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Examining Associations between Mental Health Symptoms with Cancer Screening
Behavior and the Moderating Role of Social Support in a Population-based Sample

By

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By

Rhyan Vereen

Bachelor of Science
East Carolina University
2013

Faculty Thesis Advisor: Kevin Ward, PhD

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health in Epidemiology
2015

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of research and interventions, disparities in cancer mortality still remain. In order to
further decrease the burden of cancer, it is necessary to continue identifying factors that
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regression models were used to determine the association between psychological distress
and cancer screening behavior adjusting for demographic, health related, self efficacy,
and social support variables. Interaction between psychological distress and social
support was also assessed. All analyses were weighted and run separately using two
different domains: colorectal cancer screening-eligible and mammography- eligible.

Results: Among 1,735 participants in the colorectal cancer screening-eligible domain,
472 (28.7%) reported some amount of psychological distress. Out of 1,398 participants in
the mammography-eligible domain, 451 (33.5%) reported some amount of psychological
distress. Psychological distress was not significantly associated with colorectal cancer
screening (Adjusted OR: 0.94, 95% CI: 0.55, 1.63) or mammography (Adjusted OR:
1.21, 95% CI: 0.75, 1.97). There was no moderation by emotional or informational
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health symptoms and cancer screening may only be present in particular groups of
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inform intervention strategies and efforts to increase screening and decrease the burden of
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<u>Acknowledgements</u>

I would like to thank my field thesis advisor, Dr. Kassandra Alcaraz, for dedicating her time and efforts to guiding me through my thesis process and providing unique insights and ideas. I would also like to thank her for encouraging me to think "outside of the box" and supporting me in my endeavors to become a leader in the field of disparities research.

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Chapter I: Background and Literature Review

Breast and Colorectal Cancer

Cancer remains the second leading cause of death in the United States. It is estimated that 1,658,370 new cases of cancer will be diagnosed in 2015, including 231, 840 cases of invasive breast cancer, 93,090 cases of colon cancer, and 39,610 cases of rectal cancer (1).

Breast cancer is the second leading cause of cancer death in women in the United States (1). Mortality rates decreased by about 1.9% between 2002-2011, however, breast cancer incidence remained stable at about 128 per 100,000 women (2), making it the most frequently diagnosed cancer in women, after skin cancer (1). Despite the overall decrease in cancer mortality, the burden of cancer is inequitably distributed across groups of women. For example, women who have been diagnosed with breast cancer that live in lower income areas have a significantly lower 5 year survival rate than women diagnosed living in areas with higher income (3, 4). Disparities also commonly exist by race/ethnicity. Despite having a lower incidence rate than White women, African American women have twice the risk of developing breast cancer and a 3 times higher risk of dying from breast cancer (5, 6).

Colorectal cancer is the third most commonly diagnosed cancer, as well as the third leading cause of cancer death in both men and women (1). Similar to the trend seen in breast cancer, the burden of colorectal cancer is also unequally distributed. Incidence and mortality rates have decreased, however, African Americans continue to have the highest incidence and mortality rates when compared to Whites, Asian/ Pacific Islanders, American Indian/ Alaskan Natives, and Hispanic-Latinos (7). African Americans are

also more likely to be diagnosed at later stages and earlier ages (8). Socioeconomic status is also associated with colorectal cancer risk. In a longitudinal study of American Association of Retired Persons (AARP) participants, investigators found that the rate of colorectal cancer was 1.19 (95% Confidence Interval [CI]: 1.07, 1.31) times higher in participants with less than 12 years of education than participants with postgraduate studies. In the same study, investigators concluded that neighborhood socioeconomic status was also associated with colorectal cancer risk in that the rate of colorectal cancer was 1.16 (95% CI: 1.05, 1.28) times higher in participants living in the most socioeconomically deprived neighborhoods than those living in the least deprived neighborhoods (9).

Despite decades of research devoted to determining risk factors associated with cancer incidence and excess mortality, breast and colorectal cancer continue to be a burden in the United States. Although overall breast and colorectal cancer mortality has declined, these cancers continue to disproportionately affect different socio-demographic groups. Additional research is needed to elucidate factors contributing to these disparities.

Cancer Screening

One factor contributing to the differential burden of breast and colorectal cancer is differences in screening behaviors. Screening (that can result in early detection of cancer) has been confirmed to reduce mortality for breast (10-12) and colorectal cancers (13, 14). A National Cancer Institute review of randomized control trials concluded that mammography screening leads to a 15-20% relative reduction in mortality and that screening is a strong method of prevention for colorectal cancer, with fecal occult blood

testing leading to a 15-33% relative reduction in mortality and sigmoidoscopies and colonoscopies leading to a 28% and about 60-70% relative reduction in mortality, respectively (14). The current overall reduction in mortality of these cancers is, in part, due to increased use of cancer screening (13, 15); though, the reduction has not been the same across different socio-demographic groups.

The American Cancer Society currently recommends annual mammography in women starting at age 40. Screening recommendations for colorectal cancer are more specific to the individual. Depending on doctor recommendations and individual preference, a colonoscopy every 10 years, flexible sigmoidoscopy every 5 years, double contrast barium enema every 5 years, a CT colonography every 5 years, and/ or a combination of fecal tests are encouraged in both men and women beginning at age 50 (16). With the evidenced benefit of cancer screening, it is important to understand and ameliorate underutilization of screening to help decrease disparities in breast and colorectal cancer.

Increasing cancer screening is a national public health priority. One objective of Healthy People 2020 is to increase the proportion of women who receive breast cancer screening based on current screening guidelines to 81.1 percent (17). Despite evidence demonstrating the benefits of screening, national data indicate the current percentage of females meeting these recommendations is low. For example, the Centers for Disease Control and Prevention reported that only 73.2% of African American women, 69.7% of Hispanic women, 69.4% of American Indian/ Alaska Native women, and 64.1% of Asian women were screened for breast cancer in 2010 (18). Lower rates also persist in women who are uninsured, have a low education level, have a low-income, and/ or do not have a

usual source of healthcare (19, 20). One study found that in 2002, women with higher income and women with health insurance were 3 times more likely to have had a mammogram in the past two years when compared to women with a low income and those who were uninsured (OR: 3.01, CI: 2.69, 3.36 and OR: 3.38, CI: 3.10,3.69, respectively) (19).

