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ORIGINAL PAPER

Relationship between mental health disorder symptoms and negative cancer perceptions among U.S. adults

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Abstract

Purpose Although much emphasis has been placed on the impact of ambiguity on cognitive processes, the impact of mental health disorder symptoms and racial/ethnic disparities in cancer perception of fatalism and ambiguity remains less explored. This study explored the association between mental health disorder symptoms and negative cancer perceptions. Also, we assessed differences in these outcomes within mental health disorder symptoms and racial/ethnic subgroups to investigate the association between cancer perceptions and the other covariates within the aforementioned subgroups.

Methods We used the 2019–2020 Health Information National Trends Survey data ($N = 9{,}303$) to assess the perception of cancer fatalism and cancer communication ambiguity and employed weighted multivariable logistic regression to determine the effects of mental health disorder symptoms using the Patient Health Questionnaire-4 (PHQ-4) scale on these negative cancer perceptions among United States adults.

Results People with moderate [Adjusted Odds Ratio (AOR) = 1.58, 95% Confidence Interval (CI) = 1.09, 2.31] and severe anxiety/depression (AOR = 1.88, 95% CI = 1.12, 3.14) symptoms were more likely to have cancer fatalism perceptions than people with no anxiety/depression symptoms. People with mild (AOR = 1.33, 95% CI = 1.06, 1.69) or severe (AOR = 1.80, 95% CI = 1.03, 3.16) anxiety/depression symptoms were more likely to perceive cancer communication as ambiguous compared to people who had no anxiety/depression symptoms.

Conclusions The study showed that mental health status was associated with both cancer fatalism and perceived cancer communication ambiguity. This suggests that interventions aimed at reducing mental health disorder symptoms may potentially reduce these negative perceptions, thereby improving participation in cancer prevention programs.

Keywords Cancer · Mental health · Depression · Anxiety · Perception · Racial disparities

Background

Cancer is recognized as the second leading cause of death in the United States (U.S.) [1]. It is projected that approximately 1.9 million new cancer diagnoses and 608,570 related deaths will occur in 2021 in the U.S. [2]. Additionally, nearly 1 in 3 Americans will be diagnosed with cancer at some point in their lifetime [3]. The prevalence of cancer in the U.S. has been increasing in the past few years due to reasons such as improvements in cancer treatment, population growth, increasing screening rates, and increasing life expectancy [4]. The rising cancer burden has contributed to an increase in the national cancer-related expenditure over the years. The estimated national expenditure for cancer care in the U.S. was $201 billion in 2020, up from $183 billion in 2015 [5]. This figure is projected to increase to 246 billion

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by 2030 (34% increase from 2015) [5]. The increasing cancer and associated financial burden have not only impacted the physical and mental health of diagnosed people but also their families, communities, and society as a whole; making cancer a major public health concern [6].

Several factors affect an individual's risk of morbidity and mortality from cancer. These include socioeconomic status (SES), race, gender, and lifestyle [2, 7, 8]. Modifiable behavioral risk factors such as alcohol use, lack of physical activity, smoking, and diet are thought to account for approximately a third of cancer deaths [9, 10]. Adoption and/or maintenance of these risk factors as well as other risk promoting behaviors could increase cancer risk while the converse is true [9, 10]. Factors that predict adoption of cancer risk modifying behaviors are not fully understood. Cancer fatalism, the belief or perception that developing cancer is out of one's control, that cancer is not preventable for individuals who 'must' have it, or that a cancer diagnosis inevitably leads to death [11–13], has been shown to be inversely associated with adoption of risk reducing behaviors such as participation in cancer prevention screening programs [14] and positively correlated with late symptomatic presentation [15, 16]. Studies examining this subject show that racial minorities tend to hold more fatalistic views of cancer and to be less knowledgeable about cancer risk factors compared with their non-Hispanic White counterparts [14, 17]. Although these findings were shown to persist among Latinas with high levels of acculturation [14], it is unclear if any within-race differences exist. Additionally, the role of mental health on these beliefs has yet to be explored.

Perceived cancer communication ambiguity, another concept thought to affect likelihood of involvement in cancer risk modifying behaviors, is defined as "*uncertainty regarding the trustworthiness, reliability or adequacy of information pertaining to cancer prevention*" [18]. Previous studies using the 2003 and 2005 Health Information National Trends Survey (HINTS) surveys found that perceived cancer communication ambiguity was not only associated with a decreased perception of cancer preventability but also with a decreased tendency to perform risk reducing behaviors [18, 19]. The mechanism by which it occurs is believed to be ambiguity aversion, which is the tendency to be pessimistic in decision making in the presence of ambiguity/uncertainty [19]. Much of the ambiguity is thought to stem from the multiplicity of information reaching the public. There have been suggestions that the abundance of information, rather than empowering the public, could achieve the unintended opposite effect [20]. Although much emphasis has been placed on the impact of ambiguity on cognitive processes, its predictors remain less widely explored. A study of predictors of ambiguity using 2005 HINTS survey data found that age, race, education, and mass media exposures were associated with perception of ambiguity [21]. This study, however, did not examine the possible role of mental health, which is known to affect cognitive processing. Current thinking posits that depression is characterized by an excessive amplification of and difficulty disengaging from negative information [22]. Since this study was performed, there has been a proliferation in the number of information sources [23]. It is unclear how this has affected the prevalence of perceived ambiguity and/or how the effect of sociodemographic characteristics has evolved over the years.

