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WHAT MOTIVATES SAUDI FEMALES' INTENTIONS TO GET MAMMOGRAPHY? A RANDOMIZED CONTROL TRIAL TO EVALUATE EFFECTIVE PREVENTATIVE MESSAGES

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What Motivates Saudi Females' Intentions to Get Mammography? A Randomized Control Trial to Evaluate Effective Preventative Messages

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

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Abstract

WHAT MOTIVATES SAUDI FEMALES' INTENTIONS TO GET MAMMOGRAPHY? A RANDOMIZED CONTROL TRIAL TO EVALUATE EFFECTIVE PREVENTATIVE MESSAGES

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Background. In Saudi Arabia, breast cancer mortality is a public health concern where females often discover breast cancer at an advanced stage due to ignoring preventative testing such as mammography. While increasing mammography awareness is essential in Saudi Arabia, almost nothing is known about the effectiveness of health communication messages in mammography's context. This research tested whether exposure to Entertainment-Education (E-E) message or educational infographic messages would influence Saudi females' intentions to get mammography.

Method. This research relied on a randomized control trial among n=240 Saudi females older than 40. Respondents were randomly assigned to watch YouTube E-E message or read educational infographic messages. The control group was not exposed to any preventative messages. All participants in the three arms received one validated questionnaire that measured the constructs of the Theory of Planned Behavior (TPB) (i.e., attitude, subjective norms, and perceived behavioral control) and issue involvement.

Results. Hierarchical regression revealed that females' intent to get mammography was associated with those who watched the E-E message and had a positive attitude, norms, control, and involvement. Moreover, females' intent to get a mammogram was associated

with females who got a mammogram in the past, at younger ages, without a family history of breast cancer in their mothers.

Conclusion. The findings explain what Saudi health communication professionals should consider when designing mammography educational messages for Saudi females. However, to reduce breast cancer mortality in the future, it is essential to increase health communication campaigns and assess its impacts on females' screening decisions.

Chapter 1: Introduction

Unfortunately, worldwide, breast cancer diagnoses and mortality have increased over the past century. In the Kingdom of Saudi Arabia (KSA), the most frequent type of cancer in females is breast cancer, which is also the leading cause of death in all types of cancer. Breast cancer detection via mammography is a key component to reducing breast cancer mortality rate (Elmore, Armstrong, Lehman, & Fletcher, 2005; Fletcher & Elmore, 2003). This is due to mammography's ability to detect the disease early before cancer reaches an advanced and more aggressive stage (El Bcheraoui et al., 2015; Abolfotouh et al., 2015).

Despite the benefits of mammography, in KSA low mammogram utilization was reported in Saudi females (Alshammari et al., 2020; Al-Wassia et al., 2017; El Bcheraou et al., 2015; Rehmani et al., 2013). As a result of this unwillingness to get mammography, Saudi females are more likely to be diagnosed with breast cancer at advanced stages than in any other country (Alshammari et al., 2020; Abolfotouh et al., 2015; Mamdouh et al., 2014).

The lack of knowledge about the benefits of mammography may prevent Saudi females from getting a mammogram (Alshammari et al., 2020; Al-Wassia et al., 2017; El Bcheraou et al., 2015; Rehmani et al., 2013). Therefore, as breast cancer continues to increase in Saudi females, designing a health communication campaign to increase awareness about mammography is critical (Alshammari et al., 2020; Al-Wassia et al., 2017; El Bcheraou et al., 2015; Rehmani et al., 2013).

Health communication professionals must design relevant messaging strategies that can persuade the target audience to change their attitudes or behaviors (Shen, Sheer, and Li, 2015). In KSA, even though breast cancer has killed and affected many Saudi women, little is known about health communication strategies that can persuade Saudi females to get mammography at an early stage. The primary objective of this research is to determine the

most appropriate health communication messages that could impact Saudi women's intentions to get mammograms.

To accomplish this objective, this research hypothesized that issue involvement, as well as the constructs of the Theory of Planned Behavior (i.e., attitude toward mammography, subjective norms, and perceived behavioral control), would predict intent to get a mammogram. Furthermore, the first question in this study sought to determine key demographic factors that could predict mammography intentions in Saudi females. The second research question asked if exposure to a specific E-E message would predict Saudi females' intent to get mammograms. The third research question asked if reading general educational infographic messages by a Saudi health organization would predict Saudi females' intent to get a mammogram.

The next chapter addresses relevant literature on breast cancer in KSA, potential health communication strategies such as E-E strategy, and infographics. It also addresses the theoretical framework and formulates research hypotheses and questions. Chapter three shows the research methodology to accomplish the research objective, hypotheses, and questions. Chapter four presents the result, and chapter five discusses these findings conclusions.

Chapter 2: Literature Review

2.1 An Overview of Breast Cancer

Breast cancer appears when breast cells proliferate and become a tumor (Alotaibi et al., 2018). Breast cancer has four stages, which differ in their risks to human life. These stages are the local, regional, and distant stages (American Cancer Society, 2019). The most common breast cancer signs include a lump in the breast, a change in breast size, pain in the breast, redness of the skin, and a fluid discharge from the nipple (Alotaibi et al., 2018; American Cancer Society, 2019).

Breast cancer diagnoses and deaths from breast cancer have dramatically increased during the past century worldwide. In 2008, it was reported that the number of deaths resulting from breast cancer had reached 1.4 million cases worldwide (Radi, 2013). Four years later, the incidences of breast cancer reached 1.67 million worldwide, resulting in the death of 522,000 individuals (Ferlay et al., 2015). Breast cancer continued to grow in prevalence over the course of the following five years. As the World Health Organization (WHO) pointed out, the number of worldwide breast cancer diagnoses had risen to almost 2.09 million during that period, with nearly 627,000 cases resulting in patient death (WHO, 2018-a). This number shows no sign of receding, as a 2020 global report by the WHO reported that there were 2.3 million breast cancer cases, resulting in 685,000 deaths (WHO, 2021). Today, the most frequent malignancy among women worldwide is breast cancer.

In regard to this epidemic, the Kingdom of Saudi Arabia (KSA) is no different from the rest of the world, as the most frequent type of cancer in the Kingdom is breast cancer, which is also the leading cause of death in all types of cancer among Saudi women (WHO 2018-b; Radi, 2013; El Bcheraoui et al., 2015). Based on the World Health Organization's most current report in 2020, the total number of breast cancer diagnoses in Saudi Arabia was 3954, with 1059 deaths among Saudi females (WHO, 2018-b). Such a figure demonstrates a

rising trend in breast cancer incidences over the last decade, as there were 1,308 instances in 2009, a number that had swelled to 2,800 cases in 2012. (Radi, 2013). Of particular concern is the high breast cancer mortality rate in KSA. It is estimated that 8.5% of all breast cancer diagnoses result in the patient's death (Saeed et al., 2020).

2.2 Breast Cancer Prevention

Although early detection can be conducted via self-exam or clinical breast examination, mammography is the most valuable detection method in terms of early detection, as mammography assures the most accurate diagnosis possible (El Bcheraoui et al., 2015; Abolfotouh et al., 2015). Specialists recommend mammography every two years as an early-detection measure for women aged 40 – 74, especially those women who have a family history of breast cancer (American Cancer Society, 2019; El Bcheraoui et al., 2015; Wilkin et al., 2007). Based on the accuracy of the test and the urging of experts, it is clear that early detection of breast cancer via mammography is a key component to reducing the mortality rate of breast cancer.

Reports from Western countries confirm this belief, as those reports show that mammography has reduced breast cancer mortality by 20% to 35% in women aged 40 to 69 (Elmore, Armstrong, Lehman, & Fletcher, 2005; Fletcher & Elmore, 2003). This reduction in mortality rates is due to mammography's ability to detect the disease early, before the cancer reaches an advanced and more aggressive stage (El Bcheraoui et al., 2015; Abolfotouh et al., 2015). However, unlike in Western countries, Arab females in general – and Saudi females in particular – are diagnosed with breast cancer at advanced stages and at younger ages than their Western counterparts (Alshammari et al., 2020; Abolfotouh et al., 2015; Mamdouh et al., 2014). Because of the aggressive nature of the disease, when breast cancer is diagnosed at an advanced stage, it is more likely to lead to patient mortality (Hagi & Khafaji, 2013). Thus, it is critical to encourage females to pursue early detection of breast cancer via

mammography in order to reduce the likelihood of their dying from the disease (Alshammari et al., 2020).

Despite the beneficial role of breast cancer early screening and the prevalence of studies pointing to the value of mammography, previous studies in different locations in Saudi Arabia have reported that Saudi females have inadequate knowledge and awareness about the benefits of screening for early detection of breast cancer (Alshammari et al., 2020; Alenzi et al., 2016; Mohammed, Mansour & Dorgham, 2014; Abolfotouh et al., 2015; Radi, 2013; El Bcheraoui et al., 2015). In particular, previous studies in KSA reported a low rate of Saudi females availing themselves of mammography as a form of early detection (Al-Wassia et al., 2017). As a case in point, a recent study involving 229 females working in academia found that almost half of the participants had no intention of getting a mammogram in the near future (Alshammari et al., 2020). This study also reveals that, among those who had intended to undergo mammography, only 18.8% actually received a mammogram. Al-Wassia et al. (2017) reported that 40% of 3,245 females had never had a mammogram in their life. Additionally, a study by El Bcheraou et al. (2015) found that 92% of Saudi women, out of 1135 participants aged 50–74 years, had never undergone a mammogram in their life (El Bcheraou et al., 2015). In the eastern province of KSA, 93.5% of 387 Saudi female participants had never had a mammogram (Rehmani et al., 2013). These and countless other studies illustrate that despite the advantages of early screening, Saudi females either do not know about mammography, have other barriers to mammography or simply choose to not have a mammogram. In either case, the reality is that mammography has not been widely used among Saudi females as an early-detection method for breast cancer; the mortality rate of females in the Kingdom speaks to the danger of this reality.

In order to combat the prevalence of breast cancer deaths among Saudi females, there are two important questions that need to be addressed: What are the common barriers that

keep Saudi females from seeking mammography? And, just as importantly, how has the Saudi government worked to encourage mammography utilization? The section below addresses these questions.

2.3 Mammography's Barriers

Considering that mammography is crucial for reducing breast cancer mortality, numerous studies have been dedicated to looking at the barriers to its utilization around the world in the hopes of understanding why women ignore the importance of this procedure to detect any potential breast cancer before it metastasizes and becomes lethal. According to several studies, one of the greatest barriers keeping women from getting mammograms is the cost of the screening (Wang et al., 2019; Bao et al., 2018; Mamdouh et al., 2014). Another major obstacle cited is females' lack of knowledge about the benefits of early screening for breast cancer (Wang et al., 2019). Other research studies have pointed to the lack of access to quality health-care facilities as a source of females not being able to have a mammogram (El Bcheraoui et al., 2015; Mamdouh et al., 2014).

Locally in KSA, as mammography is free to access (Bcheraoui et al., 2015), the cost of the screening itself is not a factor. By excluding what was cited as one of the most prevalent hurdles to women having the procedure performed, prior works on this particular subject instead focused on what other barriers were present that prevented Saudi females from getting mammograms. One region-specific hurdle is the fact that Saudi women were, until 2017, not allowed to drive, which can prevent them from physically being able to get themselves to the doctor's office in order to have the mammogram performed in the first place (El Bcheraoui et al., 2015). However, in 2017, the Saudi government shifted its attitude toward women during a push for female empowerment in the country. One manifestation of this push was that women were to drive in Saudi Arabia (Specia, 2019). Whether or not this change in the laws will result in more females having mammograms remains unknown.

There are, of course, other potential factors that may determine whether or not women will pursue the opportunity to have a mammogram as a form of early detection of breast cancer. First is the fatalistic belief in predestination which is the fifth pillar of Islam (al-Shahri, 2002). It explains the occurrence of any disease as simply the will of God (al-Shahri, 2002). However, this pillar is not intended to mean that a person should ignore a disease, as Islam encourages people to be healthy and prevent illness (al-Shahri, 2002). Unfortunately, the oft-misinterpreted concept of predestination, in some Saudi females, is a probable barrier to some women getting mammograms due to the belief that breast cancer occurs by the power of God and thus cannot be avoided (Molaei, Savabi & Taleghani, 2019). Another contributing factor to the lack of mammography utilization is the stigma surrounding breast cancer. In Saudi Arabia, there is a cultural stigma that links breast cancer to death, which might force Saudi females to hide their illness until it becomes an advanced stage (Almegewly, Gould & Anstey, 2019).

One factor that is somewhat unique to the region is that of modesty. Because of the quasi-intimate nature of a mammogram, Saudi females are more likely to shy away from seeking mammography, especially when a male doctor performs the procedure (El Bcheraoui et al., 2015). This attitude is a direct result of the conservative nature of Saudi society, a nature that has a tendency to prevent women from speaking about breast cancer with their healthcare providers (Hagi & Khafaji, 2013). Compounding this embarrassment is the fact that oftentimes being the recipient of pity or what might be perceived as negative comments from others can prevent Saudi females from getting mammography (Almegewly, Gould & Anstey, 2019). This tendency to shy away from pity or other negativity can lead Saudi women to be silent about their illnesses if they have any symptoms (Almegewly, Gould & Anstey, 2019). Taken collectively, these factors help to potentially explain the lack of mammography utilization by Saudi women.

Another published study found that Saudi females – specifically those who resided in Al Shariqa in the eastern province of KSA – varied in their attitudes toward mammograms (El Bcheraoui et al., 2015). This study found that women in that region had a more favorable opinion toward mammograms when compared to other regions in KSA. Other factors that were found to influence Saudi women's mammography utilization include being of an older age, having a lower level of education, employment, and marital status, having more than two children, and having a family history of breast cancer (Alshammari et al., 2020; Al-Wassia et al., 2017).

Taken together, these previous studies provide significant insights into the role of demographic factors influencing Saudi women's attitudes toward breast cancer mammography. Drawing upon this information, this study collected demographic factors such as location, age, education level, marital status, work status, family history, driving status, and mammography history to serve as a foundation to determine how these factors affect Saudi women's attitudes toward, and the likelihood of their getting a mammogram.

2.4 Saudi Government Intervention

The Saudi Ministry of Health (MOH) is the primary health sector authority in the kingdom, and their fundamental purpose is the pursuit of delivering the highest quality healthcare services to Saudi citizens for free (MOH, 2014). As stated earlier, breast cancer is one of the greatest public health challenges in KSA. In 1992, the Saudi Cancer Registry (SCR) was inaugurated under the administration of MOH and charged with collecting and registering all data related to any form cancer, including numbers of cases and mortality rates, in all KSA regions (Alotaibi et al., 2018). In 2002, mammography was introduced in KSA for eligible women at no cost to the patient (El Bcheraoui et al., 2015). In the ten years following the SCR's establishment, Saudi Arabia has experienced tremendous improvement in the health sector due to the unlimited financial support for healthcare, including the

construction of medical centers, the establishment of cancer and oncology centers, and the flourishing of breast cancer early-detection programs across the country (King Abdullah Foundation; KAF, 2010; MOH, 2012).

Specifically in regard to breast cancer, there has recently been renewed interest by MOH in increasing the number of breast cancer early-detection campaigns following the launch of the Saudi 2030 vision, which aims to reform and improve the kingdom in several areas such as education, economy, health, politics, society, technology, and innovation (Saudi Vision 2030, 2016). In line with the Saudi 2030 vision, MOH has been improving health communication campaigns and launched various health initiatives and activities, including early breast cancer screening (MOH, 2012; MOH, 2020). In compliance with the Saudi 2030 vision, this research hopes to help Saudi health officials to better understand beliefs, perceptions, and intentions related to breast cancer screening in Saudi women.

Because access to healthcare facilities may prevent women from seeking early breast cancer detection, primary and local healthcare centers, hospitals, and mobile clinics have been established throughout the kingdom in hopes of mitigating that potential obstacle (MOH, 2019; El Bcheraoui et al., 2015). Because personal embarrassment may prevent females from undergoing screening, MOH provides separate, single-gender clinics specifically for females as a way to augment women's privacy and to encourage them to get early screening procedures (El Bcheraoui et al., 2015). MOH also took into account the previous studies' recommendations of launching health communication campaigns to enhance women's knowledge and attitudes about the benefits of breast cancer early screening using both traditional and social media channels (Alshammari et al., 2020; MOH, 2020; MOH, 2012).

