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Association between self-reported depression and screening colonoscopy participation

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Abstract

The impact of depression on participation in screening colonoscopy is poorly characterized. This study attempts to understand this relationship by conducting a cross-sectional analysis on a nationally representative sample of adults aged 50–75 without a history of colorectal cancer or inflammatory bowel disease from the 2009 Medical Expenditures Panel Survey. Multivariable analysis shows that the odds of having a current colonoscopy is 1.3 times higher for individuals with depression compared to those without depression (OR =1.3; 95% CI = 1.1, 1.7). These findings suggest that depression may not be a risk factor for under-utilization of CRC screening.

Keywords

colorectal cancer; screening colonoscopy; depression; preventive care; utilization

Introduction

Colorectal cancer (CRC) is the third most common cancer in the US, and a significant cause of cancer morbidity and mortality.(1, 2) Screening is a cost-effective strategy for reducing cancer mortality through early detection of CRC and incidence through removal of adenomatous polyps.(3) Despite the ability of colonoscopy and other screening modalities to decrease the risk of CRC, approximately 45% of the eligible American population remains unscreened. (4, 5)

Depression is associated with lower rates of mammography,(6–8) pap smears,(9) blood pressure monitoring, vaccinations, and cholesterol testing(6), suggesting that depression may also be a barrier to CRC screening. Few studies have evaluated the relationship between depression and CRC screening participation, yielding conflicting results. Identification of whether or not depression is a “risk factor” for non-participation in CRC

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screening may influence policymakers seeking targeted interventions to assist the needs of this group and help prioritize spending of resources in the most effective way possible.

The purpose of this study was to use a large database representative of the US population to determine the impact of depression on CRC screening participation, specifically colonoscopy. We hypothesized that individuals with depression have lower rates of up-to-date screening colonoscopy than individuals without depression.

Materials and Methods

Data Source

We used a cross-sectional sample of the Consolidated Household and Medical Conditions data files from the Household Component Survey (HC) of the 2009 Medical Expenditures Panel Survey (MEPS), a nationally representative survey of the US civilian, non-institutionalized population. A detailed description of the MEPS-HC and additional information regarding the survey methodology and sampling are available elsewhere at <http://www.meps.ahrq.gov/mepsweb/>.

Study Sample

Our sample included survey respondents aged 50–75 without a history of colorectal cancer or inflammatory bowel disease who had complete outcome and covariate data (Figure 1).

Measures

Outcome—The primary outcome was up-to-date CRC screening with colonoscopy (yes/no) as defined by responses to the question “When did you do your most recent colonoscopy?” Individuals who answered “within the past year,” “within the past 2 years,” “within the past 3 years,” “within the past 5 years,” or “within the past 10 years” were considered up-to-date. Those who answered “more than 10 years” or “never” were not considered up-to-date.(3)

Main Independent Variable

Depression status, the main independent variable was determined by participant responses (yes/no) to the prompt “Now we are going to focus on health problems that have actually bothered you. Health problems include [...] mental or emotional health conditions, such as feeling sad, blue, or anxious about something. Include all conditions, accidents or injuries regardless of whether you saw a medical provider, received treatment, or took medications.” Responses were then manually coded using the ICD9-CM system and entered into the MEPS-HC Medical Conditions File. In our analyses, individuals with an ICD9-CM code of 311 were classified as having a self-reported history of depression.

Covariates

Covariates were selected because of their potential to confound results based on their association with CRC screening participation.(4, 10–26) We included gender, marital status, race, education, born in the US, language spoken at home, US census region, age, health insurance status, income level, BMI, diabetes, other co-morbidities (hypertension, coronary heart disease, myocardial infarction, stroke, emphysema, chronic bronchitis, asthma, cancer, and arthritis), number of other co-morbidities, presence of a usual care provider, and number of office based provider visits per year.

Statistical Analysis

Analyses were conducted in 2012 using SAS version 9.3 (SAS Institute Inc., Cary, NC). We used *proc survey* commands to account for the complex survey design and maintain the clustering structure of the full sample when taking subsets of data for analysis. We used survey weights so that our results reflected the 2009 U.S. civilian, non-institutionalized population. P values < 0.05 were considered significant.

We performed descriptive statistics on the study variables for the overall sample and by depression status. Frequencies and weighted percentages are reported for each of the categorical variables. Means and standard errors are reported for continuous variables. Sample characteristics were compared by depression status (yes/no) and between those missing and not missing outcome data, using Rao-Scott Chi-Square tests for the categorical variables and weighted regression models for the continuous variables. The prevalence of up-to-date screening colonoscopy was obtained for the overall sample and by depression status. Rao-Scott Chi-Square tests were used to test whether the prevalence of up-to-date screening colonoscopy differed by depression status.