Our study aims at exploring the impact of anxiety/depression on cancer fatalism and perceived cancer communication ambiguity regarding cancer prevention recommendations. Additionally, we will assess within-anxiety/depression status and within-race differences in these negative perceptions. An improved understanding of these associations could help health care providers and health educators in targeting their interventions more effectively.

Methods

Study design, dataset, and population

This analysis utilized the 2019–2020 (Health Information National Trends Survey (HINTS) de-identified public-use data. HINTS is a nationally representative annual cross-sectional survey, which is conducted among adults aged 18 years or older in the U.S. HINTS uses a complex multistage area probability sample of a U.S. civilian and non-institutionalized adult population. HINTS collects data on access to and use of health-related information and health-related behaviors, perceptions, and knowledge among U.S. adults. Details of the methods and survey questions can be found elsewhere [24]. The HINTS 5, Cycle 4 ($N = 3{,}865$) and Cycle 3 ($N = 5{,}438$) data, which are the two most recent HINTS data collected between February through June 2020 and January through April 2019, respectively, were used for this analysis. We merged these two datasets and the total pooled data were $n = 9{,}303$ adults, which were the analytical sample of our study. This publicly available data is de-identified and does not contain individual or state identifiers. Therefore, a review from an Institutional Review Board was not required.

Measures

Response variable

Cancer fatalism (CF)

This variable was assessed by asking the participants, "How much do you agree or disagree with each of the following

statements? There's not much you can do to lower your chances of getting cancer (strongly agree, somewhat agree, somewhat disagree, strongly disagree)". We dichotomized this variable as having CF if the participant indicated "strongly agree or somewhat agree". Otherwise, the variable was coded as having no CF if the participant indicated "somewhat disagree or strongly disagree".

Perceived cancer communication ambiguity (PCCA)

The participants were asked, "Would you say you strongly agree, somewhat agree, somewhat disagree, strongly disagree with the following statements or do you have no opinion? There are so many recommendations about preventing cancer it's hard to know which ones to follow". We coded this variable as having perception of ambiguity if the participant indicated "strongly agree or somewhat agree". Otherwise, the variable was coded as having no ambiguity perception if the participant indicated "somewhat disagree or strongly disagree".

Explanatory variable

Current anxiety/depression status

This was derived from Patient Health Questionnaire-4 (PHQ-4) in the HINTS 5 survey. The total scores of PHQ-4 range from 0 to 12, where scores are rated as normal (0–2), mild (3–5), moderate (6–8), and severe (9–12) [25, 26].

Covariates

Self-reported sociodemographic characteristics, personal history of cancer diagnosis status, and family history of cancer adjusted for in the analysis based on previous studies [10, 27–29]. The sociodemographic characteristics included age (18–25, 26–34, 35–49, 50–64, and 65 +), gender (Male/Female), race/ethnicity (Non-Hispanic White, non-Hispanic Black, Hispanic, and Non-Hispanic Other), sexual identity (heterosexual, lesbian/gay, and bisexual), level of education completed (Less than High School, High School graduate, Some college, College graduate or higher), total annual household income (< $20,000, $20,000 to < $35,000, $35,000 to < $50,000, $50,000 to < $75,000, and $75,000 or more), US census region (Northeast, Midwest, South, and West), and cigarette smoking status (non-smoker, former smoker, and current smoker). General health status was dichotomized as "Excellent/very good/good" or "Fair or poor". Personal history of cancer diagnosis status was determined by asking the participants to self-report "Have you ever been diagnosed as having cancer? (Yes/No)". Family history of cancer was obtained by asking the participants to report "Have any of your first- or second-degree biological relatives (parents, brothers and sisters, children, grandparents, aunts and uncles, nieces and nephews) ever had cancer? (Yes/No)". Past 30-day alcohol use was determined by asking the participants to self-report: "During the past 30 days, how many days per week did you have at least one drink of any alcoholic beverage?" We recorded this variable as "None" if the participant stated "None". Those who stated one or more days were coded as "At least one day per week".