One of these campaigns is #Don't_Become_the_Eighth!, which is an educational campaign on breast cancer prevention that is continually carried out as a way of raising

awareness as to the importance of breast cancer early detection (MOH, 2020). The “Think Pink” campaign is another ubiquitous breast cancer awareness campaign in Saudi Arabia that is especially prevalent during National Breast Cancer Awareness Month (Hagi and Khafaji, 2013). Additionally, in 2009, the Saudi Cancer Foundation launched the Pink Eastern Initiative to boost awareness about breast cancer early screening (Al Mulhim et al., 2015).

Despite these and other attempts at communicating to women the importance of early detection as the best way to survive breast cancer, thus far in KSA there has been relatively little attention paid to the role of health communication campaigns in the context of breast cancer early screening by government officials. Of the few studies, a survey by Hagi and Khafaji (2013) sought to assess the effect of the “Think Pink” campaign during National Breast Cancer Awareness Month. The study incorporated 722 Saudi women, of which 79% recognized the campaign's activities, but still indicated that they felt that they had insufficient knowledge about mammography's benefits (Hagi & Khafaji, 2013). In other words, the campaigns alone are not doing enough to truly impact women’s attitudes in the kingdom, nor are they doing enough to encourage those women to seek early detection of potential breast cancer.

Between October and December of 2013, a cross-sectional study assessed the effect of community-based awareness campaigns at King Faisal University among 300 staff and female students (Al-Shehri, 2015). This study measured the knowledge and practice toward mammography and found a preponderance of positive knowledge and practice toward early screening among those who attended the awareness campaign at the university (Al-Shehri, 2015). This suggests that when people are directly addressed by those whom they deem knowledgeable on the subject, they will tend to have a more positive attitude. In this case, experts on breast cancer screening provided the information directly, and the results show that this direct communication fostered more positive attitudes.

Likewise, during awareness campaigns from October 2010 to 2013, AlSaeed et al. (2015) found positive perceptions and knowledge about breast cancer early screening among study participants who had attended the awareness campaign day. The study also found that 94% of participants wanted more awareness campaigns about breast cancer early screening. Interestingly, another study found that messages about breast cancer awareness disseminated via the Snapchat social networking application effectively increased awareness about breast cancer early screening among the intervention group (Alanzi, Alobrah, Alhumaidi & Aloraifi, 2018).

While MOH's educational breast cancer campaigns are spread throughout the country, traditional awareness campaigns may not be enough to encourage women to get early screening for breast cancer (El Bcheraoui et al., 2015). Therefore, as Saudi females hesitate to get mammogram screening, designing an effective educational program is critical to upgrade the knowledge and change attitudes and beliefs related to mammography in Saudi women (Alotaibi et al., 2018; Abolfotouh et al., 2015; Radi, 2013; El Bcheraoui et al., 2015). As breast cancer mortality increases in KSA, the importance of this goal grows. This research seeks to determine the most appropriate health communication messages that could impact Saudi women’s intentions to get breast cancer early screening via mammogram as a way of combatting the hesitancy to receiving this potentially life-saving test.

To accomplish this objective, this research aims to test if exposure to an entertainment-education strategy can influence Saudi females' intentions to get mammography. In addition, this research aims to test if exposure to infographic-based educational messages by MOH has an impact on Saudi females' intentions to get mammography. Finally, the study aims to determine if the constructs of the Theory of Planned Behavior (i.e., attitude toward mammography, subjective norms, and perceived behavioral control) and issue involvement concept can predict a woman’s intention to get a

mammogram. The following sections review relevant literature about entertainment-education strategy, infographics, the Theory of Planned Behavior, and the issue involvement concept. Following these sections, a set of research questions and hypotheses are presented.

2.5 Educational Messages Based on Infographics

Infographics are data visualization tools that aim to convey educational information through elements such as graphs and images (Wilkinson et al., 2016). Infographics aim to simplify educational information to make the reader quickly and more easily understand the presented information (Occa & Suggs, 2015). Infographics include visual displays, including graphs, charts, flowcharts, and mind maps aimed at improving the reader's experience in recalling specific information (Joshi & Gupta, 2021). As they relate to the value infographics add to this specific study, Occa and Suggs (2015) articulated the importance of infographics in minimizing comprehension problems caused by low health literacy. For example, the importance of infographics in medical-related communications gained prominence when used to educate the public about the Covid-19 pandemic due to infographics' ability to reach a large audience rapidly. In a more historical context, infographics have proven invaluable for health educators seeking to educate large segments of the public about healthy eating (Wilkinson et al., 2016). In the more specific context of breast cancer awareness and the importance of early detection, social media infographic messages containing rich visual content and key awareness components, such as pink the color and pink awareness ribbons, have been associated with higher engagement (Miller, Guidry, & Fuemmeler, 2019).

In Saudi Arabia, infographics are commonly used by healthcare institutions, including MOH, to deliver educational messages to improve Saudis' perceptions and knowledge of public health issues (Jahan et al., 2021). Infographic messages have been commonly used by MOH to deliver breast cancer early screening messages, typically highlighting the benefits of breast cancer early screening. Nonetheless, it is unknown how Saudi women who are eligible

for mammogram screening would react to educational infographics messages. This lack of knowledge points to an important question that must be addressed: Can infographic messages encourage Saudi women to get mammograms? This research aims to answer that question by testing whether or not the reading of MOH's breast cancer educational infographic messages can influence Saudi females' decision to get mammography.

2.6 Entertainment Education Strategy

While there are a wide variety of health communication strategies that have the capacity to enlighten women about the benefits of mammography (Abu Awwad et al., 2020; Emmers-Sommer & Terán, 2019; Holt, Lee, and Wright, 2008; Kirby, Ureda, Rose, & Hussey, 1998), multiple studies have shown that entertainment-education communication strategy is one of the most commonly utilized strategies in influencing knowledge, attitudes, intentions, and behaviors on several health issues (Sood et al., 2017; Shen & Han, 2014; Wilkin et al., 2007; Bae & Kang, 2008).

Entertainment Education (E-E) is defined as "the process of purposely designing and implementing a media message to both entertain and educate, in order to increase audience knowledge about an educational issue, create favorable attitudes, and change overt behavior" (Singhal & Rogers, 1999, p. 9). The E-E strategy began as a broad communication approach in the 1940s and has since developed into a comprehensive strategy with its own field of study (Sood et al., 2017; Singhal & Rogers, 2001).

Two prominent pioneers in the field contributed to the development of the E-E approach: Miguel Sabido and Population Communication Services (PCS) at Johns Hopkins University (JHU). From 1970–1990, Sabido and PCS produced several E-E projects to promote family planning, encourage gender equality, and increase sexual responsibility (Sood et al., 2017; Singhal & Rogers, 2001; Singhal & Rogers, 1999). In recent years, the E-E strategy has become highly influential in raising viewers' health awareness and changing

their attitudes toward several health issues (Sood et al., 2017; Shen & Han, 2014; Wilkin et al., 2007; Bae & Kang, 2008).

An analysis of the literature currently available reveals that only a few studies have looked at the impact of the E-E strategy in a breast cancer prevention context. In 2003, three educational messages were incorporated into the advertising airing during a Spanish-language television program called *Ladròn de Corazones* that sought to educate Hispanic immigrants in the USA about breast cancer early prevention (Wilkin et al., 2007). There was a statistically relevant number of calls to the number broadcast during the program asking for further information about breast cancer early screening. A subsequent triangulation method allowed Wilkin and colleagues (2007) to survey and interview viewers in order to better understand how the E-E strategy affected women's attitudes and behaviors. The findings showed that viewers of *Ladròn de Corazones* gained knowledge about breast cancer early screening, and men were more likely to recommend that women have a mammogram as a result of their having viewed the messages. However, despite those encouraging statistics, the researchers found that there was no significant effect on females' intention to get a mammogram as a result of either the newly acquired knowledge or the encouragement of their male counterparts (Wilkin et al., 2007).

In 2005, two separate educational messages were combined into the popular entertainment medical dramas *ER* (which aired on the NBC network) and *Grey's Anatomy* (which aired on the ABC network) that were specifically designed to educate viewers about breast cancer gene mutation and the risks those mutations pose for women (Hether et al., 2008). This study showed that exposure to both storylines was associated with positive attitudes and knowledge of screening behavior. However, that influence was only a modest one based on a single exposure (Hether et al., 2008).

Another study investigated the effects of an eight-episode E-E series called *90210*, which aired in 2012 (Rosenthal et al., 2018). *90210* addressed breast cancer genetics and breast cancer early screening, and the results showed that exposure to the eight-episode *90210* was associated with positive knowledge of breast cancer genes and intentions to speak to a doctor about undergoing testing for the BRCA gene (Rosenthal et al., 2018).

A randomized controlled trial by Borrayo, Rosales, and Gonzalez (2017) compared the effect of the E-E narrative short film to non-narrative interventions. The study measured knowledge, self-efficacy, behavioral norms, and mammography intention. The findings showed that E-E narrative and non-narrative interventions were equally effective at changing the outcomes. The E-E narrative had higher effects on self-efficacy and breast cancer knowledge, but small effects on subjective norms and mammography intention (Borrayo, Rosales & Gonzalez, 2017).

While E-E strategy appears to be a promising vehicle for enhancing perception, knowledge, and behavior toward breast cancer early screening, most of these prior studies have been undertaken in Western countries. The exclusion of populations from Eastern countries has led to insufficient evidence for those countries, virtually all of which have radically different cultural contexts, but which all still require similar levels of public health attention. Indeed, although breast cancer cases and mortality rates continue to grow in KSA, almost nothing is known about the effectiveness of the E-E strategy as it relates to breast cancer early screening and prevention in that region. To date, is the first study to test the effect of the E-E strategy on Saudi women’s intentions to get mammogram.

2.6.1 Research Setting

In 2018, the E-E strategy was applied by Arabic musician Elissa, who had disclosed her battle with breast cancer in an educational song called *"Ila Kol Elli Bihebbouni*" ("To Those Who Love Me") on YouTube (Rotana, 2018; Badih, 2018). Elissa produced an E-E

message leveraging the worldwide reach afforded by a YouTube music video as a way to illustrate and promote to Arab women the importance of breast cancer early detection. The video clip ends with a strong statement from Elissa encouraging women to get breast cancer screening early. In that statement, she says, "I've recovered, I've beaten the illness, and I won." She adds that "early detection of breast cancer can save your life. Don't ignore it, face it" (Rotana, 2018; Badih, 2018). Though I argue that Elissa's E-E message deserves greater scholarly attention, to date no academic effort has investigated Elissa's message on mammography intention. This research aims to test if the entertainment-education strategy presented by Arabic artist Elissa in a musical form can in fact influence Saudi women's intention to get mammograms. The following section examines YouTube as a communication channel and music as an E-E tool.

2.6.2 EE within the Digital Environment

Thus far, the E-E strategy has mainly been studied in the context of traditional mass communication channels used to deliver educational messages (Shen & Han, 2014; Sood et al., 2017), leading to a paucity of research on using the internet as a communication vehicle to deliver educational messages (Rosenthal et al., 2018; Shen & Han, 2014; Sood et al., 2017). In their study, Riley et al. (2021) state the significance of testing how individuals would encounter online E-E messages in short video format, though they stop short of fully researching videos that are shorter in length. They write, "If E-E moves in the direction of shorter, web-based video content, further explicating how individuals are experiencing these new messages and relevant theoretical implications will be necessary." (pp. 47).

Elissa's E-E strategy revolved around her publishing her message on YouTube, which is the most commonly used platform to search for breast cancer information among Arab females (Ayoub, Chalhoub, Sleilaty, & Kourie, 2021). In a larger context, within KSA, YouTube is the most frequently used social network among Saudis (Kemp, 2020).

YouTube is a combination of video-sharing and a social media website that allows unlimited free space for videos from all types of sources and for all audiences (Zhang et al., 2017). According to YouTube statistics, over 2 billion users watch over a billion hours of video and generate billions of views (YouTube, n.d.). Beyond the sheer volume of the website's coverage and usage, YouTube provides several features that benefit both singers and users. First, YouTube provides opportunities for aspiring musicians to write, record, publish, and share their own songs (Cirigliano, 2013). Secondly, YouTube offers several analytic measures, such as identifying the number of times a video has been watched, liked, disliked, or commented on (Zhang et al., 2017; Cirigliano, 2013).

Furthermore, below each video, YouTube enables users to express their feelings by commenting on the video (Zhang et al., 2017; Cirigliano, 2013). In regard to this feature, a study indicates that when Australian artist Hugh Jackman spoke out about his cancer struggles online, a tremendous number of online comments followed his announcement (Pavelko et al., 2017). Interestingly, several users educated each other in the comments, which means online comments on celebrity health announcements provide an opportunity to raise health awareness (Pavelko et al., 2017). This is a feature that could be leveraged for breast cancer awareness and early detection.

YouTube is a promising platform for promoting health-related information in general (Zhang et al., 2017), and breast cancer prevention in particular (Esen, Aslan, Sonbahar & Kerimoğlu, 2018). Despite its obvious potential, the effectiveness of YouTube breast cancer educational videos has rarely been investigated in the Arab regions. This research seeks to fill that void by testing the effectiveness of the E-E strategy by using YouTube as an E-E communication channel.

2.6.3 Music as an EE Tool

The main goal of E-E is the incorporation of educational messages into any entertainment format to increase knowledge and to change attitudes and behaviors (Chirinos-Espin, 2021). These formats include, but are not limited to, television series (Rosenthal et al., 2018), television soap operas (Wilkin et al., 2007), radio soap operas, and TV dramas (Singhal & Rogers, 1999; Shen & Han, 2014). However, music is one E-E tool that has been under-utilized in the E-E strategy overall and, as a result, under-studied in the literature (Murrar & Brauer, 2018; Sood et al., 2017; Cirigliano, 2013). Ironically, though, according to the scant examples of published E-E literature, music is a near-perfect tool for embedding educational messages within entertaining media (Chirinos-Espin, 2021; Cirigliano, 2013; Singhal & Rogers, 2001; Singhal & Rogers, 1999).

Music involves many sources, such as songwriters, lyricists, content experts, and sound editors, all working together to reinforce, in this instance, the educational message (Macnab & Mukisa, 2019). Most importantly in regard to E-E, music often utilizes famous artists and celebrities, in this case to deliver an educational message (Chirinos-Espin, 2021). This involvement of celebrities in music educational content allows those celebrities to gain more media exposure, while simultaneously helping them to draw more public attention to the specific issue they are addressing, which increases the persuasive potential for social change (Chirinos-Espin, 2021). As of this writing, Elissa's E-E song on YouTube has been viewed by almost 24 million viewers and has earned a great deal media exposure.

In KSA, El Bcheraoui et al. (2015) recommended using media activists and celebrities (such as Elissa) as role models to improve Saudi females' breast cancer decisions. Indeed, celebrities in many cultures often have recognition, popularity, and positive reputations; therefore, they are more likely to form positive relationships with their fans (Emmers-Sommer & Terán, 2019). These relationships instill trust, so when a celebrity advocates for a

specific cause, viewers tend to trust the celebrity's opinion on the matter. For example, Angelina Jolie's decision to publicly announce her breast cancer diagnoses and subsequent double mastectomy has positively influenced several women's decisions in regard to seeking preventative care (Kosenko et al., 2016; Dean, 2015; Drizin, Malcarne, Schiaffino, & Wells, 2018; Emmers-Sommer & Terán, 2019). Elissa is no different from Jolie in terms of her popularity in the Arab world, as she has been a well-known artist since the 1990s. Thus, she has the same potential to influence women's behavior.

Unlike other E-E formats, music is shorter in length and can easily contain inspirational and enjoyable messages (Murrar & Brauer, 2018), which can encourage listeners to learn (Dunlap & Lowenthal, 2010). A possible explanation for this is that the right and left brains are both working together to process and interpret the musical elements. While the left side of the brain focuses on rhythm, dialogue, and plot, the right side concentrates on visual elements such as images, relationships, sound effects, and melodies (Mendes, Diniz & Marques, 2021; Macnab & Mukisa, 2019). Such a process enables the listener to engage in dialogue while simultaneously provoking critical thinking, which eventually improves the persuasion process (Chirinos-Espin, 2021).

