



## Research Article

# Age and Gender Differences in the Association between Serious Psychological Distress and Cancer: Findings from the 2003, 2005, and 2007 Health Information National Trends Surveys (HINTS)

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## Abstract

**Background:** Little is known about the association of serious psychological distress (SPD) with cancer.

**Aims:** This study examined the association between SPD and cancer, and tested whether such association differed by age and gender.

**Methods:** Data came from the 2003, 2005, and 2007 Health Information National Trends Surveys (HINTS) (2,637 cancer cases and 16,581 controls). Weighted univariate and multiple logistic regression analyses were used to estimate the odds ratios (ORs) with 95% confidence intervals (CIs).

**Results:** The overall prevalence of SPD was 6.7% (5.4% for males and 7.9% for females; 7.1% for cancers and 6.4% for controls). The prevalence of SPD decreased with age (7.8%, 5.8% and 3.9% for age groups 18-49, 50-64 and 65+ years, respectively). After adjusting for other factors, being female, elder (65+ years), SPD, and poor general health were positively associated with cancer ( $p < 0.05$ ). Gender-stratified analyses showed that SPD was associated with cancer only in women. Stratified by age groups, SPD and obesity were associated with cancer only in elderly.

**Conclusions:** Older age, being female, SPD and poor general health were associated with increased likelihood of cancer. Stratified by age groups and gender, SPD was significantly associated with cancer in women and elder group. It is important to develop effective strategies to manage SPD among patients with cancer, especially in women and elder adults.

**Keywords:** Cancer; serious psychological distress; age difference; gender difference

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## Introduction

In the United States (US), it has been reported that about 1,638,910 new cancer cases were expected to be diagnosed in 2012 and the 5-year relative survival rate for all cancers diagnosed between 2001 and 2007 was 67% (Cancer Facts & Figures 2012, American Cancer Society). The National Cancer Institute (NCI) estimated a total of 13.7 million cancer survivors on January 1, 2012. The three most common cancers among male survivors are prostate (43%), colon and rectum (9%), and melanoma (7%). Among female survivors, the most common cancers are breast (41%), uterine corpus (8%), and colon and rectum (8%) (Cancer Treatment & Survivorship Facts & Figures, 2012-2013, American Cancer Society).

It has been reported that about two-thirds of adults diagnosed as having cancer are expected to survive 5 years or more after diagnosis [1]. After primary treatment for cancers, many survivors experience symptoms that can impact function and well-being for years [2-4]. Nevertheless, previous reports suggested that only 10% of patients with cancers were referred for specialist's help despite potential negative impacts on patients' quality of life if those symptoms left untreated or unmanaged [5]. For example, about 30%-50% of cancer patients may suffer from depression or anxiety [6,7]. Furthermore, the prevalence of psychological distress among patients with cancers ranges from 20% to 35% [8,9]. Long-term survivors of head and neck cancer may suffer from psychological distress and reduced quality of life because of late side-effects of the treatment [10]. A case-control study showed that psychological stress, in the form of past life events and stress at work, was associated with the development of breast cancer [11]. It is important to develop effective strategies to manage these conditions among patients with cancer [12]. It is also shown that diagnostic delay may cause more psychological distress in female than in male cancer patients [13].

The Kessler 6 (K6) scale has been used to screen at the population level for individuals with possible severe mental illness [14,15]. The K6 scale consists of six questions, which ask respondents to report how frequently they experience symptoms of serious psychological distress (SPD) within a particular reference period. Although the K6 focuses on non-specific psychological distress, the scale has been clinically validated. Because of its high specificity, the majority of cases detected by the K6 would meet Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) criteria for certain mental health disorders [14, 15]. The SPD, defined as the K6 scale score of 13 or more, has been associated with presence of chronic medical conditions, cancer, and arthritis [1, 14, 15]. However, few studies have focused on the association of SPD with cancer [16]. Furthermore, little is known about age and gender differences in the association of SPD with cancer.

The objectives of the present study were to examine the association of SPD with cancer, and to test whether such association differs by age and gender.