Statistical analyses

We performed descriptive analyses to describe the percentages and their standard errors of the participants' sociodemographic characteristics, and the prevalence of personal history of cancer, family history of cancer, anxiety/depression disorder, smoking status, and past 30-day alcohol use across CF and PCCA, respectively. We also performed bivariate analyses using chi-squared tests to assess the association between each response variable and each explanatory variable or covariate. The variables that were significantly associated with each response at $p < 0.10$ were entered in multivariable logistic regression models. We assessed the association between CF and *anxiety/depression* adjusted for race/ethnicity, level of education completed, annual household income, general health status, smoking status, and past 30-day alcohol use. Additionally, we stratified the analysis by mental health status (*anxiety/depression*) and race/ethnicity to assess the differences of CF within each group. We also assessed the association between perceived cancer communication ambiguity and *anxiety/depression* adjusted for level of education completed, general health status, U.S. Census region, and family cancer history. We further analyzed this association stratified by mental health status (*anxiety/depression*) to assess the differences of PCCA within each group.

To account for the complex sample design and national representative estimates in this study, all analyses were weighted by the sampling weight. The survey weight in the merged dataset was calibrated or adjusted by dividing with the number of years that were merged (i.e., by 2 years) to achieve average annual or midpoint population estimates and nationally representative estimates. We conducted all the statistical analyses at two-tailed, 95% confidence intervals (95% CIs), and adjusted odds ratios (AORs), and statistically significant results at p-value ≤ 0.05. STATA/SE version 16.1 was used to perform the statistical analyses (StataCorp, 2019).

Results

Descriptive statistics

Cancer fatalism

Table 1 describes the weighted prevalence of cancer fatalism by sociodemographic characteristics, personal history of

Table 1 The prevalence of cancer perception among U.S. adults, HINTS 2019–2020

	Total	Cancer fatalism[a]		*p*-value	Total	Perceived cancer communication ambiguity[b]		*p*-value
		No	Yes			No	Yes	
	% (SE[c])	% (SE)	%(SE)		%(SE)	%(SE)	%(SE)	
		69.12(0.89)	30.88(0.89)			25.53(0.74)	74.47(0.74)	
Age				0.456				0.88
18–25	12.45 (0.72)	12.96 (1.03)	11.29 (1.54)		12.48 (0.72)	12.31 (1.94)	12.54 (0.95)	
26–34	12.86 (0.66)	13.44 (0.82)	11.57 (1.21)		12.81 (0.66)	13.77 (1.46)	12.48 (0.74)	
35–49	25.08 (0.75)	25.12 (1.06)	24.99 (1.38)		25.03 (0.74)	25.26 (1.79)	24.96 (0.80)	
50–64	29.57 (0.62)	29.03 (0.78)	30.78 (1.51)		29.56 (0.61)	29.42 (1.60)	29.61 (0.80)	
65 or more	20.04 (0.14)	19.45 (0.42)	21.37 (0.89)		20.12 (0.15)	19.24 (0.99)	20.42 (0.36)	
Gender				0.188				0.317
Male	49.06 (0.39)	49.79 (0.67)	47.38 (1.33)		49.12 (0.37)	50.85 (1.78)	48.53 (0.68)	
Female	50.94 (0.39)	50.21 (0.67)	52.62 (1.33)		50.88 (0.37)	49.15 (1.78)	51.47 (0.68)	
Race/ethnicity				**< 0.001**				0.768
NH[d]-White	63.69 (0.24)	67.16 (0.66)	55.69 (1.59)		63.67 (0.25)	63.90 (1.67)	63.60 (0.61)	
NH-Black	11.09 (0.19)	10.55 (0.41)	12.34 (0.83)		11.01 (0.19)	9.88 (0.99)	11.39 (0.37)	
Hispanic	16.70 (0.13)	14.36 (0.57)	22.09 (1.37)		16.77 (0.12)	17.49 (1.63)	16.53 (0.57)	
NH-Others	8.51 (0.17)	7.92 (0.42)	9.88 (0.89)		8.55 (0.16)	8.73 (1.14)	8.48 (0.40)	
Sexual identity				0.738				0.624
Heterosexual	95.07 (0.45)	94.88 (0.53)	95.51(0.89)		95.06 (0.45)	95.83 (0.89)	94.80 (0.54)	
Lesbian/gay	2.54 (0.33)	2.55 (0.42)	2.51 (0.59)		2.55 (0.33)	2.16 (0.52)	2.68 (0.38)	
Bisexual	2.39 (0.34)	2.57 (0.33)	1.98 (0.70)		2.39 (0.34)	2.00 (0.76)	2.52 (0.41)	
Education				**< 0.001**				**< 0.001**
Less than high school	7.34 (0.50)	5.19 (0.54)	12.17 (1.23)		7.35 (0.51)	6.05 (0.91)	7.79 (0.62)	
High school graduate	22.60 (0.60)	20.25 (0.80)	27.86 (1.37)		22.64 (0.60)	18.57 (1.32)	24.02 (0.79)	
Some college	39.91 (0.53)	39.95 (0.83)	39.82 (1.74)		39.77 (0.54)	38.18 (1.75)	40.32 (0.72)	
College graduate or higher	30.15 (0.14)	34.62 (0.62)	20.15 (1.21)		30.24 (0.15)	37.21 (1.34)	27.87 (0.43)	
Annual household income				**< 0.001**				0.618
Less than $20,000	16.50 (0.76)	14.40 (0.95)	21.24 (1.38)		16.46 (0.76)	15.96 (1.45)	16.64 (0.81)	
$20,000-$34,999	11.12 (0.54)	9.78 (0.61)	14.17 (1.30)		11.16 (0.54)	9.85 (1.07)	11.61 (0.60)	
$35,000-$49,999	13.08 (0.60)	12.73 (0.73)	13.88 (1.31)		13.06 (0.60)	12.84 (1.24)	13.13 (0.72)	
$50,000-$74,999	17.84 (0.86)	17.83 (1.01)	17.85 (1.49)		17.80 (0.86)	17.86 (1.44)	17.78 (0.98)	
$75,000 or more	41.47 (0.99)	45.26 (1.20)	32.86 (2.03)		41.51 (0.99)	43.48 (2.19)	40.84 (1.05)	
General health				**< 0.001**				0.124
Excellent/very good/good	85.52 (0.61)	87.61 (0.70)	80.83 (1.25)		85.50 (0.60)	87.40 (1.28)	84.84 (0.76)	
Fair/poor	14.48 (0.61)	12.39 (0.70)	19.17 (1.25)		14.50 (0.60)	12.60 (1.28)	15.16 (0.76)	
U.S. census region				0.286				**0.043**
Northeast	17.69 (0.09)	17.96 (0.52)	17.09 (1.10)		17.58 (0.09)	18.65 (1.05)	17.21 (0.37)	
Midwest	20.70 (0.17)	21.52 (0.58)	18.87 (1.19)		20.77 (0.16)	19.07 (1.43)	21.35 (0.50)	
South	37.78 (0.14)	36.72 (0.59)	40.16 (1.34)		37.86 (0.14)	35.15 (1.49)	38.78 (0.53)	
West	23.83 (0.11)	23.80 (0.60)	23.88 (1.33)		23.80 (0.11)	27.13 (1.50)	22.66 (0.51)	
Anxiety/depression symptoms				**< 0.001**				**0.005**
Normal	68.46 (0.88)	71.02 (1.13)	62.63 (1.43)		68.55 (0.88)	74.59 (1.61)	66.48 (1.04)	
Mild	17.69 (0.75)	17.40 (0.89)	18.37 (1.20)		17.60 (0.76)	15.10 (1.25)	18.46 (0.88)	
Moderate	7.76 (0.57)	6.55 (0.62)	10.49 (1.12)		7.77 (0.57)	6.11 (1.07)	8.33 (0.66)	
Severe	6.10 (0.51)	5.03 (0.58)	8.51 (1.20)		6.08 (0.51)	4.19 (0.98)	6.73 (0.62)	
Smoking status				**0.007**				0.472
Never smoker	63.66 (0.95)	65.35 (1.11)	59.84 (1.81)		63.77 (0.93)	65.67 (1.80)	63.12 (1.05)	
Former smoker	23.33 (0.81)	22.76 (0.89)	24.62 (1.51)		23.15 (0.80)	22.11 (1.36)	23.51 (0.96)	