2.6.4 Examples of Using Music as an EE Tool

Some prominent cases from the 1980s include two songs produced by JHU/PCS called "Cuando Estemos Juntos" and "Détente." Both songs sought to increase sexual responsibility awareness among Latin American teenagers (Singhal & Rogers, 1999). As cited by Singhal & Rogers (1999), the two songs contributed to raising teenagers' awareness and informing them about sexual responsibility (Kincaid et al., 1988). Additionally, during the time of the Covid-19 pandemic, music played an important role in increasing awareness about preventative measures (Chirinos-Espin, 2021). On YouTube, the Vietnamese Ministry of Health released a song about the importance of washing hands and maintaining social

distancing protocols as preventative measures aimed at curbing the virus's spread (Chirinos-Espin, 2021). Earlier in the pandemic, American artist Lady Gaga launched "One World Together at Home," a virtual concert that asked viewers to remain at home and to donate to the WHO (Chirinos-Espin, 2021).

Relying on music as an entertainment-education tool was also beneficial during the time of the Ebola crisis, when African artists created the song "Africa Stop Ebola" with the goal of disseminating health information about Ebola. The artists were perceived as trusted sources, and the song was found to be an effective way to communicate with young people (Chirinos-Espin, 2021). More recently, music continues to be utilized in several related contexts, such as teaching and education (Cirigliano, 2013; Dunlap & Lowenthal 2010), health improvement (Ekholm, Juel, & Bonde, 2016), and prejudice reduction (Murrar & Brauer, 2018).

However, despite its proven effectiveness, music is one E-E tool that has rarely been investigated within the E-E strategy literature (Murrar & Brauer, 2018; Sood et al., 2017; Cirigliano, 2013). In particular, very little is currently known about the effects of using music to deliver E-E messages in the context of breast cancer mammography. To date, the effects of Elissa's breast cancer message dissemination have not been closely examined at they pertain to the Arab world in general and the Saudi Arabia region in particular.

2.6.5 EE Mechanism

The E-E strategy mechanism has been largely studied from the principles of social cognitive theory and narrative-related concepts (Sood, Menard, & Witte, 2004; Shen & Han, 2014; Sood et al., 2017). The social cognitive theory (SCT) posits that individuals learn by observing others and are more likely to incorporate new behaviors into their own lives by identifying and modeling with those that they feel are similar to themselves (Bandura, 1986). In regard to the other theoretical lens, E-E theorists emphasize that E-E viewers tend to

experience shifts in their knowledge, attitudes, and behavior because they are not resisting the embedded educational message within the entertaining storyline due to high levels of message transportation and identification (Murphy et al., 2011; Moyer-Gusé, 2008; Slater & Rouner, 2002). Transportation relates to a recipient's feeling of being absorbed into the story (Green & Brock, 2000), while identification indicates the level of emotional interaction between E-E viewers and what a media character portrays (Cohen, 2001). In essence, then, E-E viewers feel more absorbed and identify more readily with messages and tend to identify more directly with those messages.

Undoubtedly, the continued application of these theories provides a comprehensive theoretical framework to understand E-E influences on E-E recipients. Nevertheless, beyond the SCT and narrative effects, could the E-E strategy influence viewers differently? This research relied upon the Theory of Planned Behavior (TPB) and the issue involvement concept to determine what would predict Saudi women’s intentions to get mammograms, including exposure E-E strategy. The next section reviews the theoretical framework of this research.

2.7 Theory of Planned Behavior (TPB)

The TPB was introduced to the academic literature in 1991 by Ajzen as an extended model of the Theory of Reasoned Action (Fishbein and Ajzen, 1977; Ajzen and Fishbein, 1980). The basic intent of TPB is to determine individuals' intentions based on three underlying constructs, namely: (a) attitude toward the behavior, (b) subjective norm, and (c) perceived behavioral control. The term "intention" in the TPB refers to how much effort people plan to exert or how hard they are willing to try to engage in the given behavior (Ajzen, 1991, p.181). According to the TPB, intention is an antecedent factor for shifting to actual behavior; therefore, people are presumed to engage in that behavior when they have a favorable intention for the given behavior (Ajzen, 1991). In this dissertation, based on Ajzen's (1991) definition, the term "intention" refers to the extent to which Saudi women are willing to try and plan to get mammograms every two years.

According to Ajzen (1991), a person's intention is influenced by three salient beliefs, namely: (a) a person's behavioral beliefs, which are assumed to influence attitudes toward the behavior; (b) normative beliefs, which constitute the underlying determinants of subjective norms; and (c) control beliefs, which provide the basis for perceptions of behavioral control.

The following introduces the definition of each construct according to the TPB as cited by Ajzen (1991). To begin, the phrase "attitude toward behavior" (ATB) relates to a person's favorable or unfavorable evaluation of the behavior in question. The TPB postulates that the formation of intention toward a given behavior is influenced by a person's favorable or unfavorable judgment and evaluation of the behavior in question. In this study, based on Ajzen's (1991) definition, ATB refers to Saudi females' overall evaluation (favorable or unfavorable) in regard to undergoing mammography every two years.

The second construct of TPB is subjective norms (SN), which encompasses a person's normative beliefs about whether those deemed to be significant others think they should or

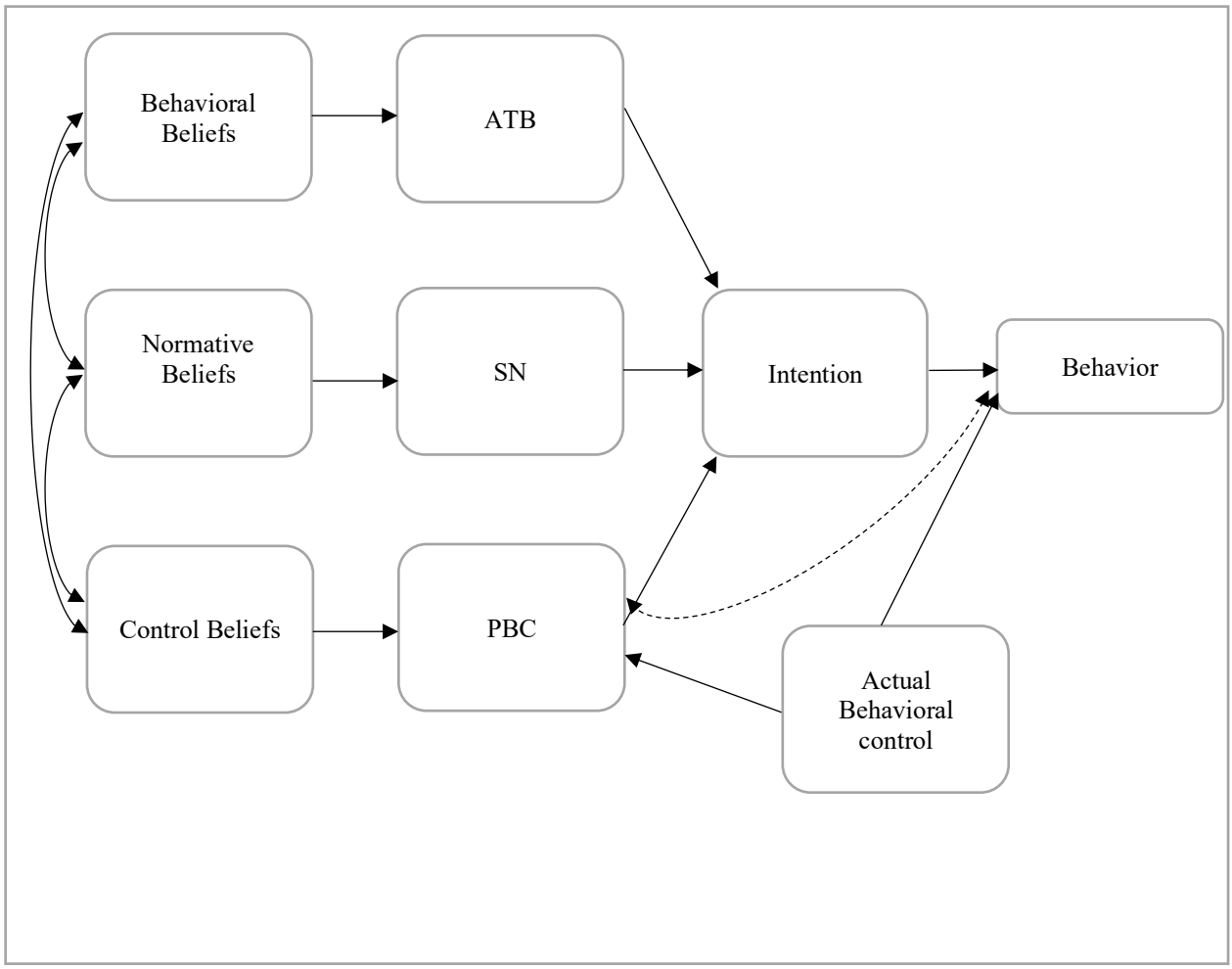
should not adopt the behavior in question (Ajzen, 1991). The TPB hypothesizes that a person's intention to adopt the behavior in question is influenced by important people's approval or disapproval of adopting that behavior. In this study, based on Ajzen's (1991) definition, the term "SN" refers to the extent to which a Saudi woman believes that whether significant others in her life (e.g., close family members, friends, and healthcare providers) think that she should (or should not) get mammogram every two years.

Finally, the perceived behavioral control construct is what distinguishes the TPB from the TRA (Ajzen, 1991). Perceived behavioral control (PBC) relates to a person's capability (ease or difficulty) to perform a behavior in question (Ajzen, 1991). The TPB assumes that the more resources people have and the fewer obstacles they might encounter, the greater control individuals would have to obtain the behavior in question. Thus, when individuals strongly believe in their ability to control a given behavior, they are more likely to engage in that behavior. According to TPB, a high PBC, together with behavioral intention, can be used directly to predict behavioral achievement. Ajzen (1991) argues that "a person who is confident that he can master this activity is more likely to persevere than is the person who doubts his ability" (pp. 184). In this research, based on Ajzen's (1991) definition, PBC is the extent of ease or difficulty a Saudi female might believe is associated with getting a mammogram every two years.

In summary, TPB is guided by three primary considerations, namely: (a) behavioral beliefs, which relate to a person's attitude toward the given behavior; (b) normative beliefs, which relate to social expectations of performing the behavior in question; and (c) control beliefs, which are linked to a person's beliefs about the factors that might hinder or facilitate performing the given behavior. In combination, the degree of these constructs, favorable or unfavorable, leads to the formation of intention, which is considered an antecedent of actual

behavior (Ajzen, 1991). The following diagram is the model depicting the predicted pathways between the TPB constructs by Ajzen (1991).

Figure 1 ***Theory of Planned Behavior by (Ajzen, 1991).***



Having defined what is meant by each TPB construct, the following sections provide justifications for using the TPB to guide this research. Broadly, the TPB has been used across a variety of health issues and has been shown as a beneficial and valid theory for determining people's intentions toward several health issues (Armitage and Conner, 2001; Steinmetz et al., 2016; Smith and McSweeney, 2007; Van, 2011). In regard to breast cancer, the TPB is a useful theory for understanding women's intention to get breast cancer early screening (Wang et al., 2019) and mammography (Zahra et al., 2021; Khani Jeihooni, Darvishi & Harsini,

2019; Griva et al., 2013; Orna Baron-Epel, 2010; Griva, Anagnostopoulos, & Madoglou, 2010; Tolma, Reininger, Evans & Ureda, 2006; Godin et al., 2001).

In breast cancer early screening, a study found higher levels in regard to intentions to get breast cancer early screening among females who held a positive attitude, experienced strong subjective norms from relatives and friends, and had held strong perceived behavioral control toward early screening (Wang et al., 2019). In mammography, positive attitude, favorable subjective norms, and strong perceived behavioral control toward the procedure have been shown to contribute to women's intentions to undergo mammography (Zahra et al., 2021; Khani Jeihooni, Darvishi & Harsini, 2019; Griva et al., 2013; Orna Baron-Epel, 2010; Griva, Anagnostopoulos, & Madoglou, 2010; Tolma, Reininger, Evans & Ureda, 2006; Godin et al., 2001).

Within the E-E field, the TPB is a relevant theory for understanding the E-E strategy's impact on its viewers (Riley, Rodrigues, & Sood, 2021; Sood et al., 2017). A meta-analysis indicates that E-E strategy has significant effects on the viewer's knowledge, attitudes, intentions, and behavior (Shen & Han, 2014). In the cornea donation context, for instance, an educational message based on the E-E approach positively impacted viewers' attitudes, norms, and perceived behavioral control, which subsequently contributed to the formation of E-E viewers' intention to sign a cornea donor card (Bea and Kang, 2008; Bae, 2008). Yet that was not the case in the mammography context, where E-E had a small effect on viewers' intention to obtain mammography (Borrayo, Rosales, Gonzalez 2017).

While the TPB provides different outcomes that help understand females' mammography intentions, there is a dearth of research in KSA that relies on TPB. By more fully exploring the subject, the TPB would provide insight into understanding Saudi females' intentions as to whether or not they get mammograms every two years based on multiple predictors. For example, the TPB would allow for the evaluation of whether or not Saudi

females hold favorable or unfavorable attitude toward mammography. Moreover, it would better the understanding of the role played by significant others (e.g., close family members, friends, and healthcare providers) in influencing Saudi females' mammography decisions. The TPB would also determine Saudi females' perception of the relative ease or difficulty associated with having a mammogram every two years. Most importantly, this research would compare the outcomes among women who were exposed to E-E messages versus those who would not. Such findings would be valuable for health officials in KSA to design relevant health communication messages relevant to this particular group.

Finally, the TPB allows the inclusion of additional intention predictors that will enhance the explanatory power of the model (Ajzen, 1991). Up to this point in time, prior works have successfully extended the TPB by adding additional predictors to predict behavioral intention, such as the role of moral norms (Van, 2011), the role of emotion (Bae, 2008), the role of past behavior (Smith and McSweeney, 2007; Van, 2011), and the role of experience on mammography (Griva, Anagnostopoulos, Madoglou, 2010). Given the feasibility of including additional predictors, this research aims to integrate the issue involvement concept into the TPB construct to demonstrate if E-E or infographic messages would predict viewers intention to get mammogram. The following reviews the concept of issue involvement.

2.8 Role of Issue Involvement

Issue involvement is occasionally labeled in the literature as *ego-involvement*, *personal involvement*, *or issue relevant* (Petty & Cacioppo, 1986). *Issue involvement* (INV) is a key variable in the persuasion process, defined as the extent to which an individual believes an issue is of intrinsic importance or has significant consequences for his or her own life (Skumanich & Kintsfather, 1996). Based on Skumanich and Kintsfather's (1996) definition, this research measures INV as the extent to which Saudi women believe that breast cancer

early screening via mammography is of intrinsic importance or has significant consequences in their life.

Before proceeding to review relevant literature related to issue involvement, it is essential to present one of the persuasion theories that helps to explain the role of issue involvement, which is the Elaboration Likelihood Model (ELM) posited by Petty and Cacioppo in 1986. The term "elaboration" relates to "the extent to which a person thinks about the issue-relevant arguments contained in a message" (Petty & Cacioppo, 1986, pp. 128). The major premise of ELM is that there are two essential routes by which people encounter persuasive messages, known as the central and peripheral routes (Petty & Cacioppo, 1986). The central route is a careful and thoughtful consideration of the message that supports what the message is advocating (Petty & Cacioppo, 1986). A person is more likely to think carefully and "centrally" about the persuasive message when issue involvement is high (Bae, 2008). Conversely, in the peripheral route, no careful or thoughtful consideration is required in order to produce attitude change; alternatively, persuasion more likely occurs due to some other external cues, such as source attractiveness and other cues (Petty & Cacioppo, 1986).

The application of ELM in the breast cancer early screening context has been examined in several studies. An example of this utilization is the study carried out by Emmers-Sommer, and Terán (2019), in which they found that women tended to report higher issue-relevance but lower values of intention to get screened when a celebrity, in this specific instance Angelina Jolie, spoke out about her breast cancer. Another study found that, among young females, high involvement with mammography screening contributed to more positive attitudes toward screening and a future intention to obtain mammograms (Labrie, Ludolph & Schulz, 2017). However, there was no significant effect between participants' involvement in

the breast cancer issue and participants' elaboration of breast cancer prevention message (Kim, 2012).

A study by Holt, Lee and Wright (2008) found that incorporating spiritual content into breast cancer prevention messages for African American women was associated with higher levels of issue involvement. Another example of using ELM is a study performed by Kirby, Ureda, Rose and Hussey (1998), in which the researchers reported that high-quality arguments had influenced females' intention to undergo mammography.

