ATTITUDES AND BELIEFS OF NURSE PRACTITIONERS TO AUGMENT BREAST CANCER SCREENING WITH ULTRASONOGRAPHY

by

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A DNP Project Submitted to the Faculty of the COLLEGE OF NURSING
In Partial Fulfillment of the Requirements For the Degree of DOCTOR OF NURSING PRACTICE
In the Graduate College
THE UNIVERSITY OF ARIZONA

2015
As members of the DNP Project Committee, we certify that we have read the DNP Project prepared by Hilary Smith entitled “Attitudes and Beliefs of Nurse Practitioners to Augment Breast Cancer Screening with Ultrasonography” and recommend that it be accepted as fulfilling the DNP Project requirement for the Degree of Doctor of Nursing Practice.

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SIGNED: __Hilary Smith________________
ACKNOWLEDGMENTS

I would first like to thank my husband for his unconditional love and support throughout my educational career and this DNP program. Without him I would not have survived this program; his constant belief, support, and understanding helped push me to want to do better each and every day. Also thank you for being my personal IT handyman!

Thank you to my chair Dr. Dubois, and my committee Dr. Wiley and Dr. Owen-Williams for your guidance and support throughout my DNP project. I am grateful that you all were a part of my committee, without each and every one of you I would not be where I am today. You have all been a joy to work with and have made this stressful process easier to handle.

Thank you to my friends and classmates, for helping me through this crazy journey. Without all of your support I would not have pushed through, you all kept me on track to help me see the light at the end of the tunnel and be where I am at today.
DEDICATION

This DNP project is dedicated to all the survivors and women who have fallen victim to breast cancer. My hope is that this project will lead to an increase in knowledge of alternative breast screening modalities, leading to an increase in women being screened and lives saved.
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ABSTRACT

**Background:** Recent studies have suggested that the diagnostic reliability and accuracy of breast ultrasonography in place of mammography in women with dense breast tissue results in more accurate breast cancer screening in this population. Since breast cancer is the second leading cause of cancer deaths among United States women, a more accurate and reliable breast cancer screening tool is needed (American Cancer Society [ACS], 2014). This process starts with describing breast screening practice patterns of nurse practitioners and analyzing their attitudes and beliefs of alternative screening modalities gathered from the survey results obtained from this DNP project.

**Purpose:** The purpose of this study is to determine the attitudes and beliefs of if nurse practitioners towards the use of ultrasonography alone in lieu of mammography followed by sonography in women aged 40-74 with mammographically dense breast tissue.

**Methods:** A survey consisting of 23 questions was sent to nurse practitioners in Arizona through the Coalition of Arizona Nurses in Advanced Practice listserv, and through an email list provided by the president of the Allied Health Providers of Yuma.

**Results:** Analysis of survey responses indicated that the majority of respondents believe that it is difficult to detect cancer using mammography in women with dense breast tissue, and more than half of respondents believe that ultrasounds are more accurate and reliable at detecting cancer in women with dense breast tissue. The results also demonstrate that the majority of nurse practitioners surveyed are not familiar with current literature regarding ultrasonography screening in women with dense breast tissue.
INTRODUCTION

Background Knowledge

Breast cancer is the second most common cancer among United States women affecting approximately 1 in 8 women (American Cancer Society [ACS], 2014). The ACS (2014) estimated that 40,000 women would die from breast cancer, 232,670 new cases of invasive breast cancer would be diagnosed, and 62,570 new cases of carcinoma in situ (CIS) would be diagnosed in 2014.

Research supports that breast screening reduces mortality rates from breast cancer. However, new research questions mammography as the gold standard and best screening tool to detect cancer (Gøtzsche & Jørgensen, 2013; Raftery & Chorozoglou, 2011). Women ages 40-47 with dense breast tissue are at high risk for breast cancer because cancerous spots are more difficult to detect on mammography (American College of Radiology [ACR], 2012; Ho, Jafferjee, Covarrubias, Ghesani, & Handler, 2014). Breast tissue is made up of primarily fibrous, glandular, and fatty tissue: dense breasts having more fibrous and glandular tissue and less fatty tissue placing these women at higher risk for cancer, and decreased diagnostic accuracy with mammography (ACR, 2012). Breast density is determined by a radiologist following an initial mammography and breast tissue density is categorized into four levels (ACR, 2012).

According to the ACR (2012) ten percent of women in the United States have extremely dense breasts, 40 percent have heterogeneously dense breasts, 40 percent have scattered areas of fibroglandular density in breasts, and ten percent have almost entirely fatty breasts. A number of factors affect a women’s breast density, such as age, menopausal status, pregnancy, genetics, and the use of certain medications such as hormone therapy (ACS, 2013). Breast density decreases
with age, and is further reduced with pregnancy and menopause (ACS, 2013). It is also noted by the ACS (2013) that women high body weight have lower breast density due to the higher proportion of fatty tissue. According to the American College of Radiology there are four levels of breast cancer density. Level 1 is an almost entirely fatty breast, level 2 has scattered areas of fibroglandular breast tissue, level 3 is a heterogeneous breast, and a level 4 is an extremely dense breast (ACR, 2012).

Recent studies have suggested the diagnostic reliability and accuracy of breast ultrasonography in place of mammography screening in women with dense breast tissue. One retrospective database review concluded that 81% of breast cancers detected on ultrasonography’s had not been detected on mammography in a study of 329 women (Bae et al., 2014). Another study concluded that in women with dense breast tissue ultrasonography detected 0.32% more cancer after a negative mammography (Northaker et al., 2009). These data support that the use of breast ultrasounds has the potential to detect small, occult breast cancers that were not detected on mammography (Northaker et al., 2009).