Table 1 (continued)

	Total	Cancer fatalism[a]		*p*-value	Total	Perceived cancer communication ambiguity[b]		*p*-value
		No	Yes			No	Yes	
	% (SE[c])	% (SE)	%(SE)		%(SE)	%(SE)	%(SE)	
		69.12(0.89)	30.88(0.89)			25.53(0.74)	74.47(0.74)	
Current smoker	13.01 (0.72)	11.89 (0.81)	15.54 (1.23)		13.07 (0.72)	12.21 (1.39)	13.37 (0.83)	
Past 30-day alcohol use				**0.005**				0.482
None	51.63 (1.09)	49.84 (1.27)	55.76 (1.81)		51.68 (1.10)	52.92 (2.18)	51.26 (1.19)	
At least one day per week	48.37 (1.09)	50.16 (1.27)	44.24 (1.81)		48.32 (1.10)	47.08 (2.18)	48.74 (1.19)	
Personal cancer history				0.876				0.309
No	90.75 (0.12)	90.71 (0.30)	90.84 (0.61)		90.83 (0.12)	91.57 (0.73)	90.57 (0.27)	
Yes	9.25 (0.12)	9.29 (0.30)	9.16 (0.61)		9.17 (0.12)	8.43 (0.73)	9.43 (0.26)	
Family cancer history				0.735				0.122
No	24.05 (0.87)	23.86 (1.00)	24.48 (1.59)		24.17 (0.86)	26.64 (1.94)	23.33 (0.95)	
Yes	75.95 (0.87)	76.14 (1.00)	75.52 (1.59)		75.83 (0.86)	73.36 (1.94)	76.67 (0.95)	

Source: 2020 Health Information National Trends Survey (HINTS 5, Cycle 4 and Cycle 3)