As far as integration of INV into the TPB, Kim et al. (2014) found a positive role of INV in moderating the effects of the anti-alcohol messaging as it pertained to E-E viewers' attitudes and intentions. In the organ donation context, Skumanich and Kintsfather (1996) found a strong direct link between involvement and attitude as they pertained to intention. In a similar case, Bae and Kang (2008) discovered that issue involvement was a common causal antecedent of TPB's constructions and directly influenced E-E viewers' intention to sign an organ donation card. Therefore, the authors concluded that "this suggests that adding INV to the TPB enhances the explanatory power of the theory in predicting intentions" (Bae and Kang, 2008, pp. 92). However, very little is known about the integration of the issue involvement concept into the TPB to predict females' mammography intentions. Based on this lack of knowledge, the current research formulated specific aims and hypotheses presented in the pages below.

2.9 Research Aims, Hypotheses, and Questions

Specific Aim 1: To test whether issue involvement with mammography would predict Saudi females' intentions to get mammograms.

H1: High level of involvement with mammography will predict Saudi females' intentions to get mammograms.

Specific Aim 2: To test whether the TPB's three constructs would reliably predict Saudi females' intentions to get mammograms.

H2: Positive attitude toward mammography will predict Saudi females' intentions to get mammograms.

H3: Positive subjective norms toward mammography will predict Saudi females' intentions to get mammograms.

H4: Positive perceived behavioral control will predict Saudi females' intentions to get mammograms.

Specific Aim 3: To test the role of demographic factors in predicting Saudi females' intention to get mammogram.

RQ1: Which of the demographic factors would predict intentions to get mammograms on the part of Saudi women?

Fourth Specific Aim: To test if exposure to E-E message or MOH infographic messages would predict Saudi females' intentions to get mammograms.

RQ2: Does exposure to E-E messaging predict Saudi females' mammography intentions?

RQ3: Does exposure to MOH infographics messages predict Saudi females' mammography intentions?

Chapter 3: Methodology

3.1 Research Design

To date in KSA, there have been no randomized controlled trials to determine what messages drive Saudi females to get mammograms. Therefore, this study relied on a three-arm parallel-group randomized controlled trial that was administered online via the Qualtrics website. By utilizing Qualtrics' randomization feature, participants were assigned randomly and evenly to one of three arms. This randomization removed any potential on the part of the investigator to exert any influence over the participants' allocation process, which is a critical step in a randomized controlled trial method (Salazar, Crosby & DiClemente, 2015).

The first arm of participants was assigned to watch Elissa's E-E song, in the same format that it appears on YouTube without any modifications. The second arm was the standard of care group, and this group was assigned to read four educational infographic messages about breast cancer early screening. The infographic educational messages that they were given were adopted from the Saudi Ministry of Health (MOH) webpage without any modifications. See these infographic educational messages in Appendix A. The third arm was the control group, which was not assigned to read or watch preventative messages.

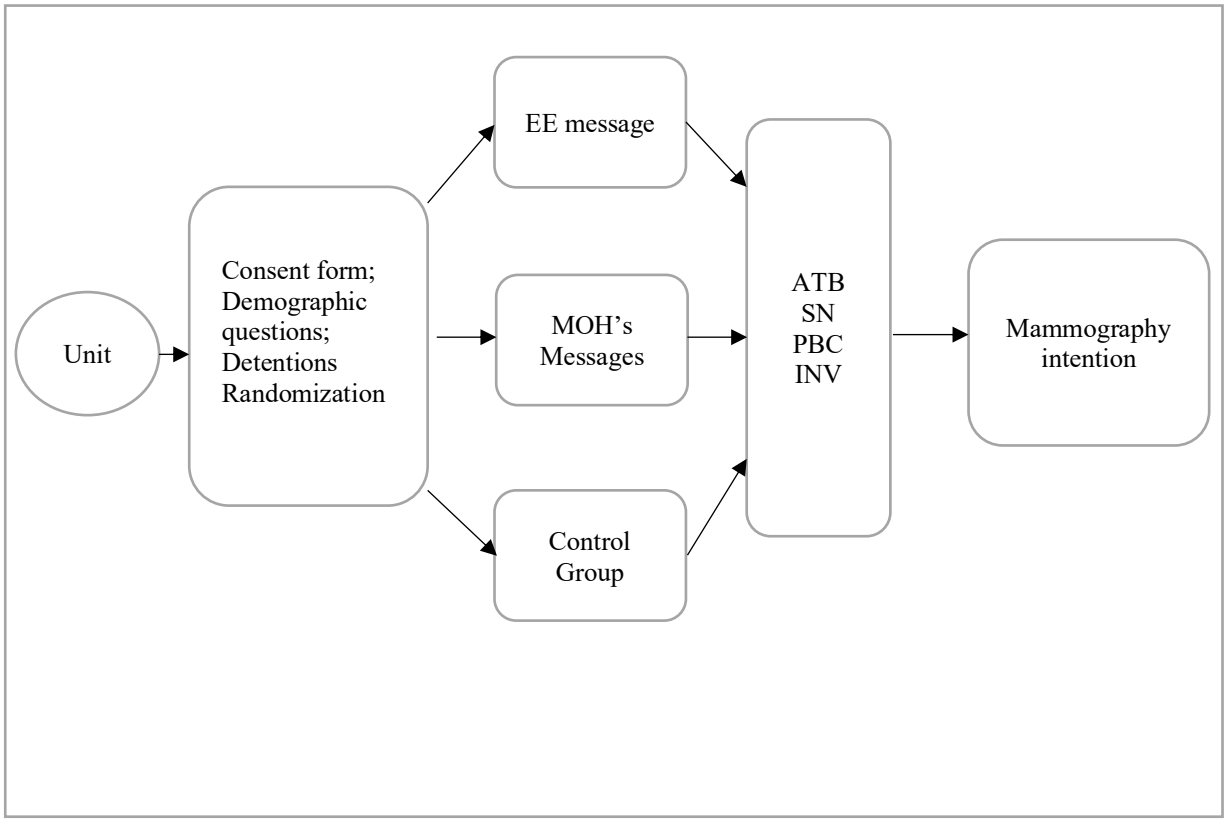
Prior to participant allocation to the three arms, participants were given a consent form based on Institutional Review Board (IRB) protocol at Virginia Commonwealth University (VCU). This form highlights the study's overall objective and informs participants that they have the option skip or withdraw from the questionnaire at any time they want. The full consent form is available for review in Appendix A.

After participants had signed the consent form, they were asked a series of demographic questions, specifically their age, education level, employment status, marital status, driving status, location in KSA, family history of breast cancer, participant’s own history of breast cancer, and their mammography history. Demographic questions related to the study exclusion criteria such as age and breast cancer status were mandatory to answer,

while the rest of the demographic questions were optional. Following this section, participants were given the definition of breast cancer and mammography in order to establish a baseline understanding of the terms as incorporated in the study. Qualtrics then randomly and evenly assigned participants to one of three arms. The demographic questions are available for review in Appendix A.

Participants in the first arm were instructed to click on the watch button to start watching the YouTube video. Following their viewing of the video, participants were given one direct question that asked them if they had ever seen this video in the past. The second arm was presented with MOH's infographic messages as discrete messages, with each message serving as a stand-alone example of the communications. Each message was presented on one page, and participants had to click the next button to move from one message to another. Immediately after reading all of the messages, participants were asked if they had ever read any of these messages in the past. As the third arm did not receive any preventative messages, they only had to click the next button in order to move directly to the questionnaire. Figure 3 below illustrates the research design; the materials presented to each of the three arms are available for review in Appendix A.

Figure 2 *Illustration of the research design*



3.2 Research Instrumentation

All participants in the three groups received one validated questionnaire which measured INV and TPB's constructs. As presented below, the research instrument was initially developed in English; therefore, it was forward translated into the Arabic language by two independent sources. The two translators are fluent in both English and Arabic, and are also familiar with the TPB and INV. Following both translators' work, there was a discussion about any differences between the two versions to ensure that the Arabic version of the questionnaire reflected the same meaning as each of the questions in the English version. A pre-test among eight participants who were over the age of 40 was also performed to ensure that there was no confusion or misconception regarding the questions, or the terms used. This pre-test resulted in slight changes to wording, changes that were reviewed and approved by the translators. The research instrument is available for review in Appendix A.

3.2.1 Issue involvement

This study used the personal involvement inventory (PII) scale created by Zaichkowsky (1994) to measure Saudi females' involvement with breast cancer mammography. While Zaichkowsky's (1994) scale was originally developed for product purchases and advertising, evidence from past research indicates that PII's scale was applicable to the breast cancer early screening context (Labrie, Ludolph, & Schulz, 2017; Kim, 2012). Following Zaichkowsky's (1994) recommendations and considering the topic of breast cancer early screening, this study relied on a reduced version of the PII scale proposed by Kim (2012).

The scale incorporated a 7-point Likert scale ranging from 1 (Not at all) to 7 (Very much) to indicate participants' reactions to six specific descriptors: *important, relevant, interesting, means a lot to me, valuable, and involving.* In this study, the selection of the six-item list was in line with Zaichkowsky's (1994) recommendations, and the internal consistency in this study was ($\alpha = .91$). The scores were added together in order to measure Saudi females' level of involvement with mammography; high scores implied a high level of involvement and lower levels implied a low level of involvement. The INV mean was calculated for each respondent. See table 1 for a full summary of the research instrument.

3.2.2 Theory of Planned Behavior

This study used the Theory of Planned Behavior scale created by Ajzen (2002). Using Ajzen's (2002) recommendations and considering the topic of breast cancer early screening, this study relied on a modified version of TPB in breast cancer early screening pioneered by the work of multiple scholars (Griva et al., 2013; Wang et al., 2019). The TPB constructs and intention were answered on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A high score reflected a positive attitude, stronger subjective norms, stronger behavioral control, and favorable intentions toward mammography; lower scores

reflected a negative attitude, weaker subjective norms, weaker behavior control, and less-favorable intentions towards mammography. The mean of TPB constructs was calculated for each respondent. For example, mean was calculated for ATB, SN, PBC and intention. I calculated Cronbach's α value to measure the internal consistency of TPB constructs; the scores and examples for each item are illustrated in the table below.

Table 1. ***Summary of Research Instruments.***

Variables	Items	Example of Item	Cronbach's α
INV	6	*To me, breast cancer mammogram is important*	.91
ATB	11	*For me, getting a mammogram every two years would be safe*	.95
SN	9	*My family thinks I should get a mammogram every two years*	.93
PBC	3	*Whether or not I get a mammogram every two years is entirely up to me*	.62
Intentions	3	*I plan to get a mammogram every two years*	.95

3.3 Sample and Procedure

As Saudi women over the age of 40 are eligible for free breast cancer screening, the target population of this study was Saudi females between the ages of 40 and 69. Exclusion criteria were (1) females under age 40 (39 or younger), (2) females above age 69, and (3) females who have had breast cancer or risk-reducing bilateral mastectomies. According to the most recent official reports issued by the General Authority for Statistics (GASSA) (2019), the total population of the Kingdom is 34,218,169. Of this number, 14,479,113 are women. In regard to the specific parameters of this study, the total number of Saudi females 40 years old and older is 2,577,617 (GASSA, 2019).

Because this is a hard-to-reach population while living in the U.S.A., the sample was recruited relying on nonprobability methods. Specifically, the target population was recruited using Saudi students studying in the U.S.A. as intermediaries. I asked those students to forward the questionnaire link to their family members in Saudi Arabia.

These Saudi students in the U.S.A. are supervised by the Saudi Arabian Cultural Mission (SACM), an officially sanctioned, specialized Saudi agency whose mission is to supervise Saudis studying in the United States. SACM initiated official Saudi clubs within each state, administrated by Saudi students to communicate and help other Saudi students in that state. According to the SACM website, there are more than 250 Saudi clubs in the U.S.A., representing roughly 35,000 to 40,000 Saudi students.

Part of the Saudi clubs' mission is to assist those Saudi students in the U.S.A. who may need help sending out their research instruments, such as a questionnaire. In most cases, this assistance takes the form of the president of a club's creating a WhatsApp group, supplemented by different social media accounts, to facilitate communication with the students in that area.

This study obtained a list of Saudi clubs from SACM's website (http://sacmclubs.org/en). I contacted the president of each Saudi club and asked them to send out the Arabic invitation through WhatsApp groups to all Saudi students in that area; Appendix B shows the research invitations. Saudi students studying in the U.S.A. were asked to forward the link to their family members living in Saudi Arabia.

Participants had the opportunity to be entered into a drawing to win one of ~7 $25 gift cards, which would give them an approximately a 1-in-20 chance of winning based on the sample size. To ensure responses were not connected to identifiers collected for incentive purposes, the link at the end of the survey automatically took participants to a separate survey to collect their information to be entered into the drawing.

This study obtained the Virginia Commonwealth University (VCU) Institutional Review Board (IRBs) approval prior to beginning. Moreover, the study was reviewed and approved by the Protocol Review and Monitoring Committee (PRMC) at VCU Massey Cancer Center (MCC). Following the securing of all requisite approvals and prior to subject recruitment, the trial was registered on VCU's Clinical Trials.gov PRS System (ID# MCC-21-18633).

Based on the IRB and PRMC protocols, participants were informed that they had the chance to skip or withdraw from the questionnaire at any time. After participants consented to engage in the study, they were given the demographic questions, including age, education level, employment status, marital status, driving status, location in KSA, family history of breast cancer, and participant's history of breast cancer. As explained earlier, questions related to the study exclusion criteria such as age and breast cancer status were mandatory to answer, while the rest of the demographic questions were optional. Following the curation of these answers, Qualtrics randomly assigned participants to one of three arms.

3.4 Sample Size

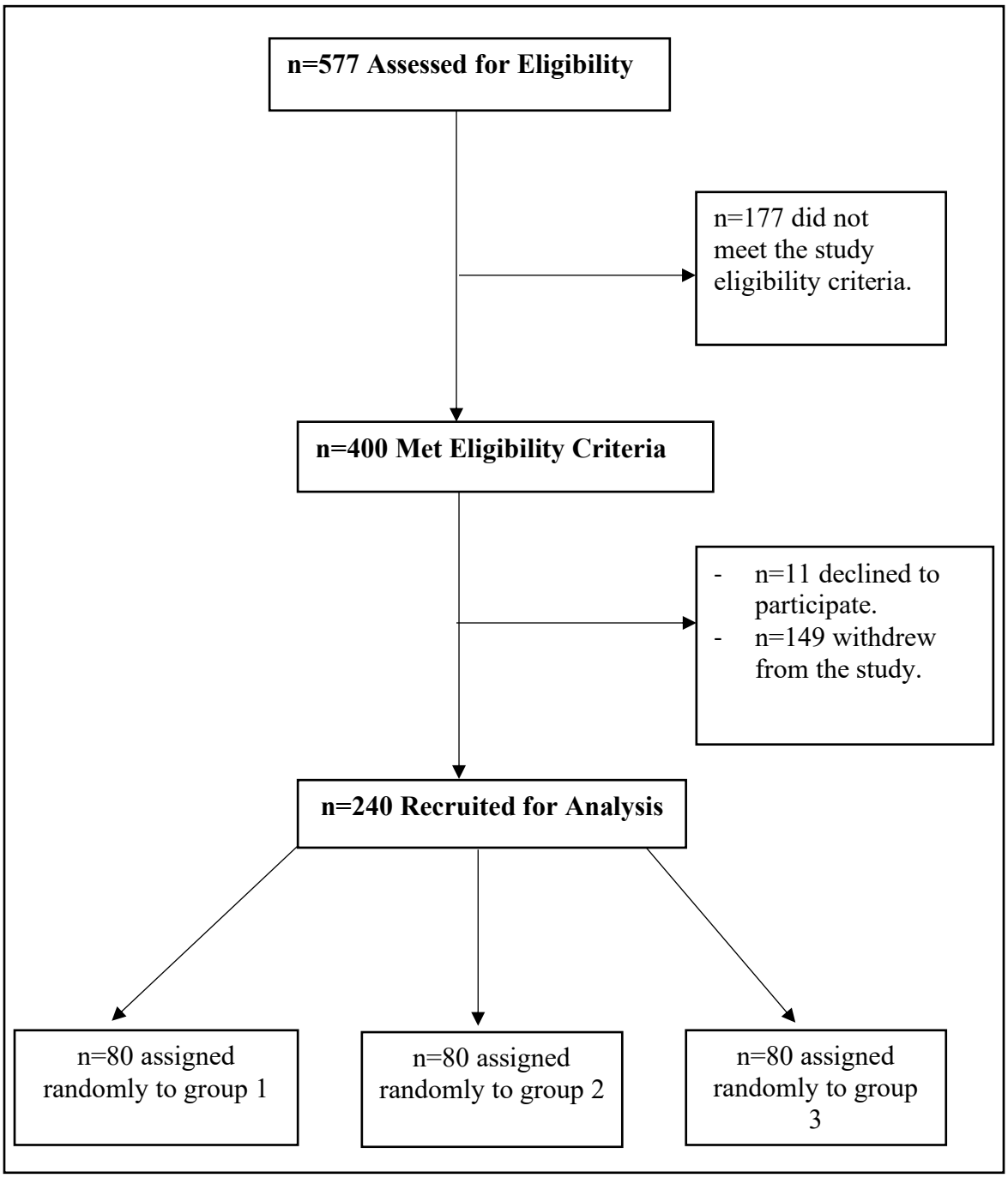
This study conducted an a priori analysis to determine the needed sample size for multiple regression tests. Relying on the effect size (*f*) of E-E messages on mammogram intention (*f*=.10) [see Borrayo, Rosales, & Gonzalez 2017] at a probability level (*p)* of .05 with 80% power and allowing 8~10% dropout, the necessary target sample size was 135 participants (45 per arm).

