Title: Financial hardship is associated with lower uptake of colorectal, breast, and cervical cancer screenings

Running title: Association of financial hardship and cancer screening

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Abstract

Purpose: Cancer screening uptake differs between groups in ways that cannot be explained by socioeconomic status alone. This study examined associations between material, psychosocial, and behavioral aspects of financial hardship and cancer screening behaviors.
Methods: Surveys were mailed to 7,979 people ages 18-75 who were seen in the statewide health system in Indiana. Participants reported SES, feelings about finances, and whether they had to forgo medical care due to cost. This was compared to uptake of mammogram, colonoscopy/sigmoidoscopy, and Pap testing in best-fit multivariable logistic regression analyses controlling for demographic and healthcare characteristics.
Results: 970 surveys were returned, the majority of respondents were female (54%), non-Hispanic White (75%), and over 50 years old (76%). 15% reported forgoing medical care due to cost; this barrier was higher among Black than White participants (24% vs. 13%; p=0.001). In a best fit regression model for colonoscopy/sigmoidoscopy, those who reported they had to forgo medical care due to cost had lower odds of screening (aOR=0.41; 95%CI=0.22-0.74). Forgoing medical care due to cost was not significantly associated with Pap testing in bivariate analyses. For mammogram, forgoing medical care due to cost was significant in bivariate analyses (OR=0.44; 95% CI=0.22-0.88), but was not significant in the multivariable model.
Conclusion: Associations between financial hardship and cancer screening suggest the need to reduce barriers to cancer screening even among patients who have access to healthcare. Future research should explore barriers related to both healthcare and personal costs.

Keywords: Early detection of cancer; health disparities; financial hardship; mammography; Papanicolaou test; colonoscopy

Introduction

Between 1991 and 2015, the overall cancer mortality rate in the U.S. fell 26% due, in large part, to effective early detection programs [1, 2]. Despite these advances, the American Cancer Society estimates there will be over 1.8 million new cancer cases and over 606,000 cancer deaths in the U.S. in 2020 [2]. There are significant disparities in cancer survival, particularly by socioeconomic status (SES). For example, people who live in poorer counties in the U.S. have higher overall cancer death rates than people who live in more affluent counties (13% higher for men, 3% higher for women) [3]. There has been extensive research examining the financial toxicity of cancer and the effects of financial hardship on cancer survivors [4-7]. However, few studies have examined how financial hardship is associated with cancer preventive behaviors. There is a consistent association between SES and cancer screening behaviors [8-13]. However, when discussing SES in the context of cancer prevention, SES may lack conceptual clarity as it is a multidimensional construct that cannot be measured with a single item, making the interpretation of the association between cancer screening and SES challenging [14, 15]. In addition, different measures of SES may have different associations by race, ethnic groups, gender, and age [16].

Recently, Tucker-Seeley *et al.* created a conceptual model of financial hardship in cancer prevention research [15]. This model, called the Material–Psychosocial–Behavioral Conceptual Model, takes into account both traditional measures of SES as well as psychosocial and behavioral aspects of financial hardship. It proposes three domains of financial hardship: material (i.e. financial resources the person has), psychosocial (i.e. how the person feels about those resources), and behavioral (i.e. what a person does with those financial resources). The authors suggest that cancer prevention researchers should complement traditional SES measures

(e.g. the “material” domain, including income and education) with other measures of financial hardship (e.g. “psychosocial” and “behavioral” domains including economizing financial resources by forgoing medical care due to cost). Therefore, we hypothesize that psychosocial and behavioral aspects of financial hardship will be inversely associated with uptake of cancer screenings, along with traditional material measures of SES. The purpose of the present study was to examine whether financial hardship is associated with the uptake of breast, colorectal, and cervical cancer screening while controlling for other covariates including demographic characteristics, health status, and healthcare utilization (Figure 1).

Methods

Data were collected as part of a larger study and the detailed materials and methods have been published elsewhere [17, 18]. Briefly, we conducted a population-based survey in Indiana of a stratified random sample of people ages 18-75 years old. Self-administered, paper and pencil surveys were mailed to participants in January and February, 2018. A reminder post card was mailed two-weeks later and a second copy of the survey was mailed to non-respondents one month later. We worked closely with the National Cancer Institute to determine items to include in the survey in order to facilitate harmonization of data collection, sharing, and merging across cancer centers nationwide [18]. Stratification was based on race (Black or White), geographic location (rural or urban), age group (18-49 or 50-75), and sex (male or female). Participants were eligible if they were seen at least once in the Indiana University Health (IUH) system during the previous year and lived in one of 34 Indiana counties with higher than average cancer mortality. The IUH system is a statewide integrated health care system with 19 hospitals across the state of Indiana and includes the Indiana University Simon Comprehensive Cancer Center, the only NCI-Designated Comprehensive Cancer center in Indiana. A total of 7,979 surveys were mailed and

970 were returned and included in the analysis (response rate=12%). The study was approved by the Indiana University–Purdue University Institutional Review Board.