[a]Weighted $N = 244,966,479$ and Unweighted $N = 8,930$ for cancer fatalism

[b]Weighted $N = 245,130,132$ and Unweighted $N = 8,960$ for perceived cancer communication ambiguity

[c]*SE*= Standard Error

[d]*NH*= Non-Hispanic

Bolded values are statistically significant at $p < 0.05$

cancer, family history of cancer, *anxiety/depression* disorder, smoking status, and past 30-day alcohol use among U.S. adults in a nationally representative survey in 2020. Notable proportions of the population reported cancer fatalism perception (30.88%), fair or poor general health (14.48%), *anxiety/depression* (mild = 17.69%, moderate = 7.76%, and severe = 6.10%), current smoking (13.01%), past 30-day alcohol use (48.37%), personal history of cancer (9.25%), and family history of cancer (75.95%). Among those who reported CF, the majority were within ages 50–64 (30.78%), females (52.62%), non-Hispanic Whites (55.69%), had some college education (39.82%), %), reported annual household income of $75,000 or more (32.86%), and resided in the South (40.16%).

Perceived cancer communication ambiguity

As shown in Table 1, most of the population perceived cancer prevention recommendations as ambiguous (74.47%). Significant proportions of those who perceived cancer prevention recommendations as ambiguous were lesbians/gays (2.68%) or bisexuals (2.52%), had fair or poor general health (15.16%), severe *anxiety/depression* (6.73%), current smoking (13.37%), past 30-day alcohol use (48.74%), personal history of cancer (9.43%), and family history of cancer (76.67%).

Multivariable logistic regression analysis

Cancer fatalism

Table 2 presents the weighted multivariable logistic regression analysis of the association between cancer CF and its covariates. The results showed that the odds of having CF were higher for those with moderate (AOR = 1.58, 95% CI = 1.09, 2.31) or severe (AOR = 1.88, 95% CI = 1.12, 3.14) *anxiety/depression* compared to no *anxiety/depression* or normal. Hispanics (AOR = 1.52, 95% CI = 1.12, 2.08) and non-Hispanics of other race (AOR = 1.53, 95% CI = 1.04, 2.24) had higher odds of having CF compared to non-Hispanic Whites. Compared to people with less than High School education, those who had some college education (AOR = 0.49, 95% CI = 0.32, 0.78) or at least college graduate degree (AOR = 0.35, 95% CI = 0.22, 0.55) had lower odds of having CF. The subgroup analysis (Table 3.) revealed that among NH-Whites, people with severe depression anxiety had higher odds of cancer fatalism compared to people with normal or no *anxiety/depression* (AOR = 2.24, 95% CI = 1.19, 4.16). Among NH-Blacks, compared to people with no or normal depression symptoms, people with moderate *anxiety/depression* symptoms had higher odds of CF (AOR = 2.62, 95% CI = 1.12, 6.14). Within the NH-white racial group, people with college degrees or more were less likely to have CF compared to people with less than a

Table 2 Weighted multivariable logistic regression of factors associated with cancer perception among U.S. adults, HINTS 2019–2020

	Cancer fatalism[a]	Perceived cancer communication ambiguity[b]
	AOR [95% CI]	AOR [95% CI]
Race/ethnicity		
NH-White	Ref	_
NH-Black	1.28 [0.93, 1.74]	
Hispanic	1.52** [1.12, 2.08]	
NH-Others	1.53* [1.04, 2.24]	
Education		
Less than High School	Ref	Ref
High School graduate	0.68 [0.44, 1.06]	1.05 [0.65, 1.71]
Some college	0.49** [0.32, 0.78]	0.79 [0.49, 1.30]
College Graduate or more	0.35*** [0.22, 0.55]	0.59* [0.37, 0.94]
Annual household income		
Less than $20,000	Ref	_
$20,000 to < $35,000	1.36 [0.94, 1.98]	
$35,000 to < $50,000	0.89 [0.60, 1.33]	
$50,000 to < $75,000	1.03 [0.74, 1.44]	
$75,000 or more	0.93 [0.66, 1.30]	
General health		
Excellent/very good/good	Ref	Ref
Fair or poor	1.10 [0.81, 1.49]	1.10 [0.79, 1.53]
Anxiety/depression		
Normal	Ref	Ref
Mild	1.19 [0.95, 1.48]	1.33* [1.06, 1.69]
Moderate	1.58* [1.09, 2.31]	1.43 [0.88, 2.32]
Severe	1.88* [1.12, 3.14]	1.80* [1.03, 3.16]
Smoking status		
Never smoker	Ref	_
Former smoker	1.24* [1.01, 1.55]	
Current smoker	1.21 [0.91, 1.61]	
Past 30-day alcohol use		
None	Ref	_
At least one day per week	0.95 [0.78, 1.17]	
U.S. Census Region	_	
Northeast		Ref
Midwest		1.32* [1.01, 1.74]
South		1.19 [0.96, 1.48]
West		0.95 [0.74, 1.21]
Family cancer history	_	
No		Ref
Yes		1.18 [0.94, 1.50]