Logistic regression models estimated the unadjusted and adjusted effect of depression and the study covariates on up-to-date screening colonoscopy. Since the covariates race, born in the US, and language spoken in the home were highly collinear, the final multivariable model included only race. Similarly, other co-morbidities and number of other co-morbidities were strongly correlated. Results were comparable when both variables were used thus the final multivariable model only includes other co-morbidities (yes/no). Interactions between depression and each of the covariates were also examined. ORs and their 95% CIs were computed from these logistic regression models.

Sensitivity analyses were conducted to assess the robustness of the study findings. First, we expanded the outcome to include being up-to-date with CRC screening via any modality (FOBT within last 1 year, flexible sigmoidoscopy within last 5 years, or colonoscopy within last 10 years) and ever having participated in any modality of CRC screening. Second, we examined the relationship of CRC screening participation with other mental health disorders, specifically anxiety and any mental health diagnosis. Third, we included the short form (SF)-1, a global indicator of health status in our models. Lastly, we examined the potential impact of missing data by conducting additional analyses assuming two extreme situations for cases missing outcomes (i.e. all had screening and none had screening).

Study Approval

This study was approved by the Boston University IRB.

Results

The 2009 MEPS study included 36,855 respondents of which 6,787 met the inclusion criteria (Figure 1). Among our sample, 836 (12%) had depression and 5,951 (88%) did not. Table 1 presents descriptive data for the overall study sample and by depression status. Sixty percent of the sample reported having an up-to-date screening colonoscopy, with a slightly higher percentage of depressed individuals compared to non-depressed individuals meeting criteria for up-to-date screening colonoscopy (64% vs. 58% respectively, $P=0.01$). The vast majority (89.8%) had a usual care provider. Those with depression differed from those without depression on all baseline characteristics except education level and U.S. census region.

Table 2 presents findings from the regression models. The unadjusted odds of having a current colonoscopy was 1.3 times higher for those individuals with depression compared to

those without depression (OR = 1.3; 95% CI = 1.1, 1.6). After controlling for the study covariates, those individuals with depression were still more likely to have an up-to-date screening colonoscopy than those individuals without depression (OR = 1.3; 95% CI = 1.1, 1.7). All study covariates were associated with up-to-date colonoscopy, except gender and BMI; diabetes was significantly related to up-to-date screening colonoscopy in the unadjusted model but insignificant in the adjusted model. None of the interactions between the covariates and depression were statistically significant (data not shown).

Sensitivity Analysis Findings

Expanding the definition of CRC screening participation and including the SF-1 in our adjusted model did not alter the findings. Furthermore, the results from the analysis examining the association of anxiety and any mental health disorder with up-to-date screening colonoscopy were comparable to our main findings adjusted odds ratio (aOR)_{anxiety} = 1.09, 95% CI = 0.88, 1.34; (aOR)_{anyMH} = 1.27, 95% CI = 1.09, 1.49. Lastly, whether or not cases with missing outcome data were assumed to be all up-to-date or all not up-to-date with screening colonoscopy did not change the original study results (Supplementary Tables A–C).

Discussion

In this study, we found that depression does not adversely affect participation in CRC screening, and may be associated with marginally higher rates of screening. We theorize two explanations for this unexpected association. First, people with depression may be more engaged in medical care. While our model controlled for having a usual care provider and the number of annual visits, we could not capture aspects of care beyond utilization such as trust in the medical system, preventive health care orientation, and provider belief in the value of preventive health. More frequent medical visits also provide more opportunities for providers to discuss and promote CRC screening, and primary care provider recommendations are an important factor in patients attending a screening colonoscopy.(4, 19, 21, 23, 24)

Secondly, more than half of the patients presenting to a primary care provider have somatization as part of depression.(27) Patients who somatize may have substantial physical symptoms which may lead to increased utilization of health services, including general physical exams.(28) Specific symptoms, such as anorexia, weight loss and chronic pain may predispose patients to being more receptive to CRC screening, which indirectly alleviates patients' concern over their general well-being while simultaneously fulfilling their providers' responsibilities toward promoting health maintenance.

