Effect of Mental Disorders on Diagnosis, Treatment, and Survival of Older Adults with Colon Cancer

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Abstract

OBJECTIVES—To evaluate the extent to which preexisting mental disorders influence diagnosis, treatment, and survival in older adults with colon cancer.

DESIGN—Retrospective cohort study.

SETTING—The Surveillance, Epidemiology and End Results (SEER)–Medicare linked database.

PARTICIPANTS—Eighty thousand six hundred seventy participants, aged 67 and older with a diagnosis of colon cancer.

MEASUREMENTS—The association between the presence of a preexisting mental disorder and the stage of colon cancer at diagnosis, receipt of cancer treatment, and overall and colon cancer-specific mortality were assessed using Cox proportional hazards regression and logistic regression.

RESULTS—Participants with mental disorders were more likely to have been diagnosed with colon cancer at autopsy (4.4% vs 1.1%; $P<.001$) and at an unknown stage of cancer (14.6% vs 6.2%; $P<.001$); to have received no surgery, chemotherapy, or radiation therapy (adjusted risk ratio (ARR) =2.09, 95% confidence interval (CI) =1.86–2.35); and to have received no chemotherapy for Stage 3 cancer (ARR =1.63, 95% CI =1.49–1.79). The rate of overall mortality (hazard ratio (HR) =1.33, 95% CI =1.31–1.36) and colon cancer-specific mortality (HR =1.23, 95% CI =1.19–1.27) was substantially higher in participants with a preexisting mental disorder than in their counterparts. All of these associations were particularly pronounced in participants with psychotic disorders and those with dementia.

CONCLUSION—Public health initiatives are needed to improve colon cancer detection and treatment in older adults with mental disorders.

Keywords

colon cancer; mental health; access to care

Mental disorders have consistently been linked with morbidity and mortality across a wide range of chronic and infectious diseases.[1–9] Given the high degree of medical comorbidity in older adults with mental disorders,[10] understanding the extent to which psychopathology adversely affects disease outcomes in this age group holds particular clinical and public health relevance. Mental disorders may influence the disease process through an array of behavioral, socioeconomic, and biological pathways. For example, behavioral factors commonly linked with mental illness—including smoking, substance abuse, lack of exercise, inadequate sleep, and poor nutrition—may contribute to disease development and exacerbation.[1–3,5,11–13] Likewise, socioeconomic factors associated with psychopathology —such as low levels of education, low socioeconomic status, and unemployment—may obstruct people's ability to obtain adequate health insurance, limiting their access to prevention and screening services, clinical care, and after-care.[1,5,8,14] Biological mechanisms, including the effect of stress and depression on the hypothalamic–pituitary– adrenal axis,[1,4] and the metabolic consequences of many psychotropic medications[5,15] may also have a direct effect on the disease process. Additionally, the cognitive and affective manifestations of mental illness may inhibit individuals' ability to navigate the complexities of the modern healthcare system.[1,16] Finally, mental disorders may affect treatment recommendations. Because of concerns about compromised informed consent and adverse effects, some medical providers may offer such individuals less-aggressive treatment.[1,2]

Although the link between mental disorders and poor health outcomes is well established,[1–9] only a handful of studies have examined the extent to which psychopathology affects the treatment and survival of people with cancer. The majority of these investigations have focused on dementia, which—unlike other mental disorders—occurs predominantly in old age. One study, for example, reported that individuals with a precancer diagnosis of dementia were less likely to receive invasive diagnostic procedures and curative intent therapies than people with cancer without dementia.[17] Likewise, another study found that people with breast cancer and with dementia were more likely to be diagnosed with cancer at a later stage and were less likely to receive surgery or chemotherapy than those without dementia.[18] A previous study of older people with cancer found that having a preexisting diagnosis of dementia was significantly associated with lower overall and cancer-specific survival.[19] In contrast to these studies, little information is available on the effect that other mental disorders, such as depression,[4] may have on the treatment and survival of older people with cancer.