In addition to detecting cancer more frequently, the augmentation of breast screening with ultrasonography has the potential to increase adherence of breast screening leading to more women being screened. Researchers have seen a decline in routine screening since 2008 due to various reasons including test efficacy, cost, and pain associated with exams (Watson-Johnson et al., 2011). Breast screening augmented with ultrasonography has the potential to increase test efficacy, decrease cost and decrease the amount of pain endured during the procedure potentially leading to increased screening adherence and a more accurate and reliable screening tool.
**Problem Statement**

Despite research that suggests the diagnostic reliability and accuracy of breast ultrasonography in the diagnosis of breast cancer, missed and under diagnosis remains significant concerns. With breast cancer being the second leading cause of cancer deaths among United States women, a more accurate and reliable breast cancer screening recommendation needs to be a priority in primary care as a secondary prevention measure (Pace, Nancy, & Keating, 2014). Early and accurate detection of cancer is essential in providing patients with increased quality of life with the least economic burden. This process starts with describing breast screening practice patterns of nurse practitioners and analyzing their attitudes and beliefs of alternative screening modalities gathered from the survey results obtained from this DNP project. In discussion with several NPs within AZ it was noted that they are unaware of current breast cancer screening guidelines or are knowledgeable about current research that supports the use of ultrasonography in lieu of mammography followed by ultrasonography in women with dense breast tissue, leading to the identification of a local problem.

**Aims of Project**

Current guidelines from the ACS and the National Comprehensive Cancer Network (NCCN) recommend breast screening beginning at age 40 (Susan G. Komen, 2015). The ACS and NCCN also note that in high risk women additional screening interventions such as the addition of ultrasonography following mammography has the potential to detect more occult breast cancer (Berg et al., 2012; Susan G. Komen, 2015). The United States Preventive Service Task Force (USPSTF) recommends biennial screening starting at age 50 and neither guideline suggest screening after the age of 75 (Hendrick & Helvie, 2011).
There are no current, accepted clinical guidelines for using ultrasonography alone in women with dense breast tissue, but new and emerging evidence is showing that ultrasounds can lead to an increase in breast cancer detection. In a multicenter study across China conducted between 2008-2010, that consisted of 13,339 high-risk women between the ages of 30-65 it was concluded that ultrasounds were more sensitive and had better diagnostic accuracy than mammography (Shen et al., 2015). Of the 30 cancers that were detected, 5 were in the mammography group and 11 in the ultrasound group with the conclusion that ultrasounds are superior to mammography in high risk Chinese women (Shen et al., 2015). In another study of 200 women who underwent breast examination with either ultrasound or automated breast volume scanning (ABVS) which is a 3D ultrasound of the breast, 194 (ultrasound group) and 273 (ABVS group) lesions were detected (Xiao, Zhou, & Chen, 2015). All of the 194 ultrasound detected lesions were also detected by ABVS, and of the 273 ABVS detected lesions it was determined that 22 lesions were malignant (Xiao, Zhou, & Chen, 2015). Ultrasound detected 21 of the 22 malignant lesions (Xiao, Zhou, & Chen, 2015). Early and accurate detection of cancer is essential in providing patients with increased quality of life with the least economic burden.

The purpose of this study is to determine the attitudes and beliefs of if nurse practitioners towards the use of ultrasonography alone in lieu of mammography followed by sonography in women aged 40-74 with mammographically dense breast tissue. The long term goal is to provide early and more accurate detection of breast cancer in women with mammographically dense breast tissue, thus initiating treatment early to improve short and long term outcomes.

**Study Questions**

The project is designed to answer the following questions:
1. What are nurse practitioners current practices for breast cancer screening in women with mammographically dense breast tissue?

2. What are the attitudes and beliefs of primary care nurse practitioners regarding alternative breast cancer screening modalities with ultrasonography alone as opposed to the current guidelines which suggest mammography followed by ultrasonography in high risk women?

3. Would nurse practitioners adopt the recommendation to offer breast cancer screening with ultrasonography alone in their patients with mammographically dense breast tissue?

FRAMEWORK

Theoretical Framework

Utilization of Kurt Lewin’s change theory will help guide and evaluate the augmentation of breast cancer screening and can increase the likelihood of successful implementation into future practice; when sufficient supporting data becomes available to support ultrasonography as a primary screening mode in women with dense breast tissue (Mitchell, 2013). Lewin’s theory uses an “unfreezing, moving, and refreezing” approach to guiding change (Mitchell, 2013, p.32).

A need for change is determined in the unfreezing stage, change is initiated in the moving stage, and change is adopted and equilibrium is re-established in the refreezing stage (Mitchell, 2013). Use of a change theory such as Lewin’s theory alongside the Plan-Do-Study-Act (PDSA) model for quality improvement (see Appendix A), can assist in the development of a program that will yield positive and sustainable results.
A need for change was determined when recent research questioned mammography as the gold standard and best screening tool to detect cancer leading to a state of disequilibrium (Gøtzsche & Jørgensen, 2013; Mitchell, 2013; Raftery & Chorozoglou, 2011). Unfreezing and causing a state of disequilibrium is a necessary part of implementing change because it helps leaders of change overcome individual resistance to change through motivation, building of trust and helping people recognize the need for change (Kritsonis, 2005). By gaining the trust of key stakeholders including patients and nurse practitioners and educating them on the diagnostic accuracy and reliability of breast ultrasonography in detecting breast cancer in women with mammographically dense breast tissue, future resistance to change can be overcome. In the movement stage, testing of change occurs and movement to a new level of equilibrium begins by persuading key stakeholders to agree that the current screening guidelines are not beneficial or the most accurate at detecting cancer (Kritsonis, 2005). Refreezing occurs when equilibrium has been re-established and is a crucial step in order for a future practice recommendation to be sustained (Kritsonis, 2005; Mitchell, 2013).