Similar trends are seen in colorectal cancer screening. Healthy People 2020 has an objective of increasing the proportion of people receiving guideline adherent colorectal screening to 70.5 percent (17). A recent study using a nationally representative sample found that 62% of Whites, 59% of Blacks, 54.6% of Native Hawaiian/ Pacific Islanders, 52.5% of English speaking Hispanics, 49.5% of American Indian/ Alaska Natives, and 47.2% of Asians were up to date on colorectal cancer screening (21). All groups were well below the Healthy People 2020 objective. Beyond race/ethnicity, studies have found additional factors associated with low colorectal cancer screening: being uninsured (20, 22), not having a usual source of care (20), low educational attainment (21, 22), low income (21, 22), and living in a rural area (22, 23). For example, the odds of having been screened for colorectal cancer were 1.19 (95% CI: 1.06, 1.34) times higher in participants who lived in an urban area than those that lived in a rural area (23). These findings provide evidence of disparities in cancer screening.

Despite decades of research and numerous programs enlisted to address these disparities, screening rates remain below Healthy People 2020 objectives. Better understanding of disparities in screening behavior can inform evidence-based strategies to increase screening in different socio-demographic groups. Although frequently assessed in cancer patients, fewer studies have explored the influence of mental health

symptoms on cancer screening behavior in populations who have not been diagnosed with cancer.

Mental Health Symptoms and Cancer Screening Behavior

Researchers continue to explore factors that may explain why some individuals get screened for cancer, while others do not. Compared to fear, worry, and anxiety surrounding cancer screenings (24), psychosocial factors such as depression and anxiety symptoms associated with every day life are less frequently explored to explain differential screening.

World Health Organization previously stated that mental illness accounts for more disability in developed countries than any other group of illnesses (25). In 2012, the National Institute of Mental Health estimated that 18.6% of adults in the United States had a diagnosable mental health illness (26); however, less is known about the population of people with mental health symptoms that do not have a formal diagnosis. Mental health is of interest as a predictor of cancer screening because mental health plays a role in determining one's thoughts and behaviors.

Psychological distress is a term used to define the state of emotional suffering characterized by depressive and anxiety symptoms (27). Although not as commonly studied as formally diagnosed mental health disorders, current literature on psychological distress suggests that these symptoms may affect cancer-screening behavior.

For example, in a review of 24 publications, researchers used 41 analyses to conclude that overall, women with mental illness (including mood disorders, serious mental illness, and/or psychological distress) were significantly less likely to receive mammography screening than women in the general population (pooled OR: 0.71, 95%

CI: $0.66, 0.77$) (28). When further exploring associations for individual mental health disorders, researchers found that women with mood disorders (depression or anxiety under diagnostic criteria DSM-IV or ICD 10) and women who had a serious mental illness (such as schizophrenia or psychosis under diagnostic criteria DSM-IV or ICD 10) were less likely to have been screened (pooled OR: 0.83, 95% CI: $0.76, 0.90$ and pooled OR: 0.54, 95% CI: $0.45, 0.65$, respectively). However, distress was not a significant predictor of mammography use (28).

Findings from research relating to mental health symptoms have been inconsistent. For example, in a study of high-risk women, researchers concluded that general anxiety was not associated with compliance with mammography (29). In contrast, a study of women with a family history of breast cancer (30) and a study of women living in Los Angeles (31) both found general psychological distress to be associated with decreased mammography use. Varying findings in the association between mental health symptoms and mammography use can be attributed to the definition of mental health symptoms used and the many different populations used for analyses. Additional research is need on a general population of women to further explain the plausibility of this association.

Similar to findings in the mammography studies, the results of studies using colorectal cancer screenings as an outcome have also been varied. Some studies have found a lack of association between mental health symptoms and colorectal cancer screening (32, 33) while others have found associations in both directions: positive (34, 35) and negative (36, 37). For example, using a nationally representative sample, Calderwood, Bacic, Kazis and Cabral (34) found that the odds of having had a current

colonoscopy were 1.3 (95% CI: 1.1, 1.7) times higher in participants with a self reported history of depressive symptoms than in participants without a history of depressive symptoms. However, using a sample of women in California, O'Donnell, Goldstein, Dimatteo, Fox, John and Obrzut (30) concluded that as psychological distress scores increased, fecal occult blood test use decreased (r = −0.115; p < .01). Results suggest that mental health symptoms may affect screening behavior differently in varied populations. Continued research is needed to further understand mental health as a complex exposure and the underlying association between mental health symptoms and cancer screening.

Social Support and Cancer Screening

Despite an apparent inverse association in many studies between mental health symptoms and screening behavior, protective factors such as social support may play a role in exaggerating or ameliorating this association. This hypothesis is supported by the Social Cognitive Theory, which posits that behavior is influenced by both individual and environmental factors such as one's social environment. It also suggests that there is a bidirectional relationship between these individual and environmental factors (38). In this context, it is possible that the effect of mental health symptoms on cancer screening behavior may differ in the presence or absence of social support. Previous literature provides evidence for the plausibility for social support to be related to both cancer screening and mental health.

There are four types of social support: emotional, instrumental, informational, and appraisal. Emotional support involves expressions of emotions such as empathy and care. Instrumental support is support in the form of tangible assistance. Informational support

is characterized by providing information or advice, while appraisal support encourages one to explore their self worth (39). Studies of social support and mammography have had varying results depending on the type of social support being assessed. In some studies, use of breast cancer screening was positively associated with social support (40-42), while others found no significant association between social support and breast cancer screening (41, 43). In a study of post-menopausal women, researchers found that women who received no or low emotional/ informational support had significantly decreased odds of having received annual mammograms within the last 5 years compared to women with a high score of emotional/ informational support (OR: 0.80, CI: 0.72, 0.88). There was no significant difference in annual mammography by tangible support score, however (41). In a separate study of women living in Allegheny County, Documet, Bear, Flatt, Macia, Trauth and Ricci (42) found that having social support was significantly associated with mammography adherence (OR: 1.43, 95% CI: 1.16, 1.77). Despite some varied results, research generally suggests a positive association between social support and mammography.

Varied results are also seen when assessing the association between colorectal cancer screening and social support. While many studies assessing the impact of social support on mammography focused on different types of social support, many studies exploring the association between social support and colorectal cancer have focused on the effect of social support in different populations.

For example, in a sample of Japanese Americans, researchers found that emotional support was directly related to colorectal cancer screening adherence (44). However, in a sample of African Americans living in the Washington, DC area, researchers determined

that social support was not a predictor of adherence to colorectal cancer screening (45).

In a more diverse sample of blacks and whites in North Carolina with more specific

exposures, neither emotional nor instrumental support were associated with screening in

blacks or whites (46). Overall, little is known about social support and colorectal cancer

screening. Further research is needed to expand the body of knowledge surrounding the

topic, more specifically in nationally representative samples of the US population.