Given the distinct behavioral and biological pathways associated with each major mental disorder, understanding the extent to which all major mental disorders—including depression, schizophrenia, substance use disorder, and dementia—collectively and independently contribute to the adverse health outcomes of older people with cancer is

important. Behavioral factors that result in delays in diagnosis and less than optimal treatment[20,21] may particularly affect people with colon cancer, which is the second-leading cause of cancer-related death in the United States.[22] The purpose of this study, therefore, was to examine the independent and aggregate effects of a preexisting diagnosis of any major mental disorder on stage of cancer diagnosis, receipt of treatment, and survival in older adults with colon cancer.

METHODS

Data Sources

Surveillance, Epidemiology and End Results (SEER)–Medicare linked data were used for this study.[23] The SEER program supports population-based cancer registries covering 25% of the U.S. population. Of people with cancer aged 65 and older listed in the SEER database, 93% were matched with their Medicare enrollment records. The SEER–Medicare database includes the following individual-level demographic and cancer-specific variables: age, race, ethnicity, type of cancer, month and year of cancer diagnosis, and extent of cancer (e.g., stage, tumor size or extension, and histological grade). It also includes selected socioeconomic characteristics of the census tract where the individual resided at the time of diagnosis.

The study population consisted of all individuals in the SEER registries diagnosed with colon cancer between January 1, 1993, and December 31, 2005, and who linked with Medicare data. Because Medicare claims data were used to identify individuals with a diagnosis of mental illness in the 2 years before colon cancer diagnosis, the subjects were limited to individuals aged 67 and older on January of the year of the colon cancer diagnosis and were enrolled in Medicare Parts A and B for at least 24 continuous months before their first cancer diagnosis. Subjects who were members of a health maintenance organization during the study period were excluded because their claims for medical services may not have been completed. This yielded a total of 80,670 eligible individuals. For the survival analyses, all individuals who were diagnosed at autopsy were excluded (n =1,591), yielding 79,079 participants.

Measures

Sociodemographic characteristics, including age at diagnosis, marital status (currently married or not), race and ethnicity (non-Hispanic white, African American, Hispanic American, or other), and the percentage of those living below the poverty line in the census tract, were obtained from the SEER database. Race and ethnicity were self-reported during the initial enrollment with the Social Security Administration. This variable was included in the analyses because cancer treatment and outcomes may vary according to race and ethnicity. The degree of comorbidity per participant was measured using an adaptation of the Charlson Comorbidity Index,[24] using information from the diagnosis codes in hospital and physician claims (inpatient and outpatient) corresponding to a date of service in the year before the cancer diagnosis.

Preexisting diagnoses of psychiatric disorders were identified using diagnosis codes as recorded in the Medicare claims data files during the 2-year period before cancer diagnosis. The *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes at any visit and in any position from inpatient, hospital outpatient, and physician claims were used to identify participants with the following diagnoses of psychiatric disorders: all mood disorders (codes 296.0, 296.1, 296.2, 296.3, 296.4, 296.5, 296.6, 296.7, 296.80, 296.81, 296.89, 296.9x, 300.4, 301.12, 301.13, 309.0, 309.1, 309.4, 311.x), all psychotic disorders (codes 293.81, 293.82, 295.xx, 297.xx, 298.xx), dementia (codes 331.0–331.2, 331.7, 290.0, 290.1, 290.10–290.13, 290.20, 290.21, 290.3, 290.40–290.43, 294.0, 294.1, 294.8, 797), substance abuse and dependence disorders (codes 291.0–291.1, 291.3–291.9, 292.xx, 303.xx, 304.xx, 305.xx), and other mental disorders that did not fall into the first three categories (codes 290.00–319.99). Colon cancer–specific death was defined as colon cancer listed as the underlying cause of death in SEER. SEER stage at diagnosis was measured using the American Joint Committee on Cancer (AJCC) staging classification. Information on months of survival was provided in SEER.

Statistical Analysis

Differences in proportion were assessed using Pearson chi-square. Logistic regression models were then used to evaluate whether the likelihood of receiving treatment varied as a function of prior diagnosis of mental disorder. The Cox proportional hazards regression model was used to analyze overall and colon cancer–specific survival for mental disorder groups, controlling for age, ethnicity, comorbidity, AJCC stage, and SEER site. Survival time was censored on December 31, 2005. All reported *P*-values were two-sided, and *P*<.05 was considered statistically significant. All analyses were performed using SAS version 9.1 (SAS Institute, Inc., Cary, NC).

