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Effectiveness of Financial Incentives in Improving Breast Cancer Screening Among Medicaid Recipients

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EFFECTIVENESS OF FINANCIAL INCENTIVES IN IMPROVING BREAST CANCER SCREENING AMONG MEDICAID RECIPIENTS

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

by

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Abstract

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

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Dissertation Chair: Susan Parish, Ph.D., MSW; Dean of the College of Health Professions and Sentara Professor of Health Administration.

Breast cancer remains one of the leading causes of death among women. Roughly 2.4 million women are diagnosed annually with breast cancer throughout the world. Although breast cancer survival rates are favorable for the United States compared to other nations (90% 5-year survival for non-metastatic disease), it comes at a high cost. The United States spends an estimated $30 billion annually on breast cancer treatment. In addition, disparities in breast cancer survival rates also exist in the United States. Women Medicaid recipients, who are predominately minorities (60%), are more likely to die of breast cancer due to their high rates of late-stage breast cancer diagnoses.

Significant efforts to improve breast cancer survival while reducing identified disparities and treatment costs have been underway for more than forty years. Advances in healthcare policy have played a critical role in saving lives and increasing access to breast cancer screening in the United States. Breast cancer screening is universally supported among professional societies as a tool to diagnose breast cancer in its earliest stages when it is most treatable. However, breast cancer screening is underutilized among Medicaid recipients, correlating with their higher rates of breast cancer mortality.

The passage of the Affordable Care Act (2010) expanded access to health insurance for millions of Americans while allowing Medicaid organizations to compensate their recipients for participating in

preventive health behaviors such as breast cancer screening. Financial incentives for preventive health behavior provided by Medicaid organizations have the potential to help cover out-of-pocket costs such as transportation, adult/childcare, or lost wages, as well as encourage Medicaid recipients to prioritize breast cancer screening and/or overcome apprehensions such as physical discomfort and fear of navigating the health care system.

Using the Gelberg-Anderson Behavioral Model for Vulnerable Populations, a retrospective quantitative study was conducted to assess the role of financial incentives in the utilization of breast cancer screening among Medicaid recipients (aged 50-64) residing in Baltimore, Maryland. The study aimed to answer the following research questions: *One*, do financial incentives increase the utilization of breast cancer screening among women with Medicaid aged between 50 and 74 compared to women who do not receive financial incentives? *Two*, are higher amounts of financial incentives associated with greater utilization of breast cancer screening? *Three*, what population characteristics are associated with higher utilization of breast cancer screenings among Medicaid recipients when financial incentives are provided?

The study included 2,578 unique Medicaid recipients who were not current with their breast cancer screening when applying the US Preventive Services Task Force recommendations (2016). Between 2019 and 2022, 738 breast screening exams were completed. Two cohorts were established in the study. One cohort did not receive a financial incentive (392) for breast cancer screening, and a second cohort did receive a financial incentive (2,186) for breast cancer screening. Logistic regression was the primary statistical tool for answering all three research questions. The dependent variable for all three questions was dichotomous, specifically, was a breast cancer screening claim identified (yes/no)? The predictor variable was the use of financial incentives which had three levels, $75, $100, and $150. Covariates such as age (years), race, geographic sub-region of Baltimore, Maryland for the primary residence, and the number of people reported as living with the Medicaid recipient (household count)

were considered when assessing the role of population characteristics and breast cancer screening utilization when a financial incentive was provided.

The primary question considered by the study was asking if financial incentives provided to Medicaid recipients increased the utilization of breast cancer screening. The study findings were inconclusive. A secondary question considered if larger-sized financial incentives increased the likelihood of breast cancer screening compared to when a smaller incentive was provided. It was identified that the smaller financial incentive ($75) was statistically significant (p-value < 0.001) for increasing the likelihood of breast cancer screening utilization while the larger financial incentives ($100 or $150) were not found to be statistically significant. The covariates of the Baltimore sub-region and the household count were identified to be not statistically significant in either the financial incentive or no financial incentive cohorts. Alternatively, the age (OR=1.07, 95% CI 1.04, 1.11, p-value <0.05) and race covariates were identified as being statistically significant (p-value <0.05) when a financial incentive was provided to increase breast cancer screening among Medicaid recipients. It was noted that American Indian/Alaskan Native and Black participants who received a financial incentive had a statistically significant (p-value <0.05) increase in their likelihood of utilizing breast cancer screening.

Keywords: Medicaid, breast cancer screening, disparities, financial incentives, breast cancer screening utilization

Chapter 1: Introduction

Breast cancer accounts for 30% of all new cancers among women each year and is the leading cause of cancer-related deaths among US women (American Cancer Society, 2022). In 2022, an estimated 287,500 new cases of breast cancer were diagnosed among women, and 43,250 women died from breast cancer (American Cancer Society, 2023).

Breast cancer survivability depends in large part on how far the tumor has spread beyond the breast when it is first diagnosed by a provider. Stage I breast cancer is when the tumor is "localized" within the breast. In contrast, stage IV breast cancer occurs when the tumor has metastasized to other parts of the body (American Cancer Society, 2019). Approximately 64% of newly diagnosed women have stage I disease (Cancer.net, 2022). Women with stage I breast cancer have an estimated five-year survival rate of 90% (American Cancer Society, 2019). Alternatively, 6% of newly diagnosed women have stage IV breast cancer (Cancer.net, 2022). Women with stage IV breast cancer have significantly lower five-year survival rates (29%) compared to women with stage I breast cancer (American Cancer Society, 2019). When providers diagnose breast cancer in its earliest stages, lives are saved.

Racial disparities exist in both breast cancer incidence and mortality (Jatoi et al., 2022). Breast cancer incidence is lower for Black women (174.0 per 100,000) than White women (186.5 per 100,000), indicating a lower occurrence of the disease among Black women (Centers for Disease Control and Prevention, 2022; Yedjou et al., 2019). However, Black women (81%) have lower five-year survival rates from breast cancer than White women (92%) (Centers for Disease Control and Prevention, 2022; Yedjou et al., 2019). Women who are American Indian/Alaska Native, Hispanic, Asian, or Pacific Islander have lower breast cancer incidence and mortality rates compared to Black and White women (Ellington et al., 2022; Kaiser Family Foundation, 2022).

Increased breast cancer incidence is associated with women who have a higher socioeconomic status. Socioeconomic status influences reproductive factors, mammography screening, hormone replacement therapy, and lifestyle choices that contribute to a higher risk of breast cancer (Lundqvist et al., 2016; Gorey et al., 2015; Silber et al., 2018). Overall, White women have a higher economic status than Black, Hispanic, Asian, and American Indian women (Hill et al., 2023).

The stage of breast cancer upon diagnosis and tumor type (hormone receptor negative) are key contributors to breast cancer mortality disparities. Black women (46%) are more likely to be diagnosed with breast tumors that have spread throughout the body (late-stage breast cancer) than White women (36%) (American Cancer Society, 2022; Liu et al., 2020; Richardson et al., 216, Tong et al., 2022). Women who are diagnosed with late-stage breast cancer have lower rates of survival (American Cancer Society, 2022). Black women have an 81% higher rate of triple-negative tumors than White women (Jatoi et al., 2023). Women diagnosed with triple-negative tumors have a 77% 5-year survival rate compared to the overall breast cancer 5-year survival rate of 90% (American Cancer Society, 2022).

Black women are more likely to have breast cancer at a younger age than women who have different racial backgrounds. Specifically, Black women under the age of 50 have a breast cancer mortality rate twice as high as White women (American Cancer Society, 2022). However, the US Preventive Services Task Force's breast cancer screening guidelines state that women should be screened between the ages of 50 and 74 (US Preventive Services Task Force, 2016). Health insurance companies (public and private) are only obligated to cover expenses for preventive health behaviors that have a rating of "A" or "B" by the US Preventive Health Services Task Force (Kaiser Family Foundation, 2022). The US Preventive Services Task Force (2012) defines an A recommendation as "there is a high certainty that the net benefit is substantial," and a B recommendation is defined as "there is moderate certainty that the benefit is moderate to substantial." Although the US Preventive Health Services Task Force does not recommend breast cancer screening among women who are younger than age 50, other well-

respected professional organizations do. The American Cancer Society (2023) recommends women aged between 40 and 44 have the option to obtain a breast cancer screening exam, and those women aged 45 and 54 obtain annual breast screening exams. In addition, the American College of Radiology, and the Society of Breast Imaging (2023) recommend that women begin annual breast cancer screening at age 40.

Breast cancer screening is a proven intervention to reduce breast cancer mortality. Diagnosing breast cancer in its earliest stages saves lives (Hendrick et al., 2019; Duffy et al., 2020; US Preventive Services Task Force, 2016). Women who have breast cancer tumors that are more difficult to treat such as BRCA mutations and triple-negative tumors are benefited from an earlier diagnosis (American Cancer Society, 2022; Huszno et al., 2019). Existing survival disparities would be reduced if women equally utilized breast cancer screening (Silber et al., 2018; Yedjou, 2019; Bourugian et al., 2011).

Healthcare leaders commonly describe both inadequate health insurance and lack of disease awareness as reasons women do not obtain timely breast cancer screening exams (Ramachandran et al., 2015; Mootz et al., 2022). However, legislation enacted over the last forty years has increased access to health insurance while boosting breast cancer awareness (Lillquist, 2001; Lee et al., 2014). The remaining barriers to consistent breast cancer screening for many women include pain associated with the procedures, women's fears of a positive diagnosis, inability to pay for or secure transportation, loss of pay from work while attending screening appointments, and stress and difficulty associated with navigating the health system (Ramachandran et al., 2015; Healthtalk, 2021; Signhoko et al., 2017; Mamdough et al., 2014). If healthcare leaders address these remaining barriers, increasing breast cancer screening utilization among women who are most vulnerable to late-stage breast cancer is more likely.

Compensating people for preventive health behaviors can be effective (Forget, 2013; Jochelson, 2007; Sutherland, 2008). International healthcare organizations and some private US companies have identified increases in preventive health behaviors when financial incentives were provided (Jochelson,

2007; Sutherland, 2008). Until the passage of the Affordable Care Act, Medicaid organizations were prohibited from compensating patients for any reason (CMS, 2010; US Department of Health and Human Services, 2019). Although it is difficult to know the precise number of Medicaid organizations currently using financial incentives to engage recipients, Vulimiri et al., (2019) identified 113 initiatives. The current experience among Medicaid organizations using financial incentives is described as having mixed results. Specifically, providing a financial incentive did not result in a consistently elevated increase in the utilization of the targeted preventive health behavior (Vulimiri et al., 2019).

Medicaid recipients are described as being among the most vulnerable members of the US population to earlier mortality (Lee & Jarosz, 2017; Sujha & Chen, 2013; Shi et al., 2015; Halpern et al., 2008). Many Medicaid organizations are enthusiastic about using financial incentives because they have the potential to engage recipients in preventive health care (Vulimiri et al., 2019; CMS, 2010). However, Medicaid leaders require additional empirical evidence to guide their decision-making if financial incentive programs are to have the needed efficacy to reduce avoidable harm and costs. For example, what type of financial incentive program (indirect, direct, or loss aversion) should be applied to the type of behavior to be modified (simple or complex)? What amount of financial incentive will engage the most vulnerable recipients to obtain a preventive health service while not overpaying those recipients who would engage in the same preventive health behavior at a lower amount (Volpp et al., 2011; Vulimiri et al., 2019; Sutherland, 2008; Jochelson, 2007)? Without this empirical evidence, it remains unclear what is the optimal incentive size, the effectiveness of process-versus outcome-based incentives, and the impact of incentives on long-term cost-effectiveness (MACPAC, 2016; Vulmiri et al., 2019; Witman et al., 2018).

Problem Statement

Providers are more likely to diagnose late-stage metastatic breast cancer among women who have Medicaid as the primary form of health insurance (Sujha & Chen, 2013; Halpern et al., 2008; Shi et al., 2015), which correlates with their unfavorable five-year survival rates (Silber et al., 2018; National

Committee on Quality Assurance, 2021). Engaging women Medicaid recipients in breast cancer screening could reduce avoidable human and treatment costs. Financial incentives can be effective in engaging people in their preventive healthcare (Sutherland et al., 2008; Kane, 2004). The early results among Medicaid organizations that have used financial incentives to increase the utilization of preventive health behaviors are mixed (CMS.gov, 2010; Wittman, 2018; Vulimiri et al., 2019; Milkman et al., 2022). Medicaid administrators and healthcare policymakers need empirical evidence because little is known about how to translate incentives into effective public health practices (Slater et al., 2017).

Study Purpose

The purpose of the quantitative retrospective study was to evaluate whether financial incentives paid directly to Medicaid recipients residing in Baltimore, Maryland influenced breast cancer screening utilization. Maryland Physicians Care, a Medicaid managed care organization with approximately 220,000 recipients, provided the claims data used to complete the study. Approximately 19% of Maryland Physician Care's recipients reside in Baltimore City, Maryland. Meritus, St. Agnes, Holy Cross, and Western Maryland Health Systems share ownership of Maryland Physicians Care.

Research Question(s)

The research questions evaluated in the study included:

1. Do financial incentives paid to women Medicaid recipients residing in Baltimore, Maryland increase the likelihood of breast cancer screening utilization?
2. Do larger financial incentive amounts paid to women Medicaid recipients residing in Baltimore, Maryland predict greater utilization of breast cancer screening utilization rates compared to smaller amounts paid as financial incentives?
3. Do women with different demographic backgrounds who are Medicaid recipients residing in Baltimore, Maryland respond to financial incentives differently when the financial incentive is sized higher or lower? Specific demographic categories examined included age, the geographic

sub-region of recipients' primary home, race, and the number of people reported as living with the Medicaid recipient (household count).

Overview of Remaining Chapters

This document has five chapters. Chapter 1 presented an introduction to the topic and an overview of the research questions examined. Chapter 2 synthesizes the literature review which provides additional background on breast cancer incidence and mortality, racial disparities in breast cancer incidence and mortality, breast cancer screening efficacy, the role of financial incentives influencing preventive health behaviors, and the proposed theoretical model that provides the framework for assessing the proposed research questions. Chapter 3 describes the methodology and statistical analysis used for the study. Chapter 4 describes and outlines the results of the study by research question and hypothesis. Finally, Chapter 5 provides an interpretation and summary of the findings.

Chapter 2: Literature Review

Chapter Overview

The research questions were derived from a comprehensive analysis and synthesis of research on the following: 1. Breast cancer incidence, mortality, and trends in incidence and mortality over time; 2. Breast cancer racial disparities in incidence, mortality, and trends over time; 3. Biological and non-biological factors influencing breast cancer incidence and mortality rate disparities; 4. The role of breast cancer screening in reducing mortality and total cost of care; 5. The role of financial incentives influencing preventive health behaviors; and 6. Economic and ethical considerations for paying financial incentives for breast cancer screening. In addition to providing a synthesis of the research on these topics, this chapter also describes the significance of the proposed research to health policy, its proposed application of the Gelberg-Andersen Behavioral Model for Vulnerable Populations as a theoretical framework and delineates the research hypotheses.

Breast Cancer Incidence and Mortality

Globally, providers have diagnosed roughly 7.8 million women with breast cancer within the last five years, making breast cancer the world's most prevalent cancer (World Health Organization, 2021). Providers diagnose approximately 2.4 million women annually with breast cancer throughout the world, and each year an estimated 523,000 women die from this disease (Global Burden of Disease Cancer Collaboration, 2017).

Although the incidence rate for breast cancer varies among countries, the global breast cancer incidence rate has increased by 20% since 2008 (Breast Cancer Research Foundation, 2022). Belgium (112.3 per 100,000) has the highest age-adjusted incidence rate whereas Iran (35.8 per 100,000) has the lowest age-adjusted breast cancer incidence rate (Lei et al., 2021). Studies examining the cause of Belgium's elevated breast cancer incidence rate identified the following factors: reduced fertility, postponing childbearing, use of hormone replacement therapy, aging (a significant percentage of the population over age 50), and smoking (Renard et al., 2011; Aljohar & Kilani, 2018). In global studies, factors affecting the incidence of breast cancer include family history (risk of genetic mutations), delayed puberty, delayed menarche, delayed marriage age, lactation failure, hormone replacement therapy, obesity, alcohol consumption, smoking, unbalanced diet, environmental toxicants, and limited physical activity (World Health Organization, 2021; Lei et al., 2021; Kashyap et al., 2022).