Social Support and Mental Health

In addition to being associated with cancer screening, social support is also

associated with mental health. Consistent evidence indicates that social support is

positively associated with mental health state. Social support and mental health seem to

interact differently depending on the type of support provided and the population of

interest. Social support may be of particular interest in reducing the odds of mental health

symptoms. A longitudinal study in a Baltimore cohort determined that social support was

associated with reduced odds of psychological distress and panic disorder, but not other

diagnosed mental health disorders such as major depressive disorder or generalized

anxiety disorder after a major life event (47). Similarly, a longitudinal study conducted

by Canadian researchers found that positive interaction and emotional support led to

improvements in psychological stress (OR: 1.44, p-value = 0.00 and OR: 1.34, p-value =

0.02, respectively), but affectionate support did not have a significant effect (OR: 1.25, p-

value=0.07). When stratified by gender, researchers found that positive interaction and

emotional support were only predictive of psychological distress in women but not men

(48).

The most common hypotheses for the differing effects of social support are explained by the buffering and direct effects hypotheses, originally published by Cohen and Wills (49). The buffering hypothesis posits that social support may buffer the effect of stress in situations when an individual may be experiencing things that are out of their control. The direct effects hypothesis suggests that social support provides people with a sense of belonging, playing a role in the formation of their beliefs and habits. Continued research is needed to better understand the mechanisms behind the relationship between mental health and cancer screening in the United States.

The present study is the first, to our knowledge, to assess the moderating effect of social support in the association between mental health symptoms and cancer screening. In addition to describing socio-demographic and mental health symptoms associated with the use of mammography and colorectal cancer screening among age and gender eligible participants, we evaluated the independent effect of mental health symptoms on use of mammography and colorectal cancer screening. Lastly, we determined the effect of social support and other demographic variables in the association between psychological distress and cancer screening.

Chapter II: Manuscript

Examining Associations between Mental Health Symptoms with Cancer Screening
Behavior and the Moderating Role of Social Support in a Population-based Sample

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Abstract

Background: Many demographics such as race/ethnicity and socioeconomic status have
been found to be significant predictors of cancer screening behaviors, leading to the
formation of screening assistance programs and targeted interventions. Despite decades
of research and interventions, disparities in cancer mortality still remain. In order to
further decrease the burden of cancer, it is necessary to continue identifying factors that
play a role in cancer screening use.

Methods: Data from the Health Information National Trends Survey (HINTS) 4, Cycle 2
cross sectional survey were used for secondary analyses in this study. Binary logistic
regression models were used to determine the association between psychological distress
and cancer screening behavior adjusting for demographic, health related, self efficacy,
and social support variables. Interaction between psychological distress and social
support was also assessed. All analyses were weighted and run separately using two
different domains: colorectal cancer screening-eligible and mammography- eligible.

Results: Among 1,735 participants in the colorectal cancer screening-eligible domain,
472 (28.7%) reported some amount of psychological distress. Out of 1,398 participants in
the mammography-eligible domain, 451 (33.5%) reported some amount of psychological
distress. Psychological distress was not significantly associated with colorectal cancer
screening (Adjusted OR: 0.94, 95% CI: 0.55, 1.63) or mammography (Adjusted OR:
1.21, 95% CI: 0.75, 1.97). There was no moderation by emotional or informational
support.

Conclusions: Psychological distress was not associated with cancer screening behavior
within this nationally representative sample. However, based on previous significant
findings within specific populations, it is possible that the association between mental
health symptoms and cancer screening may only be present in particular groups of
people. Future research should further stratify populations to identify subgroups where
mental health symptoms may be an important determinant of cancer screening.

Impact: Identifying modifiable factors associated with cancer screening behavior can
inform intervention strategies and efforts to increase screening and decrease the burden of
cancer in the United States.

Introduction

Cancer remains the second leading cause of death in the United States. It is estimated that 1,658,370 new cases of cancer will be diagnosed in 2015, including 231,840 cases of invasive breast cancer, 93,090 cases of colon cancer, and 39,610 cases of rectal cancer (1).

Despite the overall decrease in cancer mortality, the burden of cancer is inequitably distributed across groups of people. One factor contributing to the differential burden of breast and colorectal cancer is differences in screening behaviors. Screening (that can result in early detection of cancer) has been confirmed to reduce mortality for breast (10-12) and colorectal cancers (13, 14). The current overall reduction in mortality of these cancers is, in part, due to increased use of cancer screening (13, 15); though, the reduction has not been the same across different socio-demographic groups.

One objective of Healthy People 2020 is to increase the proportion of women who receive breast cancer screening based on current screening guidelines to 81.1 percent (17). However, despite evidence demonstrating the benefits of screening, national data indicate the current percentage of females meeting these recommendations is closer to between 64 to 73% (18). Similar trends are seen in colorectal cancer screening. Healthy People 2020 has an objective of increasing the proportion of people receiving guideline adherent colorectal screening to 70.5 percent (17), however, a recent study using a nationally representative sample estimates current usage to be between 47 to 62% (21).

Despite decades of research and numerous programs enlisted to address these disparities, screening rates remain below Healthy People 2020 objectives. Better understanding of disparities in screening behavior can inform evidence-based strategies

to increase screening in different socio-demographic groups. Although frequently assessed in cancer patients, fewer studies have explored the influence of mental health symptoms on cancer screening behavior in populations who have not been diagnosed with cancer.

Compared to fear, worry, and anxiety surrounding cancer screenings (24), psychosocial factors such as general depression and anxiety symptoms are less frequently explored to explain differential screening. Mental health is of interest as a predictor of cancer screening because mental health plays a role in determining one's thoughts and behaviors.

Studies exploring the affect of mental health symptoms have resulted in both significant (30) (31) and non-significant (28, 29) associations between distress (symptoms of depression and anxiety) and mammography use. Similarly, studies have found lacking evidence of an association between mental health symptoms and colorectal cancer screening (32, 33) while some have found a positive association (34, 35), and others have resulted in a negative association (36, 37). Continued research is needed to further understand mental health as a complex exposure and the underlying association between mental health symptoms and cancer screening.

Despite a possible association between mental health symptoms and screening behavior, protective factors such as social support may play a role in exaggerating or ameliorating this association. Consistent evidence indicates that social support is positively associated with mental health state. Social support and mental health interact differently depending on the type of support provided and the population of interest. Social support may be of particular interest in reducing the odds of mental health

symptoms as studies have previously found that social support was associated with reduced odds of psychological distress (47, 48).