RESULTS

Of 80,670 participants aged 67 and older diagnosed with colon cancer from 1993 to 2005, 20,699 (25.7%) had a diagnosis of any mental disorder in the 2 years preceding their colon cancer diagnosis (Table 1). Participants with mental disorders were more likely to be older, female, unmarried, and living in a census tract with a high proportion of persons below the poverty line and to have a higher degree of comorbidity.

Participants with and without mental illness demonstrated substantially different distributions of stage at diagnosis and diagnosis at autopsy (Table 2). Specifically, participants with a mental disorder were significantly more likely to have been diagnosed with colon cancer at an unknown stage (14.6%) than were those without a mental disorder (6.2%) (*P*<.001). This finding persisted across each of the mental disorder subgroups (for each comparison, *P*<.001) and was particularly pronounced in participants with psychotic disorders (22.9%) and those with dementia (24.3%). Likewise, participants with mental disorders were more likely to have been diagnosed at autopsy (4.4%) than those without a mental disorder (1.1%) (*P*<.001). Again, this finding persisted across all five subgroups (for each comparison, *P*<.001) and was particularly high in participants with a preexisting diagnosis of a psychotic disorder (7.5%) and those with a diagnosis of dementia (8.1%).

Table 3 presents unadjusted and adjusted estimates of the effects of each mental disorder on the likelihood of receiving no treatment (in all people with colon cancer) and the likelihood of receiving no chemotherapy (in participants with Stage 3 colon cancer). All analyses were restricted to participants who survived at least 6 months after diagnosis. Of all people with colon cancer (n =61,942), those with mental disorders were at greater risk of nonreceipt of treatment (6.8% vs 2.6%); participants with a psychotic disorder (12.6%) and those with dementia (13.3%) had particularly high rates of receiving no treatment. Likewise, participants with Stage 3 colon cancer (n =15,319) with mental disorders (54.6%) were at greater risk than those without mental disorders (38.7%) of receiving no chemotherapy. As reported above, participants with a psychotic disorder (72.6%) and those with dementia (78.9%) had especially high rates of receiving no chemotherapy.

Table 4 presents unadjusted and adjusted hazard ratios (HRs) of mortality (from colon cancer and from all causes) associated with each mental disorder. These analyses were conducted on the cohort members whose cancer was not diagnosed at autopsy (n =79,079). Model 1 adjusts for age, race and ethnicity, sex, marital status, SEER region, income, and year of diagnosis; Model 2 adjusts for the presence of comorbid disease and cancer stage at diagnosis in addition to the variables included in Model 1. All adjusted and unadjusted estimates show that a preexisting diagnosis of any mental disorder, mood disorder, psychotic disorder, dementia, substance abuse or dependence disorder, and "other mental disorder" were associated with greater mortality from all causes; all except mood disorders and "other mental disorders" were associated with greater colon cancer–specific mortality. Finally, assessment of all unadjusted and adjusted HRs shows that the presence of dementia was the strongest predictor of death from all causes and from colon cancer.

To assess whether receipt of treatment mediated the association between mental disorders and overall and colon cancer–specific mortality, 14,886 individuals diagnosed with Stage 3 colon cancer who had survived a minimum of 6 months following diagnosis were examined. These analyses were restricted to people with Stage 3 cancer because receipt of definitive treatment is highly variable and difficult to define at other stages of colon cancer. In the Cox proportional hazards models, the association between mental disorders and overall and colon cancer–specific survival were not attenuated after adding the variable receipt of chemotherapy to the models (data not shown).

To examine the validity of the findings, all bivariate and multivariate analyses were repeated using more-stringent selection criteria to define mental health conditions. Specifically, two or more instances of an ICD-9-CM code for a given mental health condition were required. Each of these analyses showed the same direction, magnitude, and statistical significance as those previously described.