**Key Concepts**

The major concepts used in the purpose statement consist of determining nurse practitioners attitudes and beliefs towards breast cancer screening and if they would support altering their practice recommendations following sufficient supporting data that shows the diagnostic accuracy and reliability of breast ultrasonography alone in the detection of breast cancer in women with mammographically dense breasts. Another concept includes current breast cancer screening guidelines. Currently the USPSTF recommends biennial screening starting at
The third concept also involves utilization of ultrasounds. The intended DNP project is to describe breast screening practice patterns of nurse practitioners and analyzing their attitudes and beliefs of alternative screening modalities; to determine if nurse practitioners support the use of ultrasonography in lieu of mammography followed by sonography in women. This has the potential to lead to an evidence-based practice recommendation once sufficient evidence is available to support this change. Lewin’s change theory would be used as a guide to implementing change using an unfreezing, moving, and refreezing approach, along with the PDSA model for quality improvement to develop practice recommendations (Mitchell, 2013). These approaches may help alleviate resistance to change and gain the trust of key stakeholders such as nurse practitioners and patients leading to improvements in the diagnostic accuracy and reliability of breast cancer screening in women with mammographically dense breast tissue.

**Synthesis of Evidence**

In an effort to determine if nurse practitioners would support the use of ultrasonography alone in lieu of mammography followed by sonography to detect breast cancer in women with mammographically dense breast tissue, a review of current literature was performed. A literature search was conducted using PubMed and Cumulative Index of Nursing and Allied Health Literature (CINAHL) using a combination of key words including: breast cancer, ultrasonography, breast cancer screening, and dense breasts. The search yielded over 700 results, but only 18 articles were retained. Articles were excluded if they were published before 2000, if they were not performed on humans, and if they were not published in English. Articles were
also excluded if they did not contain information on breast ultrasounds or mammography, and if they lacked experimental data.

**Strengths**

Several studies have suggested the diagnostic accuracy and reliability of breast ultrasonography in detecting breast cancer that was not seen on mammography (see Appendix A for more details) (Bae et al., 2014; Berg et al., 2012; Hooley et al., 2012; Kaplan, 2001; Kelly, Dean, Comulada, Lee, 2010; Kelly, Dean, Lee, Comulada, 2010; Kolb, Lichy, Newhouse, 2002; Leconte et al., 2003; Sardanelli et al., 2011, Schafer et al., 2010, and Weigert & Steenbergen, 2012). A single institutional study in 2001 concluded that the addition of breast sonography in 1862 women with negative mammograms resulted in 3 additional cancers per 1000 women (Kaplan, 2001). In 2002 a non-randomized study concluded that out of 11,130 asymptomatic women, 221 women were diagnosed with 246 cancers, and screening with ultrasonography increased the number of women diagnosed with non-palpable cancers by 42% (Kolb, Lichy, & Newhouse, 2002). Further, in a follow-up study, Berg et al. (2012) reported two and three year follow-up mammography and ultrasound findings of the ACRIN 6666 trial; an additional 3.7 cancers were detected by using ultrasonography per 1000 women.

In addition, several studies have been conducted evaluating screening with ultrasonography in women with dense breast tissue; findings showed an increase in breast cancer detection rates (Hooley et al, 2012; Weigert & Steenbergen, 2012). In a single institutional study consisting of 935 women (Hooley et al., 2012) and a retrospective review (Weigert & Steenbergen, 2012), the researchers concluded that the addition of ultrasonography yielded an additional 3.2 cancers per 1000 women screened.
New research suggests that the use of automated whole breast ultrasound (AWBU) leads to increased diagnostic accuracy than previous methods including the use of the handheld approach. AWBU have been shown to eliminate the lack of uniformity with imaging studies, decrease radiologist times from 19 minutes to 5-7 minutes per exam and increase the percentage of greater than 1 cm cancers by more than half (Kelly & Richewald, 2011). Bae et al (2014) found that most breast cancers that were detected by ultrasound (81%) were not seen by mammography, and 19% had subtle or evident findings that were missed by mammography. Likewise, Merry & Mendelson (2014) note that use of ultrasonography in women with dense breasts detects 3.7 additional cancers per 1000 women screened than mammography alone, but report there may be additional costs or unnecessary biopsies performed as a result. Kelly, Dean, Comulada, & Lee (2010) concluded that use of AWBUS increased the diagnostic yield of cancer detection by 3.6 cancers per 1000 women screened, and in another study by Kelly, Dean, Lee, Comulada (2010) is was concluded that AWBUS resulted in increased sensitivity of screening and increased detection from 50% with mammography to 81%.

**Weaknesses**

One of the largest and most important studies to date is the American College of Radiology Imaging Network Trial (ACRIN 6666), however the study results were published in 2008 (Berg et al., 2008). Since then Berg et al. (2012) have published an update containing 2-3 year follow-up data, noting an increase in cancer detection rates using ultrasonography. Although the data is over five years old, the results from the study are very strong and should be considered. The study was a multicenter, randomized trial involving 2637 patients who underwent imaging studies, and noted that the addition of ultrasound increased the cancer
detection rate from 11.8 per 1000 women to 16 per 1000 women (Berg et al., 2008). The study also noted the diagnostic accuracy of mammography at 0.78 and ultrasonography at 0.80 at 95% confidence interval (CI) and P for both studies was equal to .003, leading to a difference of 0, therefore the difference is not statistically significant (Berg et al., 2008). Other than research which is older than 5 years, there lacks sufficient evidence supporting the use of ultrasounds in lieu of mammography for women with mammographically dense breasts. To date there are six single center studies, and three multicenter studies showing the diagnostic accuracy and reliability of ultrasonography in lieu of mammography (Berg et al., 2012). More large scale studies would help solidify this practice recommendation.

The studies by Berg et al. (2008), Kaplan (2001), Kolb, Lichy, & Newhouse (2002), and Leconte et al. (2003) are somewhat dated, supporting the need for additional research. This in turn would inform nurse practitioners to make practice recommendations based on current evidence, ultimately leading to more accurate and reliable breast cancer screening and detection in women with mammographically dense breast tissue.