3.5 Data Collection

After obtaining all of the necessary approvals, the study was open for data collection from February 10, 2022, and continued until March 14, 2022. By applying the proposed sampling strategy and sending two reminders to the Saudi clubs, a total of n=577 Saudi females was assessed for eligibility. Figure 1 provides the participants' flow in the study. As demonstrated in Figure 1, out of the 577 participants, n=177 did not meet the study eligibility criteria. This number includes n=97 females younger than age 39, n=9 females who had breast cancer in the past, and n=19 females who previously had risk-reducing bilateral mastectomies. As indicated previously, the age and breast cancer-related questions were mandatory to answer, meaning a participant could not skip these questions. Some participants chose to exercise their option to skip some of those questions; n=22 did not provide answers the age question, while n=30 participants chose not to answer the breast cancer-related questions.

Despite those who withdrew, the necessary sample size for this trial was 135, which would allow for each arm of the study to include 45 participants. This study's participant number exceeded the necessary size, as I was able to recruit 240 females, which allowed for 80 participants per group**.**

Figure 3. *A diagram to describe participants' flow in this study*



3.6 Statistical Analysis

The data analysis was performed using Statistical Package for the Social Sciences (SPSS) 27.0. Descriptive statistics were run for participant characteristics, means and stander deviation for all variables. A hierarchical multiple linear regression was run to determine if the addition of issue involvement, attitudes toward getting a mammogram, subjective norms, and perceived behavioral control would increase the intent to get a mammogram over and above age, education level, employment status, driver's license status, location in KSA, family history of breast cancer, mammography history, and random assignments to one of the three arms. The coefficient of determination (R^2) was used to assess the proportion of variance in the dependent variable that was explained by the independent variable (signifying how much each block contributes to the overall model). Standardized regression coefficients (betas) were used to reflect the influence and changes for all predictor variables on the dependent variable. An alpha significance level p-value less than .05 expresses the significance of variables.

Chapter 4: Results

4.1 Participant Characteristics

This section reviews participant characteristics, namely age, education level, employment status, marital status, driving status, location in KSA, mammography history, and those who were assigned to one of the three arms. Table 1 summarizes the means, and standard deviations for research independent variables (ATB, SN, PBC, and INV) and the main dependent variables (intention to get a mammogram). The 240 female participants ranged in age from 40 to 67 years (mean = 49.84, SD = 7.77). In terms of education level, four females did not answer this question; of those who did respond, 11.7% (n=28) had less than high school, 11.3% (n=27) completed high school, 5.4% (n=13) attended some college, 10.8% (n=26) had an associate degree, 44.2% (n=106) had a bachelor's degree, and 15% (n=36) had graduate-level education.

For participants' employment status, only two females did not answer this question. Of the remainder, 38.3% (n=92) reported being unemployed, 35.4% (n=85) reported being employed, 1.7% (n=4) identified as students, and 23.8% (n=57) indicated that they were retired. With respect to marital status, one female chose not to answer this question. Of those who did answer it, 80% (n=192) were single, 2.9% (n=7) were married, 5.8% (n=14) were widowed, 10.4% (n=25) were divorced, and 0.4% (n=1) were separated. As to the demographic category of geographic location, the majority of participants, 54.6% (n=131), hailed from the Central Region, 21.3% (n=51) were from the Eastern Region, 17.5% (n=42) were from the Western Region, 4.6% (n=11) were from the Southern Region, and 2.1% (n=5) were from the Northern Region.

In this sample, (n=65) indicated having a driver's license, 54.2% (n=130) did not have a driver's license, and (n=44) responded that they intended to get a driver's license. Only one respondent did not answer this question. Regarding participants' mammography history, one

participant did not answer this question. 45.8 % (n=110) indicated that they had undergone mammograms at least once, while 53.8% (n=129) had never undergone a mammogram in their lives.

For participant allocation, (n= 80) participants were randomly assigned to watch a YouTube video by Elissa. Right after watching the video, participants were given one direct question asking them if they had ever seen this video in the past. In this question, (n=36) had watched this particular video before, while (n=44) had not previously seen it. Similarly, (n= 80) participants were randomly assigned to read MOH infographic messages. Those who read MOH's infographics were asked if they had ever seen these infographics. Of that arm, (n=58) reported that they had read these infographics before, while (n=22) reported never having seen them before. For the control arm, only (n= 80) participants were randomly assigned to this arm without receiving any preventative messages. Table 3 on the next page summarizes the previously mentioned participants' characteristics.

Table 2. ***Means, standard deviations for research variables of the sample (N = 240)***

Research Variables	Mean	SD
INV	33.28	7.32
ATB	44.55	10.09
SN	34.09	8.19
PBC	12.50	2.37
Intention	11.33	3.26

Table 3. ***Descriptive statistic of the sample (N = 240)***

Characteristics	Categories	n	%
Education Level			
	Below high school	28	11.7
	High school	27	11.3
	Some college	13	5.4
	Associate degree	26	10.8
	Bachelor's degree	106	44.2
	Graduate degree (e.g., MS, PhD, MD)	36	15.0
	Missed	4	1.7
Marital status			
	Single	192	80.0
	Married	7	2.9
	Widowed	14	5.8
	Divorced	25	10.4
	Separated	1	.4
	Missed	1	.4
Employment status			
	Employed	85	35.4
	Not employed	92	38.3
	Student	4	1.7
	Retired	57	23.8
	Missed	2	.8
Driver's license status			
	Yes, have a driver's license	65	27.1
	No but intend to get one	44	18.3
	No driver's license and not intend get it	130	54.2
	Missed	1	.4
Location in KSA			
	The Central Region	131	54.6
	The Western Region	42	17.5
	The Eastern Region	51	21.3
	The Southern Region	11	4.6
	The Northern Region	5	2.1
History of mammogram			
	Yes	110	45.8
	No	129	53.8
	Missed	1	.4
Randomization			

Arm 1 E-E	80	33.3
Watched the Video Before	*36*	*15.4*
Not Watched	*43*	*18.4*
Arm 2 MOH	80	33.3
Read it	*57*	*24.4*
Not read it	*21*	*9.0*
Arm 3 Control Group	80	33.3
Age		
M= 49.84	SD= 7.77	

Regarding the family history of breast cancer, this study asked participants whether a close female family member such as a mother, sister, grandmother, daughter, aunt, or cousin had ever been diagnosed with breast cancer in the past. A question was posed about each family member, with the following multiple answer choices: (1) Not diagnosed; (2) Yes, and she is still in treatment; (3) Yes, but she finished treatment; (4) Yes, and she passed away; (5) Not applicable.

When participants were asked if their mother had ever been diagnosed with breast cancer, 95.8% (n=230) replied to this question, while 4.2% (n=10) did not answer this question. Of the 230 participants who replied, 75.4% (n=181) stated that their mother had no breast cancer diagnosis; 1.7% (n=4) expressed that their mother was diagnosed and is currently in treatment; 8.3% (n= 9) mentioned that their mother was diagnosed and had finished treatment; 4.2% (n= 10) stated that their mother had been diagnosed and had subsequently passed away; 10.8% (n=26) said that this question did not apply to them.

Participants were also asked if their sister had ever been diagnosed with breast cancer. 80.4% (n=193) answered this question, while 19.6% (n=47) did not answer it. Of the 193 participants who answered the question, 60.4% (n=145) indicated that their sister had no breast cancer diagnosis; 2.1% (n=5) stated that their sister was diagnosed and is currently in treatment; 6.3% (n= 15) reported that their sister was diagnosed and had finished treatment;

2.1% (n= 5) reported that their sister had been diagnosed and had subsequently passed away; 9.6% (n=23) replied that this question did not apply to them.

In regards to whether or not the participant's grandmother had ever been diagnosed with breast cancer, 72.9% (n=175) replied to this question, while 27.1% (n=65) did not answer this question. Of the 144 participants who responded, 60% (n=144) stated that their grandmother had no breast cancer diagnosis; 0.4% (n=1) expressed that their grandmother was diagnosed and is currently in treatment; 1.7% (n= 4) stated that their grandmother had been diagnosed and had subsequently passed away; 10.8% (n=26) replied that this question did not apply to them.

In regard to the question of whether or not participants had a daughter that had ever been diagnosed with breast cancer, 70.8% (n=170) responded, while 29.2% (n=70) did not reply to this question. Of the 170 participants who responded, 58.8% (n=141) reported that their daughter had no breast cancer diagnosis; 0.4% (n=1) articulated that their daughter was diagnosed and is currently in treatment; 0.4% (n=1) said that their daughter had been diagnosed and had finished treatment; 11.3% (n=27) reported that this question did not apply to them. This study also asked participants if their aunt had ever been diagnosed with breast cancer. 72.9% (n=175) answered this question, while 27.1% (n=65) did not answer it. Of the 175 respondents, more than half of the participants, 52.9% (n=127), replied that there was no breast cancer diagnosis for their aunts. Only a few participants, 1.7% (n=4), expressed that their aunt was diagnosed and is currently in treatment. As to the remaining responses, 4.6% (n= 11) said that their aunt was diagnosed and had finished treatment; 5% (n= 12) indicated that their aunt was diagnosed and had passed away; and 8.8% (n=21) expressed that this question did not apply to them.

Finally, this study asked participants if a female cousin had ever been diagnosed with breast cancer. More than a quarter of participants, 77.5% (n=186), answered this question. In

contrast, 22.5% (n=54) did not answer this question. Of the 186 participants who responded, 39.6% (n=95) reported that their cousin had no breast cancer diagnosis; 6.3% (n=15) expressed that their cousin was diagnosed and is currently in treatment; 15% (n= 36) answered that their cousin had been diagnosed and had finished treatment; 7.5% (n= 18) said that their cousin had been diagnosed and had passed away; 9.2% (n=22) answered that this question did not apply to them. Table 4 below summarizes the family history of breast cancer in each family member.

Characteristics	Categories	n	%
Mother			
	No breast cancer diagnosis	181	75.4
	Diagnosed and currently in treatment	4	1.7
	Diagnosed and finished treatment	9	3.8
	Diagnosed and passed away	10	4.2
	Not applicable	26	10.8
	Missed	10	4.2
Sister			
	No breast cancer diagnosis	145	60.4
	Diagnosed and currently in treatment	5	2.1
	Diagnosed and finished treatment	15	6.3
	Diagnosed and passed away	5	2.1
	Not applicable	23	9.6
	Missed	47	19.6
Grandmother			
	No breast cancer diagnosis	144	60.0
	Diagnosed and currently in treatment	1	.4
	Diagnosed and passed away	4	1.7
	Not applicable	26	10.8
	Missed	65	27.1
Daughter			
	No breast cancer diagnosis	141	58.8
	Diagnosed and currently in treatment	1	.4
	Diagnosed and finished treatment	1	.4
	Not applicable	27	11.3
	Missed	70	29.2
Aunt			
	No breast cancer diagnosis	127	52.9
	Diagnosed and currently in treatment	4	1.7
	Diagnosed and finished treatment	11	4.6
	Diagnosed and passed away	12	5.0
	Not applicable	21	8.8
	Missed	65	27.1
Cousin			
	No breast cancer diagnosis	95	39.6
	Diagnosed and currently in treatment	15	6.3
	Diagnosed and finished treatment	36	15.0
	Diagnosed and passed away	18	7.5
	Not applicable	22	9.2

Missed	54	22.5

Table 4. ***Descriptive statistic for Family History of Breast cancer, Sample (N = 240)***

4.2 Regressions to Predict Mammogram Intention

The primary objective of this research was to determine the most appropriate health communication messages that could impact Saudi women's intentions to get mammograms. This research hypothesized issue involvement, as well as the constructs of the Theory of Planned Behavior (i.e., attitude toward mammography, subjective norms, and perceived behavioral control), would predict intent to get a mammogram. Furthermore, the first question in this study sought to determine key demographic factors that could predict mammography intentions in Saudi females. The second research question asked if exposure to the E-E message would predict Saudi females' intent to get mammograms. The third research question asked if reading MOH infographic messages would predict Saudi females' intent to get mammogram.

To accomplish these hypotheses and research questions, a hierarchical multiple linear regression was run to determine if the addition of issue involvement, attitudes toward getting a mammogram, subjective norms, and perceived behavioral control would increase the intent to get a mammogram over and above the factors of age, education level, employment status, driver's license status, location in KSA, family history of breast cancer, mammography history, and random assignments to one of the three arms.

Age was treated as a continuous variable. Dummy variables were created for driver's license (with those without an intention to have a valid driver's license as a reference category), mammography history (with no mammography history as reference category), family history of breast cancer on mother's side (with no family history of breast cancer as the reference category), family history of breast cancer on sister's side (with no family history of breast cancer as the reference category), family history of breast cancer on aunt's side (with no family history of breast cancer as the reference category), family history of breast cancer on cousin (with no family history of breast cancer as the reference category).

Dummy variables were created the random assignment (with the control arm as a reference category); repeated exposure to E-E message (with those who watched E-E messaging in the past as a reference category), repeated exposure to MOH messages (with those who had read MOH infographics as a reference category).

All demographic variables were entered in the first block (Model 1). Exposure to E-E, MOH, or repeated exposure was entered in Model 2. Issue involvement was entered in (Model 3), while TPB three constructs were entered in (Model 4).

The assumptions of hierarchical multiple linear regression were not violated. The assumption of linearity was met as assessed by partial regression plots and a plot of studentized residuals against the predicted values (see figure 3). There was independence of residuals, as assessed by a Durbin-Watson statistic of 1.863. The assumption of homoscedasticity was met as assessed by visual inspection of a plot of studentized residuals versus unstandardized predicted values (see figure 3).

There was no evidence of multicollinearity as assessed by tolerance values greater than .1. There were six outliers as measured by studentized deleted residuals greater than +/- 3 standard deviations. These six outliers were included in the sample. There were no leverage values greater than 0.2, nor were there values for Cook's distance above 1. The assumption of normality was met, as assessed by a histogram with a superimposed normal curve and a P-P Plot, see Figures 4 and 6.