## Methods

### Data source

Data for this study were obtained from the 2003, 2005, and 2007 Health Information National Trends Survey (HINTS). Details of this survey were published elsewhere [17-19]. Briefly, HINTS

is a nationally representative telephone survey of persons aged 18 years or older, scheduled to be conducted every 2 years. Data from the survey have been used by the NCI to monitor changes in the public's medical information environment over time and to inform the NCI's communication services and research efforts. The HINTS 2003 data were collected from October 2002 through April 2003 while the HINTS 2005 data were collected from February through August 2005. In 2003, response rates were 55% at the household screening level and 63% at the sampled person interview level; while in 2005, the respective response rates for household screening level and personal interview level were 34% and 61%, respectively. Every sampled adult who completed a questionnaire in HINTS 2003 and HINTS 2005 was assigned a final sampling weight and a set of 50 replicate sampling weights. Data were weighted to produce overall and stratified estimates that would be nationally representative of the US population. Weights were derived initially from selection probabilities to compensate for planned oversampling procedures. The resulting weights were then calibrated using comparable population characteristics for sex, age, race, and education from data publicly available through the Current Population Survey. A set of 50 replicate weights were produced to obtain an unbiased estimation of population variance. HINTS 2007 data were collected from January 2008 through May 2008. For the 2007 HINTS, data were collected by both telephone and mailed surveys. Telephone surveys were conducted using a Random Digit Dial (RDD), Computer Assisted Telephone Interview (CATI) format. They lasted approximately 30 minutes. Mailed surveys were sent to potential participants selected from a list of addresses from the US Postal Service administrative records. All adults at each sampled address were asked to fill out the questionnaire and return it in a postage-paid envelope. 3,582 surveys were completed by mail and 4,092 were completed via telephone [19]. For the HINTS 2007 data, we used the composite weights (including a final sampling weight and a set of 50 replicate sampling weights for each individual) which were used to calculate estimates based on the data from both the telephone and mailed surveys.

## **Outcome variable**

Subjects were considered to have a cancer if they responded "yes" to the question "Ever been told by a doctor you had cancer?" while controls were those if they responded "no" to this question.

## **Primary factor**

SPD is a nonspecific measure of psychological distress that has been psychometrically validated and shown to be able to discriminate community DSM-IV cases from noncases [20,21]. It is intended to characterize having at least 1 mental disorder, such as major depressive disorder, generalized anxiety disorder, or schizophrenia, as well as having serious impairment of body function. SPD was determined using the K6 scale, which comprised 6 questions asking how often during the past 30 days a person felt "so sad that nothing could cheer them up," "nervous," "restless," "hopeless," "worthless," or that "everything was an effort." Respondents in HINTS 2003, 2005, and 2007 were asked to answer the above 6 questions. Responses were scored from 0 (none of time) to 4 (all the time) and summed to produce a total score (0 to 24), with a score of 13 or above used to define SPD [20]. We defined psychological distress as a K6 score of 8 or above and mild psychological distress as a K6 score of 8-12. The K6 has been used widely to screen for DSM-IV mood and anxiety disorders in the general population [22,23].

## Covariates

Demographic factors were age group (classified as young (18-49 years), middle age (50-64 years), and elderly (65 years or older)), gender, race/ethnicity (White, African American, and other). Social characteristics included general health status (good, poor), insurance (yes, no), family history of cancer (yes, no), and obesity (defined as a Body Mass Index (BMI) of 30.0 kg/m<sup>2</sup> or above).

## Statistical analysis

We used the SAS PROC SURVEYFREQ procedure to weight and estimate population proportions in cases and controls. SAS PROC SURVEYMEANS was used to estimate the overall prevalence while SAS PROC SURVEYFREQ determined the prevalence of demographic factors. The Chi-square test was used to compare the prevalence of SPD across gender, age, races, and cancer status. We then used the SAS PROC SURVEYLOGISTIC procedure to estimate odds ratios (ORs) and 95% confidence intervals (CIs) for the relation between potential risk factors and cancer. Three models were used. In model one, simple logistic regressions were used to examine the independent roles of potential risk factors in cancer; multiple logistic regressions were then used to simultaneously adjust for all potential risk factors of cancer. In model two, to test effects of demographic factors such as sex, age and race, an interaction term between each demographic factor and SPD was added in the multiple logistic regression models. In model three, to examine the risk factors for cancer stratified by age group and gender, multiple logistic regressions were applied to adjust for all these factors. We assigned one-third of weights for HINTS 2003, 2005, and 2007, respectively. All the analyses were conducted using SAS statistical software, version 9.2 (SAS Institute, Cary, NC, USA).