The literature also suggests that research has failed to prove a decrease in mortality rates with the use of ultrasonography to detect more breast cancer in women with mammographically dense breast tissue leading to the need for more research (Druketeinis, Mooney, Flowers, & Gatenby, 2013; Le-Petross& Shetty 2011). In addition to proving a decrease in mortality rates, more up to date studies should be conducted on the use of ultrasounds alone in women with mammographically dense breasts to demonstrate increased accuracy over mammography alone.
Gaps in Knowledge

In addition to a lack of research supporting a decrease in mortality rates, my search failed to identify studies describing practice patterns of nurse practitioners regarding mammography and ultrasonography. To date there is evidence supporting the diagnostic accuracy and reliability of breast ultrasonography in lieu of mammography in women with mammographically dense breast tissue, but it has not become a standard practice. Therefore, in order to describe nurse practitioners’ attitudes and beliefs of augmenting breast cancer screening with ultrasonography in lieu of mammography, a survey was developed and disseminated to NPs; the results were compared to published clinical trials showing the diagnostic accuracy and reliability of breast ultrasounds in women with dense breast tissue in lieu of mammography.

METHODS

PDSA Model

The purpose of this study is to determine the attitudes and beliefs of nurse practitioners towards the use of ultrasonography alone in lieu of mammography followed by sonography in women aged 40-74 with mammographically dense breast tissue. The specific aims are: 1) to critically appraise the existing literature regarding breast cancer screening recommendations in women with mammographically dense breasts; 2) identify current practices for breast cancer screening and the attitudes and beliefs alternative screening recommendations by analyzing survey responses; and 3) to describe breast screening practice patterns of a sample of nurse practitioners in the state of Arizona. A descriptive design will be utilized to draw conclusions and describe breast screening patterns and attitudes and beliefs of alternative screening recommendations. The PDSA model will be used to accomplish the specific aims.
**PDSA**

The first stage of the PDSA method was the planning stage which involved a number of tasks that provide the foundation of the project, with the first task being team recruitment. For the purpose of this project, specific team recruitment was excluded. In this case academic advisory committees monitored the stages and provide feedback.

The second task within the planning stage entailed creating an aim statement. This DNP project was developed for nurse practitioners ordering and recommending breast cancer screening. A critical appraisal of the literature helped identify the practice concerns leading to the potential for a practice recommendation in the future, following the availability of sufficient evidence to support a recommendation.

The next task was to describe the current process. Screening recommendations vary with the ACS and NCCN recommending yearly screening starting at age 40 and the USPSTF recommending biennial screening starting at age 50 and ultrasonography as an adjunct to mammography in women with dense breast tissue or following an abnormal mammogram (Hendrick & Helvie, 2011; Susan G. Komen, 2015). In women with dense breast tissue ultrasonography is used as an adjunct to mammography or following an abnormal mammogram (Berg et al., 2012). Next, was to identify the causes that could hinder improvement. The current lack of continuity between guidelines leaves nurse practitioners guessing which screening modalities to use, what age to start screening and how frequently to recommend screening.

In stage two of the PDSA cycle which is the DO stage, data collection occurred by assessing available data. This occurred by recording the various treatment options, various clinical guidelines recommended starting age of treatment and the outcomes measured as
identified in peer-reviewed clinical trials. For this project, a survey was administered to nurse practitioners, to describe their current breast screening practices. Survey results were analyzed to determine describe breast screening practice patterns of a sample of nurse practitioners in the state of Arizona, and the attitudes and beliefs of nurse practitioners regarding alternative screening recommendations.

In stage three of the PDSA cycle which is the STUDY stage is where the data was analyzed for current breast cancer screening practices in women with dense breast tissue. These were compared with positive, measurable outcomes found in published clinical trials. Positive, measurable outcomes include an increase in the diagnostic accuracy and reliability of breast cancer screening in women with dense breast tissue using ultrasonography.

Stage four, which is the ACT stage of the PDSA cycle, is to determine what the next test will be. Following the availability of sufficient evidence to support a recommendation, the next potential test could be to make an evidence based practice recommendation to increase the diagnostic accuracy and reliability in breast cancer detection in women with dense breast tissue. The PDSA cycle then repeats if additional changes are needed to further improve the outcomes.

Design

This DNP project utilized a descriptive design as this type of study is useful when evaluating and assessing behaviors of healthcare professionals when attempting to initiate practice improvements (Moran, Burson, Conrad, 2014). Data is represented in quantitative form as this type of data is useful when trying to answer a specific question such as, will nurse practitioners augment their practice recommendations for breast cancer screening. The design included a 23 question survey, including demographics, Likert scale questions, and yes or no
type questions, which was sent out electronically to nurse practitioners in the state of Arizona using Qualtrics as the platform to maintain confidentiality, and the survey link was posted on the Coalition of Arizona Nurses in Advanced Practice (CAZNAP) listserv. Once the survey was posted on the CAZNAP listserv the survey could be accessed by approximately 1,685 nurse practitioners in the state of Arizona, who are approved members of the CAZNAP, no emails were provided by the CAZNAP.

**Setting and Sample**

The target population of this study was nurse practitioners in the state of Arizona, 50 were from the email group and approximately 1,685 on the CAZNAP listserv. The recruitment of survey participant’s included nurse practitioners who provide or recommend breast cancer screening. Nurse practitioners were identified through an email list provided by the vice president of the Allied Health Providers of Yuma and placement of the survey link onto the CAZNAP listserv.

**Protection of Human Subjects**

Prior to data collection, approval from the Institutional Review Board (IRB) at the University of Arizona was obtained. Voluntary participation in the study was disclaimed along with survey questions. Email responses were de-identified using the electronic survey application, to keep information confidential and private. A disclosure form (see Appendix B) was included with each survey, explaining the voluntary nature of the study, the purpose of survey questions, and how the results will be used in this DNP project.

**Procedures**
After IRB approval was received, an electronic survey account through Qualtrics was established by this author. Nurse practitioners’ email addresses were entered into this electronic format and distributed. An account through the CAZNAP was established and with written permission from the webmaster the survey link was posted on the CAZNAP listserv, where the survey link could be accessed by approximately 1,685 nurse practitioners in the state of Arizona.