Measures

Measures included: demographic characteristics (age, sex, race/ethnicity, born in the US, marital status, rural/urban geographic location [defined using the Rural-Urban Commuting Area codes]), and healthcare variables (general health, usual place for healthcare, health insurance status, and ever been diagnosed with cancer). Material (objective) measures of financial hardship included home ownership, education, income, and occupational status. The psychosocial (subjective) measure of financial hardship included a single item asking about their perceptions of the adequacy of their income with the question, "Which of these comes closest to your own feelings about your household's income these days?" with response options on a 4-point Likert scale from "living comfortably on present income" to "finding it very difficult on present income." Finally, the behavioral measure of financial hardship included the item "Was there a time in the past 12 months when you needed to see a doctor, but could not because of cost?" with binary yes/no response options.

This study focused on breast, colorectal, and cervical cancer screening. We used United States Preventive Services Task Force (USPSTF) recommendations to define whether the participant had engaged in that behavior. For breast cancer screening, we examined women 50-74 years old, and they were considered up-to-date if they had a mammogram in the last 2 years [19]. For colorectal cancer (CRC) screening, we examined anyone 50-75 years old and they were considered up-to-date in CRC screening if they reported having had a fecal blood test in the last 12 months, a sigmoidoscopy in the last 5 years, or a colonoscopy in the last 10 years [20]. For cervical cancer screening, we examined women 21-65 years old who had not had a hysterectomy

and they were considered up-to-date if they had a Papanicolou (Pap) test in the last 3 years or had an HPV test in the last 5 years [21].

Statistical Analyses

First, we assessed if uptake of the cancer screenings was associated with any of our covariates in bivariate logistic regression analyses conducted separately for each cancer site. Then, for each cancer site, we conducted multivariable logistic regression analyses with a backward elimination to create a best fit model. A p-value ≤0.1 was needed to stay in the model. All analyses were conducted using SPSS v24.

Results

The final analytic sample consisted of 970 responses. Over half of participants were female (54%; n=522); the majority were over 50 years old (76%; n=735), and were non-Hispanic White (n=709; 75%). For healthcare variables, participants reported good overall health with a majority stating their current health was either good (42%; n=408), very good (24%; n=229), or excellent (5%; n=48). Almost the entire sample had some form of health insurance (94%; n=888) and approximately one-fourth (24%; n=227) reported a previous history of any cancer diagnosis. For material measures of financial hardship, approximately one-fifth (21%; n=177) made less than $20,000 per year while almost one-third (29%; n=250) made over $75,000 per year. Most respondents were either employed (40%; n=369) or retired (33%; n=303) and only 8% (n=71) reported having less than a high school diploma or GED. For psychosocial measures of financial hardship, most reported they were either living comfortably on their present income (38%; n=345) or getting by on their present income (36%; n=329) while a smaller percentage indicated they were finding it either difficult or very difficult to get by on their present income (18% and

9%, respectively). For behavioral measures of financial hardship, 15% indicated there was a time in the last 12 months in which they needed to see a doctor, but could not because of cost, and this was higher among Black than White participants (24% vs. 13%; p=0.001).

Thirty-six percent (n=353) of the study sample were eligible for breast cancer screening and of those, 80% (n=276) had received a mammogram in the last two years. Approximately three-quarters (76%; n=732) were eligible for CRC screening and, of those, 80% (n=571) were up-to-date on CRC screening. Only 25% (n=239) of the sample was eligible for cervical cancer screening and, of those, 80% (n=182) had a Pap test in the last 3 years or an HPV test in the last 5 years. For the entire sample description, see Table 1.

Breast Cancer Screening

In bivariate comparisons, the only variables that were significantly associated with having a mammogram in the last 2 years were health insurance status and the psychosocial and behavioral measures of financial hardship. Specifically, those without any type of health insurance coverage had lower odds of having a mammogram in the last two years as compared to those who had health insurance (OR=0.28; 95% CI= 0.09-0.85). Furthermore, participants reporting they were finding it very difficult on their present income had significantly lower odds of having a mammogram compared to those who reported living comfortably on their present income (OR=0.31; 95% CI= 0.12-0.80). Those who reported that they needed to see a doctor in the past year, but could not due to cost had lower odds of having a mammogram (OR=0.44; 95% CI=0.22-0.88).