## Results

### Subjects characteristics and prevalence of SPD

The basic characteristics of the cases with cancer and controls are shown in Table 1. The proportions of SPD in cases and controls were 7% and 6%, respectively. For the subjects aged 65 years or older, the percentage was higher in cases than in controls (44% vs. 13%). 41% of cases had survived 1-2 years, 58% had survived over 3-4 years, and 1% had survived over 5 years.

The prevalence of SPD by gender, age, race, and cancer status is presented in Table 2. The overall prevalence of SPD was 6.7% (5.4% for males and 7.9 % for females; 7.1% in cases and 6.4% in controls). The prevalence decreased with age (7.8%, 5.8% and 3.9% for age groups 18-49, 50-64 and 65+, respectively).

### The relationship between all potential risk factors and cancer

After adjusting for other factors, compared to controls, cases who were females, elderly (65+), had poor general health, and had SPD were more likely to have cancer (Table 3).

## Interactions with social factors

After adjusting for potential risk factors in the multiple logistic regression models, age group and gender showed significant interactions with SPD (overall  $p < 0.0001$  and  $p = 0.0002$ , respectively). No significant interaction were found for race with SPD (overall  $p = 0.373$ ).

**Table 1** Characteristics of the cases and controls

Variable	Cases (weighted %) N=2,637	Controls (Weighted %) N=16,581
<b>Gender</b>		
Male	910(40)	6,364(48)
Female	1,727(60)	10,217(52)
<b>Age group</b>		
18-49 years	488(24)	8,448(65)
50-64 years	791(32)	4,569(22)
65 +	1,343(44)	3,484(13)
<b>Family history</b>		
No	665(26)	5,078(33)
Yes	1,929(74)	11,292(67)
<b>Insurance</b>		
No	144(7)	2,080(17)
Yes	2,426(93)	14,037(83)
<b>General health</b>		
Poor	687(31)	3,088(20)
Good	1,896(69)	13,109(80)
<b>Obesity</b>		
No	1,897(74)	11,633(74)
Yes	641(26)	4,122(26)
<b>SPD</b>		
No	2,047(78)	12,848(79)
Mild	330(15)	2,220(15)
Serious	160(7)	862(6)
<b>Race</b>		
White	2,297(88)	12,545(79)
AA	151(7)	1,805(13)
Other	93(5)	1,032(8)
<b>Time since diagnosis (years)</b>		
1-2	943(41)	
3-4	1,553(58)	
5+	28(1)	

Abbreviations: SPD=serious psychological distress; AA=African American

**Table 2** Prevalence of serious psychological distress (SPD) according to demographic characteristics and cancer status (%)

Variable	Total (N)	SPD (N)	Prevalence (%)	95%CI	p
<b>Gender</b>					
Male	7,002	301	5.4	4.6-6.1	<0.0001
Female	11,546	729	7.9	7.1-8.7	
<b>Age group</b>					
18-49	8,655	585	7.8	6.9-8.5	<0.0001
50-64	5,240	289	5.8	4.9-6.7	
65 +	4,581	152	3.9	3.1-4.7	
<b>Race</b>					
White	14,692	720	6.1	5.4-6.7	<0.0001
AA	1,903	128	8.4	6.6-10.3	
Other	1,100	108	8.9	6.9-11.1	
<b>Cancer status</b>					
No	15,930	862	6.4	6.0-7.1	0.789
Yes	2,537	160	7.1	5.7-8.5	
Overall	19,629	1,030	6.7	6.2-7.2	

Abbreviations: SPD=serious psychological distress; AA=African American; CI=confidence interval  
p-value is based on  $\chi^2$  test

### Age differences in the association of SPD with cancer

Age differences in risk factors for cancer are presented in Table 4. Stratified by age groups, SPD was positively associated with cancer only in elder adults (OR=1.8, 95% CI=1.13-2.85) and obesity was negatively associated with cancer only in elder adults (OR=0.79, 95% CI=0.65-0.96) while family history showed positive association with cancer in young adults (OR=1.46, 95% CI=1.16-1.83).

