

## ORIGINAL ARTICLE

# Moderate psychological distress as a barrier to breast cancer screening among women

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## ABSTRACT

**Objective:** To examine the relationship between Breast Cancer Screening (BCS) and Moderate Psychological Distress (MPD). Also, to assess the effect of aggregating women with No Psychological Distress (NPD) and MPD into one group, as done in prior studies when evaluating the relationship between BCS and Psychological Distress (PD).

**Methods:** The study population comprised of 34,565 women aged 50-74 years who participated in the National Health Interview Survey from 2013 to 2017. The Kessler-6 PD index score (0-24) was dichotomized (0-12: NPD; > 13: Severe Psychological Distress SPD) and trichotomized (0-5: NPD; 5-12: MPD; > 13 SPD). Two multivariate logistic regressions were conducted for the dichotomous and trichotomous PD categories. Andersen's Behavioral Model of Health Services Use guided the choice of covariates. Data analysis was conducted using SAS version 9.4.

**Results:** Our study showed 4.6% had SPD, and 17.9% had MPD. The latter group (MPD) was included in the NPD group in the dichotomous analysis. In the dichotomous analysis, women with SPD (adjusted Odds Ratio (aOR) = 0.71, 95% CI = 0.63, 0.81,  $p < .00001$ ) were less likely to have received a mammogram than those with NPD. In the trichotomous model, women with SPD (aOR = 0.76, 95% CI = 0.67, 0.87,  $p = .0001$ ) and MPD (aOR = 0.84, 95% CI = 0.78, 0.91,  $p < .00001$ ) were both less likely to have had a mammogram than those with NPD.

**Conclusions:** Prior studies that included individuals with MPD among those with NPD overestimated the effect of SPD on mammography and minimized the importance of targeting women with MPD along with those that have SPD to enhance the uptake of mammography.

**Key Words:** Mental illness, Psychological distress, Breast cancer screening, Mammogram, Mental health

## 1. INTRODUCTION

Breast cancer is the most common cancer for women in the United States, with approximately 3.5 million women living with breast cancer in this country.<sup>[1]</sup> In 2020, this malignancy is estimated to affect more than 276,000 new patients and will result in the death of approximately 42,000 individuals.<sup>[2]</sup> Breast cancer is also associated with a con-

siderable economic burden.<sup>[2]</sup> More than \$180 billion is lost annually from the treatment of breast cancer and losses in productivity.<sup>[3]</sup>

The survival rate for breast cancer has significantly improved over time as a result of early detection and advances in treatment.<sup>[3]</sup> Since recommendations for breast cancer screening were introduced in the late 80s, the rate of breast can-

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cer screening has dramatically increased.<sup>[4,5]</sup> Mammogram, which is considered to be the cornerstone for detecting breast cancer in its early stages, has been shown to have a significant impact on women's health outcomes. For example, several studies found that mammogram is significantly associated with a reduction in breast cancer-related mortality among women.<sup>[6]</sup> Currently, the United States Preventative Services Task Force (USPSTF) recommends that women between the ages of 50 and 74 receive a biennial mammography screening.<sup>[6]</sup>

Nevertheless, in 2015, the Centers for Disease Control and Prevention (CDC) reported that breast cancer screening rates fell short of the Healthy People 2020 goal.<sup>[7]</sup> Moreover, there are reports of disparities in screening rates among the medically underserved population.<sup>[8]</sup> In particular, disparities in screening related to mental illness remain among the least studied among the disparities.<sup>[9]</sup>

Results from the studies that have examined cancer screening in women with psychological distress have been mixed. While some studies found individuals with PD to have lower odds of breast cancer screening,<sup>[10-12]</sup> other studies found no significant association<sup>[13]</sup> or a positive association.<sup>[14,15]</sup> However, most extant studies had small sample sizes or selection biases.<sup>[11]</sup>

Psychological distress is a state of emotional suffering characterized by the symptoms of depression and anxiety.<sup>[16]</sup> Accordingly, the Kessler-6, a scale that measures PD developed in 2002, is increasingly and widely being used in measuring psychological symptoms in individuals. The scale is brief and has high accuracy in distinguishing between probable DSM-IV cases and non-cases.<sup>[17,18]</sup> These features made the scale an ideal screening tool for identifying individuals with severe mental illness in population-based health surveys.<sup>[19]</sup> The Kessler-6 scale traditionally categorizes individuals into those with Severe Psychological Distress (SPD) and those with No Psychological Distress (NPD) based on their score on a 6-item questionnaire.<sup>[17]</sup> In 2012, research suggested recategorization of the scale to include Moderate Psychological Distress (MPD) as a distinct group.<sup>[19]</sup> The suggestion is based on the evidence that people with MPD have mental health services needs, impairments, substance use, and other risks that are dissimilar to those with the NPD. Therefore, individuals with MPD are an essential target for interventions to reduce health and healthcare disparities.