Although the United States has experienced a 6% decline in breast cancer incidence from 1999 to 2018 (Centers for Disease Control and Preventive, 2022), the United States continues to have one of the highest breast cancer incidence rates in the world. Specifically, the age-standardized breast cancer incidence rate in the United States is 90.3 per 100,000 which is 89% higher than the world average of 47.8 per 100,000 (Lei et al., 2021). The United States has 4% of the world's total population yet represents 12% of the global breast cancer burden (Lei et al., 2021; Worldometer, 2022). Providers diagnose an estimated 281,550 US women with breast cancer annually (Breast Cancer Research Foundation, 2022).

Alternatively, the age-standardized breast cancer mortality rate in the United States is 12.4 per 100,000 which is 9% lower than the world average (Lei et al., 2021). The United States has one of the highest five-year breast cancer survival rates in the world although approximately 43,600 US women die from breast cancer annually (American Cancer Society, 2021; Lei et al., 2021). Approximately 90% of

women residing in the United States who are diagnosed with non-metastatic breast cancer are alive five years later (American Cancer Society, 2021).

Breast Cancer Incidence and Mortality Racial Disparities

Breast cancer incidence and mortality rates vary among US women of different races (Allemani et al., 2018; Trentham-Dietz et al., 2021; Williams & Thompson, 2017). Specifically, White (-6%) and Hispanic (-2%) women have experienced a decline in their breast cancer incidence while Black (+4%), American Indian/Alaska Native (+5%), and Asian/Pacific Islander (+17%) women experienced increases in breast cancer incidence between 1999 and 2018 (Ellington et al., 2022). *(Table 1).* Researchers identified Black women as having a 40% higher risk of breast cancer mortality (both crude and age-adjusted) compared to White women (Jatoi et al., 2022; Kaiser Family Foundation, 2022). *(Table 2).*

Table 1

Unadjusted Breast Cancer Incidence by Race/Ethnicity for US Women Aged 20+ Years, 1999-2018

Race	1999 Crude Rate Per 100,000	2018 Crude Rate Per 100,000	Absolute Change in Rate per 100,000	% Change in Rate	Statistical Significance Change over Time
Overall	189.3	177.8	-11.5	-6.1%	Yes
American Indian/Alaska Native	121.4	127.3	5.9	4.9%	No
Asian/Pacific Islander	122.4	143.5	21.1	17.2%	Yes
Black	167.4	174.0	6.6	3.9%	No
Hispanic	136.3	134.0	-2.3	-1.7%	No
White	198.0	186.5	-11.5	-5.8%	Yes

Source: Ellington et al., 2022

Table 2

Breast Cancer Deaths per 100,000 US Women by Race/Ethnicity

Race	2020
Overall	19.1
American Indian/Alaska Native	13.7
Asian/Pacific Islander	11.4
Black	26.4
Hispanic	13.1
White	19.4

Source: Kaiser Family Foundation, 2022

Biological Influences on Breast Cancer Incidence & Survival Rates

Women's breast cancer incidence and survival rates are influenced by biological factors, including whether the tumor has spread beyond the breast when first diagnosed, the tumor's molecular composition, and a woman's inherited genetic risks.

Invasiveness of Breast Tumor

More Black and Hispanic women are diagnosed with late-stage breast cancer (the tumor has spread outside of the breast into the body) than White women (Yedjou et al., 2019). Specifically, late-stage breast cancer diagnoses occur for approximately 36% of White women compared to 46% of Black women (Richardson et al., 2016; Centers for Disease Control and Prevention, 2016). *(Table 3).* Women whose breast cancer is diagnosed before its spreads outside of the breast have higher survival rates than other women (Richardson et al., 2016; Centers for Disease Control and Prevention, 2016). *(Table 4).*

Table 3

Trends in Breast Cancer Diagnosis by Race and Cancer Stage

	% of Women with Cancer by Region at the Time of Diagnosis		
Race	Localized	Regional	Distant
All	63	29	6
White	64	28	5
Black	54	34	9

Source: Richardson et al., 2016; Centers for Disease Control and Prevention, 2016.

Table 4

Five-Year Breast Cancer Survival by Stage at Time of First Diagnosis

Stage	5-year Relative Survival Rate*
Localized (Stage I)	99%
Regional (Stage II/III)	86%
Distant (Stage IV)	29%
All Stages Combined	90%

Source: American Cancer Society, 2022.
*Reflects women diagnosed between 2011 and 2017.

Molecular Factors

The molecular subtype of the breast cancer tumor is a biological factor contributing to racial disparities in incidence and survival rates. The molecular subtype of a tumor is determined by the proteins residing on the breast cancer tumor. Breast cancer tumors having proteins described as hormone receptor-positive or hormone receptor-negative are associated with greater and lesser availability of treatment options. Hormone receptor-positive tumors are associated with higher rates of survival whereas hormone receptor-negative tumors are associated with lower rates of survival (Prakash et al., 2020).

Hormone receptor-positive tumors account for 70% to 80% of total breast cancer cases and are the most common tumor subtypes (Joe et al., 2021; American Cancer Society, 2019). A hormone receptor-positive tumor can attach or bond with estrogen or progesterone (American Cancer Society, 2022). Women with hormone receptor-positive breast cancer tumors benefit from additional treatment options which improve the likelihood of survival (Jatoi et al., 2022).

Hormone receptor-negative tumors do not have proteins that interact with hormones thereby making endocrine-based (estrogen or progesterone) treatments ineffective (American Cancer Society, 2019). Hormone receptor-negative tumors include those cancers that are estrogen receptor-negative, progesterone-negative, and human epidermal growth factor receptor type 2 [HER2] negative (American

Cancer Society, 2022). Providers describe hormone receptor-negative tumors that do not interact with estrogen, progesterone, or HER2 as "triple-negative" (Jatoi, 2022). Women with triple-negative tumors have the least favorable morbidity and mortality outcomes among women with any breast cancer. Providers diagnose triple-negative tumors in approximately 10% to 20% of all breast cancer cases (American Cancer Society, 2022).

Black women have an 81% higher rate of triple-negative tumors (21.9 versus 12.1 cases per 100,000 women; Jatoi et al., 2022). This phenomenon is a contributing biological factor that influences racial disparities in breast cancer survival (Newman& Kalijee, 2017). Triple-negative tumors are more aggressive with a faster rate of growth, higher risk of metastases, and greater risk of recurrence (Sun, 2022). Therefore, early detection has increased importance for women who have a higher risk of a triple-negative tumor, including Black women (American Cancer Society, 2022). Earlier diagnoses of triple-negative tumors can increase survivability. *(Table 5).*

Table 5

Triple Negative Tumors Compared to Overall Breast Cancer 5-Year Survival Rate

Stage	Triple Negative Tumors 5-year Relative Survival Rate*	Overall Breast Cancer 5-year Relative Survival Rate*
Localized	91%	99%
Regional	65%	86%
Distant	12%	28%
All Stages Combined	77%	90%

Source: American Cancer Society, 2022.
*Reflects women diagnosed between 2011 and 2017.

Genetic Factors

Genetic predisposition is another biological factor that influences breast cancer incidence and survivability. Women with BRCA genetic mutations have a lower survival rate than women who do not have the mutations *(Table 6).* Health care providers identify genetic mutations in 5% to 10% of women diagnosed with breast cancer (American Cancer Society, 2022). The BRCA1 and BRCA2 genetic mutations

are the most common among women diagnosed with breast cancer (American Cancer Society, 2022). While 13% of women in the general population have breast cancer, 70% of women with a BRCA1 or BRCA2 genetic mutation have breast cancer by age 80 (National Cancer Institute, 2022; American Cancer Society, 2022). Women of all races are equally susceptible to genetic mutations (Domcheck et al., 2021).

Health care providers are more likely to diagnose breast cancer at a younger age for women who have a genetic mutation. Specifically, providers diagnose women with a BRCA mutation with breast cancer, on average, between the ages of 51 and 60, whereas the reported median age of onset for breast cancer overall is 58 for White women and 62 for Black women (Yedjou et. al., 2019; National Cancer Institute, 2017). Women may or may not know their genetic risk for breast cancer. Therefore, early detection efforts have additional importance for increasing breast cancer survival rates for those at risk of an inherited genetic predisposition (American Cancer Society, 2022).

Table 6

5-Year Breast Cancer Survival Rate by Stage for BRCA and Non-BRCA Women

Stage	BRCA1 Non-Carriers	BRCA1 Carriers
I (Localized)	97.1%	90.0%
II (Regional)	87.9%	84.5%
III/IV (Distant)	73.7%	63.5%
Total	88.1%	77.3%

Source: Huszno et al., 2019.

Non-Biological Influences on Breast Cancer Incidence & Survival Rates

Non-biological factors influencing breast cancer incidence and survival rates include socioeconomic status, neighborhood effects, psychological stress, having Medicaid as one's primary form of health insurance, as well as access and adherence to proven treatments such as adjuvant hormonal therapy.

Socioeconomic Status

Women with higher socioeconomic status have a greater incidence of breast cancer whereas women with lower socioeconomic status have a greater breast cancer mortality rate (Gorey et al., 2015;

Teheri et al., 2019). For every 100 White women who have a high socioeconomic status and survive breast cancer, only 61 White women who have a lower socioeconomic status survive breast cancer over the same period (Silber et al., 2018). For women who suffer from persistent multi-generational poverty, the risk of breast cancer mortality is 10% higher than for women with a lower socioeconomic status alone (Moss et al., 2020).

Disparate breast cancer incidence and mortality rates among women with different socioeconomic statuses are related to healthcare utilization behavior. The use of hormonal contraceptives is associated with greater breast cancer incidence. Specifically, women with a high socioeconomic status utilize hormonal contraceptives more frequently than women with lower socioeconomic status (Lundqvist et al., 2016; Akinyemiju et al., 2015). Alternatively, women with high socioeconomic status utilize breast cancer screening with greater frequency than women with low socioeconomic status (Borugian et al., 2011; Silber et al., 2018). As noted previously, breast cancer screening is associated with higher survival rates (American Cancer Society, 2022). Researchers identified women having incomes below or near the federal poverty level have lower utilization of breast cancer treatments. Specifically, these women had fewer sentinel lymph node biopsies, less radiation after breast-conserving surgery, and a reduced number of adjuvant chemotherapy treatments (Dryer et al., 2018; Killelea et al., 2020). The cause for inconsistent treatment for women having lower socioeconomic status is unclear. However, evidence suggests the inconsistent treatment is due to physician behavior. A similar result was identified even when women had the same form of health insurance (Killelea e t al., 2020).

Approximately 12% of women between the ages of 18 and 64 have income below the federal poverty level (US Census Bureau, 2022). This statistic indicates many women have elevated vulnerability to breast cancer incidence and mortality (US Census Bureau, 2022). Therefore, research that identifies

how to engage women who have a low socioeconomic status in preventive health behaviors could mitigate the disparities discussed above.

Neighborhood Effects & Access to Health Care Resources

Where a person lives influences their breast cancer incidence and survival rates (Elliot, 2000; Hiatt and Brody, 2018). These "neighborhood effects" refer to the positive and negative conditions of a local community that influence the individual and collective well-being of residents (Roosa & White, 2014; Park et al., 1925). Specific neighborhood conditions discussed are the culture of a community as well as the role of physical proximity to mammography equipment and breast cancer screening utilization.

Genetics and demographic variables such as socioeconomic status alone do not explain the disparities in breast cancer incidence and mortalities. Neighborhood effects are an important consideration as evidenced by the following: 1) Black women residing in lower-income neighborhoods have a 25% increased risk of triple-negative breast cancer after controlling for behaviors, age, and lifestyle factors (Barber et al., 2021; Hossain et al., 2019). 2) Women living in one country have a five-fold increase in breast cancer compared with women who live in other countries (Ferlay et al., 2010). 3) Immigrants originating from countries with a low breast cancer incidence rate experience a higher incidence rate in their new home country (Ferlay et al., 2010). And 4) Neighborhoods in which mothers discuss breast cancer risks with their daughters have lower breast cancer incidence and mortality (Fisher et al., 2020; Sinicrope et al., 2008). Environmental factors such as chemical toxins that may exist in a community will influence breast cancer incidence and mortality as well (Hiatt & Brody, 2018).

Another consideration is the proximity of where one resides to the location where breast cancer screening is completed. The general logic is the more access to healthcare facilities the greater the utilization of healthcare services. However, this may not be true for breast cancer screening. Women who had greater access to mammography facilities were 59% less likely of having had a previous mammogram

(Rahman et al., 2010). A Medicaid-specific study identified women living further away from a mammography facility were less likely to utilize breast cancer screening, however, the finding had a small effect [OR=0.99, 95%CI (0.99-0.99)] (Mobley et al., 2017). The existing evidence suggests that physical proximity to mammography equipment has a limited impact on increasing the utilization of breast cancer screening. One could argue that if a woman feels a breast cancer screening test is important, the distance to a breast cancer screening location from their home (unless > 30 miles) is not a barrier to care (Rahman et al., 2010).

Research examining the efficacy of financial incentives and breast cancer screening utilization while considering neighborhood effects and access to health care resources can provide additional insights while accounting for confounding biases. The findings may influence how Medicaid leaders design their financial incentive programs. They may select to provide a larger financial incentive for those recipients living in neighborhoods found to have lower breast cancer screening yet higher identified risk.

Psychological Stress

An inconclusive relationship exists between elevated levels of psychological stress and greater breast cancer incidence and mortality. One researcher identified women who had psychological stresses associated with poverty, social condition, and unsafe neighborhoods were more likely to be diagnosed with triple-negative breast cancer tumors (Prakash et al., 2020). Alternatively, other researchers conducting similar studies did not identify any statistical correlations between these phenomena (Barber et al., 2021; Schoemaker et al., 2016).

Medicaid Insurance

Women having health insurance is often cited as a critical factor in achieving equity breast cancer survival equity (Ramachandran et al., 2015; Susan G. Komen, 2022; Mootz et al., 2022). However, breast cancer survival for Medicaid recipients (76%) is not significantly different than those who are uninsured (75%; Niu et al., 2013). In contrast, women with commercial health insurance have a 90% breast cancer

survival rate (Niu et al., 2013). Researchers have identified women having Medicaid as their form of health insurance have a greater rate of late-stage breast cancer diagnoses which may explain some portion of the disparity (Sujha & Chen, 2013; Halpern et al., 2008; Shi et al., 2015). For example, women who had Missouri Medicaid as their primary health insurance were 172% more likely to have a late-stage breast cancer diagnosis and 160% more likely to have a treatment delay compared to other women (Berrian et al., 2021). Uninsured women in the same study were more likely to receive timely treatment than those with Medicaid (Berrian et al., 2021). Women diagnosed with late-stage breast cancer or having any treatment delays after a diagnosis of breast cancer have a greater mortality risk (American Cancer Society, 2022). *(Table 7).*

Table 7

Late-Stage Diagnosis and Treatment Delay by Type of Insurance for Women Greater than 20 Years Old

	Late-Stage Diagnosis (Stage III & IV)			Treatment Delay (Greater than 60 Days)		
	Cases	Event %	Adjusted Odds Ratio	Cases	Event %	Adjusted Odds Ratio
Private	15,327	16.4	1.00	15,240	6.5	1.00
Medicare	12,818	17.1	1.09	12,457	10.4	1.21
Medicaid	2,454	29.6	1.72	2,390	11.6	1.60
No Insurance	538	34.8	2.30	510	10.8	1.58

Note: Adjusted for age, race and ethnicity, marital status, neighborhood socioeconomic deprivation status, and rural residency. Based on data available from January 1, 2007, to December 31, 2015.
Source: Berrian et al., 2021.