In the multivariable regression analysis for breast cancer screening, health insurance status and feelings about income were no longer significant at $p<0.1$ and were removed from the

model. Both the inability to see a doctor because of cost and income remained in the model, but were not statistically significant at $p<0.05$. Several demographic variables became significant in the adjusted model, including age (aOR=2.13; 95% CI=1.05-4.34 for 65+ compared to 50-64 years old), and marital status (aOR=3.52; 95% CI= 1.59-7.78 for those who were not partnered compared to partnered). For complete results, see Table 2.

Colorectal Cancer Screening

In bivariate analyses, more variables were associated with CRC screening than with breast cancer screening. None of the demographic characteristics or healthcare variables were significantly associated with being up-to-date with CRC screening in bivariate analyses. Measures of material hardship that were significantly associated with CRC screening included homeownership (OR=0.50; 95% CI=0.33-0.77 for renting vs. owning), education (OR=4.79; 95% CI=2.02-11.36 for college graduate vs. less than GED), income (OR=5.41; 95% CI=2.29-12.77 for those earning $100,000 or more vs. $19,999 or less), and occupational status (OR=0.36; 95% CI=0.19-0.70 for not currently employed vs. employed). Both psychosocial and behavioral measures of financial hardship were significantly associated with being up-to-date with CRC screening. Those who reported finding it very difficult on their present income had lower odds of being up-to-date with CRC screening compared to those who were living comfortably on their present income (OR=0.19; 95% CI= 0.10-0.36). Those who had to forgo medical care due to cost had lower odds of being up-to-date with CRC screening compared to those who did not forgo medical care due to cost (OR=0.35; 95% CI= 0.22-0.57).

In the best fit model, marital status was the only demographic variable that remained in the model; those who did not have a partner had higher odds of being up-to-date on CRC screening than those who were partnered (aOR=1.77; 95% CI=1.04-3.01). Two material

measures of financial hardship that remained in the model included income (aOR=9.33; 95% CI=3.28-26.50 for those earning $100,000 or more vs. $19,999 or less), and occupational status (aOR=1.92; 95% CI=1.10-3.38 for retired vs. employed). For behavioral measures of financial hardship, those who reported they had to forgo medical care due to cost in the past year had lower odds of CRC screening compared to those who did not forgo care (aOR=0.41; 95% CI= 0.22-0.74). Neither the psychosocial measure of financial hardship nor any of the healthcare variables remained in the best fit model. For complete results, see Table 2.

Cervical Cancer Screening

Only two variables were significantly associated with being up-to-date with cervical cancer screening in bivariate analyses: age and health insurance. Compared to the youngest group (21-34 year olds), women aged 50-64 years had lower odds of cervical cancer screening (OR=0.28; 95% CI=0.09-0.85). Similarly, uninsured women had lower odds of cervical cancer screening compared to those with health insurance (OR=0.35; 95% CI= 0.13-0.96).

Both age and health insurance remained in the multivariable regression model. Women who were 50-64 years old had lower odds of cervical cancer screening compared to the youngest group (aOR=0.24; 95% CI=0.07-0.86), and those without health insurance had lower odds of screening compared to those with insurance (aOR=0.15; 95% CI=0.04-0.53). Occupational status was also in the model, although it was not significant at $p<0.05$. Having a usual place for healthcare became significant; those without a usual place for healthcare had lower odds of being up-to-date with cervical cancer screening compared to those who did have a usual place for healthcare (aOR=0.16; 95% CI=0.03-0.75).

Discussion

This study examined cancer preventive behaviors in the context of material, psychosocial, and behavioral aspects of financial hardship. Traditionally, researchers have only measured variables in the material domain of financial hardship and fail to account for the psychosocial and behavioral domains. Socioeconomic status is a multidimensional construct and may not fully explain the financial implications related to a patient's cancer preventive behaviors. Our study showed that the behavioral domain, in particular, was consistent with our hypothesis and was inversely associated with cancer screenings. Specifically, for breast and colorectal cancer screening, having to forgo medical care due to cost was independently associated with screening, even when controlling for health insurance status. Furthermore, this variable was significantly associated with both breast and CRC screening, whereas traditional objective measures of SES (e.g. education, homeownership), were not statistically significant. This indicates that material, behavioral, and psychosocial measures of financial hardship are complimentary and it is important to take subjective measures of SES, including psychosocial and behavioral aspects of financial hardship, into account along with objective measures of income, education, and other variables in the material domain.