Existing studies about breast cancer screening in women have only used the dichotomous classification of PD as measured by the Kessler-6 scale.<sup>[11]</sup> Thus, the relationship, if any, between breast cancer screening among women and MPD, is unknown. Also, the Kessler-6 scale is increasingly being

adopted and ubiquitously employed to identify individuals with PD in research and policymaking. This extensive usage of the scale makes it important to examine the impact of trichotomizing this scale instead of dichotomizing it. To address these two concerns, this study examines the relationship between MPD and mammogram using Kessler-6-scale. It also assesses the effect of aggregating women with NPD and those with MPD into one group when evaluating the relationship between breast cancer screening and PD.

## 2. METHODS

### 2.1 Data source

This study used the National Health Interview Survey (NHIS) data from 2013-2017 extracted using IPUMS database.<sup>[20]</sup> The NHIS is an annual, in-person household interview conducted by the National Center for Health Statistics of the CDC and covers a wide variety of health topics. Since 1957, this survey has continually collected data from a nationally representative sample of 35,000-40,000 households (75,000-100,000 persons).<sup>[21]</sup>

The NHIS uses a complex, multistage probability sampling technique. A Primary Sampling Unit (PSU) is first identified, which corresponds to a county or a group of small adjacent counties, and then a cluster of households or dormitories within the PSU is further selected. An adult is selected from each selected house within a cluster to form the Sample Adult Questionnaire subsample.

### 2.2 Study sample

The original unweighted size of the 2013-2017 NHIS survey was 495,663 respondents. Using data from the Sample Adult Questionnaire, we included women that are between the ages of fifty to seventy-four that answered the Kessler-6 and also responded to the breast cancer screening question, resulting in the final study sample size of 34,565.

### 2.3 Measures

#### 2.3.1 Mammogram screening

Our outcome of interest is receipt of a mammogram. The relevant question from the NHIS is "Have you had a mammogram during the past 12 months?" The response is dichotomized as Yes/No.

#### 2.3.2 Psychological distress

Psychological distress was measured using the Kessler-6, a well-validated scale for measuring psychological distress, with high accuracy in discriminating the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) cases from non-cases for various sociodemographic subsamples.<sup>[22]</sup>

This scale asks respondents how often they experience feelings of worthlessness, nervous, hopeless, restless, effort, and depression within the past 30 days. The questions use a 5-point Likert scale ranging from zero (None of the time) to four (All of the time) for all responses. The score from each question is summed to form a Kessler-6 index that ranges from 0-24. Individuals that score lower than 13 are referred to as NPD and individuals that score 13 and above are considered to have SPD in the traditional dichotomous classification of PD. However, in the new trichotomous categorization of PD, individuals that score less than five are considered to have NPD. If an individual scored 5 to 12 or 13 to 24, the person is considered to have MPD or SPD, respectively.<sup>[19]</sup> These variables were used as our primary independent variable in the two models.

### 2.3.3 Covariates

The covariates for this analysis were selected using the three constructs of the Andersen model, which uses a combination of predisposing, enabling, and needs factors to predict or explain health services utilization.<sup>[23]</sup> The predisposing variables in this study include Race (White, Black, Asian or Other), Education status (Less than high school, High school/GED, or Some college and above), and Marital status (Unmarried, Divorced or Married). Enabling factors include Employment status (Unemployed/Employed), Poverty level (Above/Below) Usual Source of care (Yes/No), Health Insurance status (Yes/No), and Region of the country (Northeast, North, Central/Midwest South or West). Included needs factors were Smoking status (Never, Former, Current), Health status (Bad to fair, or Good to Excellent), and History of cancer (Yes/No) and Functional Limitation (Yes/No).

### 2.4 Statistical analysis

For this study, we used the individual as the unit of analysis. We summarized the categorical variables using counts and percentages. Chi-square tests were used to test for the association between receipt of a mammogram and the various independent variables.