Although some evidence suggests that Medicaid expansion reduced the number of late-stage breast cancer diagnoses among women (Tsapatsaris et al., 2022), the Missouri Medicaid experience seems more likely to reflect national trends (Valvi et al., 2019; Semprini & Olopade, 2020). Compelling evidence is the disparity in breast cancer screening rates among those who have Medicaid versus commercial health insurance. Specifically, in 2018, Medicare (72%) and privately commercially insured (71%) recipients utilized breast cancer screening at similarly elevated rates compared to Medicaid

recipients (58%; National Committee of Quality Assurance, 2021; Xie et al., 2022). One researcher (Jemal et al., 2017) stated 37% of Black women's excess mortality risk could be explained by a lack of *private* health insurance.

The underlying causes for the identified disparities in breast cancer screening among Medicaid recipients are unclear. One can speculate that women may not fully understand their Medicaid benefits, which not only include no out-of-pocket costs for breast cancer screening but may also include transportation depending upon the state of their residence (CMS, 2023; United Healthcare, 2023). Another consideration is the overall complexity of the health system. Without a financial incentive to motivate or dedicated support such as a care navigator to assist, the complexities of entering the health delivery system may seem to overwhelm or not worth the effort for some recipients who already have trepidations about breast cancer screening as described above.

The implications of Medicaid recipients having lower breast cancer screening rates are significant. In 2020, 18% of adult Americans had Medicaid as their primary health insurer compared to 10% in 2000 (Statistica, 2022). Today, 65 million adult Americans have Medicaid (CMS.gov, 2021). Roughly 58% of Medicaid recipients are women, and their racial backgrounds are Hispanic (25%), Black (21%), and White (14%; Kaiser Family Foundation, 2021). Research that improves breast cancer screening utilization among Medicaid recipients could save lives and reduce known disparities for hundreds of thousands of women.

Medicaid health insurance coverage disruptions are associated with health care providers identifying a larger number of women with late-stage breast cancer (US Department of Health and Human Services, 2021). A unique challenge for Medicaid recipients is the need to continue to prove their continuing eligibility (US Department of Health and Human Services, 2021). Recipients frequently have temporary Medicaid coverage losses as they are disenrolled and subsequently re-enrolled, a process known as Medicaid "churn" (US Department of Health and Human Services, 2021). One in 10 Medicaid

recipients has a coverage disruption within one year of commencing enrollment (Corallo et al., 2021). However, when examining only non-elderly adults without disabilities, the Medicaid churn rate is higher at 12% (Waddill, 2022). Women who have uninterrupted Medicaid coverage are less likely to be diagnosed with late-stage breast cancer (18%) compared to women with interrupted coverage (29%) (Xie et al., 2022).

When studying the role of financial incentives and breast cancer screening utilization, it is important to account for the number of months that a recipient has consistently been with a Medicaid managed care organization (tenure). Financial incentives may influence the utilization of breast cancer screening as recipients engage in preventive health behaviors before being disenrolled, or as they are enrolled or re-enrolled in their benefits to obtain the incremental benefit.

Access and Adherence to Adjuvant Breast Cancer Hormone Treatment

While one group of researchers (Farias, 2022) identified a lack of consistent access to adjuvant hormone treatment as a cause for breast cancer racial disparities, other researchers have identified inconsistent medication adherence among those prescribed adjuvant hormone therapy as a contributing factor to survival disparities (American Cancer Society, 2022). It is unclear if a lack of access or inconsistent dosing of these medications contributes to racial breast cancer survivability disparities. However, the empirical evidence indicates adjuvant treatments increase survival for women with a micro-metastatic disease. A micro-metastatic disease is when breast cancer cells are located outside of the breast and lymph nodes but have not become identifiable metastases (Memorial Sloan Kettering Cancer Center, 2022). The five-year breast cancer survival rate increased to 92% for women who received adjuvant chemotherapy treatments compared to 82% for women who did not (Rossi et al., 2022).

Breast Cancer Screening

An early breast cancer diagnosis can be the difference between life and death. Breast cancer screening and mammography have prevented up to 614,000 breast cancer deaths in the United States

since 1989 (Hendrick et al., 2019). Identifying breast cancer early is the most significant contributor to a higher breast cancer survival rate and better prognosis (Howley, 2019*; Table 4).*

Breast cancer screening includes the use of mammography (Kaiser Family Foundation, 2022), which uses two- or three-dimensional imaging to identify tumors or abnormalities within breast tissue, and offer one or multiple cross-sectional images, respectively (Centers for Disease Control and Prevention, 2022; US Food and Drug Administration, 2022). Three-dimensional mammograms are helpful for women with more dense breast tissue (US Food and Drug Administration, 2022).

Professional societies universally recommend breast cancer screening for the early diagnosis of breast cancer (ACS, 2015; American College of Obstetricians and Gynecologists, 2015; International Agency for Research on Cancer, 2015; American College of Radiology, 2017; National Committee for Quality Assurance, 2021). Yet, professional societies differ in their recommendations on the age at which women should receive their first breast screening exam as well as the frequency of screening, annually versus bi-annually. For example, the American Cancer Society (2022) recommends annual breast screening for women 45 and older. The US Preventive Services Task Force (2016) recommends breast cancer screening for women aged between 50 and 74 years every other year unless a provider has identified the woman as having a higher risk of breast cancer.

Existing Health Policy Contributes to Breast Cancer Mortality Racial Disparities

Since the passage of the Affordable Care Act of 2010, the Centers for Medicare and Medicaid require state-based and private health insurance providers to offer preventive services consistent with the US Preventive Services Task Force's grade A and B recommendations (Moyer et al., 2016). The US Preventive Services Task Force (2016) recommends breast cancer screening for women aged 50 to 74 *every two years*. The US Preventive Services Task Force deemed breast cancer screening for women aged 40-49 as an individual choice (grade C), and that it would benefit women who place a higher value on the potential benefit than the potential harms (US Preventive Services Task Force, 2016). This misalignment

of the health insurance companies' regulatory requirements to only cover preventive health exams as determined by the US Preventive Services Task Force recommendations as grade A or B, and the US Health Services Task Force's general recommendation that women aged greater than 50 be screened for breast cancer is one of many contributors to breast cancer mortality racial disparities.

The US Preventive Services Task Force's current recommendations do not account for the earlier age of breast cancer onset, or the increased aggressiveness of triple-negative tumors identified among younger Black women. Approximately 23% of all breast cancers in Black women occur in women aged younger than 50 compared to 16% of White women (Rebner & Pai, 2020). Black women (21%) are more likely to be diagnosed with more aggressive triple-negative tumors compared to White women (10%; Rebner & Pai, 2020). Clinical trials used by the US Preventive Services Task Force for forming their recommendation are based on studies that included a limited number of women of color (Harvey, 2020). Advocates for racial equity in health outcomes argue the US Preventive Service Task Force breast cancer screening guidelines are inadequate (Chapman et al., 2021). Initiating breast cancer screening five years earlier would reduce Black-White mortality disparities by an estimated 57% (Chapman et al., 2021).

Some professionals and lay people may argue that racial disparities in breast cancer screening no longer exist. According to the American Cancer Society (2022), a higher percentage of Black women (74%) than White women (73%) received breast cancer screening *(Table 8)*. However, the data is for women aged 50 to 74 which is consistent with the US Preventive Services Task Force recommendations and does not account for the increased biological risk for breast cancer identified in Black women.

Table 8

Percentage of Women Ages 50-74 With Mammogram in Prior 2 Years (2018)

	% of Women Aged 50-74 with Current Mammograms (2018)
Black	74%
White	73%
Hispanic	71%
Asian American	71%
American Indian/Alaska Native	66%

Source: Susan G. Komen, 2022

Medicaid Recipients Are Among the Most Vulnerable to Inadequate Breast Cancer Screening

Women with lower socioeconomic status are at a higher risk for breast cancer mortality (Dreyer et al., 2018). Medicaid recipients have a lower socioeconomic status otherwise they would not meet eligibility criteria. Most states require one's income to be equal to or less than 138% of the federal poverty level to be eligible for Medicaid. Roughly 69% of women aged 50 to 74 with lower socioeconomic status (<200% of the Federal Poverty Level) will attain a breast cancer screening exam compared to 79% of women with incomes greater than 200% of the federal poverty level (American Cancer Society, 2020). In addition, as stated previously, Medicaid recipients are expected to verify their economic status to maintain their health insurance benefits. This process creates gaps in health insurance that are associated with reduced breast cancer screening.

Lower socioeconomic status alone is not the only risk factor for Medicaid recipients having lower breast cancer screening utilization. Less than 46% of Medicaid recipients have a high school diploma (Statista, 2022). Women having a high school education (68%) are less likely to obtain breast cancer screening than those women who are college graduates (83%; American Cancer Society, 2020). Although undocumented residents are not eligible for Medicaid in most states, Medicaid is a source of healthcare insurance for immigrants under certain circumstances. These circumstances allowing participation in Medicaid include being a lawful permanent resident (LPR or green card), refugee, asylee, Cuban/Haitian entrant, battered noncitizen (and their spouse, child, and parent), and victim of trafficking (and their

spouse, child, and parent) pending application for a victim of trafficking visa (Kaiser Family Foundation, 2023). Roughly 59% of immigrants utilize breast cancer screening compared to those people who have been in the United States for more than ten years (78%; American Cancer Society, 2022).

Medicaid recipients aged 50 or greater will have their breast cancer screening covered (CMS, 2010). However, the US Preventive Service Task Force guidelines state every two years, recipients may be considered compatible with breast cancer screening by Medicaid organizations until after they are older than age 52 (National Committee Quality Assurance, 2023). Although every Medicaid person will have the expense of their breast cancer screening covered at age 50, Medicaid organizations may not be actively engaging or encouraging women to receive breast cancer screening until after age 52. Therefore, this may further contribute to the identified higher rate of breast cancer screening delays for Medicaid recipients (69%) compared to women having commercial insurance (43%; Bonafede et al., 2019).

Legislative Efforts to Remove Barriers to Breast Cancer Screening

In 1985, the US Public Health Service Task Force deemed breast cancer as a serious threat to women's health (Lillquist, 2001). In 1990, the Breast and Cervical Cancer Mortality Prevention Act was passed (Lillquist, 2001; Lee et al., 2014). This federal law successfully launched the National Breast and Cervical Cancer Early Detection Program which was critical to increasing awareness and detection of breast and cervical cancers among women who were low-income and uninsured (Lee, 2014). While this legislation successfully increased the identification of breast cancer at an early stage for many women, it did not contain provisions to help women pay for treatment. In 2000, the Breast and Cervical Cancer Prevention and Treatment Act allowed states to expand Medicaid coverage to women in need of treatment for breast and cervical cancer (Jacobson Vann, 2011). Both federal laws have been critical to improving access to women for breast cancer screening and treatment. Since 1991, the National Breast and Cervical Cancer Early Detection Program has served more than 6.1 million women and helped to diagnose 75,961 invasive breast cancers (Centers for Disease Control and Prevention, 2022).

Engaging People in Preventive Health Behaviors Using Financial Incentives

Engaging people in preventive health behaviors can mitigate disease burden and reduce the total cost of care in the United States and worldwide (Al-Maskari, 2022; US Cancer Statistics Working Group, 2022). Specifically, an estimated 30% to 50% of individuals would avoid a cancer diagnosis throughout their lifespan if they avoided tobacco, maintained a healthy weight, and received recommended screenings (Ma & Richardson, 2022). However, engaging people in their care is challenging. Increased breast cancer education and new health policies have expanded access to preventive care, yet the women who are most vulnerable to breast cancer remain the least likely to receive breast cancer screening. Therefore, healthcare professionals and policymakers are increasingly examining whether financial incentives can effectively engage consumers in their preventive health (Forget, 2013; Haff et al., 2015).

Women have apprehensions about breast cancer screening and additional burdens that need to be considered. Apprehensions include fear of a cancer diagnosis, pain associated with mammography, concerns about prejudice, and the stress and difficulty of navigating the highly complex US healthcare system (Ramachandran et al., 2015; Healthtalk, 2021; Sighoko et al., 2017). Uncompensated costs associated with obtaining “free” care such as transportation, unpaid time from work, and child/adult care needs are also important considerations that impede women from getting the preventive care they need (Mamdouh et al., 2014; Sighoko et al., 2017). Women are more likely to live in poverty compared to their male counterparts (Borchelt, 2022). Therefore, women often must choose between obtaining preventive breast care or addressing other immediate needs (e.g., housing, food, and purchasing medicine; Borchelt, 2022). Financial incentives may address these known barriers thereby connecting women to needed preventive breast care.

Factors Influencing the Efficacy of Financial Incentives

The existing evidence supports the use of financial incentives to engage people in preventive health behaviors under certain conditions (Jochelson, 2007; Sutherland, 2008; Oliver & Brown, 2012). The efficacy of these incentives is associated with how financial incentive programs are designed and the complexity of the behavior that requires modification (Jochelson, 2007; Sutherland, 2008). The form, amount, and timing of financial incentives are constituent aspects of financial incentives design. Other key variables include population characteristics such as age, average household income, and housing density (rural/urban). The section below synthesizes existing research and describes the factors that influence the efficacy of financial incentives.

The Complexity of Modifiable Preventive Health Behavior

One-time behaviors such as obtaining a single vaccination are defined as simple behavior modification (Sutherland, 2007). Behaviors that require sustained change over time are deemed complex (e.g., weight loss, smoking cessation; Sutherland, 2007; Kane, 2004). In general, financial incentives that entail direct payment for the completion of simple or one-time behaviors are the most effective (Kane, 2004; Sutherland, 2007). Financial incentives have been less effective in modifying complex behaviors (Bains et al., 1998; Hey & Peruera, 2005). As will be further described, the efficacy of financial incentives is dependent upon matching the type of modifiable behavior (simple or complex) with the type of financial incentive program (direct, indirect, or loss aversion).

Financial Incentive Types (Direct, Indirect, Loss Aversion)

Direct incentives occur when organizations compensate people for behavioral changes that an individual can control. For example, individuals can control whether they are immunized or visit their primary care physician. Indirect incentives are based on actions that individuals cannot control. Lotteries are illustrative of an indirect financial incentive because individuals cannot control if their ticket is selected as a winner. In general, direct financial incentives are more effective than indirect incentives in

modifying preventive health behaviors (Kane, 2004; Vlaev, 2019). One researcher studied the efficacy of direct and indirect financial incentives as they related to chlamydia screening among college students. Chlamydia screening increased by 1.5% for the control group, 3% for the indirect financial incentive group that had an opportunity to win a prize, and 23% for the direct incentive group (Nize et al., 2014). This study illustrates the relatively robust effect of a direct financial incentive for a simple one-time behavior compared with indirect financial incentives.

Loss aversion is a third type of financial incentive in which individuals perceive a potential loss as psychologically or emotionally more severe than an equivalent gain (Liberto, 2022). For example, a person who lost $10 from their pocket loses more satisfaction than another person would gain from a $10 windfall (Vlaey, 2019). When attempting to modify complex behaviors such as smoking cessation or reducing risk behaviors, loss aversion has been shown to have a greater effect than direct financial incentives (Bessey, 2021). For example, one researcher studied the role of indirect and loss aversion financial incentives and their impact on long-term weight loss. The control group that did not receive a financial incentive had an average weight loss of four pounds (Volpp et al., 2008). The group that received an indirect financial incentive (the opportunity to participate in a lottery that had a large prize) had an average weight loss of thirteen pounds (Volpp et al., 2008). The loss aversion group who was at risk of losing their deposit had an average weight loss of fourteen pounds. While this amount does not appear significant compared to the indirect group, the loss aversion group maintained a statistically significant greater mean weight change than the control group or indirect incentive group when measured four months later (Volpp et al., 2008).