## Gender differences in the association of SPD with cancer

Gender differences in risk factors for cancer are presented in Table 5. After adjustment for potential confounding factors, SPD were positively associated with cancer only in women (OR=1.37, 95% CI=1.02-1.84).

**Table 3** Univariate and multiple logistic regression analyses for the relationship between all potential risk factors and cancer

Variable	Crude OR	95% CI	p-value	Adjusted OR	95% CI	p-value
<b>Gender</b>						
Male	1			1		
Female	1.36	1.21-1.54	<0.0001	1.26	1.1-1.44	0.001
<b>Age group</b>						
18-49 years	1			1		
50-64 years	3.74	3.16-4.42	<0.0001	3.54	2.99-4.21	<0.0001
65 +	8.45	7.32-9.77	<0.0001	7.43	6.37-8.67	<0.0001
<b>Family history</b>						
No	1			1		
Yes	1.26	1.09-1.44	0.0014	1.15	0.99-1.33	0.0755
<b>Insurance</b>						
No	1			1		
Yes	2.57	1.91-3.46	<0.0001	1.58	1.16-2.17	0.0043
<b>General health</b>						
Good	1			1		
Poor	1.97	1.76-2.21	<0.0001	1.87	1.63-2.14	<0.0001
<b>Obesity</b>						
No	1			1		
Yes	0.96	0.86-1.08	0.522	0.86	0.74-0.99	0.0344
<b>SPD</b>						
No	1			1		
Mild	1.04	0.89-1.23	0.627	1.11	0.92-1.34	0.27
Serious	1.19	0.94-1.49	0.149	1.31	1.06-1.62	0.0123
<b>Race</b>						
White	1			1		
AA	0.49	0.38-0.62	<0.0001	0.54	0.42-0.68	<0.0001
Other	0.44	0.31-0.63	<0.0001	0.57	0.4-0.8	0.0014

Abbreviations: SPD=serious psychological distress; AA=African American; OR=odds ratio; CI= confidence interval.

**Table 4** Age differences in the association of SPD with cancer using multiple logistic regression analyses

Variable	OR1	95% CI	p-value	OR2	95% CI	p-value	OR3	95% CI	p-value
<b>Gender</b>									
Male	1			1			1		
Female	2.51	1.84-3.43	<0.0001	1.24	1.05-1.47	0.0101	0.79	0.65-0.97	0.0215
<b>Family history</b>									
No	1			1			1		
Yes	1.46	1.16-1.83	0.0012	1.05	0.79-1.38	0.749	1.08	0.89-1.31	0.449
<b>Insurance</b>									
No	1			1			1		
Yes	1.38	0.84-2.26	0.208	1.62	1.13-2.34	0.0095	3.07	1.5-6.28	0.0021
<b>General health</b>									
Good	1			1			1		
Poor	2.14	1.57-2.9	<0.0001	2.09	1.62-2.72	<0.0001	1.51	1.27-1.79	<0.0001
<b>Obesity</b>									
No	1			1			1		
Yes	0.85	0.61-1.19	0.349	0.96	0.75-1.23	0.74	0.79	0.65-0.96	0.0146
<b>SPD</b>									
No	1			1			1		
Mild	1.27	0.89-1.82	0.186	1.13	0.8-1.6	0.477	0.92	0.65-1.28	0.606
Serious	1.21	0.77-1.92	0.408	1.06	0.72-1.54	0.782	1.80	1.13-2.85	0.0132
<b>Race</b>									
White	1			1			1		
AA	0.47	0.28-0.79	0.0043	0.65	0.46-0.93	0.0193	0.48	0.33-0.71	0.0002
Other	0.36	0.17-0.77	0.0081	0.63	0.38-1.04	0.07	0.87	0.5-1.51	0.617

Abbreviations: SPD= serious psychological distress; AA=African American; OR1=adjusted odds ratio for age group 1 (18-49 years), OR2=adjusted odds ratio for age group 2 (50-64 years), OR3=adjusted odds ratio for age group 3 (≥65 years); CI= confidence interval.