We also performed a logistic regression to assess the association between receipt of mammogram and PD while controlling for confounding. Confounding was assessed using the backward elimination approach by applying the 10% rule. Two different models, one for dichotomized PD and the other for a trichotomized PD, were used. The analysis was conducted using SAS version 9.4 and significance was set at 0.05, and a non-overlapping 95% confidence interval. In addition, multiple testing and comparison were adjusted using the Bonferroni correction. To achieve an appropriate estimation of variance, survey procedures PROC SURVEYFREQ

and PROC SURVEYLOGISTIC from SAS were used to adjust for the complex survey design.<sup>[24]</sup>

## 3. RESULTS

Table 1 shows the study population characteristics by receipt of mammograms. The total study sample for this study is 34,565, which corresponds to a weighted size of 224,631,884 women. Approximately Sixty-two percent of the respondents received a mammogram within the past 12 months. In the dichotomous classification of PD, the majority of the sample had NPD (95.4%). When PD was categorized into three levels, the majority of the population still had NPD (77.6%). Like in the dichotomous categorization of PD, the severely distressed individual also accounted for 4.6% of the sample in the trichotomous categorization of PD. A majority of the sample was White (80.9%) followed by Black (11.8%), while Asians and Native Americans accounted for a small fraction of the sample size (5.1% and 0.8%, respectively). More than half of the sample were married (59.5%), had some college education (62%), and were unemployed (50.1%). Very few of the respondents had no health insurance (6.8%), no usual source of care (5.4%), cancer (15%), or bad/fair health (18.1%). Most of the respondents never smoked (59.7%), are above the federal poverty line (89.8%), have a functional limitation (54.1%), and the largest proportion resides in the South (37.6%).

Table 2 shows the relationship between breast cancer screening and the independent variables. Breast cancer screening was significantly associated with all the independent variables except for the poverty level.

In the trichotomous classification of PD, there were more respondents that had NPD and received a mammogram within the past 12-months (49.3%) compared to those that have NPD but did not receive a mammogram (28.2%). This relationship was also true for those with MPD. There were more women that had MPD and received a mammogram (10%) than individuals with MPD that did not receive a mammogram (7.9%). However, there was the same proportion of women with SPD that received a mammogram (2.3%) compared to those that have SPD but who did not receive a mammogram (2.3%).

In the analysis with the dichotomous classification of PD, the proportion of women with SPD that received a mammogram (2.3%) is also the same as those with SPD who did not receive one (2.3%). But, those with NPD that received a mammogram was larger (59.3%) compared to those with NPD but who did not utilize a mammogram within the past 12-months (36.1%).

**Table 1.** Demographics and mammogram use

Variable	Freq	Weighted Freq	(%)
<b>Breast cancer checkup</b>			
No	13,678	86,350,461	38.4
Yes	20,887	138,281,423	61.6
<b>Trichotomous PD</b>			
No	26,404	174,223,447	77.6
Moderate	6,425	40,137,226	17.9
Severe	1,736	10,271,211	4.6
<b>Dichotomous PD</b>			
Severe	1,736	10,271,211	4.6
No	32,829	214,360,673	95.4
<b>Race</b>			
White	27,262	181,432,562	80.9
Black	4,825	26,547,832	11.8
<b>Native Americans</b>			
Asian	322	1,810,744	0.8
Others	1,504	11,534,511	5.1
	589	2,970,914	1.3
<b>Marriage</b>			
Unmarried	3,705	18,704,191	8.3
Divorced	14,864	72,019,503	32.1
Married	15,878	133,304,494	59.5
<b>Education</b>			
Less High School	4,415	26,197,952	11.7
High School/GED	9,039	58,901,575	26.3
Some College >	20,992	138,713,001	62.0
<b>Employment</b>			
Unemployed	18,367	114,479,756	51.0
Employed	16,191	110,115,868	49.0
<b>USC</b>			
No	1,941	12,053,406	5.4
Yes	32,620	212,548,999	94.6
<b>Region</b>			
North East	6,044	42,687,881	19.0
Northcentral/Midwest	7,341	49,419,661	22.0
South	12,634	84,421,604	37.6
West	8,546	48,102,738	21.4
<b>Smoking status</b>			
Never	19,957	133,954,262	59.7
Former	9,183	58,363,748	26.0
Current	5,379	32,034,809	14.3
<b>Health status</b>			
Bad/fair	6,780	40,685,184	18.1
Good/Excellent	27,774	183,883,256	81.9
<b>Insurance</b>			
Yes	32,142	208,692,801	93.2
No	2,340	15,156,995	6.8
<b>Cancer history</b>			
No	29,292	190,811,347	85.0
Yes	5,241	33,570,141	15.0
<b>Poverty</b>			
Below	4,445	21,368,688	10.2
Above	28,010	188,762,026	89.8
<b>Functional limitation</b>			
No	15,047	103,106,211	45.9
Yes	19,500	121,431,470	54.1

