Research Square

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Pain and Mental Health Patterns in Adults With a History of Cancer

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Abstract

Purpose

To examine associations of cancer-related pain, including whether pain is controlled, with frequent poor mental health and subjective cognitive decline (SCD) among cancer survivors.

Methods

We analyzed 2022–2024 Behavioral Risk Factor Surveillance System data from 24,015 adults with a history of cancer. Respondents were classified as having no pain, or pain controlled or uncontrolled, with or without medication. Sex-stratified weighted logistic regression models, adjusted for age, race and ethnicity, income, and education, estimated associations with frequent poor mental health (≥ 14 of the past 30 days) and SCD (assessed among adults aged ≥ 45 years).

Results

Current cancer-related pain was reported by 11.9% of women and 8.5% of men. Compared with no pain, uncontrolled pain was associated with the highest odds of frequent poor mental health (adjusted odds ratio [AOR] up to 5.30 among men and 2.66 among women) and SCD (AOR up to 4.66 among men and 3.56 among women). Pain controlled with medication was also associated with elevated odds of both outcomes in both sexes. Among women, gynecologic cancer was associated with higher odds of both outcomes.

Conclusions

Cancer-related pain, particularly uncontrolled pain, was associated with poorer mental health and SCD, and elevated odds persisted even when pain was controlled with medication.

Implications for Cancer Survivors:

Survivors who report pain, even when it is controlled, may benefit from routine screening for psychological distress and cognitive concerns, and survivors reporting these concerns may benefit from assessment of pain and its control.

Introduction

Cancer is historically one of the largest obstacles in all medical specialties. No body system is spared from its reach and consequences. Colorectal, breast, and prostate cancer are the most commonly

diagnosed cancers in the world [1]. Additionally, BRCA1/BRCA2 mutations are associated with approximately 5–10% of breast cancers and 15% of ovarian cancers [2]. Uterine cancer is the fourth most common cancer among women in the United States, while ovarian cancer ranks eighth. In contrast, cervical cancer is less common, largely due to the widespread implementation of effective prevention and screening strategies [3–5]. While cervical, uterine, ovarian, and prostate cancers are sex-specific, colorectal cancer ranks among the top 5 cancers to affect both men and women [6]. Across these cancers, stage at diagnosis is a key prognostic factor, with more advanced-stage disease associated with poorer outcomes and a greater likelihood of pain [7–9].

Despite decades of research and advances in cancer pain management, undertreatment remains common, with approximately 40% of patients reporting inadequately controlled pain [10]. Pain affects more than half of patients with cancer across disease stages [11], with prevalence increasing to 66%–82% among patients with advanced disease and becoming particularly pronounced near the end of life [12]. Importantly, pain may persist beyond active treatment, with nearly 40% of cancer survivors reporting chronic pain [13]. Treatment of pain can also be challenging, as approximately 10%–15% of patients with cancer-related pain have an inadequate response to opioid therapy [14].

Beyond the physical burden of cancer-related pain, cancer is also associated with substantial psychological and emotional morbidity. Mental health conditions, including anxiety, depression, and post-traumatic stress disorder, affect approximately 30% of patients with cancer [15]. The factors contributing to poor mental health are multifaceted and may include uncertainty regarding prognosis, inadequate social support, and feelings of helplessness [16]. Certain populations may be particularly vulnerable, including individuals with a history of mental health conditions and those diagnosed with advanced-stage disease [17].

Patient-reported outcomes provide an important means of assessing the broader psychological and cognitive burden associated with cancer. Measures such as poor mental health days, depressive symptoms, fatigue, and subjective cognitive decline (SCD) may identify dimensions of well-being that are not fully captured by formal psychiatric diagnoses [18, 19]. Although these outcomes are increasingly recognized as important components of cancer survivorship and quality of life, differences in their prevalence across cancer types remain incompletely characterized.