Public health officials often use “regret lotteries” to engage people to modify behaviors. A regret lottery is unique in that it provides all participants with a ticket, and each ticket has a chance of winning a lottery prize. However, individuals can only activate their lottery ticket by completing the expected behavior. Individuals with non-activated tickets are unable to claim a prize should they have a winning

ticket (Ratcliffe, 2021). A regret lottery combines an indirect financial incentive with loss aversion. The "Philly Vax Sweepstakes" is an example of a regret lottery. It was created by public health leaders in Philadelphia to encourage increased COVID-19 vaccination rates (Milkman et al., 2022). Each person was identified in the city as a potential winner. However, if a person who had a winning ticket was not vaccinated, they could not claim their prize. Regret lotteries can be effective for modifying health behaviors such as improving adherence to medical treatments and protocols as well as increasing physical activity (Volpp et al., 2011; Loewenstein et al., 2013; Kessler & Zhang, 2014). However, the Philly Vax Sweepstakes illustrates an ineffective regret lottery, substantiating the need for additional research (Yu, 2021; Milkman et al., 2022).

Amount, Form, and Timing of Financial Incentives

While the different types (direct, indirect, loss aversion) of financial incentives have been studied to some degree, research comparing the efficacy of financial incentives at different amounts is limited. Existing evidence suggests larger financial incentives result in higher utilization of preventive health behavior. For example, Bradley and Neumark (2017) found 77% of Medicaid recipients scheduled a primary care appointment when a $50 incentive was provided, 74% when a $25 incentive was provided, and 68% respond when $0 (control group) was provided. Approximately 158 Medicaid organizations have implemented financial incentive programs to increase preventive health behaviors, and they are offering financial incentives ranging from five dollars to several hundred dollars (Vulimiri et al., 2019). The results of these financial incentive programs are mixed (Vulimiri et al., 2019). Therefore, it is unclear if the inconsistent results are due to the misalignment of the type of incentive program to the type of behavior to be modified, and/or if the size of the financial incentive is adequate.

The customary form (65%) of financial incentive payment among Medicaid organizations is a gift card (Vulimiri et al., 2019). However, payment forms such as gifts (e.g., diapers, transportation vouchers, and gym memberships) have proven to be effective in engaging consumers in preventive care (Vulmiri et

al., 2019; Kane, 2004). A general theme identified in the research is personalized payments had greater efficacy (Vulimiri et al., 2019).

Robust evidence suggests financial incentives paid shortly after behavior completion are the most effective (Jochelson, 2007; Sutherland et al., 2007). However, untimely payments have proven to be effective as well (Bradley and Neumark, 2017; Vulimiri et al., 2019).

The role of Socioeconomic Status, Education, & Race in Financial Incentive Efficacy

Robust evidence indicates individuals with lower incomes are more likely to respond to financial incentives (Jochelson, 2007; Bradley & Neumark, 2017). Small cash payments have a greater influence on people with smaller incomes because of the greater proportional impact (Sutherland et al., 2007). Therefore, individuals who have Medicaid as their health insurance are a susceptible audience to financial incentives due to the low-income requirement to be a recipient.

People with different levels of educational attainment will respond to any type (direct, indirect, or loss aversion) of financial incentive initiative (Halff et al., 2015). However, the size of the financial incentive being offered with any of the types of initiative may need to be adjusted to have the desired effect. For example, people with lower health literacy will require a larger financial incentive than those people who understand the value of preventive health (Peters et al., 2007).

One study (Haff et al., 2015) found Black study participants had a higher likelihood of responding to a direct payment or conditional type of financial incentive than people of other races. The reasons for this finding are unclear (Haff et al., 2015). No other studies were identified that specifically examined the role of race and financial incentives for preventive health behaviors.

Ethical Considerations of Paying Patients for Preventive Health

Researchers have described three conditions supporting the use of financial incentives as a mechanism to modify health behaviors (Volpp & Cannuscio, 2021; Forget, 2013). The conditions include: 1) The financial incentive offsets costs individuals cannot address when care is free (e.g., time off from

work, childcare, and transportation). 2) The financial incentive engaged the most vulnerable individuals in their care to avoid chronic disease and premature mortality. And 3) A business case exists whereby the investment in preventive health reduces costs burdened and absorbed by the government and society at large (Volpp & Cannuscio, 2021; Forget, 2013).

Offering a financial incentive for preventive health behaviors does have risks. Despite the lack of evidence, some researchers speculate that financial incentives may create a dependence whereby people do not obtain needed preventive health behaviors without compensation. Financial incentives may pose risks to individual autonomy because they can be coercive to those who are poor (Kane, 2004; Vlaev, 2019; Forget, 2013). Some people report concerns about whether it is appropriate to compensate people for doing what is in their self-interest (Vlaev, 2019). A financial incentive program requires significant consideration of how best to mitigate potential negative aspects while achieving healthier outcomes for recipients.

Limited Experience Paying Medicaid Recipients for Preventive Health Behaviors

The United States has ten years of experience using financial incentives to engage Medicaid recipients in preventive health behaviors. The Affordable Care Act legalized the provision of financial incentives for preventive health behaviors for Medicaid recipients. Specifically, the Affordable Care Act established a pilot program in 2011 known as the Medicaid Incentives for the Prevention of Chronic Disease (CMS.gov, 2021). Ten states received five-year grants to compensate Medicaid recipients for preventive behaviors that reduce the chronic disease burden (CMS.gov, 2021; Gaines, 2017). This pilot program was a watershed moment in American healthcare history because it provided exceptions to the Beneficiary Inducement Law of 1996, which made it illegal to offer money or services to a person to select a particular hospital, insurance company, practitioner, or supplier (US Department of Health and Human Services, 2019). Since the passage of the Affordable Care Act, Medicaid organizations are

transitioning from adopting this tool to engaging recipients in preventive health behaviors to assess how to optimize or refine it (Vulimiri et al., 2019; Bradley & Neumark, 2017).

The Business Case for Paying Financial Incentives for Breast Cancer Screening

National breast cancer treatment expenses are significant. In 2020, US direct expenditures for breast cancer care were approximately $30 billion and represented 14% of total national healthcare expenditures (National Institute of Health, 2022). When accounting only for increases in demand for breast cancer care due to population growth and aging while dismissing incremental costs for inflation and technology changes, breast cancer costs increased by 11% since 2015 (National Institute of Health, 2022). It should be noted that inflation between 2015 and 2023 has increased by 27% (Inflation Tool, 2023), which would increase breast cancer treatment costs from roughly $30 billion to $38 billion in 2023 dollars. Economists estimated the total costs of breast cancer care (direct + indirect expenses such as lost productivity) in 2015 to be $63 billion (University of North Carolina Gillings School of Global Health, 2021). By 2030, these same economists projected the total expense of breast care (direct + indirect) to be $152 billion (University of North Carolina Gillings School of Global Health, 2021).

Breast Cancer Treatment Costs

Breast cancer treatment costs are significant but much higher when women have a late-stage diagnosis (Blumen et al., 2016; American Cancer Society, 2022*; Table 9)*. The treatment costs for stage I and stage II breast cancer range from $70,000 to $90,000 whereas stage III breast cancer treatment costs range from $130,000 to $160,000 (Blumen et al., 2016; American Cancer Society, 2022).

Women with commercial health insurance pay variable out-of-pocket expenses. Women diagnosed with early-stage breast cancer and who have a typical employer-sponsored health insurance plan pay approximately $5,800 in out-of-pocket expenses (Singleterry, 2017). For women who earn $15 per hour ($31,200 annually), this out-of-pocket cost amount represents 19% of their gross annual income.

Table 9

Average Treatment Costs Per Breast Cancer Stage

Stage	Level Description	Average Costs Per Patient Paid by Insurers 1-Year After Diagnosis (American Cancer Society, 2022)	Average Total Cost Per Patient by Stage (Blumen et al., 2016)
I	Non-invasive, no evidence of cancer cells outside the breast.	$60,637	Not provided
II	Cancer may be growing and has extended to nearby lymph nodes.	$82,121	I - $71,909 II - $97,066
III	Cancer has extended beyond the immediate region of the tumor and has invaded nearby lymph nodes and muscles.	$129,387	$159,442
IV	Cancer has metastasized beyond the breast and nearby lymph nodes to other parts of the body.	$134,682	$182,655

Source: American Cancer Society, 2022; Blumen et al., 2016.

The Business Case for Financial Incentives

For every 1,000 women diagnosed with stage I rather than stage II breast cancer, the nation would save $25 million in avoidable treatment costs (Blumen et al., 2016). Roughly ten percent of women who obtain a breast cancer screening exam will be asked to return to the center for additional testing; however, less than one percent (0.5%) of women will be diagnosed with breast cancer (Henderson et al., 2015). Therefore, providers would need to review approximately 20,000 incremental breast cancer screenings to diagnose an incremental 1,000 women with breast cancer. The average cost per breast cancer screening ranges from $100 to $250 (Stephan, 2021). Therefore, the estimated cost of the incremental 20,000 breast exams ranges from $2 million (20,000 X $100) to $5 million (20,000 X $250). If an organization provided women with a $100 financial incentive to obtain their breast cancer screening, the incremental cost for 20,000 women would be $2 million (20,000 X $100). Therefore, the total costs for providing the screening and financial incentive are projected to be $4 ($2 million in breast cancer screening cost + $2 million in financial incentive) to $7 million ($5 million in breast cancer screening cost + $2 million in financial incentive) to diagnose 1,000 women with breast cancer. As identified above, the avoidable treatment costs are projected to be $25 million. Assuming $7 million in incremental cost

(screening and incentive), the return on investment is 3.6. Specifically, for every dollar invested in screening to include a financial incentive, the savings are projected to be $3.60 based on the stated assumptions. When considering the indirect cost of breast care treatment such as loss of productivity and avoidable harm, the return on the investment is even greater.

Importance of Appropriate Sizing of Financial Incentives

The aggregate costs of financial incentives are significant. For example, if Medicaid organizations created a financial incentive program that impacted 5% of adult Medicaid beneficiaries (3.3 million people), and the individual financial incentive amount was $50, the incremental cost to Medicaid in financial incentives alone would exceed $163 million annually. Therefore, it is important not to "oversize" the financial incentive amount whereby Medicaid is paying more than needed to attain the same level of recipient engagement in preventive health behaviors.

For example, Bradley and Neumark (2017) identified that paying a $50 (77%) financial incentive rather than a $25 (74%) financial incentive resulted in a higher percentage of Medicaid recipients obtaining an annual wellness visit. Assuming a Medicaid organization has 100,000 recipients, and it paid a $25 incentive that resulted in 74% (74,000 recipients) participating in the behavior, the aggregate cost of the financial incentive would be $1.9M ($25 X 74,000). If the same organization paid a $50 financial incentive, the projected costs would be $3.9 million (77,000 recipients X $50). Therefore, the organization would have to consider if the incremental $2 million ($3.9 - $1.9 million) paid in financial incentives was equal to or less than the amount of money that would have been paid in treatment costs if additional breast cancer had not been identified in their earlier stages.

If we generalized this simple example to 25% (16.2 million) of all Medicaid recipients, a $25 incremental payment for a 3% (77% rather than 74%) increase in the utilization of annual wellness visits, is approximately $325 million. Alternatively, if financial incentives are "undersized," the incentive may

not yield sufficient participation. Without an adequate increase in breast cancer screenings, especially for those who are more vulnerable to breast cancer, a reduction in national health costs is unlikely to occur.

Significance of the Proposed Research

The empirical evidence gained from the present study has the potential to guide healthcare leaders and policymakers on how best to promote breast cancer screening among Medicaid recipients, particularly women of color. The efficacy of financial incentives to increase breast cancer screening utilization among Medicaid recipients requires additional studies (Slater et al., 2017).

The present study is timely because it coincides with current national healthcare policy priorities. Specifically, on February 2, 2022, the Biden-Harris Administration announced their "reigniting" of the *Cancer Moonshot* plan initiated in 2016 to reduce the cancer age-adjusted death rate by 50% over twenty-five years (The White House, 2022). On January 27, 2022, the Centers for Medicare and Medicaid Services Innovation Center announced an Enhanced Oncology Model aligned with the Cancer Moonshot goals while improving health equity for underserved Medicare and Medicaid beneficiaries (CMS, 2022). On February 24, 2022, the Centers for Medicare and Medicaid Services Innovation Center announced the Accountable Care Organization (ACO) Realizing Equity, Access, and Community Health (REACH) Model whose purpose is to promote health equity and support the delivery of care to underserved communities (CMS, 2022).

The information gained from the present study may increase breast cancer survival rates while reducing racial disparities. In Maryland, between 2006 and 2010, providers diagnosed 19% more Black women with late-stage breast cancer than White women (Susan G. Komen, 2015). In Baltimore, Maryland, the location of the present study, the late-stage breast cancer incidence rate is 52 per 100,000 women, or 18% greater than the national average (Susan G. Komen, 2015). A large proportion of Baltimore City residents are Black (62%; US Census Bureau, 2022). If more Black women who have

Medicaid engage in breast cancer screening, especially women who are closer to 50 than 64, it may reduce the number of women with late-stage disease and increase Black women's survivorship.

Theoretical Framework: Gelberg-Andersen Behavioral Model for Vulnerable Populations

The Gelberg-Andersen Behavioral Model for Vulnerable Populations is the theoretical framework for the study because it aligns with the study's assessment of healthcare utilization among a population group that is vulnerable to poorer outcomes (Gelberg et al., 2000). The Gelberg-Anderson Model uniquely recognizes that the same factors resulting in a person being vulnerable can impact their health service utilization (Gelberg et al., 2000). Vulnerable populations include minorities, undocumented immigrants, children, the mentally ill, the chronically ill, the elderly, and those who are impoverished or homeless (Aday, 1993).