**Table 2.** Relationship between dichotomous psychological distress and trichotomous psychological distress with breast cancer screening

Variables	Breast Cancer Screening						sig
	No			Yes			
	Freq	Weighted Freq	(%)	Freq	Weighted Freq	(%)	
<b>Trichotomous PD</b>							
Low	9,852	63,000,000	28.2	16,552	110,000,000	49.3	
Moderate	2,925	18,000,000	7.9	3,500	22,000,000	10.0	
Severe	901	5,209,473	2.3	835	5,061,738	2.3	
<b>Dichotomous PD</b>							
Severe	901	5,209,473	2.3	835	5,061,738	2.3	**
No	12,777	81,140,988	36.1	20,052	133,219,685	59.3	*
<b>Race</b>							
White	10,874	70,000,000	31.3	16,388	110,000,000	49.6	
Black	1,779	9,377,038	4.2	3,046	17,000,000	7.7	
Native-Americans	143	833,285	0.4	179	977,459	0.4	
Asians	588	4,494,005	2.0	916	7,040,506	3.1	
Others	266	1,269,720	0.6	323	1,701,194	0.8	
<b>Marriage</b>							
Unmarried	1,569	8,075,928	3.6	2,136	11,000,000	4.7	**
Divorced	6,474	32,000,000	14.1	8,390	40,000,000	18.1	
Married	5,579	46,000,000	20.7	10,299	87,000,000	38.8	**
<b>Education</b>							
Less High School	2,153	13,000,000	5.6	2,262	14,000,000	6.1	
High School-/GED	3,923	25,000,000	11.3	5,116	34,000,000	15.0	
Some College >	7,535	48,000,000	21.4	13,457	91,000,000	40.5	*
<b>Employment</b>							
Unemployed	7,433	45,000,000	20.1	10,934	69,000,000	30.9	**
Employed	6,240	41,000,000	18.3	9,951	69,000,000	30.7	
<b>USC</b>							
No	1,505	9,307,981	4.1	436	2,745,425	1.2	**
Yes	12,171	77,000,000	34.3	20,449	140,000,000	60.3	**
<b>Region</b>							
North East	2,083	15,000,000	6.5	3,961	28,000,000	12.5	**
Northcentral/-Midwest	2,955	20,000,000	8.8	4,386	30,000,000	13.2	
South	5,142	33,000,000	14.9	7,492	51,000,000	22.7	
West	3,498	19,000,000	8.2	5,048	30,000,000	13.2	**
<b>Smoking status</b>							
Never	7,201	47,000,000	21.0	12,756	87,000,000	38.7	**
Former	3,435	21,000,000	9.5	5,748	37,000,000	16.5	
Current	3,021	18,000,000	8.0	2,358	14,000,000	6.3	**
<b>Health Status</b>							
Bad/fair	3,261	19,000,000	8.6	3,519	21,000,000	9.5	**
Good/Excellent	10,413	67,000,000	29.9	17,361	120,000,000	52.0	**
<b>Insurance</b>							
Yes	11,950	75,000,000	33.6	20,192	130,000,000	59.6	**
No	1,683	11,000,000	4.8	657	4,496,522	2.0	**
<b>Cancer history</b>							
No	11,902	75,000,000	33.6	17,390	120,000,000	51.5	**
Yes	1,759	11,000,000	4.8	3,482	23,000,000	10.1	**
<b>Functional limitation</b>							
No	5,747	38,000,000	16.8	9,300	65,000,000	29.1	**
Yes	7,924	48,000,000	21.6	11,576	73,000,000	32.5	**
<b>Poverty</b>							
Below	2,282	11,000,000	5.3	2,163	10,000,000	4.9	**
Above	10,544	70,000,000	33.1	17,466	120,000,000	56.7	**

Note. \*p < .05; \*\*p < .001

The proportion of Whites that received a mammogram (49.6%) within the past 12-months is higher than those who did not receive a mammogram (31.3%). That also holds true for Blacks, Asians, and other races with more of each

group receiving a mammogram compared to those that did not receive a mammogram among each group. However, there was an equal proportion of women that received a mammogram compared to the proportion that did not among

Native-Americans (0.4%).