Despite the high prevalence of cancer, it remains unclear how pain and its control relate to mental health and cognitive outcomes among cancer survivors, and whether these associations differ by cancer type. Using the Behavioral Risk Factor Surveillance System (BRFSS), we examined associations of cancer-related pain, including whether pain was controlled with or without medication, with frequent poor mental health and subjective cognitive decline (SCD), and assessed differences across common cancer types. We hypothesized that uncontrolled pain would be associated with the greatest odds of both outcomes and that associations would vary by cancer type.

Methods

Data Source

We conducted a cross-sectional analysis of the 2022–2024 Behavioral Risk Factor Surveillance System (BRFSS), a nationwide telephone survey of noninstitutionalized US adults that collects information on chronic health conditions, health-related risk behaviors, and use of preventive services. BRFSS participants are selected through random-digit dialing of landline and cellular telephones.

Study Population and Cancer Types

Respondents were asked whether a health professional had ever told them they had skin cancer that is not melanoma, or melanoma or any other type of cancer; those answering yes to either were eligible for the optional cancer survivorship modules. Analyses were limited to respondents from states that administered these modules in each survey year, regardless of time since diagnosis. Cancer type was assessed with the question, “What kind of cancer is it?” Respondents reporting more than 1 cancer were asked about their most recent diagnosis. We grouped responses into colorectal (colon or rectum), breast, gynecologic (cervical, ovarian, or uterine), and prostate cancer [1, 5]. Respondents reporting other cancer types served as the reference group.

Pain and Pain Management

Current cancer-related pain was assessed with the question, “Do you currently have physical pain caused by your cancer or cancer treatment?” Respondents answering yes were asked, “Would you say your pain is currently under control…?” with response options of with medication (or treatment); without medication (or treatment); not under control, with medication (or treatment); and not under control, without medication (or treatment). Combined with respondents reporting no pain, this produced 5 pain categories.

Mental Health and Subjective Cognitive Decline

Mental health was assessed with the question, “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” Responses were dichotomized as frequent poor mental health (≥ 14 days) vs fewer than 14 days. Subjective cognitive decline (SCD) was assessed in the optional BRFSS Cognitive Decline module, administered to respondents aged 45 years or older, with the question, “During the past 12 months, have you experienced difficulties with thinking or memory that are happening more often or are getting worse?” Analyses of SCD were therefore limited to respondents aged ≥ 45 years in states that administered this module.

Sociodemographics

Sociodemographic variables included sex (male or female), age, race and ethnicity, annual household income, and educational attainment. Race and ethnicity were assessed using the BRFSS imputed race/ethnicity variable (_IMPRACE).

Statistical Analysis

After merging the 3 survey cycles, we accounted for the BRFSS complex survey design, using sampling weights adjusted for the multiyear data to generate population estimates. We first describe the sample and cancer-related characteristics, then report the prevalence of pain and pain management categories by sex and cancer type, compared using design-based χ^2 tests. We used weighted logistic regression to estimate associations of pain category and cancer type with frequent poor mental health and SCD, reporting unadjusted odds ratios (ORs) and adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Models were stratified by sex and adjusted for age, race and ethnicity, income, and education. Percentages are weighted and sample sizes are unweighted. Analyses were conducted in Stata version 19 (StataCorp LLC, College Station, TX), with $\alpha = .05$.

Ethics

This study used publicly available, deidentified data and did not meet the regulatory definition of human subjects research under 45 CFR 46.102(e); therefore, institutional review board review was not required. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Results

Sample and Pain Prevalence

The sample included 24,015 adults who reported a prior cancer diagnosis (10,537 men; 13,478 women). Overall, 11.9% of women (n = 1,385) and 8.5% of men (n = 790) reported current pain from cancer or its treatment (Table 1). Pain prevalence varied by cancer type. Among men, pain was most frequently reported by those with colorectal cancer (24.3%), and among women, by those with breast cancer (21.8%). Among respondents with colorectal cancer, men reported pain more often than women (24.3% vs 18.4%). Respondents with prostate cancer reported the lowest pain prevalence of any cancer type (6.2%).