Figure 4. *Scatterplot of the studentized residuals (SRE_1) against the (unstandardized) predicted values (PRE_1)*

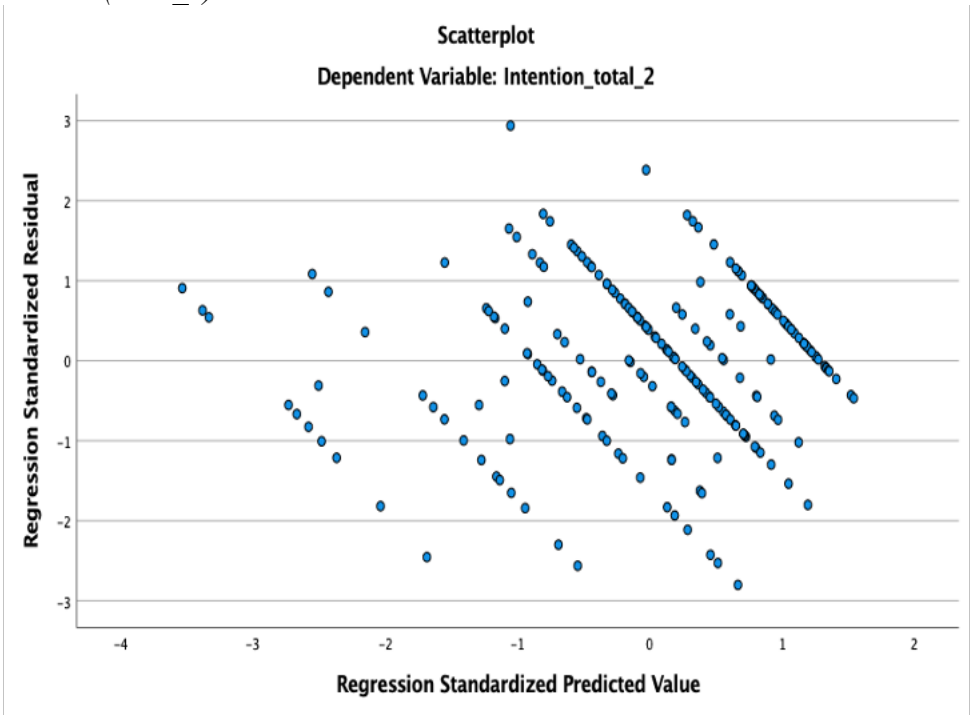


Figure 5. *Histogram with a superimposed normal*

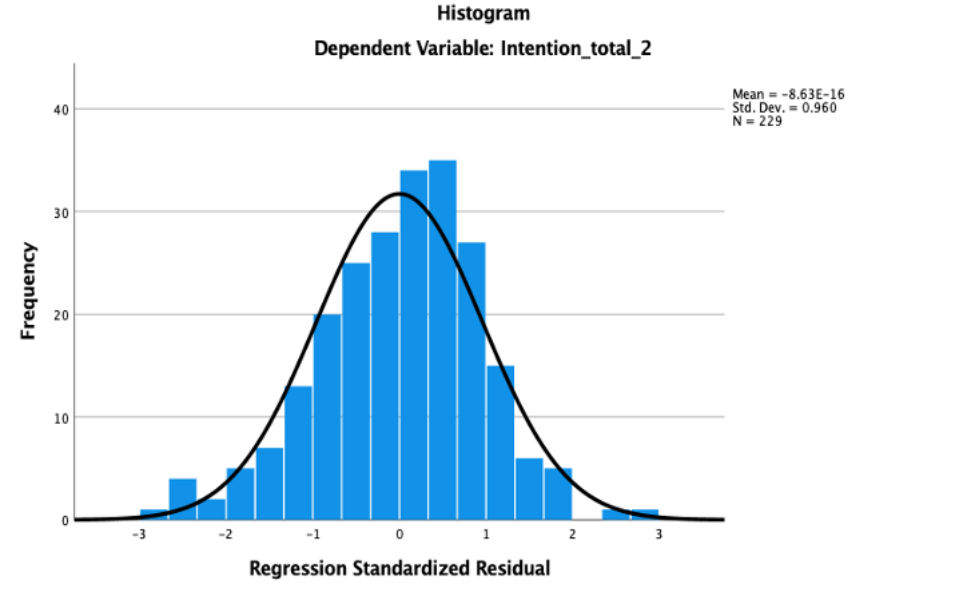
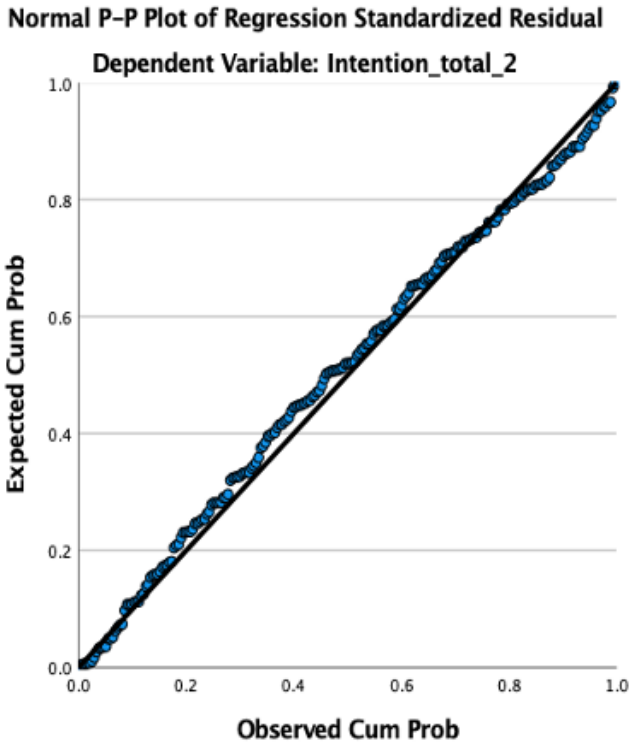


Figure 6. *P-P Plot*



A multiple hierarchical regression was used to determine if the addition of issue involvement, attitudes toward getting a mammogram, subjective norms, and perceived behavioral control would increase the intent to get a mammogram over and above age, education level, employment status, driver's license status, location in KSA, family history of breast cancer in (mother, sister, aunt, and cousin), mammography history, and random assignments to one of the three arms. The R^2 for Model 1, which included age, education level, employment status, driver's license status, location in KSA, mammography history, and family history of breast cancer, was .206, with the variables explaining 20.6% of the variation in the model, F (811, 221) = 5.224, p<.001.

The addition of exposure to any educational messages to the prediction of mammogram intention in Model 2 led to increasing in R^2 of .221, F (4, 217) =1.029, p= .393, which explained an additional 1.5% in variance. The addition of issue involvement to the prediction of mammogram intention in Model 3 was significant, R^2=.273, F (1, 216) = 15.386, p<.001, and explained an additional 5.2% in variance. Finally, the addition of TPB

three constructs in Model 4 was also significant to the prediction of mammogram intention, R^2=.784, F (3, 213) = 167.969, p<.001, and accounted for a further 51.1% in variance.

The full model, which includes all variables (demographic, exposure, INV, and TPB), to the prediction of mammogram intention (Model 4), was statistically significant: R^2=.784, F (19, 213) = 40.685, p < .001, adjusted R^2 = .767. Table 5 displays the model summary.

Table 5. ***Model Summary of Hierarchical multiple regression predicting mammography intention***

Model	R^2	R^2 Changed	Df1	Df2	F Changed	F changed P-value	Durbin-Watson
1	.206	.206	11	221	5.224	<.001	1.863
2	.221	.015	4	217	1.029	.393	
3	.273	.052	1	216	15.386	<.001	
4	.784	.511	3	213	167.969	<.001	

Full Model Interpretation. The first research question asked which demographic would determine mammogram intention. To answer RQ1, regression results indicated that respondents with prior mammogram experience were more likely, compared to respondents without prior mammogram experience, to report intent to get a mammogram in the next two years (β= .127, p=.001). Older respondents were less likely, compared to younger respondents, to report intent to get a mammogram in the next two years (β=-.106 p= .010)

Similarly, respondents with breast cancer history in their mothers were less likely, compared to respondents with no family history in their mothers, to report intent to get a mammogram in the next two years (β= -.075, p= .030). All other demographic factors, namely education level, employment status, driver's license status, location in KSA, and history of breast cancer in all other family members, were not significant to predict intention (p>.05), see table 6. Therefore, it can be concluded that in this sample, which is not a random sample of Saudi women, prior experience with mammograms, age, and family history of

breast cancer in mothers were the only demographic factors that predicted mammogram intentions. However, age and the mother's history of breast cancer were negatively related to intention. This means as age increases, or when respondents have a family history of breast cancer in their mother, the intention to get mammograms in the next two years decreases.

The second research question sought to determine if exposure to the E-E message would predict Saudi females' intent to get a mammogram. To address RQ2, regression results indicated that those who watched an E-E YouTube video were more likely, compared to those who did not watch it, to report higher intent to a mammogram ($\beta = .120$, $p = .015$) However, respondents who watched the E-E YouTube video for the first time were less likely, compared to respondents who had watched it in the past, to report intent to get a mammogram in the next two years ($\beta = -.074$, $p = .090$), see table 6. Regarding the second research question, this result means that repeated exposure to an E-E message significantly predicts the intention to get a mammogram in this non-probability sample.

The third research question asked if reading MOH infographic messages would predict Saudi females' intentions to get mammograms. In addressing RQ3, regression results indicated that reading MOH infographic messages did not predict intentions to get a mammogram ($\beta = .023$, $p = .577$). Also, in regard to participants who were reading MOH messages for the first time, compared to respondents who had read it in the past, did not predict intent to get a mammogram ($\beta = .002$, $p = .951$), (see table 6). Therefore, in this sample, MOH's infographics did not predict intent to get mammograms.

This research hypothesized that issue involvement, as well as the constructs of the Theory of Planned Behavior (i.e., attitude toward mammography, subjective norms, and perceived behavioral control), would predict intent to get a mammogram. In testing these hypotheses, regression results indicated that those who reported higher levels of involvement with mammography ($\beta = .340$, $p < .001$) and a favorable attitude toward mammography ($\beta =$

.517, p<.001), as well as those who showed stronger subjective norms (β= .433, p<.001), and showed stronger perceived behavioral control (β= .350, p<.001), were more likely to report higher intent to get a mammogram, see table 6. Therefore, H1 through H4 were accepted. Table 6 presents a full interpretation of the hierarchical multiple regression predicting mammography intentions.

Table 6. ***Hierarchical multiple regression predicting mammography intention***

Variable	Beta	p-value	Beta	p-value	Beta	p-value	Beta	p-value
Age	-.202	.007	-.198	.009*	-.125	.097	-.106	.010*
Education: BA or higher, (Ref lower than BA)	.053	.412	.065	.314	.052	.406	.032	.360
Employment	-.136	.053	-.144	.041*	-.088	.203	.015	.701
Driver's license: yes (Ref: No license)	-.004	.947	-.008	.901	-.023	.716	-.056	.115
Driver's license: plan to get (Ref: No license)	.098	.169	.090	.208	.040	.569	-.033	.393
Location (Ref. not in Central KSA)	-.057	.357	-.060	.328	-.078	.193	.001	.978
Mammogram history: Yes (Ref: No)	.436	<.001*	.424	<.001*	.348	<.001*	.127	.001*
Mother's history of breast cancer (Ref: no history)	-.089	.156	-.114	.078	-.128	.041*	-.075	.030*
Sister's history of breast cancer (Ref: no history)	.035	.574	.041	.511	.030	.619	.007	.840
Aunt's history of breast cancer (Ref: no history)	-.083	.197	-.094	.147	-.065	.301	-.028	.423
Cousin's history of breast cancer (Ref: no history)	.098	.118	.102	.110	.080	.196	.019	.582
Random assignment: EE arm (Ref: Control arm)			.172	.058	.136	.124	.120	.015*

Random assignment: MOH arm (Ref: Control arm)	.009	.907	-.025	.736	.023	.577
Repeated Exposure to EE: not watched (Ref: yes, watched it)	-.103	.202	-.102	.195	-.074	.090
Repeated Exposure to MOH: not read (Ref: yes, read it)	-.001	.989	-.001	.986	.002	.951
INV			.256	<.001*	.340	<.001*
ATB					.516	<.001*
SN					.433	<.001*
PBC					.350	<.001*

*** *p*<.05**

Chapter 5: Discussion

In KSA, while enlightening Saudi females about the importance of mammography is critical, only a few studies have evaluated the effectiveness of health communication campaigns' messages in the context of breast cancer prevention. The primary objective of this research was to determine the most appropriate health communication messages that could impact Saudi women's intentions to get mammograms. When controlling for demographic factors and exposure in a hierarchical model, attitudes, norms, control, and involvement were unique predictors of intention to get a mammogram. In addition, respondents who got a mammogram in the past, were at younger ages, without a history of breast cancer in their mother, and watched an E-E message by Elissa, were more likely to express intent to get a mammogram. The following sections discusses these findings.

5.1 Demographics Factors

The results suggest that as a female's age increases, her intention to get a mammogram actually decreases. This finding is in-line with previous studies that found Saudi females more likely to ignore the need to get a mammogram as they age (Alshammari et al., 2020; Al-Wassia et al., 2017; El Bcheraoui et al., 2015). It might be possible that respondents of older ages thought mammography was irrelevant to them. Therefore, specific campaigns should be designed for this group, explicitly mentioning that females at older ages are eligible for mammography and are encouraged to have the procedure.

Another interesting finding was that respondents with a family history of breast cancer in their mothers were less likely to report intent to get a mammogram. This a particularly concerning as prior reports showed that a female with a family history of breast cancer is more likely to get breast cancer in the future (American Cancer Society, 2019). Despite this fact, respondents of this demographic group in this study were more likely to ignore screening. It is possible that this is because women with mothers who have been

diagnosed with breast cancer are more likely to be concerned, and fear repeating the bad experience for themselves (Fang, Wang, and Lee, 2022). Therefore, it is important to increase communication from mothers with a history breast cancer to their daughters in order to encourage their daughters to get mammography to detect breast cancer at an early stage.

This study also reported that those who had gotten a mammogram in the past reported a higher intention to get a mammogram in the future. This means respondents in this study who had experienced mammograms were more likely to adhere to screening despite any pain or discomfort with the experience. Griva, Anagnostopoulos and Madoglou (2010) found a direct effect of mammography past experience on mammography intention. This is likely because those who had mammograms in the past formed a direct positive experience and were more likely to get over their apprehension about the test (Griva, Anagnostopoulos, & Madoglou, 2010). Therefore, future health communication campaigns should aim at promoting mammography for Saudi females who have already obtained a mammogram in the past. This could be done by sending a reminder to those who obtained mammograms before.

Of note, more than half of the females who participated in this study (53.8%) reported never having had a mammogram in their life. In this sample, this result reflects a lack of mammography utilization in Saudi females despite the fact that breast cancer is the leading cause of death in this population. This result is in agreement with prior studies' findings in KSA, where low mammogram utilization was reported in Saudi females (Alshammari et al., 2020; Al-Wassia et al., 2017; El Bcheraou et al., 2015; Rehmani et al., 2013). Therefore, increasing health communication efforts in Saudi Arabia is critical. Highlighting the experience of those who have undergone mammography in the past might be beneficial to encourage females who do not tend to get mammograms.

5.2 Exposure to Preventative Messages

As Saudi females hesitate to get mammograms, traditional awareness campaigns may not be enough to encourage women to get early screening for breast cancer (El Bcheraoui et al., 2015). In the current study, MOH infographic messages are examples of traditional awareness campaigns. This experiment did not detect any correlation between the intention to get a mammogram in those who were exposed to the MOH messages. However, results indicate that results indicate that exposure to the E-E message was predictive of a higher intention to get a mammogram.

Beginning with the MOH arm, it is important to note that 70% of those exposed to the MOH message stated that they had been exposed to MOH's messages in the past. There are many sources of how these respondents had seen MOH infographics in the past, such as a friend who forwarded them on social media or saw them online. This could indicate that the MOH made notable efforts in promoting these messages, as significant numbers of respondents reported exposure to MOH messages in the past. This result might mean that some respondents in this study were searching for breast cancer health information and had seen these infographics. However, exposure to the MOH messages in this study was not a significant predictor for mammography intent, even among those who were repeatedly exposed to these messages. In fact, a negative intention was reported among those who repeatedly read MOH infographics. In other words, females who had read MOH's messages in the past reported less intent to get a mammogram.

A possible explanation for this negative intention is that some of the MOH messages contain the death rate of breast cancer, which emphasizes the stigma surrounding breast cancer that links breast cancer to death (Almegewly, Gould & Anstey, 2019). As a potential solution to overcoming this stigma, MOH may want to consider converting its aggressive and direct statistical information into a short narrative, educational infographic. According to

Krakow (2017), graphic narrative infographics were very influential in cancer communication. One specific recommendation would be for the Saudi MOH to review the content and reception of its breast cancer and mammography-related infographics.

Prior works demonstrate the significance of health communication messages based on infographics (Joshi & Gupta, 2021; Miller, Guidry, & Fuemmeler, 2019; Wilkinson et al., 2016; Occa & Suggs, 2015; Wilkinson et al., 2016). However, in regard to breast cancer, it was recommended that common breast cancer components such as the pink color with the breast cancer ribbon be included, as these elements were associated with higher engagement and a tendency to share these messages on appropriate social media platforms such as Pinterest (Miller, Guidry, & Fuemmeler, 2019). MOH, therefore, should re-evaluate its infographics and use the TPB components to build effective stories of those who survived breast cancer.