Weighted $N = 244,966,479$ and Unweighted $N = 8,930$ for cancer fatalism

Weighted $N = 245,130,132$ and Unweighted $N = 8,960$ for perceived cancer communication ambiguity

[a]Cancer Fatalism = race/ethnicity + education + income + general health + depression/anxiety + smoking status + past 30 day alcohol use

[b]Perceived cancer communication ambiguity = education + general health + depression/anxiety + U.S. census region + family cancer history

AOR Adjusted odds ratio, *95% CI* 95% confidence interval, *Ref* reference group, *NH* non-Hispanic

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

High School education (AOR = 0.38, 95% CI = 1.19, 0.77). Among people with normal *anxiety/depression* symptoms, Hispanics (AOR = 1.78, 95% CI = 1.20, 2.64) and non-Hispanics of other race (AOR = 1.55, 95% CI = 1.02, 2.36) had higher odds of having CF compared to non-Hispanic Whites.

Perceived cancer communication ambiguity

The weighted multivariable logistic regression analysis of the association between PCCA and its covariates is also presented in Table 2. The results showed that those who had mild (AOR = 1.33, 95% CI = 1.06, 1.69) or severe depression symptoms (AOR = 1.80, 95% CI = 1.03, 3.16) were more likely to have PCCA compared to people who had normal or no *anxiety/depression*. People who had college education or higher degree had lower odds of PCCA (AOR = 0.59, 95% CI = 0.37, 0.94) compared to those with less than High School education. The subgroup analysis showed that among people in the normal or no *anxiety/depression* group, people with college degrees or more were less likely to have PCCA than people with less than high school education (Table 4).

Discussion

The current study explored the effects of anxiety and depression on cancer fatalism and perceived cancer communication ambiguity, using a nationwide survey. Analyses were weighted to ensure derivation of nationally representative estimates. A significant association was found between moderate and severe anxiety/depression and CF. This is similar to findings from a previous study which showed an association between fatalism and anxiety/depression [30]. Shahid et al. [30] examined the relationship between religiosity and mental health by exploring fatalism on a continuum of active to passive. Passive and active fatalism were conceptualized as constituting belief in the divine with the latter being inclusive of individual agency. In accordance with their hypothesis, Shahid et al. [30] found that active and passive fatalism were negatively and positively associated, respectively, with symptoms of depression. While Shahid et al. [30] focus on fatalism in general, the current study specifically discusses cancer fatalism. Our study also adds to the body of literature on fatalism by examining the impact of anxiety/depression on cancer fatalism and perceived cancer communication ambiguity; as well as assessing within-anxiety/depression status and within-race differences in these constructs. Although Shahid et al. [30] delineated the kind of fatalism (i.e., classic or active) that showed a positive correlation with anxiety/depression, that was beyond the scope of this study. Given the known negative association between cancer fatalism and the decisions to adopt health promoting

Table 3 Weighted multivariable logistic regression of factors associated with Cancer Fatalism among U.S. adults, HINTS 2019–2020 by Race/ethnicity and anxiety/depression status