**Data Collection**

A 23-question survey was sent via email using Qualtrics, which is an electronic survey application. The survey was sent out electronically to the 50 nurse practitioners on the email list which was provided by the vice president of the Allied Health Providers of Yuma, and the survey link posted on the CAZNAP listserv, to nurse practitioners in the state of Arizona with a projected 10-30% response rate. There are a total of 6,815 NPs in the state of Arizona, 1,048 NPs were eligible, and there were a total of 69 participants (Arizona State Board of Nursing, n.d. & S. Click, personal communication, July 20, 2015). Respondents were given 4 weeks to respond to the survey to ensure timely collection of data. A follow up email was sent out within 10 days to encourage filling out the survey. The survey was reviewed by three experts to obtain content validity.

**Data Analysis**

Descriptive statistics were used to describe nurse practitioners practice specialties and survey questions. Data from individual survey questions was expressed as the percentage of respondents and data from individual surveys was evaluated to determine practice patterns and attitudes and beliefs of a wide array of nurse practitioners (Moran, Burson, Conrad, 2014). The
non-parametric, quantitative data was presented categorically and survey results were compared with the literature.

RESULTS

Demographic Results

The Breast Cancer Screening Survey results indicated that a majority (54%) of survey respondents are FNPs, with the second largest group being ANPs at 10%. Most survey respondents were female, and more than half of the survey respondents work in family practice. A majority of respondents have been in practice for 0-4 years with the second largest group being in practice for 5-10 years. The majority of survey respondents were 51 and older at 57%. Survey respondents had to be nationally certified as Advanced Practice Registered Nurses licensed in the state of Arizona to participate in the survey. One respondent who did not meet this criteria was excluded from the study.

Practice Pattern Results

The Breast Cancer Screening Survey results indicated that most of the respondents recommend routine mammography to women without a strong familial history or personal history of breast cancer, and the majority of respondents recommended annual screening starting at age 40. The survey also indicated that almost half of the respondents stop screening for breast cancer at age 75, with (36%) of respondents choosing “other” giving them the option to free text their answers. Free texted answers to question 4, included that they do not stop screening; they defer to patient preference or declination, and stop when the patient’s quality of life is inadequate to continue screening. In women with dense breast tissue, 78% of respondents said they recommend screening annually between the ages of 40-74 with only 16% recommending
screening every two years between the ages of 40-74. One respondent stated that she recommends screening annually between the ages of 40-74 unless severe density is noted and the recommendation by radiology is to follow up every 6 months. It is apparent from the interpretation of survey results that a majority of respondents follow breast cancer screening guidelines by the ACS and NCCN on when to initiate breast cancer screening and follow the USPSTF guideline to stop screening at age 75. Almost half (40%) of respondents report they sometimes recommend both mammography and ultrasonography in women with mammographically dense breast tissue. Only 13% of respondents report they always recommend both mammography and ultrasonography in women with mammographically dense breasts.

**Attitudes and Beliefs Results**

Analysis of survey responses indicated that almost half (43%) of the respondents believe that women with mammographically dense breast tissue are at high risk for breast cancer; while 32% do not believe women are at high risk. The majority of respondents believe that it is difficult to detect cancer using mammography in women with dense breast tissue; and 51% of respondents believe that ultrasounds are more accurate and reliable at detecting cancer in women with dense breast tissue. Very few respondents feel that mammography alone accurately and reliably detects breast cancer in women with mammographically dense breast tissue; while more than half of the respondents believe that mammography followed by ultrasonography can detect cancer more accurately. A third of the respondents believe that MRI alone can more accurately and reliably detect breast cancer in women with mammographically dense breast tissue. A quarter of respondents said they would always recommend the use of ultrasonography in lieu of
mammography once sufficient supporting evidence is available and almost half stated they would often recommend this screening modality once the evidence supports it.

While most survey responses showed that nurse practitioners would support the use of ultrasonography in lieu of mammography in women with dense breast tissue and that they believe that ultrasounds are more accurate and reliable at detecting cancer in this population, it is interesting to note that 73% of nurse practitioners are not familiar with current literature regarding ultrasonography screening in women with dense breast tissue. Studies discussed in the literature review by Shen, et al. (2015) and Xiao, Zhou, & Chen (2015) note the diagnostic accuracy and reliability of ultrasonography in detecting cancer and 34% of survey respondents who believe that breast ultrasounds are more accurate and reliable at detecting cancer in women with dense breast tissue.

**DISCUSSION**

**Strengths**

This DNP project demonstrated that most of the nurse practitioners surveyed believe that it is difficult to detect breast cancer using mammography alone in women with mammographically dense breast tissue. The survey results also indicated that if sufficient evidence becomes available supporting the use of ultrasounds in lieu of mammography that most of the nurse practitioners surveyed would recommend this screening modality in place of mammography alone or mammography followed by yearly ultrasonography.

**Limitations**

First, this study was only open to actively practicing NPs who are nationally certified and licensed in the state of Arizona. Second, NPs who participated in the survey had to routinely
recommend breast screening to patients. Third, participants could stop the survey at any time and participation was completely voluntary.

**Conclusions**

In conclusion, the data presented here suggests that the majority of Arizona NPs would support the use of ultrasonography alone in lieu of ultrasonography followed by yearly mammography in women with dense breast tissue with the availability of sufficient evidence to support this screening modality. My project also identified the need for further interprofessional research on a national level regarding the use of ultrasonography screening alone versus mammography followed by sonography in women with dense breast tissue. Currently, there are several studies available to support the use of this screening modality, but there is no accepted clinical guideline leading to the potential for the future development of an evidence-based recommendation.

Potential recommendations are to provide NPs with current literature on breast cancer screening to improve their awareness of ultrasonography as the sole screening modality in women with mammographically dense breasts. The data collected from this survey supports the need for education on new screening modalities and supports the potential for altering practice recommendations of breast cancer screening once sufficient data becomes available.
APPENDIX A:

PDSA MODEL FOR QUALITY IMPROVEMENT
What are we trying to accomplish?

How will we know that a change is an improvement?

What changes can we make that will result in improvement?

Retrieve from [http://www.ihi.org/resources/PublishingImages/ModelforImprovement.gif](http://www.ihi.org/resources/PublishingImages/ModelforImprovement.gif)
APPENDIX B:

SURVEY COVER LETTER
Date TBD

To Whom It May Concern,

This is the disclosure form for your participation in this doctoral project. It will address and aim to answer any questions you might have regarding this project.