Our data show that variables in the material domain were significantly associated with CRC screening. Specifically, CRC was the only cancer screening that was significantly associated with both income and occupational status. CRC screening may be especially sensitive to financial hardship, and the material measures of financial hardship, because there are not public programs to support population-based screening for CRC among the underserved, as there are for breast and cervical cancer screening. Specific to our study population in Indiana, there is the Indiana Breast & Cervical Cancer Screening (BCCS) program, which is the Indiana implementation of the National Breast and Cervical Cancer Early Detection Program. This

program provides uninsured and underinsured women in Indiana access to breast and cervical cancer screening, diagnostic testing, and treatment [22]. The lack of public programs for CRC screening may result in people economizing CRC screening, whereas that would not be the case due to the public programs for breast and cervical cancer screening. A state-based screening program focused on the uninsured, modeled after the BCCS program may be a reasonable policy response to increase CRC screening rates.

Notably, while being unable to see a doctor because of the cost was significantly higher for non-Hispanic Black participants compared to non-Hispanic White participants (24% vs 13%), race/ethnicity was not significant in the best-fit model for any of the three cancer screening behaviors and was removed during backward elimination. Our data showed that when adjusting for other demographic characteristics as well as the material, psychosocial, and behavioral aspects of financial hardship, race/ethnicity was not associated with being up-to-date on any of the three cancer screenings we examined. There are significant health disparities in cancer screening for racial and ethnic minorities and for those born outside of the U.S. [23, 24]. Specifically, data from the Surveillance Epidemiology and End Results (SEER) databased showed that White patients were diagnosed at earlier stages than African American patients for 31 out of the 34 tumor sites examined [25]. However, studies examining breast, cervical, and CRC screening at health centers in the U.S. found racial and ethnic minorities had higher odds of screening than White patients [26]. The authors of this study indicate this may be because health centers are fulfilling an important safety-net role in reducing racial/ethnic disparities in cancer screening. Another study reported that increasing access to care may not be sufficient in reducing racial/ethnic disparities in CRC screening, and suggested other structural and cultural factors may be inhibiting screening [27]. One such factor may be racial discrimination, which has been

found to be an important issue across racial/ethnic groups and women who reported racial discrimination had lower odds of receiving a clinical breast exam in an adjusted model [28]. While our study did not collect data on perceived racial discrimination, our data do show that race/ethnicity was not associated with being up-to-date on cancer screenings when accounting for financial hardship. This may indicate racial disparities in cancer screening identified in epidemiologic studies would benefit from additional analyses of data on perceived racial discrimination and financial hardship to provide context to the findings and elucidate the relationship between financial hardship, cancer screening, and racial disparities.

This statewide survey provides important information on the complementary aspects of three domains of financial hardship (material, psychosocial, and behavioral) and the association with cancer screening behaviors. However, results should be interpreted in light of some limitations. First, this sample was more affluent than the general population in Indiana. Specifically, our sample had higher income and education and fewer uninsured than the general population in Indiana [29]. Therefore, our results may not be generalizable to the broader population and the prevalence of hardship may be higher than what is documented in our results. However, because we controlled for these variables in our multivariable analyses, this should not have affected the relationships between financial hardship and cancer screening behaviors. Second, our sample included patients who had been seen in a single, statewide health system. Therefore, patients being seen in other health systems or who were not accessing care at all are not represented. However, this health system is the largest health system in Indiana and serves patients throughout the state. Third, we used logistic regression to examine the binary screening outcome. Because this was a common outcome, the odds ratio may overestimate the prevalence ratio. However, because we have a binary outcome, we opted not to use a modified Poisson

regression due to the risk of bias.[30] Fourth, the data were self-report and are therefore subject to social desirability and recall bias. Fifth, the original survey design was not guided by the Tucker-Seeley model and some of the wording of the measures could have been altered to more clearly delineate model constructs [15]. However, we believe the variables we used did accurately reflect the intent of the model constructs. Lastly, the response rate for the survey was low and respondents were more likely to be White, older, female, and live in rural areas, limiting generalizability. While we did receive responses from all of Indiana's 92 counties, future studies should focus on recruiting populations that are racial/ethnic minorities, younger, and urban.