The present study is the first, to our knowledge, to assess the moderating effect of social support in the association between mental health symptoms and cancer screening. In addition to describing socio-demographic and mental health symptoms associated with the use of mammography and colorectal cancer screening among age and gender eligible participants, we evaluated the independent effect of mental health symptoms on use of mammography and colorectal cancer screening. Lastly, we determined the effect of social support and other demographic variables in the association between psychological distress and cancer screening.

Methods

Data Source and Study Population

The study used data from Health Information National Trends Survey (HINTS) 4, Cycle 2, a cross sectional survey administered to a nationally representative sample of civilian non-institutionalized people ages 18 and older by the National Cancer Institute. Survey data were collected via mail between October 2012 and January 2013. HINTS data are used to provide information on health communication, cancer behaviors (risks and screening), and information needs of the general public. Additional details of the survey and survey collection have been published elsewhere (50, 51). Of the 3,689 returned questionnaires, 3,630 were eligible for review. Two subpopulations were used for the current analyses: (1) one subpopulation of mammogram eligible participants who were females ages 40 and older (n=1,398) and (2) one subpopulation of colorectal cancer

screening eligible participants that included males and females ages 50 and older

(n=1,735).

Measures

Dependent Variables: The outcomes of interest were self-reported cancer

screening behavior, specifically, use of breast and colorectal cancer screening.

Breast Cancer Screening: Use of mammography was assessed among female

respondents ages 40 and older using the question "When did you have your most recent

mammogram to check for breast cancer, if ever?" Response options were "a year ago or

less", "more than 1, up to 2 years ago", "more than 2, up to 3 years ago", "more than 3,

up to 5 years ago", "more than 5 years ago", and "I have never had a mammogram".

Following with American Cancer Society's recommended annual screening (16), those

who responded "A year ago or less" were considered to be up to date with screening

guidelines. Those who responded that they had never had a mammogram or had a

mammogram more than one year ago were considered not up to date.

Colorectal Cancer Screening: Following brief descriptions of three types of

screening tests (colonoscopy, sigmoidoscopy, stool blood test), use of colorectal cancer

screening was assessed among respondents ages 50 and older using the question "Have

you ever had one of these tests [colonoscopy, sigmoidoscopy, or stool blood test] to

check for colon cancer?" Response options were yes or no. Responses of yes were coded

as ever screened, while a response of no was coded as never screened.

Independent Variable: The independent variable of interest was mental health

symptoms. Four questions were used to assess mental health symptomology. These

questions used in the HINTS survey were taken from the Patient Health Questionnaire

(PHQ-4) and are collectively referred to as a brief measure of psychological distress. Although slightly lower than the measures in the longer depression and anxiety scales, this 4-item scale has a chronbach alpha of 0.85 (52). The PHQ-4 consists of 2 questions regarding depressive symptoms and 2 questions assessing anxiety symptoms that combine to assess psychological distress. The question asked, "Over the past 2 weeks, how often have you been bothered by any of the following problems?" The problems included limited interests in doing things, feelings of depression or hopelessness, feelings of nervousness or anxiety, and feelings of worry. Responses ranged from 0 through 3 (0= Nearly every day, 1=More than half the days, 2=Several days, 3=Not at all). The responses to these questions were summed to obtain a score ranging from 0 to 12. Responses were reverse coded for ease of comprehension and further quartiled into none (0-2), mild (3-5), moderate (6-8), and severe (9-12) based on the scale proposed by Kroenke, Spitzer, Williams, and Lowe (52). To avoid small cell count, psychological distress was dichotomized into none and any (mild, moderate, or severe).

Moderator: Social Support: Social support was assessed in two forms: emotional and informational support. Emotional support was assessed using the question "Is there anyone you can count on to provide you with emotional support when you need it-such as talking over problems or helping you make difficult decisions?" Informational support was assessed with the question "Do you have friends or family members that you talk to about your health?" Response options were limited to yes or no.

Covariates: Covariates included demographics variables, health-related variables, and self-efficacy.

Demographic variables included self-reported age, gender (in the colorectal cancer screening sample), race/ethnicity, education, household income, employment status, and marital status. Race/ethnicity included Hispanic, Non-Hispanic White, Non-Hispanic Black, and Non-Hispanic Other. Due to low counts, participants who reported being Non-Hispanic American Indian or Alaska Native, Non-Hispanic Asian, Non-Hispanic Native Hawaiian or other Pacific Islander, and Non-Hispanic Multiracial were combined into a Non-Hispanic Other category. Education was determined by the highest level of school completed. Responses were categorized into less than high school, high school graduate, some college, and college graduate or more. Combined annual household income was divided into 4 groups: less than $20,000, $20,000 to less than $50,000, $50,000 to less than $75,000, and $75,000 or more. Employment status was divided into 3 categories: Employed, Unemployed, and Other (including retired, disabled, homemaker, student, and those who marked "other"). Because the specific type of support provided could not be determined from the survey question, marital status was assessed as a demographic variable as opposed to a social support variable. Marital status responses were grouped into 4 categories: Married (married or living as married), Divorced or Separated, Widowed, and Single, never married.

Health related variables were self-reported use of a regular provider, healthcare insurance status, self-rated health, and comorbidities. Use of a regular provider was determined with the question "Not including psychiatrists and other mental health professionals, is there a particular doctor, nurse, or other health professional that you see most often?" Response options were yes or no. Participants were also asked "Not including psychiatrists and other mental health professionals, is there a particular doctor,

nurse or other health professional that you see most?" and responded yes or no.

Participants were also asked "Do you have any kind of health care coverage, including

health insurance, prepaid plans such as HMOs or government plans such as Medicare?"

and responded yes or no. Self-rated general health status was recorded using the

statement "In general, would you say your health is…" and response options excellent,

very good, good, fair or poor. For analysis, responses were dichotomized into very good

or excellent versus good, fair, or poor to gather information on respondents who reported

an above average report of health compared to those who reported average or less than

average health. Comorbidities that were asked about within the survey were diabetes,

high blood pressure, heart conditions, lung disease, arthritis, and depression or anxiety.

Comorbidities were analyzed as a continuous scale from 0 to 6 based on how many

conditions a respondent reported having been diagnosed with.

Lastly, self-efficacy was assessed. The following two questions were used:

"Overall, how confident are you about your ability to take good care of your health?" and

"Overall, how confident are you that you could get advice or information about cancer if

you needed it?" Response options for both items were completely confident, very

confident, somewhat confident, a little confident, and not confident at all. For analysis,

response options were dichotomized into completely or very confident and somewhat, a

little, or not at all confident as we wanted to gather information on those who reported

being confident versus less confident.