The Gelberg-Andersen Behavioral Model embraces the framework of the original Andersen Behavioral Model that was conceived in the 1960s, specifically, *population characteristics*, *health utilization*, and *outcomes* (Gelberg et al., 2000; Andersen, 1995). However, the Gelberg-Andersen Model acknowledges population characteristics and health behaviors among vulnerable populations are different than traditional populations (Gelberg et al., 2000). *(Figure 1).*

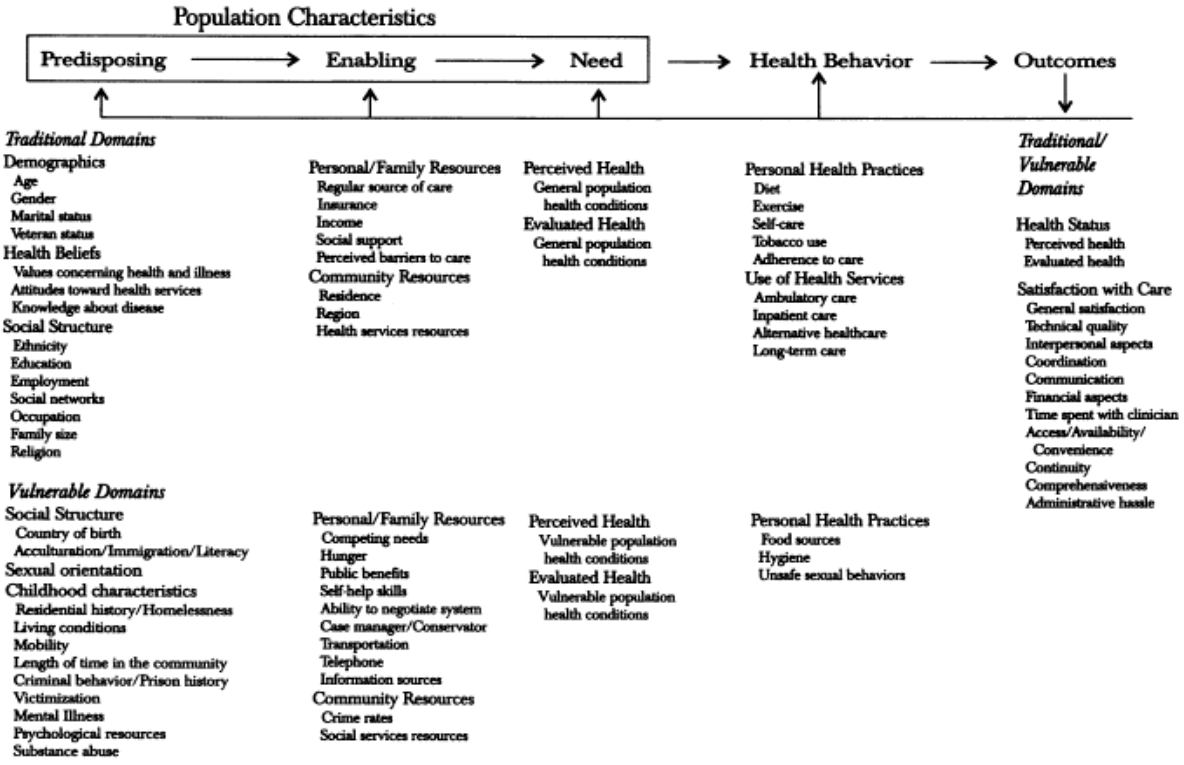
Population characteristics are organized into three categories: *predisposing*, *enabling*, and *need*. The Gelberg-Andersen Model accounts for the traditional domains described in Andersen's Behavioral Model while describing vulnerable domains that influence health behaviors and outcomes (Gelberg et al., 2000; Andersen, 1995). Predisposing characteristics in the traditional domain are focused on demographics (age, gender, marital status), health beliefs (how one values health and health care), and social structure (ethnicity, level of education, occupation); whereas the vulnerable domain is more expansive accounting for childhood experiences (homelessness, time in country, victimization) and sexual orientation while expanding the social structure to include immigration and literacy (Gelberg et al., 2000; Stein et al., 2007). Enabling characteristics in the traditional domain account for personal or family

resources (income, health insurance, social support) and community resources (place of residence, church organization); whereas the vulnerable domains are more inclusive by expanding their understanding of personal or family resources to include competing needs, transportation, ability to negotiate the system; Gelberg et al., 2000; Stein et al., 2007). Need characteristics in the traditional domain limit perceived and evaluated health to the general population and health conditions; whereas the vulnerable domain is more specific to populations that have additional needs, e.g., people who are homeless or have diseases such as AIDs (Gelberg et al., 2000; Stein et al., 2007).

The Gelberg-Andersen Model (2000) retains the concepts of potential versus realized access as well as recognizing the role of mutable factors. *Potential access* is defined as the existence of resources (physicians, health clinics, mammography equipment) while *realized access* is when people utilize existing healthcare resources (annual wellness visits, immunizations, breast cancer screenings; Aday & Andersen, 1974). *Mutable* factors can be modified to influence health outcomes (Andersen, 1995; Gelberg et al., 2000). For example, women can increase their utilization of breast cancer screening (mutable) whereas people cannot change their biological age (immutable). The present study examined the role of financial incentives and the utilization of breast cancer screenings. Breast cancer screening utilization reflects potential access (existing mammography equipment) being utilized (realized access). The decision made by women to overcome existing barriers (economic, psychological, or physical) reflects the level of mutability when a financial incentive is provided.

Figure 1

Gelberg-Andersen Behavioral Model for Vulnerable Populations



Application of the Gelberg-Andersen Behavioral Model for Vulnerable Populations

Applying the Gelberg-Andersen Behavioral Model for Vulnerable Populations begins by recognizing that Medicaid recipients are vulnerable. Medicaid is a means-tested public health insurance (Centers for Medicare and Medicaid Services, 2022). Medicaid recipients include minorities, children, disabled adults, people suffering from chronic diseases such as diabetes and hypertension, and/or suffer from mental disorders (Centers for Medicaid & CHIP, 2020). Medicaid recipients are among the most vulnerable group in the United States (Lee & Jarosz, 2017).

The purpose of the study is to assess the efficacy of financial incentives among Medicaid recipients for breast cancer screening utilization. A description of how the research aligns with the Gelberg-Andersen Behavioral Model for Vulnerable Populations is provided below *(Figure 2)*.

Figure 2

Application of the Gelberg-Andersen Behavioral Model for Vulnerable Populations

Population Characteristics		**Use of Health Services**	**Population Outcomes**
<u>Predisposing</u> • Race (Covariate) • Age (Covariate) • Health beliefs • Trust of healthcare workers • Health literacy • Location of residence (Covariate) • Mobility • Psychological stress	Research <u>Intervention</u> A financial incentive for breast cancer screening	Research <u>Outcomes</u> • Utilization of breast cancer screening exams • Utilization of breast cancer screening by the size of financial incentive • Utilization of breast cancer screening by the size of financial incentive associated with the identified covariates, i.e., race, age, location of residence, and the number of people living in a Medicaid recipients' household.	• Increased diagnoses of Stage I/II breast cancer while reducing the number of Stage III/IV diagnoses • Reduced rates of breast cancer mortality
<u>Enabling</u> • Socio-economic status • Medicaid churn, tenure • Employment status • Competing needs • Household Count (Covariate) • Access to transportation • Community resources • Ability to navigate the healthcare system			
<u>Needs</u> • Late-stage breast cancer diagnosis disparities • Breast cancer mortality disparities • Higher costs associated with the treatment of late-stage breast cancer			

Research Questions and Hypotheses

Based on the theoretical model and stated research questions, the following hypotheses were tested:

Research Question 1

Do financial incentives paid to women Medicaid recipients aged 50-64 residing in Baltimore, Maryland aged 50-64 increase the likelihood of increased breast cancer screening utilization?

Hypothesis (H1): When a financial incentive is provided, a higher likelihood of increased breast cancer screening utilization will occur.

Research Question 2

Are larger financial incentive amounts paid to women Medicaid recipients aged 50-64 residing in Baltimore, Maryland associated with a higher likelihood of increased breast cancer screening utilization?

Hypothesis (H2): The larger the financial incentive, the higher the likelihood of an increase in breast cancer screening utilization.

Research Question 3

Do different population characteristics among Medicaid recipients residing in Baltimore, Maryland influence the utilization of breast cancer screening when a financial incentive is provided? Specific population characteristics examined included age, the geographic sub-region of recipients' primary home, race, and the number of people reported as living with the Medicaid recipient (household count).

Hypothesis (H3): The size of the financial incentive will be a greater predictor of breast cancer screening among Medicaid women aged between 50 and 64 residing in Baltimore, Maryland than any other demographic variable (age, race, geographic sub-region, or number of people residing with the Medicaid recipient (household count).

Chapter 3: Methodology

Chapter Overview

This chapter describes the methodology used for evaluating the effectiveness of financial incentives paid to Medicaid recipients for breast cancer screening. Research design, a description of the general and sample population, sampling, research setting, analyses, and ethical considerations are discussed in this chapter.

Research Design

This quantitative retrospective study was designed to evaluate whether financial incentives influence breast cancer screening utilization among women aged 50 to 64 who had Medicaid as their primary health insurance provider from 2019-22 *(Table 10).*

Maryland Physicians Care, a Medicaid managed care organization, provided the claims data for the study. Maryland Physician Care has approximately 220,000 recipients throughout Maryland. However, only claims data for Medicaid recipients residing in Baltimore, Maryland were analyzed for this study.

The financial incentive paid to women for breast cancer screening varied during different years. In 2019, from May to September, the financial incentive was $75. From October 2019 to September 2020, the financial incentive was $100. From October 2020 to December 2022, the financial incentive was $150. However, the financial incentive was specifically directed to those women who were not adhering to the US Preventive Services Task Force recommendations.

The present study utilized logistic regression as the primary mechanism for assessing the statistical significance and strength of the relationship between breast cancer screening utilization and financial incentives. In addition, logistic regression was used to evaluate if breast cancer screening utilization when a financial incentive was provided was influenced by covariables such as age, race, the geographic region of Baltimore, and the number of people living in the household.

Table 10

Overview of Research Strategy

Research Question	Method	Participants	Key Outcomes
Do financial incentives paid to women Medicaid recipients aged 50-64 residing in Baltimore, Maryland increase the likelihood of increased breast cancer screening utilization?	Claims data were analyzed by year and in aggregate for all four years (2019-2022) to determine if a financial incentive of any size resulted in a statistically significant increase in breast cancer screening utilization using logistic regression.	Medicaid recipients who met eligibility criteria. Specifically, claims data were cleaned to account for recipients meeting eligibility criteria only.	Determine if there is a statistically significant likelihood that enrollees increased breast cancer screening utilization when a financial incentive was provided.
Are larger financial incentive amounts paid to women Medicaid recipients aged 50-64 residing in Baltimore associated with a higher likelihood of increased breast cancer screening utilization?	Claims data were organized by the date of service the breast cancer screening was completed and the amount of financial incentive that was offered to recipients. Logistic regression was used to assess the likelihood of breast cancer screening being completed for each level of financial incentive.	Medicaid recipients who met eligibility criteria. Specifically, the Medicaid claims data will be cleaned to only include those participants that meet eligibility criteria and for each level of financial incentive.	Determine if there are statistically significant likelihood of enrollees who increase breast cancer screening utilization when a larger financial incentive was provided.
Do women with different demographic backgrounds who are Medicaid recipients residing in Baltimore, Maryland respond to financial incentives differently when the financial incentive is sized higher or lower? Specific demographic categories examined included age, the geographic sub-region of recipients' primary home, race, and the number of people reported as living with the Medicaid recipient (household count).	Claims data by year and in aggregate (2019-2022) was analyzed to identify any statistically significant relationships between the first paid breast cancer screening completion and the size of the financial incentive for breast cancer screening while accounting for covariates (age, race, geographic sub-region, and household count) .	Medicaid recipients who met eligibility criteria. Specifically, the Medicaid claims data will be cleaned to only include those participants that meet eligibility criteria	Determine if the relationship between financial incentives and breast screening is influenced by specific population characteristics.

General Population

The study analyzed women Medicaid recipients residing in Baltimore, Maryland. The overall population in Baltimore, Maryland declined (6%) between 2020 and 2010 while the percentage of people with Medicaid as their primary health insurance provider increased (35%*; Table 11).*

Table 11

Changes in Population and Medicaid Recipients in Baltimore, Maryland

	2010	2020	# Change	% Change
Population	620,903	585,708	-35,135	(5.67%)
Medicaid Recipients	164,405	222,800	57,995	35.2%
Medicaid Recipients as a % of the Population	26.5%	38.0%	11.5%	43.3%

Sources: Maryland Medicaid eHealth Statistics, 2022; BaltimoreCity.gov, 2020.

The racial composition of the population residing in Baltimore is significantly different than the Maryland and United States averages. Specifically, Baltimore has a larger percentage of Black residents, a greater number of people who live in poverty, and more people with less education. *(Table 12)*.

Table 12

Comparison of Baltimore, Maryland, and United States Demographics

	Baltimore City	Maryland	United States
Race			
White, not Hispanic	27.3%	49.0%	59.3%
Black alone	62.3%	31.4%	13.6%
American Indian/Alaska Native	0.3%	0.7%	1.3%
Asian alone	2.5%	6.9%	6.1%
Two or more Races	3.2%	3.1%	2.9%
Hispanic or Latino	5.4%	11.1%	18.9%
Housing			
Living in the same house 1 year ago	84.3%	86.8	86.2%
Education			
High school graduate	85.5%	90.6%	88.5%
Poverty			
Persons in poverty	20.0%	9.0%	11.4%

Source: United States Census Bureau, 2022. Data as of July 1, 2021.

Baltimore, Maryland contains 100 local neighborhoods and 32 ZIP Code areas. Baltimore City Planners officially categorize the city into nine geographical regions or districts: Inner Harbor, Fells Point, Downtown, Midtown, South Baltimore, North Baltimore, Southeast Baltimore, West Baltimore, and East Baltimore (LiveBaltimore.com, 2022). To align ZIP Code (how Medicaid information is captured) and District definitions (based on specific neighborhoods), it was necessary to consolidate four districts into one as well as to create some assumptions in other districts that had ZIP codes that covered more than one district. *(Table 13).* The specific four districts categorized into Central Baltimore were Inner Harbor, Fells Point, Downtown, and Midtown.

Table 13

Local Neighborhood and ZIP Code Definitions of Six Geographic Sub-Regions of Baltimore City

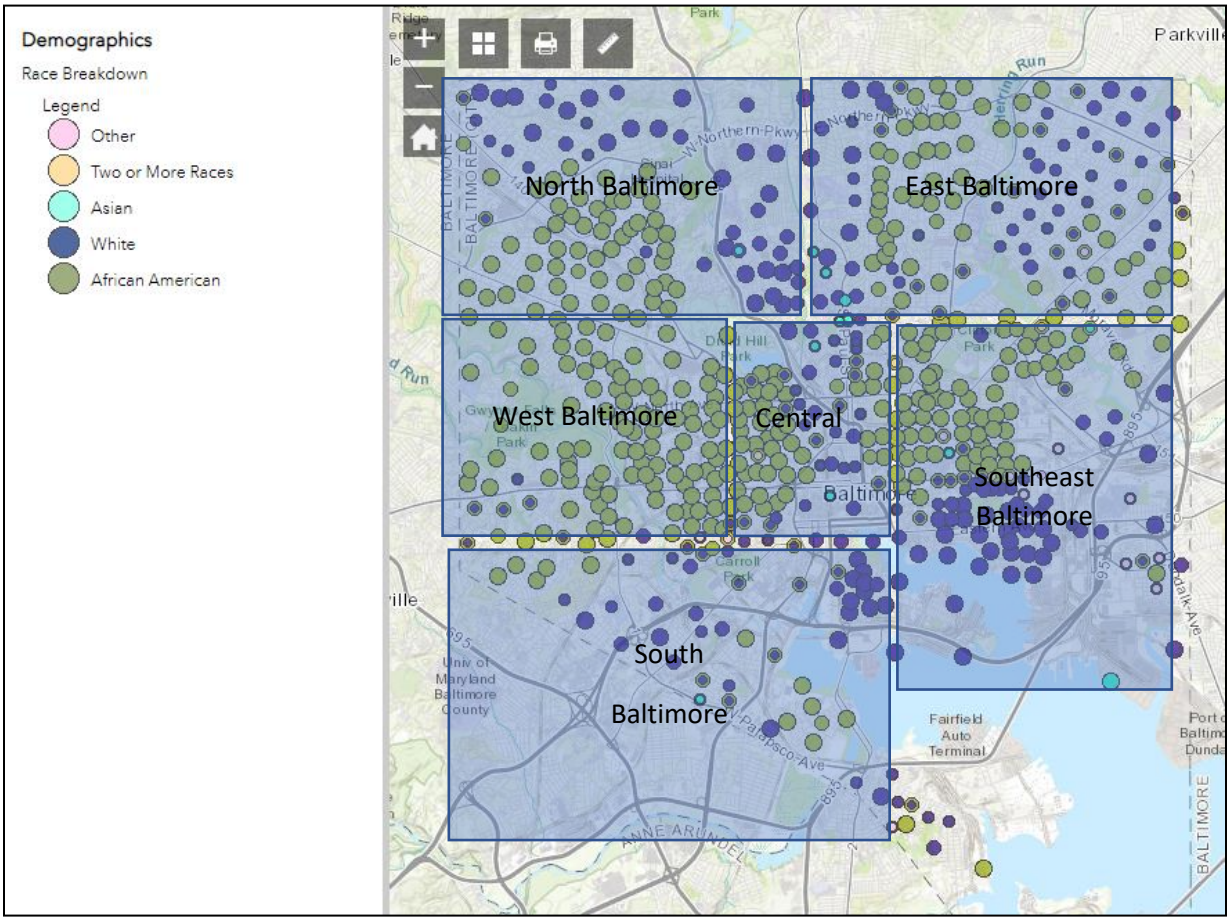
Name	Planning	ZIP Code	Community Statistical Areas
North Baltimore	1	21208	N/A
North Baltimore	1	21209	Mt. Washington / Coldspring
North Baltimore	1	21210	Greater Roland Park/Poplar Hill/North Balimore/Guilford/Homeland
North Baltimore	1	21211	Medfied/Hampden/Woodberry/Remington
North Baltimore	1	21215	Glen-Fallstaff/Cross-Country/Cheswolde/Pimlico/Arlington/Hilltop/ Southern Park Heights/Dorchester/Ashburton
East Baltimore	2	21206	Cedonia/Frankford
East Baltimore	2	21212	Chinquapin Park/Belvedere/Greater Govans
East Baltimore	2	21213	Belair-Edison/Clifton-Berea/Greenmunt East
East Baltimore	2	21214	Harford/Echodale/Lauraville
East Baltimore	2	21218	Greater Charles Village/Barclay/The Waverlies/Northwood/Midway/Coldstream
East Baltimore	2	21234	N/A
East Baltimore	2	21236	N/A
East Baltimore	2	21237	N/A
East Baltimore	2	21239	Loch Raven
East Baltimore	2	21251	N/A
West Baltimore	3	21207	Howard Park/West Arlington
West Baltimore	3	21216	Forest Park/Walbrook/Greater Mondawmin/Greater Rosemont
West Baltimore	3	21217	Sandtown-Winchester/Harlem Park/ Upton/Druid Heights
Central Baltimore	4	21201	Midtown/Downtown/Seton Hill/Poppleton/The Terraces/Hollins Market
Central Baltimore	4	21202	Greenmount East/Oldtown/Middle East
Central Baltimore	4	21231	Fells Point/Harbor East/Little Italy
Central Baltimore	4	21287	N/A
Southeast Baltimore	5	21205	Madison/East End/Claremont/Armistead
Southeast Baltimore	5	21222	N/A
Southeast Baltimore	5	21224	Canton/Patterson Park North & East/Highlandtown/Southeaster/Orangeville/Eash Highlandtown
South Baltimore	6	21223	Southwest Baltimore
South Baltimore	6	21225	Cherry Hill/Brooklyn/Curtis Bay/Hawkins Point
South Baltimore	6	21226	N/A
South Baltimore	6	21227	Morrell Park/Violetville
South Baltimore	6	21228	N/A
South Baltimore	6	21229	Beechfield/Ten Hills/West Hills/Allendale/Irvington/S. Hilton/Edmondson Village
South Baltimore	6	21230	Wetport/Mt. Winans/Lakeland/WashingtonVillage/Pigtown/Inner Harbor/Federal Hill/South Baltimore