DISCUSSION

The effect of mental illness on health and health care in the United States represents a critically important area of research.[1–8] Numerous studies have examined the biological, behavioral, and social pathways of this association, focusing primarily on cardiovascular, pulmonary, and infectious disease outcomes.[1–3,5] The current study—the first population-

based investigation to assess the effects of all major mental disorders on cancer treatment and outcomes—showed that older adults with colon cancer and a preexisting mental disorder had a greater likelihood of being diagnosed at an unknown stage of cancer or being diagnosed at autopsy; they also had higher rates of non-treatment and lower overall and colon cancer–specific survival rates than their mentally healthy counterparts. These findings persisted even after adjustment for socio-demographic characteristics, comorbid disease, and stage at diagnosis. It was also observed that psychotic disorders and dementia had particularly strong adverse effects on colon cancer diagnosis, treatment, and survival. It is likely that these findings reflect the profound degree of symptomatology—including cognitive impairment, paranoid ideation, disorganized thinking, and severe social impairment—that people with these disorders experience.

The finding that participants with mental disorders had a greater likelihood of diagnosis at an unknown stage may be attributable to a number of factors, including psychosocial and economic barriers to medical care, complexity of healthcare needs, and incomplete evaluation.[25] Because complete cancer staging often requires that individuals undergo multiple diagnostic procedures over an extended period of time, individuals with mental disorders may be at greater risk of dropping out of evaluation before staging can be completed. Individuals diagnosed with unknown stage cancer tend to have survival profiles similar to those diagnosed with Stage 4 cancer.[26] The four times greater rate of diagnosis of colon cancer at autopsy in individuals with mental disorders further suggests that such individuals may face significant barriers to accessing routine clinical care. To address the possibility that people with mental disorders were more likely to have undergone an autopsy, whether the frequency of underlying cause of death—particularly suicides, homicides, or accidental deaths—varied according to presence of mental disorder was examined. No such variation in mortality attributable to these causes, colon cancer, or other cancers was found. Stage at diagnosis was also examined in individuals whose colon cancer was diagnosed at autopsy, but the vast majority of such individuals (88%) were classified as unknown stage.

The finding that the presence of a preexisting mental disorder was associated with greater risk of not receiving treatment is consistent with previous reports. A study of more than 24,000 older adults with a diagnosis of breast cancer found that women with a prior diagnosis of depression had a greater likelihood of receiving nondefinitive cancer treatment.[4] Likewise, a study of older adults hospitalized for confirmed acute myocardial infarction reported that individuals with mental disorders were substantially less likely to undergo coronary revascularization procedures than those without mental disorders.[2] As mentioned previously, such treatment disparities may be associated with a number of participant and provider characteristics. As an example, impaired communication skills and less motivation associated with some mental disorders may make it difficult for individuals to navigate the healthcare system.[5] The barriers that individuals with psychotic disorders and those with dementia face may be particularly profound. For example, cognitive impairment may significantly complicate the informed consent process, limiting the extent to which providers are willing to recommend certain diagnostic procedures and treatments, including enrollment in clinical trials, for such individuals.[27] Disorganized thinking may hinder a person's ability to follow medical recommendations, such as scheduling follow-up medical

appointments or adhering to complex treatment regimens.[5,27] People with delusions or paranoia may perceive certain clinical procedures, even those that are noninvasive, as threatening.[5] As a result, providers may be apprehensive about providing treatment and may have concerns about the additional time, support staff, and costs such treatment may require.

Individuals with a diagnosis of a mental disorder had lower overall and colon cancer–specific survival rates than those without such a diagnosis. This association remained even after controlling for other factors that might influence survival, such as number of comorbidities, stage at diagnosis, and receipt of treatment. Likewise, in a population-based study of older women with breast cancer, individuals with a preexisting diagnosis of depression had a higher risk of cancer-related death.[4] As in the current study, this association persisted even when the analysis adjusted for number of comorbid conditions, stage at diagnosis, and receipt of treatment.