Analysis

All analyses were conducted using SAS version 9.4 using the proc survey

command to account for complex survey design. To calculate accurate standard error of

estimates, 50 replicate weights and the jackknife replication method were used. The Domain command was used to create estimates for subpopulation analysis to take into account survey design. Associations were considered significant where values of $p<0.05$. Any responses marked as "missing data", "inapplicable", "multiple responses selected in error", or "question answered in error" were coded as missing.

Bivariate analyses were conducted using Wald Chi-squared tests for categorical variables and t-tests for continuous variables to determine associations between each individual characteristic (demographics variables, health-related variables, self-efficacy, and social support) and cancer screening behavior (mammography or colorectal cancer screening). Mammography and colorectal cancer screening outcomes were assessed separately using their respective age and gender eligible domains. The mammography eligible domain consisted of participants who were reported being female and over age 40. The colorectal cancer screening eligible domain consisted of participants who reported being over age 50.

We examined condition indices and variance decomposition proportions to determine collinearity in both the mammography eligible and colorectal cancer screening eligible domains. No variables were determined to be collinear. Moderation by social support (emotional and information support) was also assessed. Moderation was not evident in either domain (mammography eligible or colorectal cancer screening eligible), therefore, the final models presented do not include moderation assessment.

Binomial logistic regression was used to determine the independent association between psychological distress and cancer screening. Models were built in a stepwise manner. Psychological distress was first entered into the model. Social Support variables

were then added, followed by self-efficacy, health related, and then demographic variables. The model with all of the variables is presented. The models were run separately for the mammogram eligible domain and the colorectal cancer screening eligible domain. . Respondents with missing data for any variables were not included in the logistic regression analyses.

Results

Characteristics of the colorectal cancer screening eligible domain are presented in Table 1a. This subpopulation included 1,735 respondents, 1157 (66.69%) had been screened and 539 (31.07%) had never been screened. Of those who had been screened, 67.65% of respondents reported having no psychological distress and 25.07% had some amount of psychological distress. In comparison, of those who had not been screened, only 58.51% or respondents reported no psychological stress, while 35.75% had some psychological distress. Participation in colorectal cancer screening differed by all characteristics except gender, race/ethnicity, marital status, emotional support, and informational support.

The subpopulation of respondents in the mammogram eligible domain included 1,398 females (Table 1b). Of these females, 770 (55.08%) were up to date with mammography screening, while 579 (41.42%) were not. Of those who were up to date on screening, 63.07% reported no psychological distress, while almost 30.15% reported some psychological distress. Of those who were not up to date on screening, 55.45% had no psychological distress and 38.76% had some report of psychological distress. Whether or not participants were up to date with mammography screening differed by all other

characteristics except race/ethnicity, occupation, and self-efficacy in accessing cancer information.

Results from logistic regression models in the colorectal cancer screening eligible domain are presented in Table 2a. After adjusting for all covariates, psychological distress was not a significant predictor of colorectal cancer screening use (Adjusted Odds Ratio [Adjusted OR]: 0.94; 95% CI: 0.55, 1.63). However, having a regular healthcare provider (Adjusted OR: 1.89; 95% CI: 1.14, 3.15), having an increasing number of comorbidities (Adjusted OR: 1.22; 95% CI: 1.00, 1.48), older age (insert), being non-Hispanic black in comparison to non-Hispanic white (Adjusted OR: 1.98; 95% CI: 1.11, 3.54), having an increasing income ($75,000 or more compared to less than $20,000 [Adjusted OR: 7.79; 95% CI: 2.99, 20.33), and holding an occupation in the "other" category in comparison to being employed (OR: 1.98; 95% CI: 1.14, 3.45) were significantly associated with increased odds of having ever had a colorectal cancer screening. Being widowed in comparison to being single (Adjusted OR: 0.29, 95% CI: 0.10, 0.83) was significantly associated with decreased odds of colorectal cancer screening. There was no significant interaction between psychological distress with emotional or informational support (Results not presented).

Table 2b presents the results from the logistic regression in the mammography eligible domain. After adjusting for all covariates, psychological distress was not a significant predictor of being up to date on mammography use (Adjusted OR: 1.21; 95% CI: 0.75, 1.97). Having a regular healthcare provider (Adjusted OR: 1.99; 95% CI: 1.26, 3.15), having healthcare insurance (Adjusted OR: 2.39; 95% CI: 1.26, 4.53), self rated health as very good or excellent in comparison to good, fair, or poor (Adjusted OR: 1.82;

95% CI: 1.34, 2.91), and having an increasing number of comorbidities (Adjusted OR: 1.25; 95% CI: 1.02, 1.54) was significantly associated with increased odds of being up to date on mammography. There was no significant interaction between psychological distress with emotional or informational support (Results not presented).

Discussion

The purpose of this study was to evaluate the independent association between psychological distress and cancer screening behavior in a nationally representative sample. We also wanted to determine if there was an interaction between psychological distress and social support that played a role in cancer screening behavior. In this study, psychological distress was not associated with colorectal cancer screening use or being up to date with mammography screening. Also, the association between psychological distress and cancer screening was not moderated by emotional or informational support.

Our findings were consistent with the pooled findings of 5 analyses (n= 21, 491 women) that did not find psychological distress to be significantly associated with mammography use (28). Findings also supported previous literature on mental health symptoms and colorectal cancer screening, as a study of family medicine patients (32) and women over age 50 (33) also lacked a finding of association between mental health symptoms and colorectal cancer screening.

However, our findings conflicted with the works of previous literature on populations of people living in Los Angeles (30), women with a family history of breast cancer (31), patients at the Veteran Affairs (36), and one other nationally representative sample (34) that all found significant associations between mental health symptoms and cancer screening behavior. It is possible that the effect of psychological distress is

different by population. It is also possible that differences in association were due to the measure of mental health symptoms. For example, the Mental Health Inventory Survey (31), the International Statistical Classification of Diseases and Related Problems (ICD-9) codes (36), single survey questions (34), and more have been used to define mental health symptoms (depression, anxiety, and general distress). Continued exploration of this association in more specific stratified populations is needed to determine which population, if any, are truly most affected.

One of the strongest predictors of having participated in colorectal cancer screening was race/ethnicity. We found that non-Hispanic blacks were almost twice as likely as non-Hispanic whites to have had a colorectal cancer screening (Adjusted OR: 1.98; 95% CI: 1.11, 3.54). This racial difference was not expected, as previous literature suggests that racial minorities, including non-Hispanic blacks are less likely than non-Hispanic whites to participate in colorectal cancer screening (53, 54). Blacks are less likely than whites to participate in research activities (55); therefore, it is possible that previous estimates of screening were an inaccurate representation of the screening activities of this race/ethnicity as a whole.