By beginning and completing the survey (link provided below), you acknowledge that you have read this information and agree to participate in this research survey, with the knowledge that you are free to withdraw your participation at any time without penalty. The project was approved by the U of A IRB.

Thank you for taking the time to participate in this project

Sincerely,

Hilary Smith, RN
DNP Candidate
APPENDIX C:

DISCLOSURE FORM AND SURVEY
DISCLOSURE FORM: Attitudes and Beliefs of Nurse Practitioners to Augment Breast Cancer Screening with Ultrasonography.

You are being invited to participate in a research study being conducted by the Hilary Smith, a Doctor of Nursing Practice student enrolled at the University of Arizona. Please read and review this form prior to your participation so that you are aware of potential risks and how the information you provide will be used. The information in this form is provided to help you decide whether or not to take part in the study. If you decide to take part in the study, your responses will be anonymous. If you decide you do not want to participate, there is no penalty to you, and you will not lose any benefit you normally would have. Participation in this study is voluntary. There are no costs associated with the study and there is no compensation for participation in the study.

The purpose of the study is to evaluate the attitudes and beliefs of nurse practitioners regarding current screening recommendations and to determine if they would support augmenting their current practice and use ultrasonography in lieu of mammography. Survey results will be used in the development of quality improvement recommendations for breast cancer screening in women with mammographically dense breast tissue.

You are being asked to participate in this survey to determine nurse practitioners' attitudes and beliefs regarding current breast cancer screening recommendations and if they would support augmentation of breast cancer screening with ultrasonography in lieu of mammography in women with dense breast tissue. You will be asked to complete a survey of 21 questions, taking approximately 15 minutes and return electronically to the Principal Investigator in the study.

Although the researchers have tried to avoid risks, you may feel that some questions are uncomfortable. You do not have to answer any questions that you do not want to answer and you may withdraw from the study altogether at any time with no penalty. If you decide to quit at any time prior to completing the survey, your answers will be not be recorded. There may be no direct benefit to you by participating in the study. What researchers find out from this survey may help other nurse practitioners in augmenting their practice recommendations.

Information about you will be kept confidential to the extent permitted or required by law. We will not know your IP address when you respond to the study. The list of e-mail addresses will be stored electronically in a password protected folder. After data collection is completed, the list of participant’s e-mail addresses will be destroyed. People who have access to your information include the Principal Investigator and project committee. Representatives of regulatory agencies such as the Office of Human Research Protections (OHRP) and entities such as the University of Arizona Human Subjects Protection Program may access your records to make sure the study is being run correctly and that information is collected properly. If there are any professional presentations or publications about this study or survey responses, your name, practice name, e-mail address, or postal address will not be in them.

You may contact the Principal Investigator to tell him/her about a concern or complaint about this research study. Principal Investigator Hilary Smith, BSN, can be called at (928)342-5727.
You may also contact the Principal Investigator’s advisor, Janet DuBois, DNP, ARNP, FNP-BC, FAANP at jdubois3@email.arizona.edu. If you want to talk to someone other than the Investigator or advisor; you may call the University of Arizona Human Subjects Protection Program office.

Local phone number (520) 626-6721
Website (this can be anonymous: https://orcr.arizona.edu/hbpp

By beginning the survey, you acknowledge that you have read this information and agree to participate in this research survey, with the knowledge that you are free to withdraw your participation at any time without penalty.

Survey Questionnaire

Thank you for agreeing to participate in this survey about breast cancer screening. This survey should take approximately 15 minutes to complete. Your honest and thoughtful responses are appreciated. Exclusion criteria for this survey include nurse practitioners not recommending routine breast cancer screening. To begin the survey, please answer the following qualifying questions:

1. Are you a nationally certified Advanced Practice Registered Nurse, licensed in the state of Arizona?
   a. Yes
   b. No
   
   If you answered no to this question, thank you for your interest in this project but you do not meet the qualifications to continue with the survey. If yes, please answer the following question.

2. Do you routinely recommend breast screening to your patients as per clinical guidelines?
   a. Yes
   b. No

   If you answered no to this question, thank you for your interest in this project but you do not meet the qualifications to continue with the survey. If you answered yes, please continue with the survey.

What type of certification do you hold? ANP, FNP, WHNP, CNMW, other

What type of practice do you work at? Family practice, Internal Medicine, OB-GYN, Women’s Clinic, other.

How many years have you been in practice? 0-4, 5-10, 11-15, 16+.

Please select your gender: Male/Female
Please circle which age group you fall under: 21-25, 26-30, 31-40, 41-50, 51+.

1. Do you recommend routine mammography to patients without a strong familial or personal history of breast cancer?
   a. No
   b. Yes

2. If yes, at what age do you recommend starting?
   a. 30
   b. 35
   c. 40
   d. 45
   e. 50
   f. 55
   g. 60

3. If yes how often?
   a. Annually
   b. Every other year
   c. Other ________
   d. N/A

4. At what age do you stop screening for breast cancer?
   a. 65
   b. 70
   c. 75
   d. Other ________
   e. N/A
Please mark the box for the response that best reflects your opinion of each of the following statements.