As noted above, Baltimore has a disproportionate number of people who are Black compared to national and Maryland averages. The west and east sub-regions of Baltimore, Maryland have a larger portion of people who are Black than White. The southeast, north, and south Baltimore sub-regions are more diverse, appearing to have a greater number of people who are White. *(Figure 3).*

A key consideration of the study was to assess if financial incentives influenced or mitigated known breast cancer screening disparities among Medicaid recipients. Identifying racial composition differences among the geographic sub-regions of Baltimore was important in this assessment. If geographic sub-regions with higher concentrations of Black people had been found to have a statistically significant lower response rate to financial incentives for breast cancer screening than geographic sub-regions with higher concentrations of White people, additional research should be completed to assess any structural or cultural barriers to care such as less access to public transportation or mammography services.

Figure 3

Overview of Racial Composition by Baltimore City Geographic Sub-Region

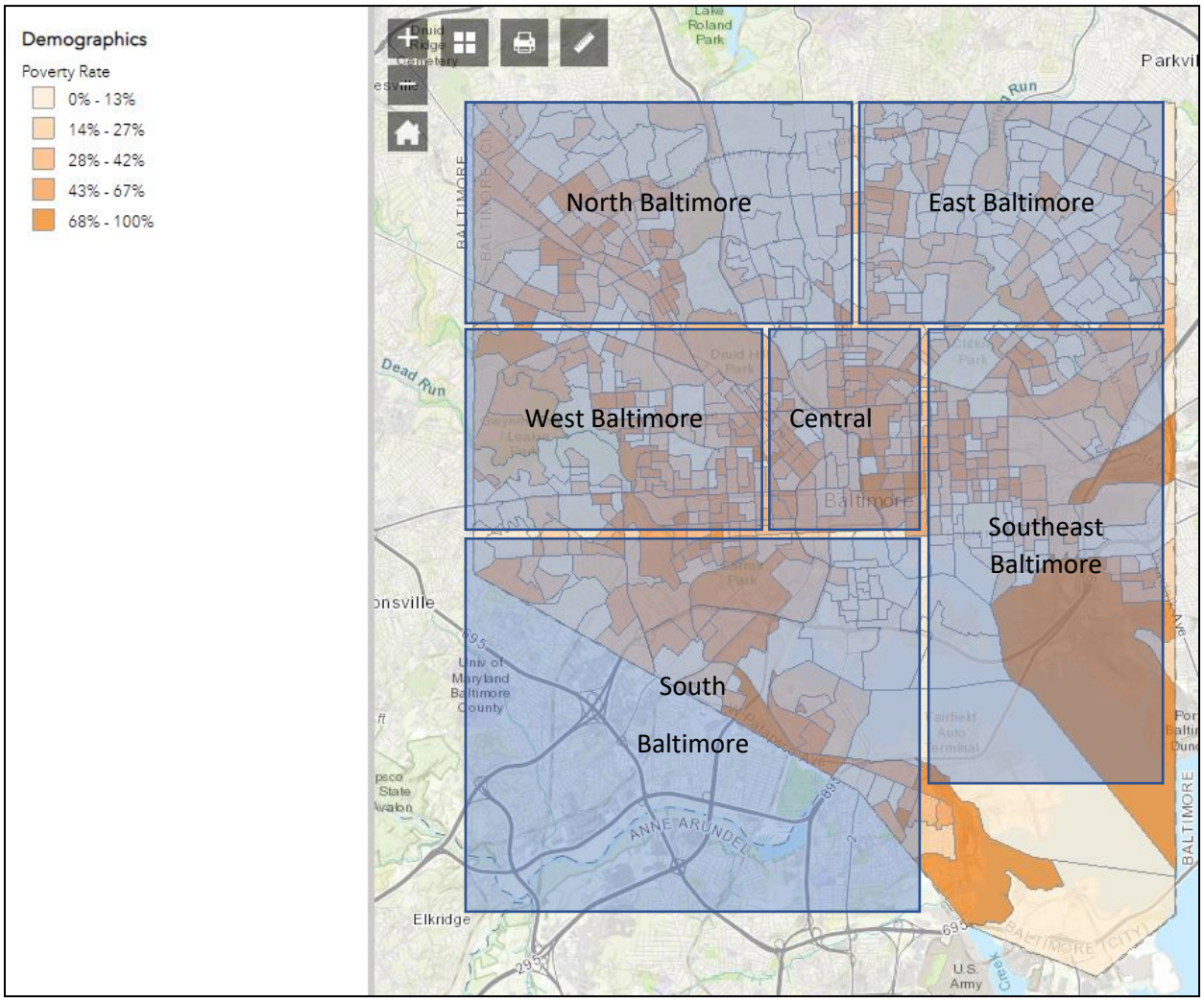


Source: Baltimore Panning Map, 2022.

As described above, Baltimore has a disproportionate number of people who qualify for Medicaid and have lower annual household earnings compared to Maryland and national averages. While all geographic sub-regions of Baltimore, Maryland have concentrations of people in poverty, the southeast, south, and central sub-regions appear to have the highest concentrations. *(Figure 4).*

Figure 4

Poverty Rate for Baltimore City by Geographic Sub-Region



Source: Based on the Department of Planning, Baltimore City, Maryland.

Study Participants

Between 2019 and 2022, 8,218 Medicaid women were identified as needing breast cancer screening using the US Preventive Services Task Force (2016) guidelines. Approximately 31% (2,578) of the women met the study eligibility criteria. Two cohorts were established for those participants meeting eligibility criteria, those women who were offered a financial incentive (2,186) for breast cancer screening and those women who had not been provided a financial incentive (392).

The eligibility criteria for the study included: 1) The Medicaid recipient must have been a recipient of the Maryland Physician Care managed care organization during the period when the financial incentives were provided for breast cancer screening. 2) Participants must meet the demographic and clinical risks that are appropriate for breast cancer screening as defined by the US Preventive Services Task Force (2016) and NCQA HEDIS (2021). Specifically, recipients must be aged between 50-64 years (recipients will quality for Medicare at age 65) and assigned as a woman upon birth. And 3) Participants breast cancer screening status is inconsistent with the US Preventive Services Task Force (2016) recommendations, specifically, breast screening mammography completion every two years. The proposed ineligibility criteria include women who are actively being treated for breast cancer because the needs for these recipients are greater than breast cancer screening.

Sample Size & Power Calculations

The study sample and power calculations were based on the primary outcome, which is the number of women who utilized breast cancer screening as identified by a processed claim. A chi-square test was used to determine the significance of bivariate differences for each level of financial incentive provided (e.g., $75, $100, $150). Logistic regression was used to assess the statistical significance and odds ratios to determine if the likelihood of breast cancer utilization increased (yes/no) when a financial incentive was provided. With statistical power of 80% (β) and statistical significance (α) of 0.05 (two-tailed), and medium effect size of 0.2 (consistent with other studies), the a priori population size needed was calculated at 387 (Faul et al., 2007).

Research Setting

Eligible recipients were able to obtain a financial incentive when receiving breast cancer screening at two designated locations: Ascension St. Agnes Breast Center (3449 Wilkens Avenue, Baltimore, Maryland, 21229) and American Radiology Services (3700 Fleet Street, Baltimore, Maryland,

21224). The Ascension St. Agnes Breast Center is in the South sub-region while the American Radiology Services site is in the Southeast Baltimore geographic sub-region. Starting in October 2021, eligible recipients were provided a financial incentive if the breast cancer screening was completed with no regard to location.

Study coordinators worked directly with breast cancer screening leaders at each of the two sites. (*Table 14).* In addition, the study coordinators scheduled the Medicaid recipients for their breast cancer screening exams but were also on site. Study coordinators provided the payment after each recipient's breast cancer screening exam was completed.

Table 14

*Scheduled Clinic Days by Year by Site**

	St. Agnes Screening Center Southeast Baltimore			American Radiology Screening Center South Baltimore			Total		
	2019	2020	2021	2019	2020	2021	2019	2020	2021
Days on Site	7	17	8	4	7	11	11	24	15

Note: *In 2019, clinic days were from May to September. In 2020, clinic days were from March to September. In 2021, a financial incentive was provided to recipients who received care at a clinic or any mammography center. In 2020, a financial incentive was provided if attended the clinic.
Source: Maryland Physician Surgical Center.

In addition, study coordinators reviewed study responsibilities with local operational leaders. The study coordinators developed a process to ensure a consistent methodology for scheduling and paying the financial incentives thereby maximizing the validity and reliability of anticipated retrospective reviews. Mammography technologists who provided breast cancer screening exams were unaware of the study and patients' insurance status to protect the privacy of the women.

Study coordinators compensated Medicaid recipients using a gift card. The gift card had broad acceptance at all stores with no prohibitions on what recipients could purchase.

Data Collection

Participants were notified of the financial incentive for the breast cancer screening initiative using texts and letters *(Table 15; Figure 5)*. Messages included information about the importance of breast cancer screening, the amount of the financial incentive, and contact information for scheduling an appointment at one of the established clinic sites. A sample text message from March 2020 that was sent to Medicaid recipients stated, "Hi from Maryland Physicians Care! Doctors recommend regular mammograms. This is an x-ray that helps doctors find & treat breast cancer early. If you attend our clinic for a mammogram, you'll get a $100 Visa gift card! We can also arrange a ride for you. Call 443-902-1285 to schedule."

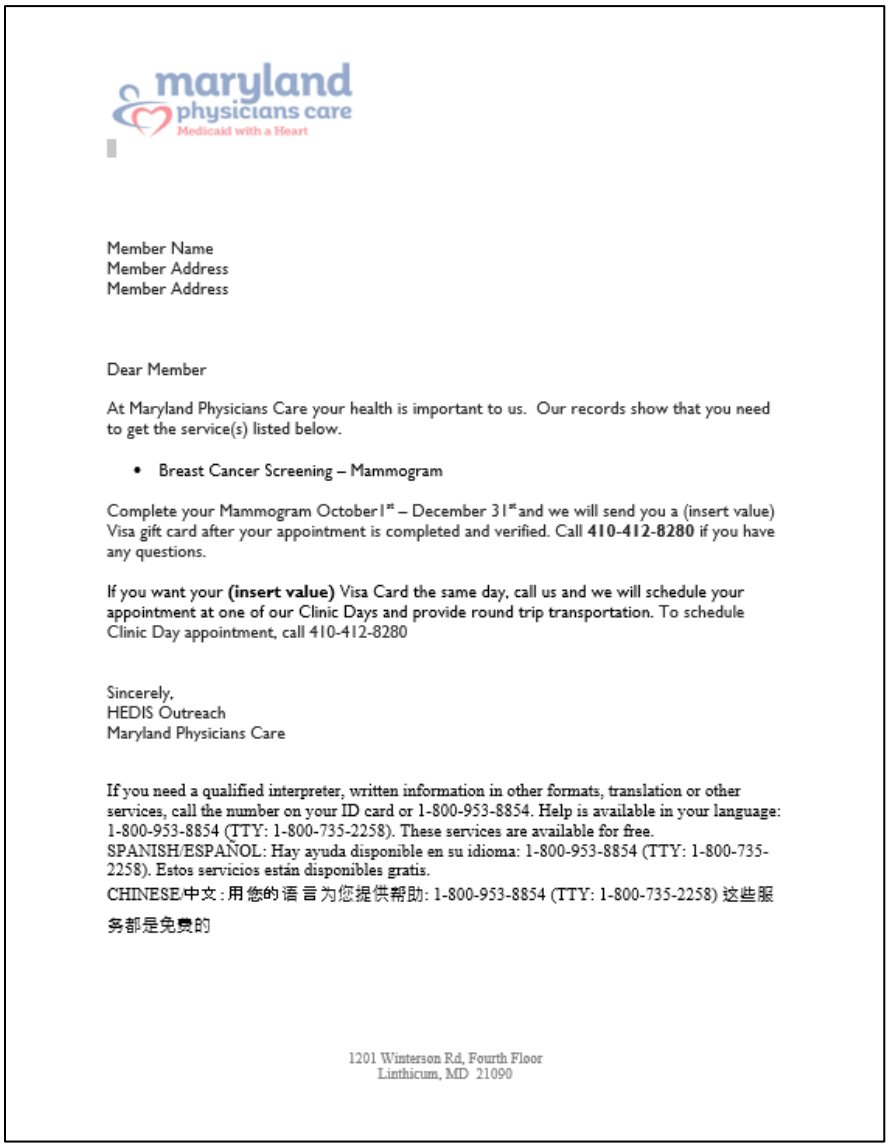
Table 15

Frequency of Texts and Letters by Years Used to Inform Medicaid Recipients

Frequency	Text	Letter
2019	1- (4th Quarter)	3 – (Between May and Sept.)
2020	4 - (quarterly)	1 - (9/12/2020) Mail interruptions due to COVID-19
2021	4 – (quarterly)	4 – (sent to recipients who did not receive a text; in 4th quarter sent to those recipients not adhering to screening recommendations)
2022	4 – (quarterly)	2 – (sent to those recipients not adhering to screening recommendations)

Figure 5

Sample Communication Letter



maryland physicians care
Medicaid with a Heart

Member Name
Member Address
Member Address

Dear Member

At Maryland Physicians Care your health is important to us. Our records show that you need to get the service(s) listed below.

- Breast Cancer Screening – Mammogram

Complete your Mammogram October1st – December 31st and we will send you a (insert value) Visa gift card after your appointment is completed and verified. Call **410-412-8280** if you have any questions.