Our findings are consistent with three previously published studies. In a retrospective single-center study, Stecker et al. found that women > 50 years of age with depression were more likely to receive colonoscopy within the past 5 years compared to women with hypertension. (29) A retrospective study at a single Veterans Administration (VA) center found that female veterans with mental health diagnoses were as likely as those without a mental health diagnosis to receive any CRC screening and were more likely to be up-to-date on CRC screening, though neither were statistically significant likely due to underpowered results. (30) A separate survey of elderly persons in North Carolina found that depression was not associated with receipt of FOBT.(31)

In contrast, two studies at the VA have shown a negative association between depression and CRC screening participation. In a national study, Druss et al. found rates of CRC screening with FOBT, flexible sigmoidoscopy, or colonoscopy within the previous 5 years were marginally lower among those with psychiatric conditions compared to those without

any psychiatric co-morbidities.(32) The weaknesses of this study include lack of adjustment or stratification by number of visits and use of a 5-year window for the outcome measure, despite guidelines recommending yearly FOBT.

A study at the VA in Minnesota found that the relationship between mental health diagnoses and up-to-date CRC screening by FOBT, flexible sigmoidoscopy, or colonoscopy was greatly influenced by the number of outpatient visits.(33) In unadjusted models, those with any mental health disorder appeared more likely to be screened (57% vs. 47%, $p < 0.01$), with a similar but non-significant trend for depression. After accounting for usual care visits, however, the directionality of this association changed, supporting the inclusion of this variable in our model. This study was limited in generalizability because of a co-morbid VA population and related selection effects. Those with mental disorders had far greater medical visits compared to those without (16.8 vs. 5.9) and high burden of concurrent mental health diagnoses (on average 5.8 per patient).

Differences between the MEPS sample and the VA cohorts may help explain the discrepancy between our findings and those within the VA. MEPS is a sample of individuals designed to be nationally representative of the US population. On average, the VA population tends to be sicker with an increased number of co-morbidities and concurrent mental illness, including a large proportion of substance abuse and post-traumatic stress disorder. These particular diagnoses may influence screening behavior differently than depression does. Perhaps those with depression in MEPS are less severe and more functional than those with depression at the VA, where issues of self efficacy, navigating logistics, impaired psychomotor ability, and lack of family support become important barriers to screening. Addressing severity of depression and its influence on CRC screening is an opportunity for future research.

Our study has several strengths. First, we used a large sample of US households within the rigorous study design of MEPS and to our knowledge, this is the first study conducted on a nationally representative sample. Second, we used self-reported mental health disorders to capture patients who may not have sought health care for their symptoms or perhaps were under-diagnosed or misdiagnosed by their providers. Third, we evaluated three different CRC screening outcomes with the primary being colonoscopy in order to reflect temporal trends in clinical practice and account for all acceptable CRC screening modalities by current guidelines. Fourth, we included having a usual care provider and number of provider visits as a proxy for engagement in care, which was previously shown to be relevant to models describing CRC screening participation.(33) Lastly, we confirmed findings in the literature with regard to characteristics influencing CRC screening and socio-demographic factors associated with depression, lending further validity to our findings.

Despite these strengths, we acknowledge certain limitations. First, the cross-sectional design allows evaluation of associations but does not provide direct data on causality or any plausible pathway of explanation. Second, the temporal relationship between depression and utilization of CRC screening remains unknown, but again, we only attempt to show an association, not causality. Third, we rely on self-reported depression and CRC screening in lieu of documentation within medical charts or billing codes. However, studies show that self-reported mental health is the third most accurately reported condition in MEPS, with a sensitivity rate of 88%.(34) (35) Self-reported colonoscopy is also dependable, with sensitivity and specificity rates of 97% and 72% respectively.(36, 37) Fourth, we do not know disease severity, utilization of anti-depressants or other medications, or functional impairment as a result of the mental health conditions, all of which would be useful to evaluate in future studies. Lastly, those missing data or lost to follow-up were slightly

different than the sample with complete data. To address this, we performed sensitivity analysis in which our results remained relatively unchanged and robust.

In conclusion, our study shows that depression does not negatively impact CRC screening rates. These results have implications for clinical practice and research. In the general US population, depression, while important to consider in overall management, may not be a risk factor for underutilization of CRC screening and equal effort should be expended to encourage CRC participation regardless of depression status. Future research should consider the age of onset, duration, and severity of depression, as well as the role of somatization with regard to CRC screening to identify subgroups that may be particularly vulnerable.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Study sample diagram
Abbreviations: CRC = Colorectal Cancer

Socio-demographic and baseline medical/utilization characteristics of the study sample in the 2009 Medical Expenditures Panel Survey by depression status