Conversely, being assigned to E-E message group, which relied on a narrative of a celebrity who survived breast cancer, was associated with a higher intent to get a mammogram in this sample. Specifically, repeated exposure to E-E messages significantly increased mammography intent over those exposed to a single exposure. This is in-line with findings of a previous systematic review by Shen and Han (2014), which found that multiple exposures to an E-E strategy were more effective than a single exposure on influencing the viewer's behavior. This result indicates that MOH should adopt the E-E strategy, even beyond Elissa's message, to educate Saudi females about the benefits of mammograms to encourage them to get screening. This E-E strategy should be promoted well on social media to allow for repeated exposures. Another potential strategy is to use a series with multiple episodes about a well-known female actor who survived breast cancer thanks to mammography. This series might be published on the Netflix streaming platform to allow more extensive exposure. A great example of this is an E-E series called 90210, which aired

in 2012 and was associated with positive behavior toward breast cancer screening (Rosenthal et al., 2018).

From a more extensive viewpoint, Elissa's E-E strategy revolved around her publishing her message on YouTube, which is the most commonly used platform to search for breast cancer information among Arab females (Ayoub, Chalhoub, Sleilaty, & Kourie, 2021). Therefore, Elissa should remind her Arab female fans, including Saudi female fans, about her song. Health communication professionals, in turn, may promote her song as part of future campaigns. A short E-E film based on Elissa's story could be aired to increase mammography screening in the Arab world. In this film, Elissa's song could be embedded at the end of the film.

5.3 Theoretical Framework Discussion

When creating mammogram education messages for Saudi females, Saudi health officials and health communication professionals must rely on the TPB and issue involvement. This is because this theoretical framework strongly predicted mammogram intention, especially in relation to TPB. Therefore, Saudi policy health makers should consider that Saudi females are more likely to get a mammogram if they have a good impression of the mammography procedure (attitudes) and consider mammography as relevant and important to them (involvement). Case in point, some Saudi females with limited knowledge backgrounds might form a negative perception of mammography due to an oft-misinterpreted religious belief that breast cancer occurs by the power of God and thus cannot be avoided (Molaei, Savabi & Taleghani, 2019). Using religious leaders to clarify that getting mammograms is religiously acceptable and that God rewards those who care for their health might increase involvement with mammography. Furthermore, using social media influencers who are followed by the target audience might be beneficial to increasing

involvement with mammography due to their popularity with and recognition by the target group.

In terms of attitudes, females might hesitate to get mammograms due to a stigma associated with breast cancer that links breast cancer with death (Almegewly, Gould & Anstey, 2019). Therefore, creating a message that tells the story of those who survived breast cancer and how mammography saved them might help to overcome such stigmas. Another potential source is to use an oncologist to underline the benefits of mammography and how early detection reduces breast cancer risk.

Respondents in this research were more likely to get a mammogram when significant others in their life (e.g., close family members, friends, and healthcare providers) thought they should. A key step when building educational messages about mammography is to enlighten Saudi male partners about the importance of breast cancer early screening for their close female family members. This is because Saudi male partners' positive encouragements with their mothers, wives, sisters, and daughters could contribute to improving mammography screening behaviors (Hagi & Khafaji, 2013).

Healthcare providers are credible sources of mammography information for Saudi females (Alshammari et al., 2020). Therefore, if an eligible female visited a family physician or visited a healthcare facility, she could be informed about the benefits of mammography. Furthermore, MOH provides a free hotline number (937) for free medical consultation to those who have any medical queries (Alkhalifah et al., 2022). When an eligible female calls this number, it might be beneficial to inform her about the advantages of mammography.

In regard to perceived behavioral control, the results support what the TPB postulates, specifically that intention to get mammography was associated with respondents who believed in their ability to easily obtain the procedure. Therefore, in future campaigns, Saudi females must be informed that a mammogram is easy to access without difficulties (e.g.,

showing a map of the nearby locations, no prior appointment is needed, a female physician would conduct mammography, mammography is free of charge).

The result of this study supports previous studies findings that TPB is significant to predict mammogram intention (Zahra et al., 2021; Khani Jeihooni, Darvishi & Harsini, 2019; Griva et al., 2013; Orna Baron-Epel, 2010; Griva, Anagnostopoulos, & Madoglou, 2010; Tolma, Reininger, Evans & Ureda, 2006; Godin et al., 2001). Moreover, this study is in agreement with previous research which found that a high level of involvement with mammography was associated with the intention to get mammograms (Labrie, Ludolph & Schulz, 2017; Kirby et al., 1998). Therefore, as breast cancer is a serious health issue in KSA, it is urgent to build messages relying on the TPB and issue involvement, as engagement is shown to have a significant effect on mammography intention.

5.4 Research Implications

In all, a key contribution of this research is that it provides a foundation for Saudi health officials to understand what encourages Saudi females' intentions to get mammograms. Locally in KSA, there has been a lack of research that has evaluated health communication messages as a way of designing appropriate educational messages within the context of mammography. This research determined the most appropriate health communication messages that could impact Saudi women's intentions to get breast cancer early screening via mammogram as a way of combatting the hesitancy to receiving this potentially life-saving test.

Surprisingly enough, although TPB provides a rigorous framework to understand what predicts female intention to perform mammography, almost nothing was known about TPB in the mammography context within the Saudi Arabia region. This research shows that TPB is a significant theory in predicting Saudi females' intentions to get a mammogram. Another theoretical contribution is that issue involvement, as well as past mammogram experience, can be added as additional predictors of intention to get a mammogram.

As previously stated in the literature, the E-E strategy has rarely been investigated within Middle Eastern countries. Furthermore, it was recommended that the E-E strategy be incorporated within a musical format, leveraging a digital environment. This research bridges that gap in the research, as the findings revealed that the E-E strategy in musical format within a digital environment is a promising vehicle to encourage Saudi females to get mammograms. Also, as the E-E strategy mechanism has been largely studied from the principles of social cognitive theory and narrative-related concepts (Sood, Menard, & Witte, 2004; Shen & Han, 2014; Sood et al., 2017), this research showed that TPB could be applied to test the effectiveness of E-E strategy outcomes.

5.5 Limitations and Recommendations

As in any research, this study is not without its limitations. One major limitation related to the sampling strategy is that participants were selected relying on nonprobability methods. Even though this pilot was not a representative sample of the target population because of the way the participants were recruited, this method enabled the reaching of diverse cultural backgrounds from different locations within Saudi Arabia because many Saudi students in the U.S.A. arrived from different cities in Saudi Arabia with varying demographic and cultural qualities. Thus, future sampling should rely on a more representative sample of Saudi females.

In this sample, n= 149 participants skipped a significant number of questions or, at some point withdrew from the survey without answering more than 70% of the questions. The reasons for this withdrawal are not clear, but the withdrawals may have had something to do with discomfort potential participants felt while answering questions about what is very a sensitive topic for many Saudi females. Another potential reason is the ethical right of participants to withdraw from the study at any time they want, which was clearly stated in the consent form. Finally, some females within the target population might have limited technological skills, especially those over the age of sixty, which might hinder their ability to complete the questionnaire. Therefore, future study should be careful when targeting this group and consider the sensitive of this topic.

Moreover, this research only tested one form of E-E messaging –music – while there are other formats recently published in KSA (e.g., non-musical short YouTube videos). Therefore, future researchers should test other forms of E-E messages to better understand how this strategy influences Saudi females' intention to get a mammogram. Similarly, this research only tested MOH's infographics, while there are other types of infographics in KSA.

Therefore, future researchers should rely upon randomized control trials for infographic-only interventions in order to evaluate infographics' various message media within KSA.

In the multiple hierarchical regression, of the 240 respondents, 80% (n=192) were single, while the remaining were married, widowed, divorced, or separated. This led to the dropping of this variable in the regression model as the sample was insufficient. Future researchers would be well-served to rely on an equal sample of divorced Saudi females versus their married counterparts and test their perception of mammograms.

Similarly, the family history of breast cancer in the grandmother and daughter was dropped from the regression as many participants had no family history of breast cancer in the grandmother and daughter. This research only tested whether respondents had a family history of breast cancer without differentiating if this family member survived or passed away. This is because the aim of this research was not designed to test such important different and the sample size was not big enough for this comparison. Therefore, it would be interesting to test females' intention to get a mammogram if these close family members survived breast cancer or passed away because of breast cancer.

Chapter 6: Conclusion

While breast cancer is the leading cause of death in KSA, Saudis are more likely to be diagnosed with breast cancer at more advanced stages, meaning there is a tendency to either ignore or otherwise forego preventative testing and other measures. Thus, health communication campaigns are needed to increase awareness about the benefits of early screening are needed to ensure that Saudi women receive more timely and more effective treatment. This research sought to determine the most appropriate health communication messages that could impact Saudi women's intentions to get breast cancer early screening via mammogram as a way of combatting the hesitancy to receiving this potentially life-saving test. The E-E strategy, MOH infographic, The Theory of Planned Behavior constructs (i.e., attitude toward mammography, subjective norms, and perceived behavioral control), and issue involvement concept were tested relying on a randomized controlled trial method.

This study hypothesized that the Theory of Planned Behavior (i.e., attitude toward mammography, subjective norms, and perceived behavioral control) and issue involvement would predict intent to get a mammogram. Furthermore, the current study asked if exposure to the E-E message or MOH infographic messages would predict Saudi females' intent to get a mammogram in the next two years.

The key findings of hierarchical regression demonstrate that the construct of the Theory of Planned Behavior (i.e., positive attitude toward mammography, strong subjective norms, and strong perceived behavioral control) was beneficial in predicting mammogram intention. Therefore, relying on the TPB constructs to build educational messages is critical to encouraging future mammography utilization. Another key finding is that Saudi females who thought mammograms as important screening and personally relevant (e.g., high level of issue involvement) reported a higher intention to get mammograms in the future. Thus, when

building an educational message for Saudi females, it is important to consider what message elements could increase females' involvement with mammography.

Additionally, the E-E strategy was powerful in affecting females' mammography intention, which means future campaigns in KSA should adopt the E-E strategy to educate females about mammography. However, in KSA, there is insufficient knowledge about the benefits of mammography, as a significant number of females did not obtain mammograms in the past. Intention to get a mammogram is inadequate among females older than sixty years, as well as among females who have a family history of breast cancer in their mothers.

The current research contributions to the existing literature include determining factors that may influence Saudi females' intention to get mammograms, such as involvement, attitudes, norms, control, history of mammography, mother's history of breast cancer, and age. Furthermore, while there is a shortage of studies that tested the E-E interventions in KSA, the current research found that E-E YouTube music videos to promote mammography screening behavior in Saudi women is a promising approach. Therefore, the findings of this study explain what health communication designers should take into account when designing health communication messages designed to influence mammogram screening behaviors positively.

However, as breast cancer incidence and deaths are increasing in Saudi females, raising awareness about the significance of mammography is critical. Therefore, extensive health communication campaigns in the future are necessary to promote knowledge about the benefits of mammography in Saudi women. Most importantly, future academic efforts should assess the effectiveness of health communication campaigns in Saudi Arabia to recommend compelling and relevant educational messages to Saudi health officials.

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Appendix A: Qualtrics survey instrument

Participant Consent Form

Title: Understand beliefs, perceptions, and intents related to breast cancer early screening in Saudi females.
VCU IRB Protocol Number: HM20022255
Investigator: Dr. Jeanine Guidry

Study Description

This research's primary purpose is to test the influence of health communication messages on Saudi females' intention to get breast cancer early screening via mammogram. You are invited to participate in this research if you are a Saudi female between the ages of 40-69. Exclusion criteria are (1) females under age 40 (39 or younger), (2) females above age 69, (3) who have had breast cancer or risk-reducing bilateral mastectomies.

This is a survey study, and you must click on the "agree" button below to consent to participate in this research. By accepting to participate, you will be randomly assigned to either one of the three groups. The first group will be randomly assigned to watch a YouTube video that shows a breast cancer survivor story presented by an Arabic celebrity. Watching the entire YouTube video will take 7 minutes and about 8 to answer the whole questionnaire. Therefore, this survey will take about 15 minutes for this particular group. The second group will be randomly assigned to read four infographic messages related to breast cancer early screening, presented by the Saudi Ministry of Health. Reading these preventative messages will take approximately 5 minutes of your time and about 8 minutes to answer the entire questionnaire. Therefore, this survey will take about 13 minutes for this specific group. These prevention messages for both groups will consist of educational information about the benefits of breast cancer early screening. The third group will not be viewing any prevention message; therefore, they will be directly asked to answer the entire questionnaire, taking about 8 minutes of their time. The three groups will be asked one questionnaire without any changes in questions. The survey will be administered online on the Qualtrics website.

Given the topic might be sensitive for some participants, all participants can skip discomfort questions or withdraw at any time they want as their responses are voluntary. There is no charge or penalty associated with their withdrawal.

While we take your valuable opinions into consideration and appreciate your valuable time in answering the questions honestly, all participants will have the opportunity to be entered into a drawing to win one of 7 Amazon gift cards ($25 each). Also, your responses could help Saudi health officials to precisely understand beliefs, perceptions, and intents related to breast cancer early screening to help to design effective educational campaigns in the future.

We assure you that there is no way to identify your name with your responses. Also, collected data are very confidential, meaning it will be protected from unauthorized access and ensure it will be stored in the password-protected external hard drive. Therefore, data will be kept very confidential and will be used only for research purposes such as publishing, presenting, or reporting the results. The raffle to win $25 Amazon gift cards is optional. Participants who want to enter this raffle will be automatically taken to a separate survey to collect drawing information (no names will be collected only by phone/email). All email addresses and/or phone numbers will be deleted once the researcher randomly selects the winners. We ensure you that your responses are not connected to the data we collected as the link at the end of the survey automatically takes you to a separate survey.

If you have any questions related to this research, feel free to contact the researcher (Dr. Jeanine Guidry) at (guidryjd@vcu.edu)

Do you agree to participate in this study?

- ○ **Yes, I agree**
- ○ **No, I disagree**

Start of Block: Demographic Questions

Q2 **How old are you?**

Q3 **What is your highest level of education completed?**

- ○ Less than high school
- ○ High school
- ○ Some college no degree (attended some college classes but did not graduate)
- ○ Associates degree or certificate program
- ○ Bachelor degree
- ○ Graduate degree (e.g., MS, PhD, MD)

Q4 **What is your marital status?**

- ○ Single
- ○ Married
- ○ Widowed
- ○ Divorced
- ○ Separated

Q5 **What is your employment status?**

- ○ Employed
- ○ Not employed
- ○ Student
- ○ Retired

Q6 **Do you currently have a driver's license?**

- ○ Yes, I currently have a driver's license
- ○ No, I'm not currently not having a driver's license but I intend to have one in the next 6 months
- ○ No, I do not have a driver's license

Q7 **Where do you currently live in KSA?**

- ○ The Central Region (Includes Riyadh city, Al Qassim city, and any city in this region)
- ○ The Western Region (Includes Mecca city, Jeddah city, and any city in this region)
- ○ The Eastern Region (Includes Dammam city, Dhahran city, and any city in this region)
- ○ The Southern Region (Includes Jazan city, Abha city, and any city in this region)
- ○ The Northern Region (Includes Tabuk city, Al Jowf city , and any city in this region)

Q8 **Has a close female family member - mother, sister, grandmother, daughter, aunt, or cousin - ever been diagnosed with breast cancer?**

	No breast cancer diagnosis (1)	Diagnosed and currently in treatment (2)	Diagnosed and finished treatment (3)	Diagnosed and passed away (4)	Not applicable (5)
Mother	○	○	○	○	○
Sister	○	○	○	○	○
Grandmother	○	○	○	○	○
Daughter	○	○	○	○	○
Aunt	○	○	○	○	○
Cousin	○	○	○	○	○

Q9 **Have YOU ever been diagnosed with breast cancer or had a risk-reducing bilateral mastectomy?**

- ○ Yes, breast cancer
- ○ Yes, risk-reducing bilateral mastectomy
- ○ No

Start of Block: Definitions

Q10
Definitions
Breast Cancer:
Breast cancer is a malignant tumor that has developed from cells in the breast.