	Race/Ethnicity				Anxiety/depression status			
	NH-White	NH-Black	Hispanic	Other	Normal	Mild	Moderate	Severe
	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]
Anxiety/depression								
Normal	Ref	Ref	Ref	Ref				
Mild	1.33 [0.98, 1.80]	0.85 [0.42, 1.73]	0.81 [0.44, 1.48]	1.83 [0.83, 4.04]				
Moderate	1.66 [0.98, 2.80]	2.62* [1.12, 6.14]	0.74 [0.35, 1.43]	1.29 [0.28, 5.84]		–	–	–
Severe	2.24* [1.19, 4.16]	0.94 [0.25, 3.56]	1.93 [0.65, 5.73]	1.70 [0.94, 30.82]				
Race/ethnicity								
NH-White					Ref	Ref	Ref	Ref
NH-Black					1.39 [0.97, 1.98]	0.84 [0.42, 1.64]	2. 85* [1.01, 8.10]	0.75 [0.20, 2.83]
Hispanic		–			1.78 ** [1.20, 2.64]	0.89 [0.46, 1.72]	1.49 [0.59, 3.83]	1.53 [0.43, 5.42]
NH-Others					1.55 * [1.02, 2.36]	1.63 [0.75, 3.58]	1.16 [0.29, 4.77]	1.98 [0.47, 8.37]
Education								
Less than High School	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
High School graduate	0.76 [0.38, 1.50]	0.33 [0.10, 1.11]	0.74 [0.35, 1.52]	0.38 [0.04, 3.29]	0.70 [0.38, 1.29]	0.58 [0.24, 1.34]	0.98 [0.20, 4.73]	0.44 [0.11, 1.79]
Some college	0.54 [0.26, 1.11]	0.26 [0.08, 0.90]	0.48 [0.21, 1.10]	0.23 [0.03, 1.70]	0.55 [0.30, 1.03]	0.22 *** [0.09, 0.52]	0.62 [0.14, 2.68]	0.42 [0.10, 1.80]
College Graduate or more	0.38** [0.19, 0.77]	0.27 [0.06, 1.18]	0.35 [0.14, 0.89]	0.16 [0.02, 1.10]	0.33** [0.18, 0.62]	0.22*** [0.09, 0.53]	0.53 [0.11, 2.52]	0.37 [0.07, 1.90]
Annual household income								
Less than $20,000	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
$20,000 to < $35,000	1.17 [0.72, 1.90]	1.28 [0.49, 3.29]	1.70 [0.79, 3.67]	3.17 [0.73, 13.83]	1.41 [0.94, 2.11]	1.83 [0.73, 4.59]	0.84 [0.27, 2.57]	1.57 [0.32, 7.71]
$35,000 to < $50,000	0.78 [0.45, 1.34]	1.23 [0.54, 2.77]	1.03 [0.49, 2.19]	1.21 [0.32, 4.56]	0.88 [0.57, 1.36]	1.21 [0.42, 3.49]	0.81 [0.24. 2.72]	1.30 [0.39, 3.89]
$50,000 to < $75,000	0.77 [0.48, 1.21]	1.39 [0.63, 3.1]	1.97 [0.79, 4.90]	1.33 [025, 7.10]	1.18 [0.80, 1.75]	1.27 [0.56, 2.91]	1.69 [0.56, 5.12]	0.29 [0.06, 1.42]
$75,000 or more	0.78 [0.50, 1.21]	0.74 [0.33, 1.64]	1.36 [0.57, 3.24]	1.57 [0.52, 4.71]	1.02 [0.68, 1.52]	0.98 [0.46, 2.10]	0.81 [0.35, 1.87]	1.01 [0.27, 3.81]
General health								
Excellent/very good/good	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Fair or poor	0.98 [0.66, 1.45]	1.42 [0.71, 2.88]	0.67 [0.36, 1.25]	3.33 [0.88, 12.55]	1. 32 [0.84, 2.08]	1.03 [0.56, 1.88]	1.03 [0.44, 2.39]	0.69 [0.29, 1.65]
Smoking status								
Never smoker	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Former smoker	1.56** [1.17, 2.10]	0.73 [0.37, 1.47]	0.61 [0.26, 1.44]	0.78 [0.25, 2.42]	1.10 [0.85, 1.44]	1.01 [0.53, 1.92]	2.22 [0.95, 5.21]	1.75 [0.56, 5.41]
Current smoker	1.49* [1.01, 2.18]	1.08 [0.49, 2.39]	0.76 [0.39, 1.47]	0.66 [0.18, 2.46]	1.25 [0.84, 1.85]	0.90 [0.45, 1.82]	1.10 [0.35, 1.87]	2.30 [0.75, 7.01]

Table 3 (continued)

	Race/Ethnicity				Anxiety/depression status			
	NH-White	NH-Black	Hispanic	Other	Normal	Mild	Moderate	Severe
	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]
Past 30-day alcohol use								
None	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
At least one day per week	0.87 [0.67, 1.14]	0.97 [0.55, 1.71]	0.94 [0.54, 1.63]	2.26 [0.95, 5.34]	1.03 [0.79, 1.33]	0.82 [0.53, 1.27]	0.85 [0.50, 2.42]	0.87 [0.33, 2.26]

Weighted $N = 244{,}966{,}479$ and Unweighted $N = 8{,}930$ for cancer fatalism

AOR Adjusted odds ratio, 95% CI = 95% confidence interval, *NH* non-Hispanic

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 4 Weighted multivariable logistic regression of factors associated with perceived cancer communication ambiguity among U.S. adults, HINTS 2019–2020 by anxiety/depression status

	Anxiety/depression status			
	None/Normal	Mild	Moderate	Severe
	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]	AOR [95% CI]
Education				
Less than High School	Ref	Ref	Ref	Ref
High School graduate	0.73 [0.47, 1.15]	1.85 [0.46, 7.35]	2.99 [0.45,19.69]	0.75 [0.14, 3.92]
Some college	0.51** [0.32, 0.79]	1.99 [0.53, 7.56]	1.61 [0.23, 11.21]	0.40 [0.07, 2.32]
College Graduate or more	0.41*** [0.27, 0.61]	1.27 [0.34, 4.69]	1.19 [0.11, 12.52]	0.22 [0.03, 1.74]
General health				
Excellent/very good/good	Ref	Ref		
Fair or poor	1.12 [0.73, 1.69]	0.94 [0.45, 1.97]	1.39 [0.53, 3.67]	0.96 [0.43, 2.16]
Family cancer history				
No	Ref	Ref	Ref	Ref
Yes	1.15 [0.87, 1.51]	1.18 [0.68, 2.07]	1.39 [0.53, 3.37]	2.34 [0.58, 9.40]
U.S. Census Region				
Northeast	Ref	Ref	Ref	Ref
Midwest	1.14 [0.83, 1.51]	2.00 [0.85, 4.72]	1.85 [0.40,8.52]	2.49 [0.47, 13.340
South	1.18 [0.90, 1.56]	1.29 [0.60, 2.77]	0.57 [0.18, 1.84]	2.41 [0.46, 12.76]
West	0.91 [0.70, 1.23]	1.07 [0.45, 2.58]	0.44 [0.11,1.75]	4.89 [0.92, 26.05]