Table 1

Characteristic	Overall Sample N = 6 787		No Depression N = 5 951 (87.08%)		Depression N = 836 (12.92 %)		P-Value
	n	Weighted % or Mean (SE)	n	Weighted % or Mean (SE)	n	Weighted % or Mean (SE)	
Up-to-date screening colonoscopy	3 762	58.48 %	3249	57.62	513	64.27 %	0.01
<i>Socio-demographics</i>							
Gender							
Male	3 068	47.64 %	2812	49.83 %	256	32.90 %	<0.0001
Female	3 719	52.36 %	3139	50.17%	580	67.10%	
Marital Status							
Married	4 242	65.69 %	3834	67.87%	408	51.04%	<0.0001
Widowed/Divorced/Separated	2 001	27.51 %	1642	25.43 %	359	41.52%	
Never Married	544	6.80 %	475	6.70 %	69	7.44 %	
Race							
Hispanic	1 165	8.13%	1037	8.33 %	128	6.85 %	<0.0001
White, non-Hispanic	3 797	77.14%	3235	76.19%	562	83.50%	
Black, non-Hispanic	1 296	9.55 %	1191	10.15%	105	5.48 %	
Other	529	5.18%	488	5.33 %	41	4.17%	
Education							
<HS	1 324	12.17%	1143	11.87%	181	14.19%	0.16
HS Diploma / GED	320	49.50 %	2840	49.38 %	400	50.30 %	
>HS	2 223	38.33 %	1968	38.75 %	255	35.51 %	
Born in US							
Yes	5 381	88.13%	4665	87.56%	716	92.03 %	0.0007
No	1 406	11.87%	1286	12.44 %	120	7.97 %	

Characteristic	Overall Sample N = 6 787		No Depression N = 5 951 (87.08%)		Depression N = 836 (12.92 %)		P-Value
	n	Weighted % or Mean (SE)	n	Weighted % or Mean (SE)	n	Weighted % or Mean (SE)	
Language Spoken at Home							0.0079
English	5 798	92.66 %	5054	92.32 %	744	94.99 %	
Non-English	989	7.34 %	897	7.68 %	92	5.01 %	
US Census Region							0.08
Northeast	1 081	18.40%	957	18.62%	124	16.91 %	
Midwest	1 369	23.17%	1169	22.83 %	200	25.48 %	
South	2 694	36.56 %	2394	37.10%	300	32.92 %	
West	1 643	21.87%	1431	21.45%	212	24.70 %	
Income Level							<0.0001
Poor/Near Poor/Low Income	2 085	23.53 %	1741	22.27 %	344	32.00 %	
Middle Income	2 040	27.55 %	1801	27.18%	239	30.03 %	
High Income	2 662	48.92 %	2409	50.55 %	253	37.97 %	
Age (in years)							0.01
50–64	4 836	70.85 %	4217	70.19%	619	75.33 %	
65	1 951	29.15%	1734	29.81 %	217	24.67 %	
Health Insurance							<0.0001
Private	4 409	72.32 %	3948	73.54%	461	64.09 %	
Public Only	1 602	13.20%	1310	18.02%	292	27.17%	
Uninsured	776	8.48 %	693	8.44 %	83	8.75 %	
General Medical Information							
Diabetes							<0.0001
Yes	1 296	16.21 %	1072	15.13%	224	23.45 %	
No	5 491	83.79%	4879	84.87%	612	76.55 %	
Co-morbid conditions							<0.0001

Characteristic	Overall Sample N = 6 787		No Depression N = 5 951 (87.08%)		Depression N = 836 (12.92 %)		P-Value
	n	Weighted % or Mean (SE)	n	Weighted % or Mean (SE)	n	Weighted % or Mean (SE)	
No	1 299	19.67 %	1223	21.29%	76	8.81 %	
Yes	5 488	80.33 %	4728	78.71 %	760	91.19%	
Number of co-morbid conditions							<0.0001
None	1 299	19.67 %	1223	21.29%	76	8.81 %	
1	2 073	29.85 %	1898	30.72 %	175	24.01 %	
2	1 625	24.15%	1411	23.94%	214	25.58 %	
3	831	12.41 %	676	11.47%	155	18.74%	
4	441	6.43 %	346	5.89%	95	10.04 %	
5	518	7.48 %	397	6.69 %	121	12.84 %	
BMI							<0.0001
Mean (SE)		28.92(0.10)		28.69(0.11)		30.54(0.30)	
Min – Max		9.4–75.1		9.4–75.1		11.8–65.0	
Healthcare Utilization							
Usual Care Provider							0.0020
Yes	6 023	89.83 %	5238	89.24 %	785	93.82%	
No	764	10.17%	713	10.76%	51	6.18%	
# Office Based Provider Visits / Year							<0.0001
Mean (SE)		8.43(0.19)		7.83 (0.20)		12.52(0.55)	
Min – Max		0–173		0–173		0–105	