A number of behavioral and socioeconomic factors may underlie these findings. For example, persons with mental disorders are more likely to engage in behaviors with adverse health consequences, such as smoking, substance abuse, excessive alcohol consumption, poor nutrition, and poor sleep patterns.[1,5] These individuals may also be less likely to receive appropriate health screening and treatment and may demonstrate poorer adherence to medical recommendations.[4] All of these factors would increase mortality from other illnesses. Mental illness may also have a direct biological effect on physical health through dys-regulation of the hypothalamic–pituitary–adrenal axis.[1] Additionally, a substantial proportion of psychotropic medications may have an adverse effect on physical health.[5] In particular, the second-generation antipsychotic medications are associated with weight gain, diabetes mellitus, insulin resistance, dyslipidemia, and metabolic syndrome.[5,6,15]

Several factors should be considered when making a decision about recommending aggressive colon cancer treatment for older adults with psychotic disorders or dementia. Such individuals may have a limited understanding of the clinical course of their cancer and may have difficulty assessing the risks and benefits of treatment. For these individuals, especially those without family support, the physical and mental effects of surgery, radiation therapy, and chemotherapy present a number of challenges. Clinicians must weigh the physical and emotional costs of treatment against the possible health benefits in this vulnerable population.

This study may have had several limitations. First, because Medicare data were used, and 2 years of data before the diagnosis of cancer was required, the study was limited to individuals aged 67 and older who had Medicare Part A and B coverage. The findings may not be relevant to younger people or to individuals enrolled in Medicare health maintenance organizations. Second, how cancers were diagnosed, that is through screening or on the basis of symptoms, was not assessed. Whether these individuals were living in the community or were institutionalized at the time of diagnosis was also not examined. Third, mental illness was identified using diagnoses listed on the physician's professional charges. This may be an insensitive measure to identify some mental illnesses, such as depression and dementia, that many physicians frequently underrecognize.[19,28] Moreover, because copayments and coinsurance burdens for mental health treatment of Medicare beneficiaries

are substantial (e.g., 45% coinsurance for Part B mental health treatment in 2010), mental illness may be underreported in members of the study cohort who are from low-income backgrounds. Third, people with colon cancer identified from the SEER–Medicare linked database and enrolled in Medicare Part B for a minimum of 2 years may not be reflective of the general population of older adults with colon cancer in the United States. Additionally, sensitivity analyses were conducted in which the definition of mental disorders was restricted to two or more instances of the ICD-9-CM code for a given condition. The direction, magnitude, and statistical significance of the effect estimates observed in these analyses were unaltered. Third, the assessment of socioeconomic status was limited to census tract–level measures of income. Fourth, it is possible that undetected selection bias and residual confounding may have affected the findings. For example, although comorbidity was controlled in the analyses, mental disorders may be associated with other unmeasured health indicators that contribute to the observed effect of mental illness on treatment and survival.

In summary, these findings suggest that older adults with colon cancer and a preexisting mental disorder, particularly a psychotic disorder or dementia, may have poorer cancer outcomes. This may be related to the significant challenges such individuals face in accessing cancer treatment, navigating the healthcare system, and managing their cancer. Developing an adequate understanding of the complex behavioral, socioeconomic, and biological pathways that underlie these disparities will require additional studies. Research focusing on medical decision-making, doctor–patient communication, and treatment adherence of older adults with mental disorders will be particularly important. Ultimately, such information will be critical in developing new clinical approaches, such as intensive case management or patient navigator linkage, for improving cancer prevention, screening, and treatment in individuals with mental disorders.

Acknowledgments

References

1. Druss BG, Bornemann TH. Improving health and health care for persons with serious mental illness: The window for US federal policy change. JAMA. 2010; 303:1972–1973. [PubMed: 20483975]

2. Druss BG, Bradford DW, Rosenbeck RA, et al. Mental disorders and use of cardiovascular procedures after myocardial infarction. JAMA. 2000; 283:506–511. [PubMed: 10659877]

3. Druss BG, Bradford WD, Rosencheck RA, et al. Quality of medical care and excess mortality in older patients with mental disorders. Arch Gen Psychiatry. 2001; 58:565–572. [PubMed: 11386985]