Conclusion

This study examined the associations between financial hardship and the uptake of colorectal, breast, and cervical cancer screening. While previous studies only examined variables in the material domain of financial hardship (e.g. income, education), this study additionally measured variables in the psychosocial and behavioral domains of financial hardship. We found that, specifically, needing to see a doctor and being unable to because of the cost was more strongly associated with uptake of cancer screenings than most material measures of financial hardship. This indicates people may have to "economize" cancer screenings if they feel they are not living comfortably on their present income. Future research would benefit from a more nuanced measure of socioeconomic status and financial hardship that incorporates the psychosocial and behavioral aspects of financial hardship to increase uptake of cancer screenings. Understanding these differences will give a more holistic picture and may be an important step to addressing disparities in cancer screening behaviors.

Declarations

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Conflicts of Interest: The authors declare no potential conflicts of interest.
Availability of data and material: The data that support the findings of this study are available, upon reasonable request.

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Table 1. Sample Description (n=970)

Variable	**n(%)**
Demographic Characteristics	
Age	
18-34	105 (10.8)
35-49	130 (13.4)
50-64	380 (39.2)
65+	355 (36.6)
Sex	
Male	448 (46.2)
Female	522 (53.8)
Race/ethnicity	
Non-Hispanic White	709 (75.3)
Non-Hispanic Black	179 (19.0)
Non-Hispanic Other (including multiracial)	35 (3.7)
Hispanic (of any race)	19 (2.0)
Born in the U.S.	
Yes	920 (97.6)
No	23 (2.4)
Marital status	
Partnered (married, living as married)	571 (60.7)
Not partnered (divorced, widowed, separated, never married)	369 (39.3)
Geographic Location	
Rural	523 (53.9)
Urban	447 (46.1)
Healthcare Variables	
General health	
Excellent	48 (5.0)
Very good	229 (23.7)
Good	408 (42.2)
Fair	217 (22.4)
Poor	65 (6.7)
Usual place for healthcare	
Yes (including more than one)	857 (91.7)
No	78 (8.3)
Health insurance (any)	
Yes	888 (94.2)
No	55 (5.8)
Ever been diagnosed with cancer	
Yes	227 (23.8)
No	726 (76.2)
Eligible for breast cancer screening (yes)[a]	353 (36.4)
Of those eligible, ever received a mammogram (yes)[b]	338 (97.4)
Of those eligible, received a mammogram in the last 2 years (yes)	276 (79.8)

Eligible for colorectal cancer screening (yes)[c]	732 (75.5)
Of those eligible, ever received colorectal cancer screening (yes)[d]	615 (84.0)
Of those eligible, received either blood stool test in the last 12 months, sigmoidoscopy in the last 5 years, or colonoscopy in the last 10 years	571 (80.1)
Eligible for cervical cancer screening (yes)[e]	239 (24.6)
Of those eligible, ever received cervical cancer screening (yes)[f]	225 (94.1)
Of those eligible, had a Pap in the last 3 years or had HPV test in the last 5 years (yes)	182 (80.2)
Material Domain	
Homeownership	
Own	638 (68.4)
Rent	219 (23.5)
Occupied without paying monetary rent	76 (8.1)
Education	
Less than GED	71 (7.8)
Completed high school or GED	260 (28.4)
Some college or vocational training	253 (27.6)
College graduate	192 (21.0)
Postgraduate	140 (15.3)
Income	
$0-19,999	177 (20.5)
$20,000-34,999	141 (16.3)
$35,000-49,999	127 (14.7)
$50,000-74,999	170 (19.7)
$75,000-99,999	107 (12.4)
$100,000+	143 (16.5)
Occupational status	
Employed	369 (40.0)
Not earning income (unemployed, homemaker, student, other)	104 (11.3)
Retired	303 (32.8)
Disabled	147 (15.9)
Psychosocial Domain	
Feelings about income	
Living comfortably on present income	345 (37.7)
Getting by on present income	329 (35.9)
Finding it difficult on present income	161 (17.6)
Finding it very difficult on present income	81 (8.8)
Behavioral Domain	
Needed to see doctor and couldn't because of cost (last 12 months)	
Yes	142 (15.1)
No	798 (84.9)

[a]Eligible for breast cancer screening based on current USPSTF guidelines- women between the ages of 50 and 74

[b]Reported ever having a mammogram

[c]Eligible for colorectal cancer screening based on current USPSTF guidelines- between the ages of 50 and 75
[d]Reported ever having a blood stool test, sigmoidoscopy, or colonopscopy
[e]Eligible for cervical cancer screening based on current USPSTF guidelines- women between the ages of 21 and 65 who have never had a hysterectomy
[f]Reported ever having had a Papanicolou (Pap) test or HPV test