Table 1
Pain and pain management by cancer type and sex among adults with a history of cancer, Behavioral Risk Factor Surveillance System, 2022–2024

Cancer type	No pain	Pain under control, with medication or treatment	Pain under control, without medication or treatment	Pain not under control, with medication or treatment	Pain not under control, without medication or treatment	Total, n
Men						
Other cancers	7,542 (91.8)	241 (3.5)	181 (2.5)	63 (1.1)	87 (1.2)	8,114
Colorectal	335 (75.7)	34 (11.5)	17 (6.9)	5 (1.2)	19 (4.7)	410
Prostate	1,870 (93.8)	62 (2.3)	47 (2.5)	12 (0.7)	22 (0.7)	2,013
Total	9,747 (91.5)	337 (3.6)	245 (2.7)	80 (1.0)	128 (1.3)	10,537
Women						
Other cancers	8,040 (92.4)	245 (2.9)	179 (2.4)	62 (0.9)	90 (1.3)	8,616
Colorectal	373 (81.6)	29 (8.7)	21 (3.6)	13 (3.6)	12 (2.5)	448
Breast	2,597 (78.2)	233 (8.1)	240 (9.8)	40 (1.5)	71 (2.3)	3,181
Gynecologic	1,083 (86.7)	69 (5.9)	42 (4.0)	10 (1.0)	29 (2.4)	1,233
Total	12,093 (88.1)	576 (4.7)	482 (4.4)	125 (1.2)	202 (1.7)	13,478

Values are unweighted n (weighted %). Gynecologic cancers include cervical, ovarian, and uterine cancer; colorectal includes colon and rectal cancer.

Frequent Poor Mental Health

Compared with no pain, every pain category was associated with higher odds of frequent poor mental health in both sexes, with the highest odds among those whose pain was not under control (Table 2). Among men, odds were highest when pain was not under control despite medication or treatment (AOR, 5.30; 95% CI, 3.01–9.34), followed by uncontrolled pain without medication or treatment (AOR, 3.61; 95% CI, 2.28–5.72). Men whose pain was under control also had elevated odds, both with medication or treatment (AOR, 2.27; 95% CI, 1.66–3.12) and without (AOR, 2.30; 95% CI, 1.60–3.31). Among women, odds were similar whether pain was not under control with medication or treatment (AOR, 2.60; 95% CI, 1.67–4.05) or without (AOR, 2.66; 95% CI, 1.84–3.84). Controlled pain was also associated with elevated

odds among women, both with medication or treatment (AOR, 2.20; 95% CI, 1.76–2.76) and without (AOR, 1.40; 95% CI, 1.06–1.84).

Table 2
Associations of pain status and cancer type with frequent poor mental health and subjective cognitive decline, by sex

Characteristic	Frequent poor mental health		Subjective cognitive decline	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Men				
Pain condition				
No pain	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Pain under control, with medication or treatment	3.24 (2.45–4.30)	2.27 (1.66–3.12)	2.49 (1.76–3.52)	2.29 (1.57–3.35)
Pain under control, without medication or treatment	2.76 (1.98–3.84)	2.30 (1.60–3.31)	1.71 (1.10–2.64)	1.82 (1.13–2.91)
Pain not under control, with medication or treatment	9.34 (5.75–15.20)	5.30 (3.01–9.34)	3.36 (1.77–6.37)	4.10 (2.11–7.99)
Pain not under control, without medication or treatment	7.04 (4.74–10.47)	3.61 (2.28–5.72)	4.89 (3.03–7.88)	4.66 (2.76–7.89)
Cancer type				
Other cancers	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Colorectal	1.13 (0.82–1.55)	1.02 (0.71–1.45)	1.25 (0.89–1.76)	1.17 (0.81–1.69)
Prostate	0.74 (0.61–0.90)	0.86 (0.69–1.05)	0.83 (0.69–1.01)	0.75 (0.60–0.92)
Women				
Pain condition				
No pain	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Pain under control, with medication or treatment	3.00 (2.46–3.66)	2.20 (1.76–2.76)	1.93 (1.46–2.55)	1.73 (1.28–2.34)
Pain under control, without medication or treatment	2.05 (1.61–2.60)	1.40 (1.06–1.84)	1.50 (1.08–2.10)	1.37 (0.96–1.97)

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; OR, odds ratio. Estimates are weighted. Adjusted models control for age, race and ethnicity, income, and education. Frequent poor mental health was defined as 14 or more of the past 30 days. Subjective cognitive decline models are limited to respondents aged 45 years or older in states administering the Cognitive Decline module.