GED = General Equivalency Diploma, HS=high school

Note:

- All percentages and means reported in table are weighted to represent the 2009 United States civilian and non-institutionalized population.
- P-values reported in this table for the categorical variables are for the Rao-Scott Chi Square tests for differences in characteristics by depression status.
- P-values reported in this table for the continuous variables are from regression models that are weighted to the 2009 US civilian and non-institutionalized population and that take into account the sample's complex survey design.

d. The income categories are based on the federal poverty line (FPL). The classification of each income category based on the FPL is as follows: poor/near poor/low income is <200% FPL, middle income is 200–400% FPL, and high income is >400% FPL.

Table 2

Unadjusted and adjusted associations between depression and up-to-date colonoscopy (N = 6 787) in the 2009 Medical Expenditures Panel Survey

	Unadjusted Associations		Adjusted Associations	
Variable	OR (95 % CI)	P-Value	OR (95 % CI)	P-Value
Depression		0.0050		0.0069
Yes	1.32 (1.09, 1.61)		1.34 (1.09, 1.68)	
No	REF		REF	
Gender		0.86		0.57
Male	0.99(0.88, 1.11)		1.04(0.91, 1.18)	
Female	REF		REF	
Marital Status		<0.0001		<0.0001
Married	2.19(1.73, 2.77)		1.99(1.56, 2.54)	
Previously Married	1.82(1.42, 2.33)		1.90(1.46, 2.49)	
Never Married	REF		REF	
Education		<0.0001		<0.0001
<HS	0.40 (0.34, 0.48)		0.51 (0.41, 0.63)	
HS Diploma/GED	0.59 (0.52, 0.67)		0.63 (0.56, 0.72)	
>HS	REF		REF	
Race		<0.0001		<0.0001
Hispanic	0.49 (0.40, 0.60)		0.80 (0.65, 0.99)	
Black, non-Hispanic	0.92(0.77, 1.08)		1.33 (1.11, 1.58)	
Other	0.54 (0.44, 0.67)		0.63 (0.50, 0.80)	
White, non-Hispanic	REF		REF	
US Census Region		0.0107		0.04
Northeast	1.41(1.13, 1.75)		1.25(1.00, 1.55)	
Midwest	1.05(0.86, 1.28)		0.94(0.77, 1.15)	
South	1.14(0.95, 1.36)		1.08(0.90, 1.29)	
West	REF		REF	
Income Level		<0.0001		<0.0001
Poor/Near Poor/Low Income	0.47 (0.41, 0.56)		0.63 (0.52, 0.75)	
Middle Income	0.64 (0.54, 0.76)		0.76 (0.64, 0.90)	
High Income	REF		REF	
Age (in years)		<0.0001		<0.0001
50 – 64	0.47 (0.41, 0.54)		0.46 (0.40, 0.54)	
65	REF		REF	
Health Insurance		<0.0001		<0.0001
Public Only	0.82(0.71, 0.95)		0.76 (0.62, 0.93)	

	Unadjusted Associations		Adjusted Associations	
Variable	OR (95 % CI)	P-Value	OR (95 % CI)	P-Value
Uninsured	0.23 (0.18, 0.29)		0.45 (0.36, 0.58)	
Private	REF		REF	
Usual Care Provider		<0.0001		<0.0001
No	0.35 (0.28, 0.43)		0.53 (0.42, 0.67)	
Yes	REF		REF	
Diabetes		0.03		0.16
Yes	1.19(1.02, 1.39)		1.13 (0.95, 1.34)	
No	REF		REF	
Co-morbid conditions		<0.0001		<0.0001
Yes	1.72(1.46, 2.02)		1.41 (1.19, 1.68)	
No	REF		REF	
BMI	1.00(0.99, 1.01)	0.69	1.00(0.99, 1.01)	0.94
# Office Based Provider Visits	1.04(1.03, 1.05)	<0.0001	1.03 (1.02, 1.04)	<0.0001

GED = General Equivalency Diploma, HS=high school

Notes:

- a. All models take into account the 2009 MEPS multi-stage complex survey design
- b. All models are weighted to reflect the 2009 US civilian, non-institutionalized population
- c. All models are based off the same 6 787 study subjects
- d. The income categories are based on the federal poverty line (FPL). The classification of each income category based on the FPL is as follows: poor/near poor/low income is <200% FPL, middle income is 200–400% FPL, and high income is >400% FPL.
- e. The C-statistic for the adjusted model = 0.71