Table 2. Logistic regression analyses for uptake of breast, colorectal, and cervical cancer screening

	Breast cancer screening (mammogram in the last 2 years; n=353)		Colorectal cancer screening (blood stool test [12 months], sigmoidoscopy [5 years], or colonoscopy [10 years]; n=732)		Cervical cancer screening (had a Pap in the last 3 years or HPV in last 5 years; n=239)	
	Bivariate comparisons OR(95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)
Demographic Characteristics						
Age				[a]		
21-34	n/a	n/a	n/a		Ref.	Ref.
35-49	n/a	n/a	n/a		0.52 (0.15-1.82)	0.60 (0.15-2.40)
50-64	Ref.	Ref.	Ref		**0.28 (0.09-0.85)**	**0.24 (0.07-0.86)**
65+	1.51 (0.88-2.58)	**2.13 (1.05-4.34)**	1.44 (0.99-2.10)		n/a	n/a
Sex	n/a	n/a		[a]	n/a	n/a
Male	n/a	n/a	Ref.		n/a	n/a
Female	n/a	n/a	0.73 (0.51-1.06)		n/a	n/a
Race/ethnicity		[a]		[a]		[a]
Non-Hispanic White	Ref.		Ref.		Ref.	
Non-Hispanic Black	1.09 (0.56-2.10)		0.87 (0.55-1.38)		1.43 (0.59-3.47)	
Non-Hispanic Other (including multiracial)	1.01 (0.21-4.92)		0.86 (0.34-2.18)		1.84 (0.22-15.47)	

	Breast cancer screening (mammogram in the last 2 years; n=353)		Colorectal cancer screening (blood stool test [12 months], sigmoidoscopy [5 years], or colonoscopy [10 years]; n=732)		Cervical cancer screening (had a Pap in the last 3 years or HPV in last 5 years; n=239)	
	Bivariate comparisons OR(95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)
Hispanic (of any race)	0.25 (0.02-4.12)		1.47 (0.18-12.33)		1.05 (0.11-9.72)	
Born in the U.S.		[b]		[a]		[a]
Yes	Ref.		Ref.		Ref.	
No	[b]		1.37 (0.30-6.26)		0.61 (0.12-3.26)	
Marital status						
Partnered (married, living as married)	Ref.	Ref.	Ref.	Ref.	Ref.	[a]
Not partnered (divorced, widowed, separated, never married)	1.44 (0.81-2.57)	**3.52 (1.59-7.78)**	0.84 (0.57-1.23)	**1.77 (1.04-3.01)**	0.99 (0.51-1.94)	
Geographic Location		[a]		[a]		[a]
Rural	Ref.		Ref.		Ref.	
Urban	1.66 (0.97-2.84)		1.57 (1.08-2.30)		1.40 (0.72-2.70)	
Healthcare Variables						
General health		[a]		[a]		[a]
Excellent	Ref.		Ref.		Ref.	
Very good	2.60 (0.70-9.63)		1.34 (0.53-3.41)		0.33 (0.04-2.7)	
Good	1.31 (0.40-4.36)		1.45 (0.60-3.54)		0.24 (0.03-1.97)	

	Breast cancer screening (mammogram in the last 2 years; n=353)		Colorectal cancer screening (blood stool test [12 months], sigmoidoscopy [5 years], or colonoscopy [10 years]; n=732)		Cervical cancer screening (had a Pap in the last 3 years or HPV in last 5 years; n=239)	
	Bivariate comparisons OR(95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)
Fair	0.82 (0.24-2.81)		0.78 (0.32-1.94)		0.16 (0.02-1.29)	
Poor	1.17 (0.24-5.70)		0.76 (0.27-2.15)		0.19 (0.01-2.47)	
Usual place for healthcare		[a]		[a]		
Yes (including more than one)	Ref.		Ref.		Ref.	Ref.
No	0.24 (0.08-0.70)		0.85 (0.39-1.82)		0.47 (0.13-1.62)	**0.16 (0.03-0.75)**
Health insurance (any)		[a]		[a]		
Yes	Ref.		Ref.		Ref.	Ref.
No	**0.28 (0.09-0.85)**		0.45 (0.20-1.04)		**0.35 (0.13-0.96)**	**0.15 (0.04-0.53)**
Ever been diagnosed with cancer		[a]		[a]		[a]
Yes	Ref.		Ref.		Ref.	
No	0.86 (0.48-1.57)		0.72 (0.47-1.11)		1.21 (0.49-3.02)	
Material Domain						
Homeownership		[a]		[a]		[a]
Own	Ref.		Ref.		Ref.	
Rent	0.88 (0.47-1.66)		**0.50 (0.33-0.77)**		1.33 (0.59-3.00)	