Characteristic	Frequent poor mental health		Subjective cognitive decline	
	OR (95% CI)	AOR (95% CI)	OR (95% CI)	AOR (95% CI)
Men				
Pain not under control, with medication or treatment	4.94 (3.36–7.25)	2.60 (1.67–4.05)	4.22 (2.43–7.31)	3.56 (1.95–6.49)
Pain not under control, without medication or treatment	4.19 (3.06–5.72)	2.66 (1.84–3.84)	3.95 (2.59–6.03)	3.18 (2.02–5.02)
Cancer type				
Other cancers	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Colorectal	1.20 (0.91–1.57)	1.33 (0.98–1.79)	1.00 (0.70–1.43)	0.92 (0.62–1.35)
Breast	0.80 (0.70–0.92)	0.84 (0.72–0.98)	0.99 (0.84–1.15)	1.02 (0.86–1.21)
Gynecologic	2.07 (1.78–2.41)	1.35 (1.13–1.61)	1.55 (1.25–1.92)	1.35 (1.07–1.71)

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; OR, odds ratio. Estimates are weighted. Adjusted models control for age, race and ethnicity, income, and education. Frequent poor mental health was defined as 14 or more of the past 30 days. Subjective cognitive decline models are limited to respondents aged 45 years or older in states administering the Cognitive Decline module.

Compared with other cancers, breast cancer was associated with lower odds of frequent poor mental health among women (AOR, 0.84; 95% CI, 0.72–0.98), whereas gynecologic cancer was associated with higher odds (AOR, 1.35; 95% CI, 1.13–1.61). Prostate cancer was not significantly associated with frequent poor mental health among men (AOR, 0.86; 95% CI, 0.69–1.05), nor was colorectal cancer in either sex (men: AOR, 1.02; 95% CI, 0.71–1.45; women: AOR, 1.33; 95% CI, 0.98–1.79).

Subjective Cognitive Decline

A similar pattern was observed for SCD (Table 2). Among men, odds were highest when pain was not under control, both without medication or treatment (AOR, 4.66; 95% CI, 2.76–7.89) and with it (AOR, 4.10; 95% CI, 2.11–7.99). Controlled pain was also associated with higher odds among men, both with medication or treatment (AOR, 2.29; 95% CI, 1.57–3.35) and without (AOR, 1.82; 95% CI, 1.13–2.91). Among women, odds were highest when pain was not under control with medication or treatment (AOR, 3.56; 95% CI, 1.95–6.49) and without (AOR, 3.18; 95% CI, 2.02–5.02). Pain controlled with medication or treatment was associated with higher odds of SCD among women (AOR, 1.73; 95% CI, 1.28–2.34), whereas pain controlled without medication or treatment was not (AOR, 1.37; 95% CI, 0.96–1.97).

Compared with other cancers, prostate cancer was associated with lower odds of SCD among men (AOR, 0.75; 95% CI, 0.60–0.92), and gynecologic cancer was associated with higher odds among women (AOR, 1.35; 95% CI, 1.07–1.71). Breast cancer was not significantly associated with SCD (AOR, 1.02; 95% CI, 0.86–1.21), nor was colorectal cancer in either sex (men: AOR, 1.17; 95% CI, 0.81–1.69; women: AOR, 0.92; 95% CI, 0.62–1.35).

Discussion

Our study examined associations among cancer-related pain, pain control, poor mental health days, and subjective cognitive decline (SCD) among adults who reported having cancer. Cancer-related pain was associated with greater odds of both frequent poor mental health days and SCD, and the strongest associations were observed among individuals with uncontrolled pain. Odds of both outcomes were lower among those with controlled pain than among those with uncontrolled pain; however, elevated odds persisted relative to those without pain. Men are noted as having the strongest associations with both SCD and poor mental health days when pain is uncontrolled, although women also have significant increases when pain is uncontrolled. This could be due to different cancers having different levels of baseline pain. When comparing different types of cancer, the association with mental health and subjective cognitive decline is varied; however, these associations are much less distinct. Among survivors of colorectal cancer, women reported pain less frequently than men (18.4% vs 24.3%).