5. Do you believe women with mammographically dense breast tissue are at high risk for breast cancer?
   Yes  No  Unsure

6. Do you believe it is difficult to detect breast cancer using mammography in women with dense breast tissue?
   Yes  No  Unsure

7. Do you believe breast ultrasounds are more accurate and reliable at detecting cancer in women with dense breast tissue?
   Yes  No  Unsure

8. Do you think routine breast cancer screening reduces breast cancer deaths?
   Yes  No  Unsure

9. Which of the following modes do you believe can detect cancer more accurately and reliably in women with mammographically dense breast tissue?

   a. Mammography
   b. Mammography followed by Ultrasonography
   c. MRI
   d. Ultrasonography

10. In women with dense breast tissue, how often would you recommend screening?

   a. Annually between the ages of 40-74
   b. Every two years between the ages of 40-74
   c. Other ________
   d. N/A
11. Do you routinely recommend clinical breast exams (CBE) performed by a practitioner in women without a strong familial or personal history of breast cancer?
   a. Yes
   b. No

12. At what age do you recommend starting CBE in women without a strong familial or personal history of breast cancer?
   a. 30
   b. 35
   c. 40
   d. 45
   e. 50
   f. N/A

13. If yes how often?
   a. Monthly
   b. Annually
   c. Every other year
   d. Other ________
   e. N/A

14. Do you recommend routine breast self-exams performed by the patient without a strong familial or personal history of breast cancer?
   a. No
   b. Yes
15. If yes how often?
   a. Monthly
   b. Annually
   c. Every other year
   d. Other ________
   e. N/A

16. At what age do you recommend starting self-breast exams in women without strong familial or personal history of breast cancer?
   a. 30
   b. 35
   c. 40
   d. 45
   e. 50
   f. N/A

17. How often do you use the following sources to obtain information about breast cancer screening guidelines?

   Never Rarely Sometimes Often Always

   a. United States Preventive Services Task Force
   b. American Cancer Society
   c. Colleagues
   d. Internet Websites
   e. Medical Conferences
f. National Cancer Institute

g. Professional Organizations (e.g., AAFP, ACOG, AMWA, etc.)

18. How often do you routinely recommend both mammography and ultrasonography in women with mammographically dense breasts?

   Never Rarely Sometimes Often Always

19. Are you familiar with current literature regarding ultrasonography screening in women with dense breast tissue?

   a. Yes
   b. No

20. How often would you recommend the use of ultrasonography in lieu of mammography if evidence supports that it can detect cancer more accurately and reliably in women with dense breasts?

   Never Rarely Sometimes Often Always
APPENDIX D:

EVIDENCE SYNTHESIS
**Project Question:** What are the attitudes and beliefs of primary care nurse practitioners regarding augmentation of breast cancer screening with ultrasonography in lieu of mammography in women with mammographically dense breasts?