If you want your **(insert value)** Visa Card the same day, call us and we will schedule your appointment at one of our Clinic Days and provide round trip transportation. To schedule Clinic Day appointment, call 410-412-8280

Sincerely,
HEDIS Outreach
Maryland Physicians Care

If you need a qualified interpreter, written information in other formats, translation or other services, call the number on your ID card or 1-800-953-8854. Help is available in your language: 1-800-953-8854 (TTY: 1-800-735-2258). These services are available for free.
SPANISH/ESPAÑOL: Hay ayuda disponible en su idioma: 1-800-953-8854 (TTY: 1-800-735-2258). Estos servicios están disponibles gratis.
CHINESE/中文：用您的语言为您提供帮助: 1-800-953-8854 (TTY: 1-800-735-2258) 这些服务都是免费的

1201 Winterson Rd, Fourth Floor
Linthicum, MD 21090

The validity and reliability of the claims data collected from Maryland Physicians are based on methods used within the organization. Specifically, Maryland Physician Care uses a software program called Inovalon which is a fully certified HEDIS software system that can track and confirm the correctness of the information. The Inovalon software certification and validation are consistent with national guidelines (National Committee for Quality Assurance, 2022).

Variables and Outcome Measures

The primary outcome is the number of women Medicaid recipients who obtained their breast cancer screening as evidenced by a specific processed claim thereby creating a dichotomous response. Specifically, they either did or did not receive a breast cancer screening exam.

The financial incentive is the predictor variable and has three levels ($75, $100, and $150). The covariates included race, age, the geographic sub-region of the Medicaid recipient's primary address within Baltimore, and household count (the number of people residing with the Medicaid recipient). (*Table 16).*

Table 16

Summary of Measures and Data Sources

Research Question	Variable	Level of Measures	Variable Description	Data Source
1, 2, 3	DV	Dichotomous	breast cancer screening obtained (Yes / No)	Medicaid Claims Data
1, 2, 3	IV	Categorical	financial incentives: $75, $100, and $150	Time of claim processed, e.g., in 2019 from May to Sept., the financial incentive was $75.
3	CV	Categorical	Geographic sub-region	Geographic sub-regions definitions *(Table 14)*. Data includes de-identified recipients' ZIP codes.
3	CV	Categorical	Race: American Indian/Alaska Native, Asian, Black, Hispanic, White, Not Provided	Based on information captured in the database
3	CV	Continuous	Age	Based on information captured in the database
3	CV	Continuous	Number of Members in the Household	Based on information captured in the database.

Data Analyses

Maryland Physicians Care provided de-identified breast cancer screening data from 2019 and 2022 that underwent a cleaning process. The IBM SPSS 28 statistical program was used to perform the analyses and data-cleaning process. Data per Medicaid recipient was reviewed. Recipients who did not meet eligibility criteria were removed from the data set. Less than five Medicaid recipients had incomplete or missing data which was removed from the data set.

Data were coded as follows: 1) *Breast cancer screening* – if yes, 1; if no, 0. 2) Financial incentive was provided – if yes, 1, if no 0. 3) *Level of financial incentive* – if $0, 0; if $75, 1; if $100, 2, if $150, 3. 4) *Baltimore sub-region* – As outlined in *Table 16*, Baltimore was categorized into sub-regions: if North, 1; if East, 2; if West, 3; if Central, 4; if Southeast, 5; if South, 6. 5) *Race* – Self-reported race was coded: if American Indian/Alaska Native, 1; if Asian or Pacific Islander, 2; if Black, 3; if Caucasian, 4; if Hispanic, 5; if

not provided, 6. 6) *Household Count* - The number of people in the household is the actual number provided by the Medicaid recipient. And 7) *Age* – Based on the actual date of birth.

Sources of bias associated with logistic regression were assessed. Specifically, variables were assessed for linearity, complete separation, and overdispersion. Linearity was evaluated via descriptive statistics as well as the Hosmer and Lemeshow test. Multicollinearity was assessed to ensure a complete separation of variables (outcome and predictors) existed. The Chi-square Goodness-of-Fit statistic was assessed to determine no overdispersion existed among the data variables. *(Table 17).*

Table 17

Summary of Statistical Tests and Measures

Research Question	Statistical Test	Measures Assessed
1, 2, 3	Descriptive Statistics	Assess Measures of Central Tendency, Normality, Skew, and Kurtosis
1 Do financial incentives paid to women Medicaid recipients aged 50-64 residing in Baltimore, Maryland increase the likelihood of increased breast cancer screening utilization?	Logistic regression	Determine the statistical significance of providing a financial incentive increases the utilization of breast cancer screening as well as assess the odds ratio to identify the magnitude of the relationship.
2 Are larger financial incentive amounts paid to women Medicaid recipients aged 50-64 residing in Baltimore associated with a higher likelihood of increased breast cancer screening utilization?	Logistic regression	Determine the statistical significance of each level of financial incentive ($75, $100, and $150) and the associated odds ratio. The statistical significance and odds ratio were reviewed to determine if one level of financial incentive appears to have a greater likelihood of increasing breast cancer screening utilization.
3 Do different population characteristics among Medicaid recipients residing in Baltimore, Maryland influence the utilization of breast cancer screening when a financial incentive is provided? Specific population characteristics examined included age, the geographic sub-region of recipients' primary home, race, and the number of people reported as living with the Medicaid recipient (household count).	Logistic Regression	Identify any statistically significant relationship between financial incentives and breast cancer utilization as well as calculate the odds ratio to assess the magnitude of the relationship.

Problems & Mitigation Strategies

The influence of the COVID-19 pandemic is one of the most significant challenges for the study.

It is unclear if the same number of women would have responded to a financial incentive for breast cancer screening if a threat of a life-threatening pandemic had not been a factor. Alternatively, many people had reduced hours or lost their employment during the pandemic. Therefore, some women would have had more time and/or perhaps a greater economic need to respond to the financial incentive for breast cancer screening. To account for this factor, logistic regression was used to assess the likelihood of obtaining a breast cancer screening versus an alternative methodology such as INOVA that would account for differences in means.

Generalizing the findings may be difficult not just because of the timing of the pandemic. Baltimore is a unique city with its own culture. The racial composition of Baltimore is dissimilar to the racial composition of the aggregate Medicaid population. The sample population used for the study had larger percentages of American Indians/Alaska Natives and Black women than the national Medicaid population. Alternatively, the sample population had a smaller representation of Hispanic and Asian/Pacific Islander women than the national Medicaid racial composition.

Expected Outcomes & Implications

The study findings may influence healthcare policy and care delivery thereby potentially reducing the risk of breast cancer mortality while fostering greater equity in health outcomes among Medicaid recipients. In addition, the findings may optimize investments made by public payers to reduce the total cost of care *(Table 18).*

Table 18

Expected Outcomes and Implications

Expected Outcome	Implication(s)
Evidence will exist to suggest whether the financial incentive is or is not effective in increasing breast cancer screening utilization among women Medicaid enrollees when framed using a direct payment method and supported by a care navigator.	If financial incentives are found to influence breast cancer screening utilization, an evidence-based tool will be added to their portfolio to reduce breast cancer among low-income and minority females. Healthcare policymakers and Medicaid administrators will be able to examine the mode of payment, use of care navigator, and proximity to the site to guide them on factors that may influence how they implement financial incentive initiatives for breast cancer screening in other communities.
Evidence will exist to assess if a higher financial incentive is more or equally effective than a smaller financial incentive.	Medicaid administrators have limited resources, and it is important to maximize health utility for their enrollee population. If a smaller financial incentive is identified as having equal or similar efficacy as a smaller FI, it could reduce costs while having no adverse effect in engaging enrollees to attain their BCS.
Evidence will exist to identify if Medicaid recipients with specific characteristics are differently motivated to attain breast cancer screening when a financial incentive is provided and if a larger or smaller financial incentive is needed to achieve the desired response.	If Medicaid administrators can identify what population characteristics are most likely to influence the efficacy of a financial incentive to increase breast cancer screening utilization, it has the potential to increase the efficacy of financial incentive initiatives in various locations. For example, if proximity to breast cancer screening is a dominant factor influencing utilization, Medicaid administrators can include more mammography centers in their initiatives. Another consideration is the ability to target financial incentives to foster health equity. For example, if Hispanic women with many people in their households are more likely to respond when a higher financial incentive is provided, then Medicaid administrators who have large populations of people who have similar demographics may need to increase their level of financial incentive rather than feeling the financial incentive was not effective for their community.
Future research implications	Assessing the role of enrollees who have repeat breast cancer screening utilization over multiple years, as well as assessing the role of breast cancer screening as a "gateway" to other preventive health behaviors are two potential follow-up research studies.

Chapter Summary

This chapter delineated the research questions and hypotheses, research design, sample population, power analysis, variables of interest, and an overview of the research setting. The analytical approach includes the use of logistic regression and multivariate regression to identify correlations that

assess the role of financial incentives and breast cancer screening based on de-identified claims data. I described the potential threats to the reliability and validity of the present study, as well as outlined their mitigation strategies. The chapter described ethical considerations associated with the present study. The present study was deemed exempt by Virginia Commonwealth University's Institutional Review Board.

Chapter 4: Results

Chapter Overview

This chapter summarizes the results of the analyses to include: 1) An overview of the raw data that was collected; and 2) Findings from the statistical analyses associated with answering the research questions and hypotheses.

Data Analysis

In 2018, no financial incentive was provided to Medicaid women for breast cancer screening. The overall adherence rate of breast cancer screening using the US Preventive Services Task Force recommendations among eligible Medicaid women who were members of the managed care organization was 56%. From 2019 to 2022, a financial incentive was provided to women whose breast cancer screening status was not current with US Preventive Services Task Force recommendations living in Baltimore, Maryland. During this period, the breast cancer screening adherence rate improved. For all study years, the breast cancer screening adherence rate was higher (64% to 73%) than the overall 2018 experience (56%; *Table 19*).

Table 19

Breast Cancer Screening Adherence with US Preventive Services Task Force Recommendations by Year

	Pre-Study	Study Period with Eligible Participants				
US Preventive Service Task Force Status	2018*	2019**	2020	2021	2022	Total 19-22
Breast Cancer Screening Current						
Number of Participants	3,984	1,190	1,345	1,531	1,574	5,640
% of Total Participants	55.6%	64.4%	68.7%	72.5%	68.4%	68.6%
Breast Cancer Screening Not Current						
Number of Participants	3,181	658	612	582	726	2,578
% of Total Participants	44.4%	35.6%	33.1%	31.5%	39.3%	31.4%
Total Participants	7,165	1,848	1,957	2,113	2,300	8,218

Note: *Total Maryland Physician Care experience that included women outside of Baltimore.
** The Financial incentive was provided starting in May 2019.

Medicaid women who met eligibility criteria were divided into two cohorts. One cohort (2,186) was provided a financial incentive for breast cancer screening. A second cohort (392) was not provided with a financial incentive for breast cancer screening. Breast cancer screening utilization was higher for the cohort that did not receive a financial incentive (79%) than the cohort that did receive a financial incentive (21%; *Table 20*).

Table 20

Breast Cancer Screening Utilization Between Cohorts for 2019-2022

	No Financial Incentive Cohort		Financial Incentive Cohort	
	Participants	%	Participants	%
Breast Cancer Screening Completed	279	71.2%	459	21.0%
Breast Cancer Screening Not Completed	113	28.8%	1,727	79.0%
Total	392	100.0%	2,186	100.0%

Analysis of Demographics

Assumptions for linearity and independence were validated. The Hosmer and Lemeshow has a p-value of 1.0 thereby indicating a good fit with the logistic regression model. The household count variable was skewed (3.57) and kurtotic (14.1). However, the sample size was large enough to apply the Central Limit Theorem (Field, 2018). The remaining demographic variables age (years), race, and Baltimore sub-region had a normal distribution. No R-value was identified to be greater than 0.9 when assessing multicollinearity. The chi-square good-of-fit test had a p-value of less than 0.001 indicating no overdispersion would create bias to the findings. *(Table 21)*.

Table 21

Population Characteristics by Cohort (2019-2022)

	No Financial Incentive Cohort		Financial Incentive Cohort	
	Participants	%	Participants	%
Financial Incentive Amounts				
$0	392	100.0%	N/A	N/A
$75	N/A	N/A	520	23.8%
$100	N/A	N/A	666	30.5%
$150	N/A	N/A	1,000	45.7%
Total Participants	392	100.0%	2,186	100.0%
Age (Average)	57.9		57.3	
Household Count (Median)	1.0		1.0	
Race				
American Indian/Alaskan Native	75	19.1%	535	24.5%
Asian/Pacific Islander	7	1.8%	30	1.4%
Black	169	48.1%	904	41.4%
Caucasian/White	47	12.0%	243	11.1%
Hispanic	3	0.8%	14	0.6%
Not Provided	91	23.2%	460	21.0%
Total	392	100.0%	2,186	100.0%
Baltimore Sub-Region				
Surrounding Baltimore	70	17.9%	303	13.9%
North Baltimore	43	11.0%	245	11.2%
East Baltimore	76	19.4%	447	20.4%
West Baltimore	76	19.4%	404	18.5%
Central Baltimore	36	9.2%	210	9.6%
Southeast Baltimore	16	4.1%	101	4.6%
South Baltimore	75	19.1%	476	21.8%
Total	392	100.0%	2,186	100.0%

Research Question 1

The first research question considered if paying financial incentives to women Medicaid recipients residing in Baltimore, Maryland increased the likelihood of their utilizing breast cancer screening.

Hypothesis 1 Testing

The model was able to correctly predict 79% of the classifications. However, the model was not able to account for any shared variance between breast cancer utilization and breast cancer screening variables. Both the Cox & Snell R-square and Nagelkerke R-square values were 0.00. The Medicaid participants in both cohorts (financial incentive and no financial incentive) had a statistically significant

likelihood of utilizing breast cancer ($p < 0.001$). However, a negative relationship was identified. Those participants in the cohort receiving a financial incentive were less likely to utilize breast cancer screening (OR=0.27). Alternatively, the cohort not receiving a financial incentive had a higher likelihood of utilizing breast cancer screening (OR=2.5). The *(Table 22)*

H_o -Financial incentives paid to women Medicaid recipients residing in Baltimore, Maryland for breast cancer screening will not increase utilization.

H_a - Financial incentives paid to women Medicaid recipients residing in Baltimore, Maryland for breast cancer screening will increase the likelihood of utilization.

Table 22

Breast Cancer Screening Utilization and Any Level of Financial Incentive

	No Financial Incentive Cohort				Financial Incentive Cohort			
		95% Confidence Interval				95% Confidence Interval		
Research Question 1	b (S.E.)	Lower	Odds Ratio	Upper	B (S.E.)	Lower	Odds Ratio	Upper
Screening Completed	0.90 (0.11)**		2.5		-1.33 (0.05)**		0.27	

Note: *p < 0.05; **<.001

Research Question 2

The second research question considered if paying a larger financial incentive to women Medicaid recipients residing in Baltimore, Maryland increased their likelihood of utilizing breast cancer screening.

Hypothesis 2 Testing

The model was able to correctly predict 79% of the classifications. The omnibus tests of model coefficients were statistically significant chi-square statistical significance of less than 0.001. The Cox & Snell R-square (.02) and Nagelkerke R-square values (0.4) identified that only a small portion of the variance between the size of financial incentives and breast cancer utilization was explained by the model. Participants who received a financial incentive of $75 had a statistically significant ($p < 0.001$) increased likelihood of utilizing breast cancer screening. Alternatively, no statistically significant

relationship was identified when the $100 and $150 incentive was provided for breast cancer screening. *(Table 23).*

H_o - Larger financial incentives paid to women Medicaid recipients residing in Baltimore, Maryland for breast cancer screening will not increase utilization compared to the likelihood of utilization when a smaller financial incentive is provided.

H_a – Larger financial incentives paid to women Medicaid recipients residing in Baltimore, Maryland for breast cancer screening will increase utilization greater than a smaller financial incentive.

