. A family history of ASVCD is not

Medicine, 21(1), 41–46. doi:10.1177/1358863X15611758	to determine whether a family history of different subtypes of ASCVD and parental versus sibling history correlated with AAA.		laboratories at the Mayo Clinic.	1.31 (1.08-1.59, p <0.01). Patients with a family history of ASCVD had a 27% higher risk of having a AAA after adjustment for family history of aortic aneurysm (adjusted OR, 95%, CI: 1.27, 1.05-1.55, p = 0.01). A family history of ASCVD in multiple arteries correlated with higher odds of having AAA, specifically 1.23 times higher for each additional location (1.08-1.40, p = 0.01).		(>98%), and potential recall bias with respect to family history.	mentioned in the guidelines. However, this may help inform clinicians of additional screening criteria to consider.

Appendix B: Permission to Use the Iowa Model

From: Kimberly Jordan - University of Iowa Hospitals and Clinics <noreply@qualtrics-survey.com>
Sent: Friday, September 20, 2019 1:40 AM
To: Rank, Jennifer Elizabeth <[redacted]>
Subject: Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care.* Click the link below to open.

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Citation: Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing, 14(3), 175-182. doi:10.1111/wvn.12223*

In written material, please add the following statement:
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Please contact [redacted] or [redacted] with questions.

Appendix C: CITI Training for Social and Behavioral Research

This is to certify that:

Jennifer Rank

Has completed the following CITI Program course:

Social & Behavioral Research - Basic/Refresher (Curriculum Group)

Social & Behavioral Researchers (Course Learner Group)

1 - Basic Course (Stage)

Under requirements set by:

Liberty University

Verify at www.citiprogram.org/verify/?w9e1c8303-f1f9-4879-b91d-bf5f63a8a656-33191318

Appendix D: Letter of Support from Organization

October 2, 2019

To whom it may concern at Liberty University,

Jennifer Rank, R.N., B.S.N, has the support of [redacted] to complete her scholarly project aimed at increasing the number of abdominal aortic aneurysm screenings completed in the primary care setting.

Sincerely,

DeeDee Hicks

Administrator, Billing/Insurance

[redacted]

Appendix E: AAA Screening Tool

Abdominal Aortic Aneurysm Screening Checklist

	Yes	**No**
Male Gender		
Age 65-75		
Current or Past Smoking Status (total of 100 cigarettes in lifetime for Medicare coverage of ultrasound)		
Family history of AAA in a first degree relative		

*If the first 3 criteria are met, a one-time ultrasound to screen for AAA is covered by insurance.

*The 4th criterion (family history) is supported by the evidence; insurance coverage for the AAA screening should be evaluated, and screening should be completed based on patient/provider decision.

Screening Ultrasound Ordered by provider: **Yes** **No**

Reason for not ordering (patient declined, other):

Appendix F: Pre- and Post-Test

Pre- and Posttest

1. At what age should AAA screening start?
    a. 50
    b. 55
    c. 60
    d. 65
2. At what age should AAA screening stop?
    a. 65
    b. 70
    c. 75
    d. 80
3. How often should AAA screening be repeated
    a. Every 6 months to 1 year (depending on clinical scenario)
    b. Every 5 years
    c. Every 10 years
    d. This is a one-time screening
4. What is considered high-risk criteria for AAA development (select all that apply)?
    a. Advanced age
    b. Male gender
    c. History of DM II
    d. Current or past smoker

5. What additional risk factor may be considered in the clinical decision-making for ordering a one-time AAA screening? (Select all that apply)
    a. Family history of AAA (First degree relative)
    b. African American race
    c. Hypertension or ASCVD
    d. HFrEF
6. What is the preferred method for AAA screening?
    a. Ultrasonography
    b. CT
    c. MRI
    d. MRA
7. Screening for AAA using ultrasonography is deemed to have which of the following:
    a. High specificity and repeatability
    b. High sensitivity
8. What is the smoking criterion for insurance coverage of AAA screening?
    a. Current smoker
    b. Smoked in the past 10 years
    c. 30 pack year history of smoking
    d. 100 total cigarettes smoked
9. Which of the following are correlated with higher mortality associated with AAA? (select all that apply)
    a. Advanced age
    b. Medical comorbidities

c. Size of AAA at repair

d. Patient presentation at time of repair

10. AAA screening is associated with which outcomes? (Select all that apply)

a. 43 % reduction in AAA-associated mortality for men at 3-5 years post-screening

b. 42 % reduction in AAA-associated mortality for men at 13-15 years post-screening

c. Reduction in all-cause mortality for men at 13 years post-screening

d. Reduction in AAA-associated mortality for women at 13 years post-screening

e. Reduction in all-cause mortality for women at 13 years post-screening

Appendix G: IRB Approval

LIBERTY UNIVERSITY.
INSTITUTIONAL REVIEW BOARD

January 31, 2020

Jennifer Rank
Vickie Moore

Re: IRB Application - IRB-FY19-20-24 Increasing Provider Knowledge of Abdominal Aortic Aneurysm Screening and Introduction of a Screening Tool to Increase the Number of AAA Screenings Ordered for Eligible Patients in a Family Practice Clinic- An Evidence Based Practice Project

Dear Jennifer Rank, Vickie Moore:

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Decision: No Human Subjects Research

Explanation: Your study does not classify as human subjects research because:

(2) evidence-based practice projects are considered quality improvement activities, which are not considered "research" according to 45 CFR 46.102(d).

Please note that this decision only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued non-human subjects research status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this determination or need assistance in determining whether possible modifications to your protocol would change your application's status, please email us at irb@liberty.edu.

Sincerely,

G. Michele Baker, MA, CIP
Administrative Chair of Institutional Research
Research Ethics Office