<table>
<thead>
<tr>
<th>Author / Article</th>
<th>Qual: Concepts or phenomena</th>
<th>Design</th>
<th>Sample (N)</th>
<th>Data Collection (Instruments/tools)</th>
<th>Findings</th>
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</thead>
<tbody>
<tr>
<td>Bae et al., (2014). Breast Cancer Detected with screening US: Reasons for Nondetection at Mammography.</td>
<td>5 blinded radiologist and 3 unblinded radiologist independently reviewed mammograms to determine reasons for nondetection of breast cancer</td>
<td>Retrospective review.</td>
<td>n=329 women</td>
<td>Fisher exact test was used to compare the proportions of the reasons for nondetection with breast density, risk group, invasive tumor size, and cancer type. All statistical analyses were conducted by using commercial software (SAS, version 9.2; SAS Institute, Cary, NC). A P value less than .05 was considered to indicate a significant difference.</td>
<td>335 cancers were depicted out of the 329 women. Of the 335 depicted cancers, 63 (19%) were recalled by 3 or more of the 5 blinded radiologists, and 272 (81%) showed no mammographic findings that required immediate action. In the repeat review with the unblinded radiologists, 263 (78%) of the cancers were obscured by overlapping dense breast tissue, 81% of cancers detected at screening with ultrasounds were not seen on mammography.</td>
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<td>Berg et al. (2008). Combined screening with ultrasound and mammography vs mammography alone in women at elevated risk of breast cancer.</td>
<td>Research question: Will the addition of ultrasonography to mammography yield addition cancer detection in women at elevated risk.</td>
<td>Multicenter randomized trial.</td>
<td>N= 2,637</td>
<td>Women who presented for routine annual screening who were at elevated risk each underwent mammography and ultrasonography screening in a randomized order. Random assignments of screening order was completed by site and block randomization.</td>
<td>The addition of ultrasound increased cancer detection rate from 11.8 to 16 per 1000 women screened. Diagnostic accuracy of mammography at 0.78 and ultrasonography at 0.80, showing that ultrasounds are more accurate in the diagnosis of breast cancer.</td>
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<td>Berg et al., (2012). Detection of Breast Cancer With Addition of Annual Screening Ultrasound or a Single Screening MRI to Mammography in Women With Elevated Breast Cancer Risk</td>
<td>Research question: To determine supplemental cancer detection yield of ultrasound and MRI in women at elevated risk for breast cancer.</td>
<td>RCT</td>
<td>N= 2662</td>
<td>Web-based data capture and quality monitoring were conducted by the ACRIN biostatistics and data management center.</td>
<td>7473 mammogram and ultrasound screenings were conducted. 110 women had 111 breast cancer events: 33 were detected by mammography only, 32 by ultrasound only, 26 by both, and 9 by MRI after mammography plus ultrasound; 11 were not detected by any imaging screen. Among 4814 incidence screens in the second and third years combined, 75 women were diagnosed with cancer. Supplemental incidence screening ultrasound identified 3.7 cancers per 1000 screens. Sensitivity for mammography plus ultrasound was 0.76 (95% CI, 0.65-0.85) and for mammography alone, sensitivity was 0.52 (95% CI, 0.40-0.64).</td>
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<td>Hooley et al., (2012). Screening US in Patients with Mammographically Dense Breasts: Initial Experience with Connecticut Public Act 09-41.</td>
<td>Research question: to determine performance and utilization of screening breast ultrasonography in women with dense breast tissue who underwent additional screening to determine if this is beneficial.</td>
<td>Single institutional study.</td>
<td>N=935</td>
<td>Informed consent was waived, IRB approval, retrospective review from 2009-2010.</td>
<td>3.2 per 1000 patient increase in cancer detection using ultrasound.</td>
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<td>Kaplan. (2001). Clinical utility of bilateral whole-breast US in the evaluation of women with dense breast tissue.</td>
<td>Research question: Does the use of bilateral whole-breast US increase cancer detection rates in women with mammographically dense breast tissue (category 3 or 4 on the BI-RADS density scale).</td>
<td>Single institutional study.</td>
<td>N=1,862 women</td>
<td>Between 1998 and 2000 women with negative findings at clinical examinations, and had negative mammograms results were evaluated for bilateral whole-breast US. Out of the 1,862 women screened, 57 biopsies were recommended in 56 patients, and six cancers were detected yielding a 0.3% cancer detection rate, not seen on mammography.</td>
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<td><strong>Kelly, Dean, Comulada, Lee, (2010).</strong> Breast cancer detection using automated whole breast ultrasound and mammography in radiographically dense breasts.</td>
<td>Blinded clinical trial.</td>
<td>N= 4,419</td>
<td>Women were recruited from 2003 to 2007 for AWBU at 8 facilities in CA, NM, GA, and UT. Study participation was offered to asymptomatic women with confirmed BI-RADS breast density rating of 3 or 4, family history or breast cancer, implants, or greater than 35 years old. One of 10 radiologists read and interpreted each AWBU study and were blinded to the results of the corresponding mammograms.</td>
<td>Research question: Does the addition of automated whole breast ultrasounds (AWBU) in women with mammographically dense breasts increase cancer detection improvement than with mammography alone.</td>
<td>Breast cancer detection doubled from 23 to 46 in 6,425 studies using AWBU with mammography, resulting in an increase in diagnostic yield from 3.6 per 1,000 with mammography alone to 7.2 per 1,000 by adding AWBU.</td>
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<td>Kelly, Dean, Lee, &amp; Comulada, (2010). Breast cancer detection: radiologists’ performance using mammography with and without automated whole-breast ultrasound.</td>
<td>Research question: Is radiologist reader performance for breast cancer detection more accurate using mammography plus automated whole-breast ultrasound (AWBU) than mammography alone.</td>
<td>Blinded multi-reader, multi-case study.</td>
<td>102 mammograms (66 cases of original analog films and 36 cases of prints of digital films)</td>
<td>12 radiologists blinded to the diagnosis; half of which were abnormal. Reader performance was compared across screening techniques using absolute callback, areas under the curve (AUC), and figure of merit (FOM).</td>
<td>AWBU resulted in an increase in the sensitivity of breast cancer detection from 50% to 81%. True positivity of cancer detection increased 63%, with only a 4% decrease in true negativity. Reader-averaged AUC was higher for mammography plus AWBU compared with mammography alone by BIRADS (0.808 versus 0.701) and likelihood scores (0.810 versus 0.703). Similarly, FOM was higher for mammography plus AWBU compared with mammography alone by BIRADS (0.786 versus 0.613) and likelihood scores (0.791 versus 0.614).</td>
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<td>Kolb, Lichy, &amp; Newhouse. (2002). Comparison of the performance of screening mammography, physical examination, and breast US and evaluation of factors that influence them: an analysis of 27,825 patient evaluations.</td>
<td>Does the addition of breast US increased cancer detection rates in women with dense breast tissue.</td>
<td>Non-randomized study</td>
<td>11,130 asymptomatic women underwent 27,825 screening sessions.</td>
<td>Between 1995 and 2000 screening sessions which included PE and mammography were performed who were asymptomatic. Women with dense breasts were followed with a bilateral whole breast ultrasound.</td>
<td>In 221, 246 cancers were detected; screening with US increased the number of women diagnosed with nonpalpable cancers by 42% (30-71).</td>
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<tr>
<td>Leconte et al. (2003). Mammography and subsequent whole-breast sonography of nonpalpable breast cancers: the importance of radiologic breast density.</td>
<td>Research question: Is sonography useful in the detection of breast cancer in women with mammographically dense breasts.</td>
<td>Single institutional study</td>
<td>N= 5,376 women.</td>
<td>Between 2000-2001 the study was conducted, women were excluded if they were pregnant, breast-feeding, and younger than 30 in whom only sonography was performed.</td>
<td>For BI-RADS categories 1 and 2 the sensitivities of mammography and sonography were 80% and 88%, and not statistically significant. For BI-RADS categories 3 and 4 the sensitivity for mammography was 56% and for sonography 88.</td>
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<td>Sardanelli et al. (2011). Multicenter Surveillance of Women at High Genetic Breast Cancer Risk Using Mammography, Ultrasonography, and Contrast-Enhanced Magnetic Resonance Imaging (the High Breast Cancer Risk Italian I Study): Final Results.</td>
<td>Research question: compare clinical breast examination, mammography, ultrasonography, and contrast-enhanced magnetic resonance imagining in high risk women.</td>
<td>Multicenter study.</td>
<td>N=501; 18 centers.</td>
<td>18 centers enrolled 501 women aged over 25, BRCA mutation carriers, first degree relatives of BRCA carriers, and women with strong family history of either breast or ovarian cancer, or those with previous history of ovarian cancer.</td>
<td>MRI was more sensitive (91%) than clinical breast examination (18%), mammography (50%), ultrasonography (52%), or mammography plus ultrasonography (63%) ($P&lt;0.001$). Specificity ranged 96% to 99%, positive predictive value 53% to 71%, positive likelihood ratio 24 to 52 ($P$ not significant).</td>
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<td>Weigert&amp;Steenbergen (2012). The Connecticut Experiment: The Role of Ultrasound in the Screening of Women With Dense Breasts</td>
<td>Research question: aim of this study was to determine the potential of screening breast ultrasound to improve breast cancer detection in women with mammographically normal, but dense breasts.</td>
<td>Retrospective review.</td>
<td>N= 72,030 mammograms and 8,647 ultrasounds were performed at 12 research sites.</td>
<td>Sensitivity, Specificity, Positive Predictive Value, and Negative Predictive Value were calculated.</td>
<td>Twenty-eight additional cancers were detected, for an additional cancer yield of 3.25 cancers per 1000 women screened. The PPV was 6.7%, and 14% of patients were recalled. Compliance with screening was low: only 28% of women offered ultrasound screening accepted.</td>
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REFERENCES