Health related variables were the strongest predictors of being up to date with mammography. Respondents who reported having a regular healthcare provider, having some form of health insurance, or self reported their health to be very good or excellent were more likely to be up to date on mammography than respondents who did not have a health care provider, did not have health insurance, or self reported their health to be good, fair, or poor. This finding was not surprising, as having a regular healthcare provider (which may be a proxy for getting physician recommendation), having health

insurance (a measure of access to care), and self reported health have all historically been named as strong predictors of health behavior (56, 57). These findings suggest that interventions created to increase mammography should focus on increasing healthcare engagement in general as these are factors that are associated with mammography use.

We did not find any moderation between psychological distress and social support. However, it is possible that the impact of social support may differ within different populations. Previous studies have found that the affect of social support differs by race (46), gender (58), and socioeconomic status (59). Further research should be done to explore the impact of social support on the association between mental health symptoms and cancer screening within different populations.

As with other literature, strengths and limitations were observed during the study. The nationally representative sample added strength to the study because previous similar studies had been limited to very specific populations such as veterans, patients at specific healthcare facilities, or people living in one area of the United States. We were also able to use a validated measure of mental health symptomology (PHQ-4) as the exposure for this study, as opposed to creating a measure that had not previously been validated.

Limitations were also present. HINTS is a cross sectional survey, therefore limiting the interpretation of temporality of our exposure and outcome. Psychological distress was assessed over the most recent two-week period. It is uncertain if these symptoms were also present before or during the time when cancer screening took place. Also, despite having a validated measure of mental health symptoms, the measure has not frequently been used in analyses. This factor, along with the many different definitions of mental health symptoms that have previously been used, made it difficult to confidently

compare results across studies. Furthermore, to avoid small cell size and convergence issues, many variables had to be dichotomized, taking away from the possible associations that may have been present if the variable could have included additional categories.

In conclusion, our study did not find psychological distress to be associated with colorectal cancer screening or being up to date with mammography. We also did not find this association to be moderated by social support. Based on previous significant findings within specific populations, it is possible that the association may only be present in particular groups of people. Future research should further stratify their populations to identify subgroups where mental health symptoms may be an important determinant of cancer screening.

Table 1a. Characteristics of Colorectal Cancer Screening- Eligible Domain* (Weighted)

Characteristics	Total sample n=1,735	Ever Screened n=1,157	Never Screened n=539	p-value
	n (%) or M (se)	n (%) or M (se)	n (%) or M (se)	
Exposure				
Psychological Distress				0.009
None	1135 (64.37)	782 (67.65)	331 (58.51)	
Any	472 (28.74)	293 (25.07)	169 (35.75)	
Demographic Variables				
Age (cont.)	62.97 (0.15)	64.12 (0.31)	60.45 (0.50)	0.051
Gender				0.872
Male	703 (45.19)	477 (45.50)	213 (44.93)	
Female	1001 (53.35)	669 (53.55)	320 (54.18)	
Race/Ethnicity				0.789
Hispanic	197 (9.62)	116 (9.05)	79 (11.09)	
Non Hispanic White	1016 (67.07)	697 (68.61)	303 (65.84)	
Non Hispanic Black	233 (7.58)	157 (7.67)	68 (7.25)	
Non Hispanic Other	86 (3.93)	59 (3.79)	25 (3.48)	
Education				<0.001
Less than High School	205 (15.87)	121 (13.46)	78 (19.49)	
High School Graduate	437 (24.43)	278 (22.14)	144 (29.47)	
Some College	488 (33.29)	315 (34.07)	161 (31.77)	
College Graduate or More	590 (25.85)	434 (29.72)	150 (18.80)	
Household Income				<0.001
Less than $20,000	411 (20.23)	225 (16.02)	177 (28.93)	
$20,000 to <$50,000	455 (25.36)	304 (24.26)	138 (26.40)	
$50,000 to <$75,000	230 (14.17)	158 (14.53)	68 (13.89)	
$75,000 or More	385 (26.55)	293 (31.46)	85 (16.78)	
Occupation Status				0.001
Employed	721 (43.88)	440 (40.04)	265 (51.33)	
Unemployed	103 (5.12)	52 (4.75)	49 (6.09)	
Other (retired, disabled, homemaker, student, other)	877 (48.98)	643 (53.23)	213 (40.36)	
Marital Status				0.214
Married or living as married	874 (63.26)	607 (65.28)	251 (58.93)	
Divorced or Separated	374 (13.74)	239 (13.72)	125 (13.71)	
Widowed	268 (12.18)	174 (10.57)	86 (15.33)	
Single, never married	195 (9.85)	120 (9.33)	70 (11.28)	

Note. Due to missing data, the percentages may not add up to 100 percent

*Colorectal cancer screening- eligible domain included respondents 50 years or older with no previous diagnosis of cancer

Table 1a. Characteristics of Colorectal Cancer Screening- Eligible Domain* (Weighted), continued

Characteristics	Total sample n=1,735	Ever Screened n=1,157	Never Screened n=539	p-value
	n (%) or M (se)	n (%) or M (se)	n (%) or M (se)	
Health Related Variables				
Regular Healthcare Provider				<0.001
Yes	1267 (74.00)	918 (80.18)	326 (62.21)	
No	435 (24.61)	216 (18.32)	203 (36.53)	
Healthcare Insurance				0.001
Yes	1481 (85.05)	1042 (88.79)	406 (77.11)	
No	230 (13.77)	98 (9.88)	128 (22.18)	
Self Rating of Health				0.049
Very good or excellent	718 (41.30)	505 (43.62)	198 (36.28)	
Good, fair, or poor	965 (55.88)	615 (53.36)	329 (61.52)	
Comorbidities (cont.)	1.66 (0.05)	1.74 (0.05)	1.48 (0.10)	0.015
Self Efficacy Variables				
Self efficacy in taking care of own health				0.002
Completely or very confident	1085 (61.92)	758 (65.28)	301 (54.53)	
Somewhat, a little, or not at all confident	592 (34.93)	361 (31.60)	222 (42.52)	
Self efficacy in getting advice or information about cancer				0.005
Completely or very confident	1072 (61.48)	754 (65.68)	297 (54.21)	
Somewhat, a little, or not at all confident	638 (37.54)	385 (33.18)	236 (45.14)	
Social Support Variables				
Emotional Support				0.052
Yes	1445 (83.91)	988 (85.58)	428 (80.58)	
No	231 (13.21)	129 (11.46)	96 (16.99)	
Informational Support				0.143
Yes	1468 (85.98)	999 (87.03)	439 (82.72)	
No	213 (11.25)	121 (10.08)	86 (13.98)	