There were more women that were screened for breast cancer compared to those that did not get screened among unmarried (4.7% vs. 3.6%), divorced (18.1% vs. 14.1%), and married (38.8% vs. 20.7%) women in our study. More participants received a mammogram than those that did not receive one for the various sub-groups of educational level, employment sta-

tus, regions, health status, cancer status, functional limitation, and poverty level categories.

However, our result showed that there were more women that did not receive a mammogram compared to those that received a mammogram in women that have no insurance (4.8% vs. 2%), no USC (4.1% vs. 1.2%) or are current smokers (8% vs. 6.3%).

**Table 3.** Relationship between dichotomous psychological distress and trichotomous psychological distress with breast cancer screening

Variables	Dichotomous Model		Trichotomous Model			
	aOR	95% CI	aOR	95% CI		
<b>PD</b>						
Severe	0.71	****	(0.63, 0.81)	0.76	***	(0.67, 0.87)
No (ref)						
Severe	0.91			0.91		(0.79, 1.04)
Moderate (ref)						
Moderate	0.84			0.84	****	(0.78, 0.91)
No (ref)						
<b>Smoking Status</b>						
Never	2.16			2.16	****	(1.98, 2.34)
Former						
Current (ref)	2.08			2.08	****	(1.90, 2.29)
<b>Health Status</b>						
Poor/Fair	0.67	****	(0.62, 0.72)	0.75	****	(0.69, 0.81)
Good/Excel (ref)						

Note. aOR (adjusted Odd Ratio); \*\*\* *p*-value < .001; \*\*\*\* *p*-value < .0001; aOR and 95% CI are unadjusted for multiple testing/comparison but *p* values are adjusted using Stepdown Bonferroni correction

The results of the logistic regression (see Table 3) indicate that women with SPD were 29% less likely to receive a mammogram (aOR = 0.71, 95% CI= 0.63, 0.81, *p* < .00001) compared to those that have NPD in the dichotomized categorization of PD. Compared to individuals with NPD in the trichotomized PD, women with SPD (aOR = 0.76, 95% CI= 0.67, 0.87, *p* = .0001) and those with MPD (aOR = 0.84, 95% CI= 0.78, 0.91, *p* < .00001) were 24% and 16% less likely to have received a mammogram within the past 12-months, respectively. The relationship between SPD and MPD that was assessed in the trichotomous model was not statistically significant.

In the dichotomous and trichotomous models, health status was found to be a significant confounder in the relationship between PD and the use of mammograms. Compared to those that perceived their health to be either good/excellent, women with perceived poor/fair were 33% and 25% less likely to receive a mammogram in the dichotomous model (OR = 0.67, 95% CI = 0.62, 0.72, *p* < .0001) and trichotomous model (OR = 0.75, 95% CI = 0.69, 0.81, *p* < .0001), respectively. Smoking status was also a confounder in the trichotomous model. Compared to those that are current

smoker, women that have never smoked were 2.2 times more likely to receive a mammogram (OR = 2.16, 95% CI=1.98, 2.34, *p* < .0001), and those that were former smokers are 2.1 times more likely to receive a mammogram (OR = 2.08, 95% CI = 1.90, 2.29, *p* < .0001).

#### 4. DISCUSSION

To our knowledge, this is the first study using a national representative sample of women 50-74 years that examined the relationship between receipt of USPSTF recommended mammograms and the three-level categorization of PD (trichotomous) as measured by the Kessler-6 scale. Traditionally, the relationship between PD and receipt of mammograms has been examined using a two-level categorization of PD (dichotomous). The trichotomous classification of PD made it possible for us to examine the true relationship between the three various levels of PD and the use of mammograms. The prevalence of SPD in both categorizations was 4.6%. This closely reflects the prevalence of SPD for women in the general public, which is 3.9%.<sup>[25]</sup> In the trichotomous categorization of PD, MPD had a prevalence of 17.9%, indicating that 17.9% of the study sample that would

have otherwise been categorized as having no PD, should be considered to have a milder form of PD. The proportion of women that had a mammogram within the last 12-months in our study sample was 61.6%, which is less than the proportion of women who received a mammogram in the general population (71.7%).<sup>[26]</sup>