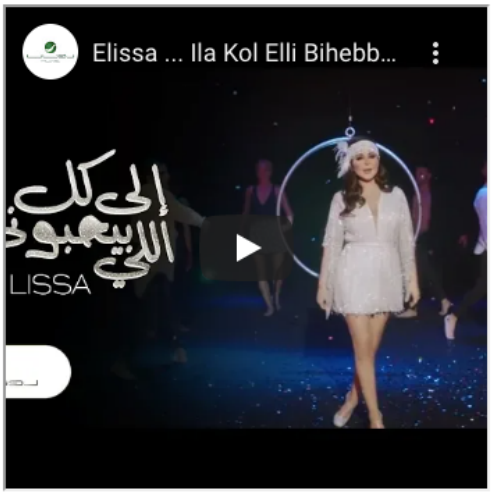
Breast cancer mammography:
According to the Saudi Ministry of Health, mammography is an x-ray imaging method used to examine the breast. Mammography is the most accurate way to detect breast cancer early. Women are recommended to have mammograms at least once every two years, starting at the age of 40.

Q11 Have you ever had a mammogram?

- ○ Yes,
- ○ No

Start of Block: Condition 1 EE in Video Format

Q12
Please carefully watch the following video. When you are finished please click on the next button below.



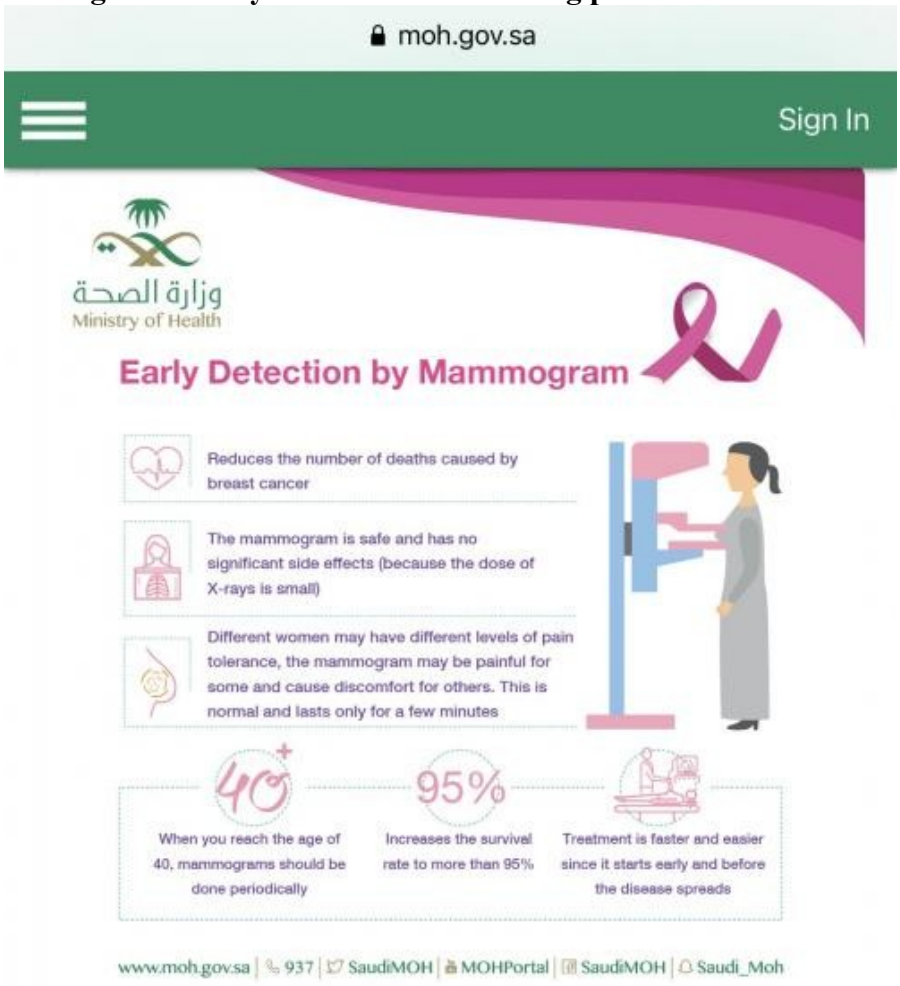
Q14 **Have you ever seen this video before?**

- ○ Yes, I have
- ○ No I have not

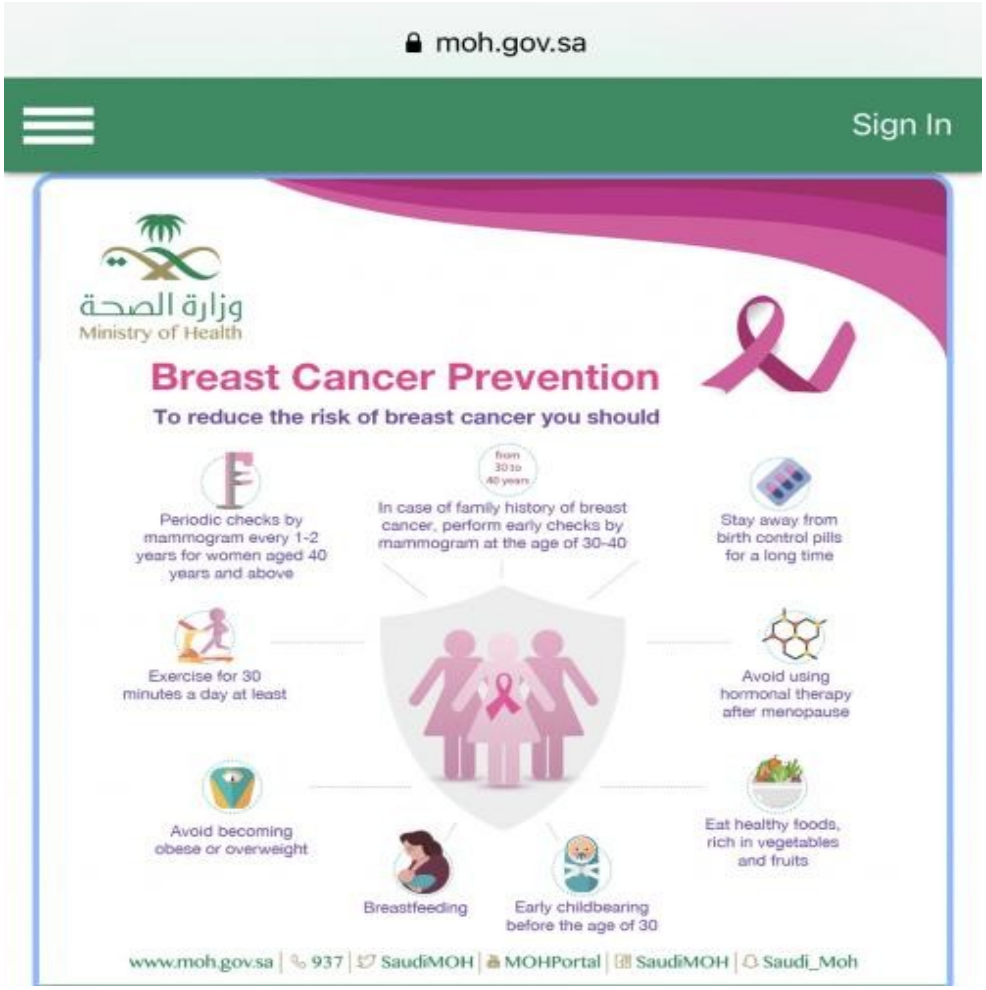
Start of Block: Condition 2 MOH's message

Q15 **The following pages will present you with four preventive messages about breast cancer early screening by the Saudi Ministry of Health. Please read the following message carefully, and when you are finished please click on the "next" button below.**

Message 1. When you are finished reading please click the "next" button below.

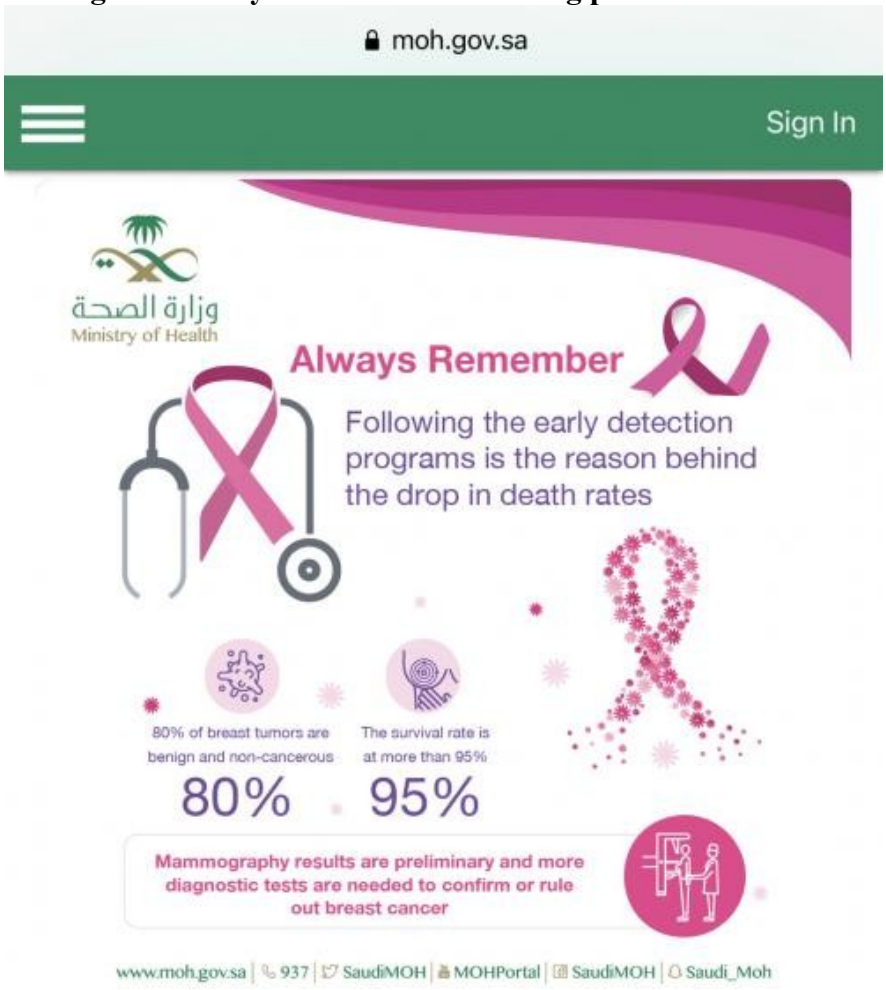


Message 2. When you are finished reading please click the "next" button below.


moh.gov.sa
Sign In
وزارة الصحة
Ministry of Health
Breast Cancer Prevention
To reduce the risk of breast cancer you should
Periodic checks by mammogram every 1-2 years for women aged 40 years and above
from 30 to 40 years
In case of family history of breast cancer, perform early checks by mammogram at the age of 30-40
Stay away from birth control pills for a long time
Exercise for 30 minutes a day at least
Avoid using hormonal therapy after menopause
Avoid becoming obese or overweight
Eat healthy foods, rich in vegetables and fruits
Breastfeeding
Early childbearing before the age of 30
www.moh.gov.sa | 937 | SaudiMOH | MOHPortal | SaudiMOH | Saudi_Moh

Message 3. When you are finished reading please click the "next" button below.

Message 4. When you are finished reading please click the "next" button below.



Q20 **Have you ever seen these infographics before?**

- ○ Yes, I have (1)
- ○ No I have not (2)

End of Block: Condition 2 MOH's message

Start of Block: Condition 3 No EE messages

In the following pages, you will be given several questions. Please click on the "**Next**" below to continue.

End of Block: Condition 3 No EE messages

<u>INV Block</u>: Please indicate your agreement with the following statements.

	Not at all agree (1)	Not agree (2)	Somewhat not agree (3)	Neither agree nor disagree (4)	Somewhat agree (5)	Agree (6)	Very much agree (7)
To me, breast cancer mammogram is **important**. (1)	○	○	○	○	○	○	○
To me, having a mammogram to detect breast cancer is **relevant**. (3)	○	○	○	○	○	○	○
To me, having a mammogram to detect breast cancer is **interesting**. (4)	○	○	○	○	○	○	○
To me, having a mammogram to detect breast cancer **means a lot**. (5)	○	○	○	○	○	○	○
To me, having a mammogram to detect breast cancer is **valuable**. (6)	○	○	○	○	○	○	○
To me, having a mammogram to detect breast cancer is **involving**. (7)	○	○	○	○	○	○	○

<u>Part 1 ATB Block:</u> Please indicate your agreement with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
For me, getting a mammogram every two years would be **good**. (1)	○	○	○	○	○
For me, getting a mammogram every two years would be **safe**. (2)	○	○	○	○	○
For me, getting a mammogram every two years would be **useful**. (3)	○	○	○	○	○
Getting a mammogram every two years can **detect breast cancer early.** (4)	○	○	○	○	○
Getting a mammogram every two years would help me **get over my apprehension** about the test. (5)	○	○	○	○	○
Getting a mammogram every two years would allow a **better medical follow-up.** (6)	○	○	○	○	○

<u>Part 2 ATB Block:</u> Please indicate your agreement with the following statements.
I would have a mammogram every two years even if....

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I were afraid that a **cancer would be detected**. (1)	○	○	○	○	○
It is **embarrassing**. (2)	○	○	○	○	○
It forced me to **see a doctor**. (3)	○	○	○	○	○
I were performing **breast self-exams** regularly. (4)	○	○	○	○	○
My physician was **a man**. (5)	○	○	○	○	○

SN Block: **Q25 Please indicate your agreement with the following statements.**

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Most **people who are important to me think** I should get a mammogram every two years. (1)	○	○	○	○	○
Most **people who are important to me expect** me to get a mammogram every two years. (2)	○	○	○	○	○
Most **people who are important to me would approve** of me getting a mammogram every two years. (3)	○	○	○	○	○
My **family would approve** of me getting a mammogram every two years. (4)	○	○	○	○	○
My **friends would approve** of me getting a mammogram every two years. (5)	○	○	○	○	○
My **healthcare provider would approve** of me getting a mammogram every two years. (6)	○	○	○	○	○
My **family thinks I should** get a mammogram every two years. (7)	○	○	○	○	○
My **friends think I should** get a mammogram every two years. (8)	○	○	○	○	○
My **healthcare provider thinks** I should get a mammogram every two years. (9)	○	○	○	○	○

PBC Block: Please indicate your agreement with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Whether or not I get a mammogram every two years is entirely **up to me.** (1)	○	○	○	○	○
I believe it is **feasible** to get a mammogram every two years. (2)	○	○	○	○	○
I am **confident that if I wanted** I would be able to get a mammogram every two years. (3)	○	○	○	○	○

Intention Block: Please indicate your agreement with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
I **plan** to get a mammogram every two years. (1)	○	○	○	○	○
I **want** to get a mammogram every two years. (2)	○	○	○	○	○
I will **try** to get a mammogram every two years. (3)	○	○	○	○	○

Start of Block: Raffle

Q32 **Do you want to enter a drawing to win one of ~7 $25 gift cards? (Your response will still remain anonymous).**

○ Yes, (1)

○ No (2)

End of Block: Raffle

Appendix B Research Invitations

Invitation 1

Greeting,

A Saudi PhD student is studying Saudi females' intention and perception toward breast cancer mammograms after exposure to health communication messages. If you know any Saudi females between the ages of 40 to 69, the investigator kindly asks you to forward the survey link to them. The survey will take approximately 10 to 15 minutes, and participants will have the opportunity to be entered into a drawing to win one of ~7 Amazon gift cards ($25 each). Thank you in advance for your time and efforts.

Invitation's Link:

https://vcurobertsonschool.co1.qualtrics.com/jfe/form/SV_eKbbfWzhZRR6H8G

Invitation 2 Email

Subject: Saudi PhD Student Survey, Sample Recruitment

Dear, Saudi Clubs at (Club's location)

My name is Saleh Bin Khulayf, a Saudi student in the United States of America. I am a PhD candidate at Virginia Commonwealth University. I am conducting a study to examine Saudi females' intention and perception toward breast cancer early screening via mammograms after exposure to health communication messages. The target population is Saudi females between the ages of 40 to 69. I'm writing this email to kindly ask you to forward the attached survey invitation via WhatsApp groups to the Saudi students in your area. I would also apricate it asking them to please forward the survey link to their family members or any female between the ages of 40 to 69 in Saudi Arabia. If you need any further clarifications about this study, please do not hesitate to ask.

Vita

Saleh Bin Khulayf is a doctoral candidate in the Media, Art, and Text PhD program at Virginia Commonwealth University. In 2017, Saleh earned his Master's degree from the New York Institute of Technology in Communication Arts, specializing in Integrated Marketing Communications. In 2011, Saleh earned his Bachelor's degree from King Saud University in Mass Communication.