Note. Due to missing data, the percentages may not add up to 100 percent
* Colorectal cancer screening- eligible domain included respondents 50 years or older with no previous diagnosis of cancer

Table 1b. Characteristics of Mammography-Eligible Domain* (Weighted)

Characteristics	Total sample n= 1398	Up to Date with Screening n= 770	Not Up to Date with Screening n= 579	p-value
	n (%) or M (se)	n (%) or M (se)	n (%) or M (se)	
Exposure				
Psychological Distress				0.020
None	854 (59.92)	501 (63.07)	326 (55.45)	
Any	451 (33.49)	215 (30.15)	222 (38.76)	
Demographic Variables				
Age (cont.)	58.12 (0.18)	57.16 (0.50)	59.03 (0.74)	0.004
Race/Ethnicity				0.982
Hispanic	183 (11.64)	95 (11.43)	80 (11.45)	
Non Hispanic White	771 (64.16)	431 (64.36)	318 (65.45)	
Non Hispanic Black	226 (9.62)	128 (9.49)	93 (9.74)	
Non Hispanic Other	67 (4.54)	36 (4.66)	27 (3.84)	
Education				0.036
Less than High School	133 (13.79)	61 (13.69)	66 (13.71)	
High School Graduate	347 (22.85)	180 (21.50)	154 (24.79)	
Some College	401 (37.10)	221 (35.60)	169 (39.40)	
College Graduate or More	299 (16.01)	299 (28.42)	185 (21.67)	
Household Income				0.002
Less than $20,000	336 (20.11)	151 (17.76)	171 (22.49)	
$20,000 to <$50,000	375 (25.36)	196 (22.06)	166 (29.88)	
$50,000 to <$75,000	179 (12.87)	110 (13.07)	67 (12.91)	
$75,000 or More	319 (27.75)	215 (34.02)	93 (19.59)	
Occupation				0.912
Employed	670 (48.36)	375 (49.71)	271 (46.78)	
Unemployed	86 (6.53)	36 (6.53)	48 (6.74)	
Other (retired, disabled, homemaker, student, other)	615 (42.94)	348 (42.79)	244 (42.90)	
Marital Status				0.022
Married or living as married	647 (61.83)	393 (67.21)	230 (54.29)	
Divorced or Separated	318 (12.63)	167 (11.76)	143 (14.20)	
Widowed	241 (13.63)	108 (10.17)	122 (17.63)	
Single, never married	172 (10.81)	90 (9.84)	76 (12.61)	

Note. Due to missing data, the percentages may not add up to 100 percent

*Mammography- eligible domain included females 40 years or older with no previous diagnosis of cancer

Table 1b. Characteristics of Mammography- Eligible Domain* (Weighted), continued

Characteristics	Total sample n= 1398	Up to Date with Screening n= 770	Not Up to Date with Screening n= 579	p-value
	n (%) or M (se)	n (%) or M (se)	n (%) or M (se)	
Health Related Variables				
Regular Healthcare Provider				<0.001
Yes	1005 (73.98)	620 (80.99)	352 (64.43)	
No	371 (24.95)	140 (18.26)	218 (31.14)	
Healthcare Insurance				0.004
Yes	1154 (82.01)	674 (86.31)	437 (75.72)	
No	223 (16.92)	84 (12.63)	133 (23.12)	
Self Rating of Health				0.002
Very good or excellent	582 (42.89)	354 (47.78)	211 (36.83)	
Good, fair, or poor	779 (54.56)	395 (49.46)	356 (61.23)	
Comorbidities (cont.)	1.52 (0.04)	1.56 (0.06)	1.46 (0.06)	0.000
Self Efficacy Variables				
Self efficacy in ability to take care of own health				0.000
Completely or very confident	875 (61.64)	525 (67.66)	325 (53.93)	
Somewhat, a little, or not at all confident	483 (35.84)	224 (29.70)	239 (44.00)	
Self efficacy in getting advice or information about cancer				0.070
Completely or very confident	868 (60.73)	511 (63.99)	324 (55.81)	
Somewhat, a little, or not at all confident	512 (38.45)	254 (35.44)	243 (43.01)	
Social Support Variables				
Emotional Support				0.026
Yes	1186 (86.41)	673 (88.58)	474 (83.57)	
No	168 (10.92)	77 (8.62)	86 (14.42)	
Informational Support				0.032
Yes	1212 (87.86)	688 (89.82)	484 (85.40)	
No	149 (9.79)	63 (7.61)	81 (12.88)	

Note. Due to missing data, the percentages may not add up to 100 percent

* Mammography- eligible domain includes females 40 years or older with no previous diagnosis of cancer

Table 2a. Binary Logistic Regression for the Association Between Psychological Distress and Colorectal Cancer Screening in an Age-Eligible Population Based Sample (n=1,735)

Characteristics	Adjusted OR	95% CI
Exposure		
Psychological Distress		
Any	1.00	
None	0.94	0.55, 1.63
Social Support		
Emotional Support		
No	1.00	
Yes	1.17	0.53, 2.59
Informational Support		
No	1.00	
Yes	1.23	0.52, 2.90
Self Efficacy		
Self efficacy in taking care of own health		
No	1.00	
Yes	1.11	0.68, 1.81
Self efficacy in getting advice or information about cancer		
No		
Yes	1.41	0.87, 2.29
Health Related		
Regular Healthcare Provider		
No	1.00	
Yes	*1.90	1.14, 3.15
Healthcare Insurance		
No	1.00	
Yes	1.34	0.74, 2.42
Self Rating of Health		
Very good or excellent	1.26	0.74, 2.14
Good, fair, or poor	1.00	
Comorbidities (cont.)	*1.22	1.00, 1.48

Note. OR: odds ratio; CI: confidence interval

$*p<0.05$

Table 2a. Binary Logistic Regression for the Association Between Psychological Distress and Colorectal Cancer Screening in an Age-Eligible Population Based Sample (n=1,735), continued