4. Goodwin JS, Zhang DD, Ostir GV. Effect of depression on diagnosis, treatment, and survival of older women with breast cancer. J Am Geriatr Soc. 2004; 52:106–111. [PubMed: 14687323]

5. Parks, J.; Svendsen, D.; Singer, P., et al., editors. Morbidity and Mortality in People with Serious Mental Illness. Alexandria, VA: National Association of State Mental Health Program Directors; 2006. Available at http://www.nasmhpd.org/publicationsmeddir.cfm [Accessed July 5, 2010]

6. Newcomer JW, Hennekens CH. Severe mental illness and risk of cardiovascular disease. JAMA. 2007; 298:1794–1796. [PubMed: 17940236]

7. Colton CW, Manderscheid RW. Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. Prev Chronic Dis [serial online]. 2006; 3:A42. Available at http://www.cdc.gov/pcd/issues/2006/apr/05_0180.htm.

8. Saha S, Chant D, McGrath J. A systematic review of mortality in schizophrenia: Is the differential mortality gap worsening over time? Arch Gen Psychiatry. 2007; 64:1123–1131. [PubMed: 17909124]

9. Green AI, Canuso CM, Brenner MJ, et al. Detection and management of comorbidity in patients with schizophrenia. Psychiatr Clin North Am. 2003; 26:115–139. [PubMed: 12683263]

10. Prince JD, Akincigil A, Kalay E, et al. Psychiatric rehospitalization among elderly persons in the United States. Psychiatr Serv. 2008; 59:1038–1045. [PubMed: 18757598]

11. Hamer M, Chida Y, Molloy GJ. Psychological distress and cancer mortality. J Psychosom Res. 2009; 66:255–258. [PubMed: 19232239]

12. Chida Y, Hamer M, Wardle J, et al. Do stress-related psychosocial factors contribute to cancer incidence and survival? A systematic quantitative review of 40 years of inquiry. Nat Clin Pract Oncol. 2008; 5:466–475. [PubMed: 18493231]

13. Compton MT, Daumit GL, Druss BG. Cigarette smoking and overweight/ obesity among individuals with serious mental illness: A preventive perspective. Harv Rev Psychiatry. 2006; 14:212–222. [PubMed: 16912007]

14. Aro S, Aro H, Keskimaki I. Socio-economic mobility among patients with schizophrenia or major affective disorder. A 17-year retrospective follow-up. Br J Psychiatry. 1995; 166:759–767. [PubMed: 7663824]

15. Reist C, Mintz J, Albers LJ, et al. Second-generation antipsychotic exposure and metabolic-related disorders in patients with schizophrenia: An observational pharmacoepidemiology study from 1988 to 2002. J Clin Psychopharmacol. 2007; 27:46–51. [PubMed: 17224711]

16. Griswold KS, Zayas LE, Pastore PA, et al. Primary care after psychiatric crisis: A qualitative analysis. Ann Fam Med. 2008; 6:38–43. [PubMed: 18195313]

17. Gupta SK, Lamont EB. Patterns of presentation, diagnosis, and treatment in older patients with colon cancer and comorbid dementia. J Am Geriatr Soc. 2004; 52:1681–1687. [PubMed: 15450045]

18. Gorin SS, Heck JE, Albert S, et al. Treatment for breast cancer in patients with Alzheimer's disease. J Am Geriatr Soc. 2005; 53:1897–1904. [PubMed: 16274370]

19. Raji MA, Kuo YF, Freeman JL, et al. Effect of a dementia diagnosis on survival of older patients after a diagnosis of breast, colon, or prostate cancer: Implications for cancer care. Arch Intern Med. 2008; 168:2033–2040. [PubMed: 18852406]

20. Luo R, Giordano SH, Zhang DD, et al. The role of the surgeon in whether patients with lymph node-positive colon cancer see a medical oncologist. Cancer. 2007; 109:975–982. [PubMed: 17265530]

21. Luo R, Giordano SH, Freeman JL, et al. Referral to medical oncology: A crucial step in the treatment of older patients with stage III colon cancer. Oncologist. 2006; 11:1025–1033. [PubMed: 17030645]

22. American Cancer Society. [Accessed July 5, 2010] Colorectal cancer. [online]. Available at http://www.cancer.org/Cancer/ColonandRectumCancer/DetailedGuide/colorectal-cancer-key-statistics

23. Warren JL, Klabunde CN, Schrag D, et al. Overview of the SEER-Medicare data: Content, research applications, and generalizability to the United States elderly population. Med Care. 2002; 40(8 suppl):IV-3–IV-18.