Compare and contrast

These findings are generally consistent with previous research examining pain relating to cancer and cognitive issues. A 2026 study by Hofbauer et al. showed higher levels of depression and anxiety when comparing those with cancer-related pain versus no pain [20]. This adds to the existing idea that pain is associated with poorer mental health and cognitive outcomes [21] by examining SCD in a population of those diagnosed with cancer.

Limitations

Limitations of the BRFSS data include self-report measures, which may be subject to recall and social desirability bias, leading participants to downplay, exaggerate, or withhold experiences. The analyses within our project are also cross-sectional in nature and should be interpreted as correlational rather than causal. Directionality of the variables, or influence of an outside variable, cannot be determined. Additionally, BRFSS does not capture cancer stage or time since diagnosis, which may confound the observed associations. Our sample also included respondents currently receiving cancer treatment, so findings may not reflect survivors who have completed primary treatment. Subjective cognitive decline was assessed only among respondents aged 45 years or older in states administering the Cognitive Decline module, and the cancer survivorship modules were optional, which may limit generalizability. Conversely, a strength of this project is the examination of pain control, which captures the adequacy of pain management rather than the presence of pain alone. BRFSS is the largest population-based health survey conducted in the United States and has shown reliable data for decades. Finally, further research

should focus on longitudinal and interventional studies to see if there is a relationship between treating pain and increased good mental health days.

Implications & Recommendations

These findings have several potential implications for cancer care. Uncontrolled cancer-related pain may serve as a clinical marker of broader psychological and cognitive burden, supporting assessment of mental health and cognitive concerns when patients report persistent or inadequately controlled pain. Conversely, patients reporting frequent poor mental health days or cognitive concerns may benefit from concurrent assessment of pain and its adequacy of control.

Importantly, adverse mental health and cognitive outcomes remained more common in some patients even when pain was controlled, suggesting that pain control alone may not fully address the broader symptom burden experienced by patients with cancer. These findings support an integrated approach that incorporates routine assessment of pain, psychological distress, and cognitive concerns and facilitates referral to supportive services, including behavioral health, pain management, rehabilitation, or palliative care when appropriate. Rather than viewing pain, mental health, and cognitive symptoms independently, clinicians may benefit from recognizing them as interconnected components of the cancer experience that warrant coordinated assessment and management.

Conclusions

Among adults with a history of cancer, pain – particularly uncontrolled pain – was associated with higher odds of frequent poor mental health days and SCD. Associations by cancer type were mixed: breast cancer was associated with lower odds of frequent poor mental health among women, gynecologic cancer with higher odds, and prostate cancer with lower odds of SCD among men, while colorectal cancer was not associated with either outcome. Future longitudinal research should examine whether improving pain management is associated with better mental health and cognitive outcomes.

Declarations

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Competing Interests

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Author Contributions

Kyra Hirshey, Laney Goodman, Carsen Chandler, and Micah Hartwell contributed to the study conception and design. Data acquisition and statistical analysis were performed by Micah Hartwell, and interpretation of data by Micah Hartwell and Natasha Bray. The first draft of the manuscript was written by Kyra Hirshey, Laney Goodman, Carsen Chandler, Natasha Bray, and Micah Hartwell, and Natasha Bray critically revised the manuscript for important intellectual content. Micah Hartwell supervised the study, had full access to all data, and takes responsibility for the integrity of the data and the accuracy of the data analysis. All authors read and approved the final manuscript.

Ethics Approval

This study used publicly available, de-identified data and did not meet the regulatory definition of human subjects research under 45 CFR 46.102(e); therefore, institutional review board review was not required.

Consent to Participate

Not applicable; this study was a secondary analysis of publicly available, deidentified survey data.

Data Availability

The data analysed in this study are publicly available from the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System, https://www.cdc.gov/brfss/.

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