Weighted $N = 245{,}130{,}132$ and Unweighted $N = 8{,}960$ for perceived cancer communication ambiguity

AOR Adjusted odds ratio, *95% CI* 95% confidence interval

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

behaviors [15, 31–34], it is imperative for policies and programs to target identified subgroups with high proportions of cancer fatalism perceptions for possible intervention.

Our study also revealed an association between race/ethnicity and cancer fatalism. Hispanics had higher odds of holding fatalistic views of cancer compared with their white counterparts. This association has previously been described among ethnic minorities including Hispanic, Asian, and Black populations [17]. Some studies have suggested language barriers may play a role in perpetuating these beliefs among minorities [35]. For instance, it was found in one study that 62% of Spanish speaking versus 42% of English-speaking Latinos believed cancer was not preventable [17, 35]. Additionally, it has been suggested that medically underserved groups as well as ethnic groups exposed to repeated cycles of trauma are more likely to hold fatalistic views given repeated exposure to situations beyond their control [13, 17].

On racial/ethnic subgroup analysis, the association between severe anxiety/depressive symptoms and cancer fatalism persisted for non-Hispanic Whites but not Hispanics or non-Hispanic Blacks. Among non-Hispanic Blacks, the association was significant for moderate but not severe depressive symptoms. Overall, this suggests that the association between anxiety/depression and cancer fatalism is modified by race/ethnicity. It remains unclear why the association was significant among non-Hispanic Blacks with moderate anxiety/depression but not among those with severe anxiety/depression. One possible explanation could be the rarity of severe anxiety/depression among the surveyed non-Hispanic Blacks. Severe anxiety/depression was present in only about 6% of the non-Hispanic Blacks surveyed compared to non-Hispanic Whites, making it likely that the study was underpowered to detect any possible differences that may exist. Moreover, the small sample size may explain the lack of association among non-Hispanic Blacks in the severe anxiety/depression group. Further studies exploring these differences are needed.

We found a positive association between PCCA and mild and severe anxiety/depression. PCCA about cancer prevention recommendations is associated with lower perceived preventability and increased perceived risk and worry about certain cancers [18]. There is a dearth of literature on the association between anxiety/depression and perception of cancer communication ambiguity. However, studies show that depression is associated with negative/pessimistic biases in processing ambiguous communication [36]. More so, there is evidence suggesting a positive association between intolerance for ambiguous communication and anxiety/depression within cancer-related [37] and non-cancer related contexts [38, 39].

Evidence from this study showed that cancer fatalism and perceived ambiguity surrounding cancer communication have a significant association with anxiety/depression. Anxiety and depression are related to higher cancer incidence and mortality [8]. Cancer fatalism and perception of cancer communication ambiguity could be mediating or moderating factors in this association. This association could also be a reverse causality. Future studies can investigate the pathways and mechanisms through which this association occurs.

Strengths and limitations

Strengths of the current study include the fact that it was conducted using recently collected data, through a national database. To the best of our knowledge, most studies exploring this topic have done so using data that were current at the time of the study but has now become dated and may not necessarily reflect current trends. Additionally, this study investigated previously underexplored concepts (i.e., the association between anxiety/depression and perception of cancer communication ambiguity as well as the association with cancer fatalism).

Limitations include the use of survey data which was cross sectional and does not allow for establishment of causality. Additionally, we acknowledge that these variables are at best proxy indicators and may not necessarily reflect actual performance of preventative behaviors. We do however believe that given the established association between these cancer perceptions and preventative behaviors, these findings put forward important considerations in health promotion and cancer prevention efforts.

Conclusions

The study demonstrated that mental health status was associated with both cancer fatalism perception and perceived ambiguity in cancer recommendations. The likelihood of these negative cancer perceptions worsened as anxiety/depression symptoms aggravated. This implies that improving mental health interventions to reduce mental health disorder symptoms may potentially reduce negative perceptions of cancer and its recommendations, thereby improving adherence to cancer prevention programs.

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Data availability The datasets generated during and/or analyzed during the current study are publicly available at https://hints.cancer.gov/data/download-data.aspx

Code availability The code generated and used during this study is available upon request.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Ethical approval The study subjects were de-identified and there was no patient contact; thus, the study is exempt from an Institutional Review Board's review.

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