24. Klabunde CN, Warren JL, Legler JM. Assessing comorbidity using claims data: An overview. Med Care. 2002; 40(8 suppl):IV-26–IV-35.

25. Koroukian SM, Xu F, Beaird H, et al. Complexity of care needs and unstaged cancer in elders: A population-based study. Cancer Detect Prev. 2007; 31:199–206. [PubMed: 17658225]

26. Goodwin JS, Samet JM, Key CR, et al. Stage at diagnosis of cancer varies with the age of the patient. J Am Geriatr Soc. 1986; 34:20–26. [PubMed: 3941240]

27. Frayne SM, Halanych JH, Miller DR, et al. Disparities in diabetes care: Impact of mental illness. Arch Intern Med. 2005; 165:2631–2638. [PubMed: 16344421]

28. Davidson JR, Meltzer-Brody SE. The underrecognition and undertreatment of depression: What is the breadth and depth of the problem? J Clin Psychiatry. 1999; 60(Suppl 7):4–9. [PubMed: 10326869]

Table 1

Sociodemographic and Clinical Characteristics of 80,670 Participants with Colon Cancer

Characteristics	All (N = 80,670)	No Mental Disorder (n =59,971)	Any Mental Disorder (n =20,699)	Difference, Chi-Square (*P*-Value)
		%		
Age				
67–74	32.1	34.5	25.1	
75–84	46.0	46.2	45.2	
85	21.9	19.3	29.7	1,194.6 (<.001)
Race or ethnicity				
White	83.6	83.5	83.8	
Black	8.2	8.0	8.8	
Hispanic	3.7	3.6	4.0	
Other	4.5	4.9	3.4	101.2 (<.001)
Sex				
Female	57.6	55.2	64.6	
Male	42.4	44.8	35.4	567.3 (<.001)
Marital status				
Married	46.1	49.8	35.6	
Not married	53.9	50.2	64.8	1,306.9 (<.001)
Living below poverty line, % [*]				
<3	13.3	13.7	12.2	
3–6	31.1	31.6	29.4	
7–13	26.3	26.3	26.1	
14	29.4	28.4	32.3	131.2 (<.001)
Charlson Comorbidity Index				
0	63.2	68.1	48.9	
1	22.1	20.7	26.2	
2	8.7	7.1	13.4	
3	6.0	4.1	11.5	3,549.8 (<.001)

[*] Because of missing data, n =79,662 for this analysis.

Table 2

Stage at Diagnosis and Diagnosis at Autopsy of Participants with Colon Cancer Stratified According to Preexisting Mental Disorder

Characteristic	No Mental Disorder (n =59,971)	Any Mental Disorder (n =20,699)	Mood Disorder (n =8,261)	Psychotic Disorder (n =3,576)	Substance Use Disorder (n =3,443)	Dementia (n =7,267)	Other Mental Disorder (n =9,322)	Difference, Chi-Square (P-Value)
				%				
Stage at diagnosis								
1	21.9	21.1	21.4	18.5	21.6	17.6	22.7	
2	31.4	28.6	28.6	26.1	30.2	25.9	29.8	
3	23.1	20.1	20.8	16.4	19.2	17.2	21.4	
4	17.5	15.7	15.4	16.1	17.8	15.0	15.7	
Unknown	6.2	14.6	13.8	22.9	11.2	24.3	10.5	966.9 (<.001)
Diagnosis at autopsy	1.1	4.4	4.2	7.5	3.1	8.1	4.1	875.5 (<.001)

Chi-square analyses used to assess difference between those with no mental disorder and those with any mental disorder.