Characteristics	Adjusted OR	95% CI
Demographics		
Age (cont.)	*1.06	1.03, 1.10
Gender		
Male (ref.)	1.00	
Female	0.98	0.64, 1.49
Race/Ethnicity		
Non Hispanic White	1.00	
Hispanic	1.24	0.68, 2.28
Non Hispanic Black	*1.98	1.11, 3.54
Non Hispanic Other	1.26	0.57, 2.78
Education		
Less than High School	1.00	
High School Graduate	0.79	0.33, 1.90
Some College	1.05	0.51, 2.20
College Graduate or More	1.21	0.51, 2.86
Household Income		
Less than $20,000	1.00	
$20,000 to <$50,000	*2.55	1.30, 4.97
$50,000 to <$75,000	*3.25	1.39, 7.60
$75,000 or More	*7.80	2.99, 20.33
Occupation		
Employed	1.00	
Unemployed	1.56	0.64, 3.79
Other (retired, disabled, homemaker, student, other)	*1.98	1.14, 3.45
Marital Status		
Single, never married	1.00	
Married or living as married	0.68	0.29, 1.59
Divorced or Separated	1.14	0.47, 2.79
Widowed	0.29	0.10, 0.83

Note. OR: odds ratio; CI: confidence interval

*$p < 0.05$

Table 2b. Binary Logistic Regression for the Association Between Psychological Distress and Up to Date Mammography Use in a Gender and Age-Eligible Population Based Sample (n=1,398)

Characteristics	Adjusted OR	95% CI
Exposure		
Psychological Distress		
Any	1.00	
None	1.21	0.75, 1.97
Social Support		
Emotional Support		
No	1.00	
Yes	1.30	0.66, 2.54
Informational Support		
No	1.00	
Yes	1.06	0.44, 2.60
Self Efficacy		
Self efficacy in ability to take care of own health		
No	1.00	
Yes	1.31	0.75, 2.29
Self efficacy in getting advice or information about cancer		
No	1.00	
Yes	1.31	0.83, 2.07
Health Related		
Regular Healthcare Provider		
No	1.00	
Yes	*1.99	1.26, 3.15
Healthcare Insurance		
No	1.00	
Yes	*2.39	1.26, 4.53
Self Rating of Health		
Very good or excellent	*1.82	1.14, 2.91
Good, fair, or poor	1.00	
Comorbidities (cont.)	*1.25	1.02, 1.54

Note. OR: odds ratio; CI: confidence interval

*p<0.05

Table 2b. Binary Logistic Regression for the Association Between Psychological Distress and Up to Date Mammography Use in a Gender and Age-Eligible Population Based Sample (n=1,398), continued

Characteristics	Adjusted OR	95% CI
Demographics		
Age (cont.)	1.00	0.97, 1.02
Race/Ethnicity		
Non Hispanic White	1.00	
Hispanic	1.32	0.77, 2.25
Non Hispanic Black	1.53	0.87, 2.67
Non Hispanic Other	1.85	0.30, 11.57
Education		
Less than High School	1.00	
High School Graduate	0.57	0.23, 1.40
Some College	0.56	0.21, 1.52
College Graduate or More	0.50	0.20, 1.29
Household Income		
Less than $20,000	1.00	
$20,000 to <$50,000	0.66	0.31, 1.43
$50,000 to <$75,000	1.23	0.47, 3.24
$75,000 or More	1.34	0.54, 3.28
Occupation		
Employed	1.00	
Unemployed	1.55	0.65, 5.17
Other (retired, disabled, homemaker, student, other)	1.12	0.66, 1.89
Marital Status		
Single, never married	1.00	
Married or living as married	1.25	0.47, 3.28
Divorced or Separated	0.76	0.30, 1.90
Widowed	0.54	0.15, 1.93

Note. OR: odds ratio; CI: confidence interval

*$p<0.05$

Chapter III
Summary

The purpose of this study was to evaluate the independent association between psychological distress and cancer screening behavior. It was one of few studies conducted using a nationally representative sample. We also wanted to determine if there was an interaction between psychological distress and social support that played a role in cancer screening behavior. This was the first study, to our knowledge, to assess the influence of social support in this manner. In this study, psychological distress was not associated with colorectal cancer screening use or being up to date with mammography screening. Also, the association between psychological distress and cancer screening was not moderated by emotional or informational support. Based on previous significant findings within specific populations, it is possible that the association between mental health symptoms and cancer screening may only be present in particular groups of people. Future research should further stratify populations to identify subgroups where mental health symptoms may be an important determinant of cancer screening.

Public Health Implications

Cancer remains the second leading cause of death in the United States. It is estimated that 589,430 people will be die of cancer in 2015, including 40,290 from female breast cancer and 49,700 from colorectal cancer (1). One strongly encouraged method of reducing cancer mortality is to increase earlier detection of cancer via screening. Many demographics such as race/ethnicity and socioeconomic status have been found to be significant predictors of cancer screening behaviors, leading to the formation of screening assistance programs and targeted interventions. Despite these interventions and decades of research to elucidate risk factors and methods of prevention,

disparities in cancer mortality still remain. In order to further decrease the burden of cancer and address present disparities, it is necessary to identify factors, more specifically modifiable factors, that may be interacting with these demographics that play a role in the decision to participate in cancer screening.

Fear, worry, and anxiety surrounding cancer screenings have been associated with decreased cancer screening use (24), however, less is known about how these feelings and symptoms of mental health in everyday life or in general may affect cancer screening behavior. If it is found that mental health symptoms affect cancer screening differently in dissimilar groups of people, it will be important for future interventions and program that encourage screening to address mental health to increase the effectiveness of their programs. It may also be beneficial to include mental health professionals as an additional source to encourage screening in their patients. Bridging the gap between physical and mental health may be beneficial to increase cancer screening and decrease the burden of cancer in the United States.

Possible Future Directions

There are many directions for future research surrounding mental health and cancer screening. In order to conduct meaningful comparable studies, it will first be necessary to identify a more consistent definition and measure of mental health and its symptoms. There are many definitive measures and cutoff points for mental health disorders, however, not many that simply measure symptomology without having a formal diagnosis of a disorder. Once a more consistent measure is determined, it would be necessary to conduct studies in many different populations to determine which, if any, populations are affected.

In order to identify populations most affected, we also need study samples that include adequate numbers of individuals from underserved populations. This would allow us conduct analyses by group. It would also be beneficial to have longitudinal studies that assess mental health symptoms over a period of time, as opposed to within the most recent 2 weeks prior to survey collection, as our measure of mental health symptoms did. In addition to longitudinal studies, intervention studies may also be of interest. Intervention studies that include a mental health component would allow us to determine if addressing mental health issues can increase cancer-screening use.

Most importantly, continued research is needed to identify modifiable risk factors that influence cancer-screening behavior. Cancer screening is a proven method for decreasing adverse outcomes in both colorectal and breast cancer (12, 14); however, screening rates remain below the recommended usage (17). Elucidating areas of one's lives, both individual and environmental, that can be intervened on will help to influence more effective interventions and programs and play a role in decreasing disparities in the burden of cancer.

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