Table 23

Breast Cancer Screening Utilization by Level of Financial Incentive

Research Question 2 Level of Financial Incentive	Financial Incentive Cohort			
		95% Confidence Interval		
	B (S.E.)	Lower	Odds Ratio	Upper
$75	**			
$100	Not Significant			
$150	Not Significant			

Note: *p-value < 0.05; **<0.001

Research Question 3

The third research question attempted to identify the influence of population characteristics (covariates) on breast cancer screening and financial incentives. Specific population characteristics examined included age, race, household size (number of people residing with the recipient), and Baltimore sub-region (based on the ZIP Code of the Medicaid recipient's stated residence). The approach included the predictor and covariates in the same model.

Hypothesis 3 Testing (Effects of Population Characteristics)

The model was able to correctly predict 79% of the classifications. The omnibus tests of model coefficients were statistically significant chi-square statistical significance of less than 0.001. The Cox & Snell R-square (.08) and Nagelkerke R-square values (0.13) increased as additional variables such as age, race, geographic sub-region, and household count were included in the model. Participants were found to have a statistically significant ($p < 0.001$) higher likelihood of utilizing breast cancer screening at the

$75 level when the full model (incentives and covariates) was considered. No statistically significant relationship between breast cancer screening utilization and a $100 and $150 incentive was identified when examining the full model. No statistically significant relationship was identified when examining the Baltimore sub-regions or household count covariates with breast cancer screening utilization in the full model. Alternatively, a relationship was identified between breast cancer screening utilization with race and age for the cohort that received a financial incentive. Specifically, women who are American Indian/Alaskan Native or Black are more likely to utilize breast cancer screening when a financial incentive is provided in Table 24.

H_o - Population characteristics (age, household count, geographic sub-region, and race) will not be associated with higher breast cancer screening when a financial incentive is provided.

H_a – Population characteristics (age, household count, geographic sub-region, and race) will be associated with higher breast cancer screening when a financial incentive is provided.

Table 24

Population Characteristics & Breast Cancer Screening Associated with Financial Incentives (Full Model)

Research Question 3		95% Confidence Interval		
	B (S.E.)	Lower	Odds Ratio	Upper
Any Level of Financial Incentive	0.49 (0.07)**	1.42	1.64	1.88
Financial Incentive				
$75	**			
$100	Not Significant			
$150	Not Significant			
Age	0.07 (0.02)**	1.04	1.07	1.11
Household Count	Not Significant			
Baltimore Sub-Region				
Surrounding Baltimore	*			
North Baltimore	Not Significant			
East Baltimore	Not Significant			
West Baltimore	Not Significant			
Central Baltimore	Not Significant			
Southeast Baltimore	Not Significant			
South Baltimore	Not Significant			
Race				
American Indian/Alaskan	*			
Asian/Pacific Islander	Not Significant			
Black	0.42 (0.15)*	1.13	1.52	2.03

Caucasian/White	Not Significant
Hispanic	Not Significant
Not Provided	Not Significant

Note: *p-value < 0.05; **<.001

Chapter Summary

Chapter 4 presented the results from the statistical analysis of this dissertation to assess the role of financial incentives directly provided to Medicaid recipients and the utilization of breast cancer screening.

Chapter 5: Conclusions and Recommendations

Chapter Overview

This chapter provides a summary of the study results.

Summary and Overview of the Problem

Addressing breast cancer mortality inequities associated with a person's race and health insurance can save lives, avoid harm, and reduce the total cost of cancer care. Medicaid recipients, which are largely composed of women (58%) and people of color (60%), are associated with higher rates of breast cancer mortality (Kaiser Family Foundation, 2021; Barian et al., 2021; Sujha & Chen, 2013). Breast cancer screening is a proven mechanism to identify breast cancer in its earliest stages thereby increasing women's survival rate while lowering the cost of treatment (Hendrick et al., 2019; Duffy et al., 2020; US Preventive Services Task Force, 2016; Blumen et al., 2016). However, breast cancer screening is under-utilized, especially among Medicaid recipients (National Committee on Quality Assurance, 2021; Bonafede et al., 2019).

While barriers such as requiring health insurance providers to cover screening and treatment costs as well as eliminating the need for a physician order have been largely addressed, disparities in breast cancer screening remain (Centers for Medicare and Medicare Services, 2022; American College of Radiology, 2021). The Affordable Care Act (2010) created a legal mechanism whereby Medicaid organizations can provide a financial incentive directly to their recipients to engage in preventive health behaviors such as breast cancer screening. This financial incentive has the potential to address barriers to screening such as women's fear of a positive diagnosis, physical discomfort during the test, lost wages, costs associated with attaining transportation, or requirements to ensure adult/childcare for family members is adequately addressed (Healthtalk.org, 2021; Hanson & Bondurant, 2009; Lee et al., 2014).

Although paying a financial incentive directly to a Medicaid recipient has the potential to engage them in preventive healthcare behaviors, Medicaid organizations report mixed results when describing its

efficacy (Kane, 2004; Sutherland et al., 2008; Jochelson, 2007; Liver & Brown, 2012, Slater et al., 2017; Vulimiri et al., 2019). Empirical evidence that can increase the efficacy and consistency of vulnerable Medicaid recipients utilizing breast cancer screening can save lives and reduce known breast cancer mortality disparities. It can also reduce the total cost of breast cancer care if more women are diagnosed and treated in the earlier stages of breast cancer (stage I/II) versus the later stages of breast cancer (stage III/IV). Achieving an earlier diagnosis of breast cancer requires Medicaid recipients to engage in consistent breast cancer screening. Financial incentives represent one tool that can be used to engage in breast cancer screening. However, it requires the size of the financial incentive to be the optimal amount. If the financial incentive is inadequately sized, it will be ineffective in engaging those women who are not currently obtaining preventive breast care. Alternatively, a financial incentive can be too high. An "overpayment" can increase the cost of care without any benefit because the recipient would have engaged at a lower incentive threshold.

Purpose of the Study

The present study examined the effectiveness of financial incentives and their role in increasing breast cancer screening utilization among Medicaid recipients. Specific research questions that were addressed included: 1) Do financial incentives paid to Medicaid recipients residing in Baltimore, Maryland increase breast cancer screening utilization? 2) Do larger financial incentives paid to Medicaid recipients residing in Baltimore, Maryland predict a greater utilization of breast cancer screening compared to when a smaller financial incentive is provided? And 3) Do different population characteristics among Medicaid recipients residing in Baltimore, Maryland influence the utilization of breast cancer screening when a financial incentive is provided? Specific population characteristics examined included age, the geographic sub-region of recipients' primary home, race, and the number of people reported as living with the Medicaid recipient (household count).

Review of Theory

The Gelberg-Andersen Behavioral Model for Vulnerable Populations was used as the theoretical basis for this study. The theory posits that factors associated with a vulnerable population may be the same factors that influence their access to healthcare resources (Gelberg et al., 2000). Therefore, the theory uniquely accounted for differences between those who may be described as traditional versus those who are described as vulnerable (Gelberg et al., 2000). These differences between traditional and vulnerable populations provided additional context to guide researchers, health leaders, and health policymakers to identify mutable factors that allow potential access to be realized thereby increasing the utilization of health resources.

For purposes of this study, the theory was applied to examine the role of financial incentives and their ability to influence the utilization of breast cancer screenings among Medicaid recipients. Medicaid recipients are a vulnerable population in general to health inequities, and they specifically have higher rates of breast cancer mortality associated with increased late-stage diagnoses (Lee & Jarosz, 2017; Sujha & Chen, 2013; Halpern et al., 2008; Shi et al., 2008). Medicaid recipients have lower rates of breast cancer screening contributing to breast cancer outcome disparities (National Committee of Quality Assurance, 2020).

This study examined if providing a financial incentive for breast cancer screening would increase utilization among Medicaid recipients. In addition, it attempted to provide empirical evidence supporting if a larger or smaller financial incentive increased the likelihood of Medicaid recipients having an impact on breast cancer screening utilization, and if Medicaid recipients with different population characteristics had a greater likelihood of utilizing breast cancer screening when a financial incentive was provided.

Review of Methodology

A non-experimental, retrospective quantitative study was designed and conducted for this study. Medicaid claims associated with breast cancer screenings were assessed for the years 2019 through 2022

to assess changes in utilization when a financial incentive was provided. The dependent variable was if a breast cancer screening was completed. The predictor variable was the financial incentive. While one research question evaluated if any level of financial incentive increased breast cancer screening among Medicaid recipients, a separate research question assessed change in breast cancer screening utilization by the level of financial incentive ($75, $100, and $150). A third research question assessed the role of covariates associated with breast cancer screening when a financial incentive was provided. Covariates included age, race, number of people residing with the Medicaid recipient, and the geographic sub-region of Baltimore City, Maryland. Logistic regression was used to answer research questions.

Synopsis of Major Findings

Research Question 1

The primary question considered by the study was asking if financial incentives provided to Medicaid recipients increased the utilization of breast cancer screening. The study findings were inconclusive. When examining the use of financial incentives and breast cancer screening without the covariates being included in the model, the findings from the research suggest that financial incentives may decrease breast cancer utilization rather than increase it (OR=0.27, p-value <0.001). However, when the question was further analyzed to include the covariates, financial incentives were identified as increasing the likelihood of breast cancer screening among Medicaid recipients (OR 1.64, 95% CI 1.42, 1.88; p-value <0.001). *(Table 22)*

H_1 - Financial incentives paid to women Medicaid recipients residing in Baltimore, Maryland for breast cancer screening will increase utilization.

Research Question 2

A secondary question considered if larger-sized financial incentives increased the likelihood of breast cancer screening compared to when a smaller incentive was provided. It was identified that the smaller financial incentive ($75) was statistically significant (p-value < 0.001) for increasing the likelihood

of breast cancer screening utilization while the larger financial incentives ($100 or $150) were not found to be statistically significant. *(Table 23).*

H_2 – Larger financial incentives paid to women Medicaid recipients residing in Baltimore, Maryland for breast cancer screening will increase utilization.

Research Question 3

The third question assessed if breast cancer utilization increased when a financial incentive was provided adjusting from covariates. The covariates of the Baltimore sub-region and the household count were identified to be not statistically significant in either the financial incentive or no financial incentive cohorts. Alternatively, the age (OR=1.07, 95% CI 1.04, 1.11, p-value <0.05) and race covariates were identified as being statistically significant (p-value <0.05) when a financial incentive was provided to increase breast cancer screening among Medicaid recipients. It was noted that American Indian/Alaskan Native and Black participants who received a financial incentive had a statistically significant (p-value <0.05) increase in their likelihood of utilizing breast cancer screening *(Table 24)*.

H_3 - Population characteristics (age, household count, geographic sub-region, and race) will be associated with higher breast cancer screening when a financial incentive is provided.

Contributions to the Literature

This study aimed to increase the amount of empirical evidence associated with providing financial incentives to Medicaid recipients for preventive health behaviors, specifically, breast cancer screening. While it was identified that financial incentives may decrease the utilization of breast cancer screening, it was also identified that smaller financial incentives ($75) may increase the utilization of breast cancer screening. Evidence identified that a relationship exists between breast cancer screening utilization and financial incentives for American Indians/Alaska Natives and Black recipients, which may provide additional insight regarding how to foster equity in breast cancer screening. The study suggests that proximity to the mammography location from one residence has no statistically significant impact on breast cancer screening when a financial incentive was provided.

Potential considerations for future research include 1) Examine the role of financial incentives among younger Black women, e.g., navigation programs, mobile screenings, and peer-to-peer consultations to assess and compare efficacy and costs among the program options. 2) Assess the role of financial incentives to engage women in breast cancer screening who have no history of breast cancer screening compared to women who are not current with US Preventive Services Task Force recommendations by more than 5 years. 3) Assess if women who engaged in the compensated breast cancer screening were more likely to utilize other preventive health behaviors such as annual wellness exams. And 4) Assess if the financial incentive for breast cancer screenings occurring after the initial compensated exam requires the same or a different level of financial incentive to maintain the behavior.

Research Implications

The most critical implication of the study is that paying a financial incentive to a Medicaid recipient to obtain a breast cancer screening may not be a wise investment. However, as stated earlier, the evidence from the present study is inconclusive if paying a financial incentive does or does not increase the utilization of breast cancer screening. While the higher levels of financial incentive were not found to increase the likelihood of breast cancer screening, the smaller $75 financial incentive did have a statistically significant increase in breast cancer screening utilization. More research is required to understand if other factors contributed to the finding.

Race was a key consideration in the study. Therefore, it is noteworthy that American Indian/Alaska Natives and Black women had a statistically significant response to increasing breast cancer screening utilization when a financial incentive was provided. Fostering racial equity in breast cancer outcomes is paramount to the United States healthcare policy. The findings of this study may provide needed insight for researchers, health policy analysts, and Medicaid managed care organizations who are examining all methods to engage people in preventive healthcare.

If the US Preventive Services Task Force should lower the age in their recommendation for breast cancer screening, insights from this study may support financial incentives as a mechanism to engage younger women. Specifically, the age variable was identified as having a statistically significant relationship with increasing breast cancer screening when a financial incentive is provided. While additional study is needed, the present study provides evidence that a relationship exists.

Limitations

The study's limitations include its non-experimental design and the inability to have control over the data-gathering process. A significant limitation is associated with the transition of computer systems between 2018 and 2019 that occurred at the managed care organization providing the claims data. The transition and loss of data pre-2019 disadvantaged the study for many reasons because the validity of the results would be greater if the baseline (pre-financial incentive experience) would have had a larger sample size.

Threats to Validity

The most significant threats to the study’s validity are a result of the pandemic. While fear of the pandemic may have influenced the willingness of Medicaid recipients to participate in breast cancer screenings, even when a financial incentive was provided, the change in policy allowing for consistent enrollment of Medicaid recipients was more detrimental to the study’s validity. Between 2019 and 2022, the percentage of women with non-current breast cancer screening declined from roughly 44% to 35%. It remains unclear if the increase in the number of women whose breast cancer screening was compatible with the US Preventive Services Task Force recommendation was a result of increased screening due to financial incentives or a longer amount of time with the managed care organization.

The validity of the study would have been enhanced if the cohorts had been equally sized, or if different levels of financial incentive were randomly assigned during the same time. However, the primary intent of the managed care organization was to engage recipients in preventive breast care.

Providing inconsistent financial incentives while randomizing the company's at-risk recipients would have been counter to this goal. Therefore, the existing data were used while working with experts to mitigate the risk of interpretation error.

The study navigators may have been a source of bias. The navigators assisted Medicaid recipients to schedule appointments and guide how to use the health system while collecting information and distributing gift cards. It is unclear how much of the increased adherence is due to the navigators, financial incentives, or the combination of both approaches.

Conclusions and Recommendations for Future Research

Evidence supporting a direct financial incentive for engaging Medicaid recipients in breast cancer screening remains mixed. Multiple reasons for Medicaid recipients not engaging in preventive health care exist. The provision of a financial incentive alone was never anticipated as being the remedy for engaging all Medicaid recipients in their care. Yet, evidence suggests that it could be a remedy by itself or in combination with other initiatives for some Medicaid recipients. Therefore, additional research is needed to understand how best to apply the financial incentive as a tool for recipient engagement.

Future studies may include more discernment on the population that did respond to the financial incentive for breast cancer screening. For example, how many of the Medicaid recipients received their first breast cancer screening when a financial incentive was provided? For these women, did it increase their use of other preventive health behaviors such as annual wellness visits? If breast cancer screening was identified as a gateway to obtaining additional preventive health care among women, it would have significant implications for health policy.

Approximately 15% of the women who were compensated for breast cancer screening in the study had a history of obtaining a breast cancer screening exam. Additional research identifying if a larger or smaller financial incentive increased the likelihood of their participation, as well as understanding the

number of months or years since their last screening, may provide insights that may support consistent engagement in preventive breast health.

Empirical evidence associated with the use of financial incentives to engage Medicaid recipients in preventive health behaviors is limited, and additional research must be conducted to reduce avoidable mortalities and harm as well as lower the total cost of healthcare.

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