Table 3

Nonreceipt of Treatment of Participants with Colon Cancer with and without Preexisting Mental Disorders

Risk Factor	No Treatment (All Stages, n =61,942)			No Chemotherapy (Stage 3, n =15,319)		
	%	Unadjusted RR	Adjusted RR	%	Unadjusted RR	Adjusted RR
No mental disorder	2.6	Reference	Reference	38.7	Reference	Reference
Any mental disorder	6.8	2.76 (2.52–3.01)	2.09 (1.86–2.35)	54.6	1.88 (1.74–2.04)	1.63 (1.49–1.79)
Mood disorder	6.5	1.22 (1.07–1.39)	1.28 (1.08–1.52)	55.0	1.36 (1.21–1.54)	1.27 (1.10–1.46)
Psychotic disorder	12.2	1.71 (1.45–2.02)	1.42 (1.13–1.78)	72.9	1.91 (1.51–2.43)	1.56 (1.21–2.03)
Dementia	13.3	4.03 (3.56–4.56)	2.47 (2.08–2.93)	78.9	4.42 (3.71–5.27)	3.23 (2.66–3.91)
Substance abuse disorder	4.9	1.08 (0.89–1.32)	1.21 (0.94–1.56)	43.6	0.88 (0.73–1.01)	1.15 (0.94–1.41)
Other mental disorder	6.3	1.21 (1.07–1.37)	1.28 (1.05–1.55)	51.4	1.12 (0.99–1.25)	1.03 (0.90–1.76)

Associations between preexisting mental disorders and no treatment (all stages) and no chemotherapy (Stage 3 only) were estimated using logistic regression models that adjusted for age; race and ethnicity; sex; marital status; Surveillance, Epidemiology, and End Results region; income; comorbidity; year of diagnosis; and stage (for no-treatment model only).

Analyses were restricted to patients who remained alive and enrolled in Medicare at least 6 months after their date of diagnosis.

RR =risk ratio.

Table 4

Risk of Overall and Colon Cancer–Specific Mortality Stratified According to Preexisting Mental Disorder*

Type of Mental Disorder	Hazard Ratio (95% Confidence Interval)	
	Overall Mortality	Colon Cancer-Specific Mortality
Any mental disorder		
Unadjusted	1.55 (1.52–1.58)	1.31 (1.27–1.35)
Model 1	1.44 (1.41–1.47)	1.23 (1.19–1.27)
Model 2	1.33 (1.31–1.36)	1.23 (1.19–1.27)
Mood disorder		
Unadjusted	1.08 (1.05–1.12)	1.02 (0.97–1.06)
Model 1	1.11 (1.08–1.15)	1.03 (0.99–1.08)
Model 2	1.07 (1.03–1.10)	1.04 (0.99–1.10)
Psychotic disorder		
Unadjusted	1.39 (1.33–1.46)	1.27 (1.20–1.36)
Model 1	1.30 (1.24–1.36)	1.19 (1.11–1.27)
Model 2	1.22 (1.17–1.28)	1.16 (1.10–1.24)
Dementia		
Unadjusted	2.01 (1.95–2.10)	1.75 (1.67–1.83)
Model 1	1.60 (1.55–1.66)	1.49 (1.42–1.56)
Model 2	1.45 (1.40–1.50)	1.41 (1.34–1.48)
Substance use disorder		
Unadjusted	1.21 (1.15–1.26)	1.04 (0.97–1.10)
Model 1	1.37 (1.31–1.43)	1.14 (1.06–1.21)
Model 2	1.26 (1.20–1.32)	1.12 (1.04–1.20)
Other mental disorder		
Unadjusted	1.07 (1.03–1.10)	1.01 (0.96–1.05)
Model 1	1.06 (1.02–1.09)	0.99 (0.95–1.04)
Model 2	1.04 (1.01–1.08)	1.03 (0.99–1.08)

As defined in Measures section.

Analyses excluded patients whose colon cancer was diagnosed at autopsy.

Model 1 adjusted for age; race and ethnicity; sex; marital status; Surveillance, Epidemiology and End Results region; income; and year of diagnosis.

Model 2 additionally adjusted for comorbid disease index and cancer stage at diagnosis index.