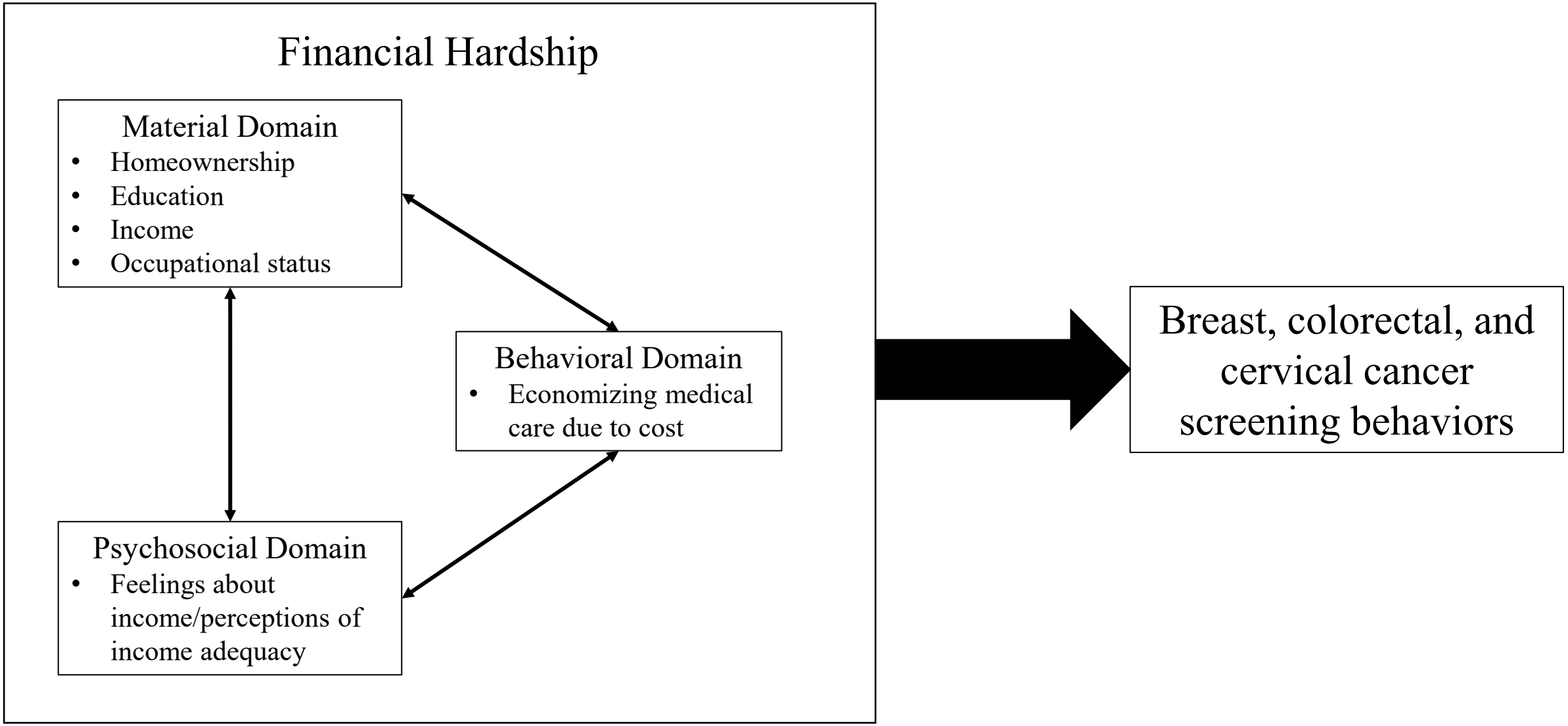
	Breast cancer screening (mammogram in the last 2 years; n=353)		Colorectal cancer screening (blood stool test [12 months], sigmoidoscopy [5 years], or colonoscopy [10 years]; n=732)		Cervical cancer screening (had a Pap in the last 3 years or HPV in last 5 years; n=239)	
	Bivariate comparisons OR(95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)
Occupied without paying monetary rent	0.70 (0.18-2.69)		**0.44 (0.19-1.00)**		1.15 (0.31-4.29)	
Education		[a]		[a]		[a]
Less than GED	Ref.		Ref.		Ref.	
Completed high school or GED	0.71 (0.24-2.10)		1.28 (0.66-2.45)		1.50 (0.32-7.14)	
Some college or vocational training	0.81 (0.28-2.43)		1.51 (0.78-2.92)		2.83 (0.60-13.44)	
College graduate	1.73 (0.51-5.87)		**4.79 (2.02-11.36)**		2.39 (0.53-10.79)	
Postgraduate	1.10 (0.33-3.60)		**3.86 (1.66-9.01)**		1.55 (0.33-7.37)	
Income						[a]
$0-19,999	Ref.	Ref.	Ref.	Ref.	Ref.	
$20,000-34,999	0.77 (0.33-1.76)	0.55 (0.20-1.53)	1.32 (0.74-2.36)	1.92 (0.97-3.81)	0.91 (0.28-2.94)	
$35,000-49,999	1.27 (0.51-3.20)	1.11 (0.37-3.37)	1.48 (0.80-2.75)	**2.48 (1.16-5.31)**	0.41 (0.12-1.34)	
$50,000-74,999	0.95 (0.37-2.44)	0.80 (0.26-2.49)	**2.70 (1.42-5.11)**	**3.86 (1.76-8.45)**	0.92 (0.28-3.07)	
$75,000-99,999	2.79 (0.73-10.67)	2.99 (0.68-13.11)	**2.85 (1.28-6.33)**	**5.23 (1.98-13.82)**	1.00 (0.29-3.48)	
$100,000+	2.77 (0.92-8.40)	3.09 (0.85-11.27)	**5.41 (2.29-12.77)**	**9.33 (3.28-26.50)**	1.13 (0.34-3.75)	