In line with prior studies, this study found that women with PD or psychological disorders are less likely to receive preventative services.<sup>[11,27]</sup> However, our study found that literature that reported a dichotomous measure of PD underestimated the effects of PD on receipt of mammograms. When PD is dichotomized, women with SPD were 29% less likely to receive a mammogram than women with NPD. However, when PD is trichotomized, SPD women were 24% less likely to receive a mammogram compared to women with NPD. This is a five percent difference in the likelihood of receipt of a mammogram between the two categorizations. Perhaps the most important finding in this study is the relationship between MPD and the use of mammograms. Women with MPD were found to be 16% less likely to receive a mammogram compared to those that had no PD. The finding of a significant relationship between MPD and NPD, coupled with the lack of statistically significant difference between SPD and MPD affirms prior studies showing that moderately distressed individuals belong to a distinct category that is different from NPD, and also have a healthcare utilization challenges.<sup>[19]</sup>

By comparing these two models, our research highlights the utility of categorizing PD into three levels to more accurately estimate the effect of SPD on mammogram use. It also calls in question the validity of prior research that dichotomized PD and failed to find statistical significance. And most important, the identification of individuals with MPD, who are larger in proportion within the community compared to those with SPD, as likely having a barrier to receipt of mammograms, will provide policymakers with an additional target for interventions that seek to improve the adoption of mammogram screening. Lastly, our findings highlight the usefulness of the Kessler-6 tool for screening those at risk of forgoing breast cancer screening.

#### 4.1 Limitations

We used cross-sectional data, and so causation cannot be inferred. The data is self-reported, and there is the possibility of recall or social desirability bias among respondents. For example, the bias introduced by answering self-reporting the Kessler-6 scale might have a possible impact on the study's treatment effects. However, it is unclear that these biases might affect the three groups differently. Moreover, for the Kessler-6 scale, it is well-validated and research has found it

to be consistent in capturing PD levels with minimal discrepancies among different subpopulations. Despite our attempt to controlling for several potential confounders, some residual confounding from unmeasured variables may invariably biased our results. To minimized this bias, we used the Andersen's Behavioral Model of Health Services Use to identify our potential confounders. It should also be noted that both severe and moderate PD are non-specific for a clinical diagnosis of mental illness;<sup>[25]</sup> instead, the Kessler-6 scale measures depression and anxiety symptoms.

#### 5. CONCLUSIONS AND IMPLICATIONS

There overwhelming evidence suggesting that early screening of breast cancers using mammogram decreases breast cancer-related mortality.<sup>[6,28,29]</sup> Conversely, individuals with psychological distress have been shown to carry a disproportionate burden of cancers and cancer-related death.<sup>[30,31]</sup> This underscores the importance of screening for cancers in individuals that have psychological distress. Nonetheless, our study found that severely and moderately psychologically distressed women fifty to seventy-four years in the United States have lower odds of mammogram use. We also found that prior research that categorized women into those that either has severe or no psychological distress using the Kessler scale might have significantly overestimated the effect of having severe psychological distress on mammogram use. Therefore, we suggest that future research that uses this scale to examine health services use should ensure that moderately psychologically distress individuals are treated as a distinct group. The lower observed utilization of mammograms among women with SPD and MPD also warrants further investigation to determine how best to improve mammogram use for these individuals. To address the general problem of underutilization of preventative services<sup>[32,33]</sup> and the specific issue of breast cancer screening,<sup>[7-9]</sup> policymakers and healthcare providers must pay close attention to women with both MPD and SPD. Due to the simplicity of its administration, practitioners can utilize the Kessler-6 scale as a screener to identify women (MPD and SPD) at risk of not adhering to the USPSTF recommendations. Special interventions like reminders and other cues to actions could be used to encourage them to get screened. The Kessler-6 scale could also be administered to women that have missed a couple of screenings to see if their non-adherence is related to psychological distress so that it could be effectively addressed.

#### DATA AVAILABILITY STATEMENT

The datasets analyzed during the current study are available in the IPUMS repository, <https://nhis.ipums.org/nhis/>.

**ETHICAL STANDARDS**

We declare that this manuscript complies with the current laws of the United States of America.

**CONFLICTS OF INTEREST DISCLOSURE**

The authors declare they have no conflicts of interest.

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