	Breast cancer screening (mammogram in the last 2 years; n=353)		Colorectal cancer screening (blood stool test [12 months], sigmoidoscopy [5 years], or colonoscopy [10 years]; n=732)		Cervical cancer screening (had a Pap in the last 3 years or HPV in last 5 years; n=239)	
	Bivariate comparisons OR(95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)
Occupational status		†				
Employed	Ref.		Ref.	Ref.	Ref.	Ref.
Not earning income (unemployed, homemaker, student, other)	1.02 (0.35-2.97)		**0.36 (0.19-0.70)**	0.62 (0.28-1.36)	3.38 (0.76-15.02)	4.55 (0.86-23.89)
Retired	0.80 (0.43-1.51)		1.33 (0.84-2.11)	**1.92 (1.09-3.38)**	0.43 (0.16-1.19)	0.38 (0.12-1.22)
Disabled	0.51 (0.23-1.11)		0.71 (0.42-1.22)	1.82 (0.87-3.77)	0.58 (0.23-1.46)	0.67 (0.24-1.88)
Psychosocial Domain						
Feelings about income		a		a		a
Living comfortably on present income	Ref.		Ref.		Ref.	
Getting by on present income	0.53 (0.28-1.02)		**0.52 (0.32-0.86)**		0.87 (0.42-1.84)	
Finding it difficult on present income	0.51 (0.23-1.12)		**0.37 (0.21-0.65)**		0.97 (0.37-2.58)	
Finding it very difficult on present income	**0.31 (0.12-0.80)**		**0.19 (0.10-0.36)**		3.16 (0.39-25.78)	
Behavioral Domain						

	Breast cancer screening (mammogram in the last 2 years; n=353)		Colorectal cancer screening (blood stool test [12 months], sigmoidoscopy [5 years], or colonoscopy [10 years]; n=732)		Cervical cancer screening (had a Pap in the last 3 years or HPV in last 5 years; n=239)	
	Bivariate comparisons OR(95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)	Bivariate comparisons OR (95% CI)	Best Fit Regression Model aOR(95% CI)
Needed to see doctor and couldn't because of cost (last 12 months)						[a]
No	Ref.	Ref.	Ref.	Ref.	Ref.	
Yes	**0.44 (0.22-0.88)**	0.41 (0.16-1.06)	**0.35 (0.22-0.57)**	**0.41 (0.22-0.74)**	0.78 (0.35-1.72)	

[a]Not significant at p≤0.01, removed from model
[b]Not assessed due to insufficient sample

Figure 1. Conceptual Model


Financial Hardship
Material Domain
• Homeownership
• Education
• Income
• Occupational status
Behavioral Domain
• Economizing medical care due to cost
Psychosocial Domain
• Feelings about income/perceptions of income adequacy
Breast, colorectal, and cervical cancer screening behaviors