**Table 5** Gender differences in the association of SPD with cancer using multiple logistic regression analyses

Variable	OR (Male)	95% CI	p-value	OR (female)	95% CI	p-value
Age group						
18-49 years	1			1		
50-64 years	5.44	3.96-7.46	<0.0001	2.78	2.32-3.32	<0.0001
65 +	14.5	10.6-19.9	<0.0001	4.97	4.17-2.92	<0.0001
Family history						
No	1			1		
Yes	1.15	0.92-1.43	0.229	1.17	0.98-1.38	0.0775
Insurance						
No	1			1		
Yes	3.79	2.19-6.56	<0.0001	1.1	0.76-1.58	0.626
General health						
Good	1			1		
Poor	1.72	1.41-2.10	<0.0001	1.95	1.6-2.37	<0.0001
Obesity						
No	1			1		
Yes	0.93	0.73-1.18	0.544	0.83	0.67-1.01	0.0635
SPD						
No	1			1		
Mild	1.26	0.88-1.79	0.209	1.02	0.78-1.32	0.906
Serious	1.05	0.62-1.78	0.866	1.37	1.02-1.84	0.0398
Race						
White	1			1		
AA	0.48	0.3-0.78	0.0027	0.57	0.41-0.78	0.0004
Other	0.6	0.36-0.99	0.0442	0.57	0.36-0.88	0.0116

Abbreviations: SPD=serious psychological distress; AA=African American; OR=adjusted odds ratio; CI=confidence interval.

## Discussion

In this study, we found the prevalence of SPD in females is higher than that in males and the prevalence decreased with age. After adjusting for other factors, SPD was positively associated with cancer. Stratified by age groups and gender, SPD was associated with cancer in women and elder group.

Our results showed that cancers reported a little higher rate of SPD compared with controls (7.1% vs 6.4%), which is consistent with the report by Hoffman *et al* [1] that reported the prevalence of SPD was higher among long-term cancer survivors than among respondents who

were never diagnosed as having cancer (5.6% vs 3.0%;  $p=0.001$ ). The prevalence of SPD in cancer was 7.1%, a little higher than the previous report (6.6%) using the 2009 Behavioral Risk Factor Surveillance System data [16]. However, most previous studies focused on psychological distress rather than SPD in cancer patients, with the prevalence of psychological distress in cancer patients ranging from 20% to 35% [8,9].

We found that SPD was positively associated with cancer. Hoffman *et al* [1] reported that survivors remained to be more likely to experience SPD (OR=1.4; 95% CI=1.2-1.7). However, Hoffman *et al* [1] used SPD as the primary outcome in a population-based study and examined whether social factors were associated with SPD, which was different from our study.

Furthermore, being female, elderly (65+) and poor general health were found associated with cancer. Stratified by age groups, the association between SPD and cancer was just found in elderly (65+ years). Denduluri and Ershler (2004) [24] reported that the majority of cancer patients in the US population were 65 years and older. Recently, one report showed that greater than 60% of new cancers occurred in people aged >65 years, and 60% of the current 10 million cancer survivors are 65 years and older [25]. Another study revealed the incidence of cancer increased with age in both human and animal studies [26]. It has been predicted that from 2010 to 2030, the total projected cancer incidence in US population will increase by approximately 45%, from 1.6 million in 2010 to 2.3 million in 2030 while the percentage of all cancers diagnosed in older adults will increase from 61% to 70% [27]. More recently, it has been reviewed that the ageing of populations worldwide is leading to an unprecedented increase in cancer cases and fatalities. However, some ageing processes probably foster cancer development whereas others hinder it, possibly in a tissue-specific manner [28]. Therefore, continued efforts are needed to improve cancer care for older adults.

Gender-specific analysis showed that the association between SPD and cancer was only observed in women. Many previous psycho-oncological studies reported a higher prevalence of stress in female cancer patients [29, 30]. In women, the risk of experiencing psychological distress in the context of cancer is about twice as high as in men (OR = 1.97) [31]. However, the gender difference in the distress of male and female patients with colon cancer may not exist [32]. Recently, Ernst and colleagues [33] investigated whether psychological distress (anxiety and depression), measured with the HADS, was modulated in cancer patients by gender and parenthood. They found that women tended to report anxiety, whereas men tended to show higher depression scores. They also revealed that men were more significantly affected by anxiety when they had children, whereas for women, anxiety ratings did not differ between the groups. However, to our knowledge, this is the first study to investigate the gender difference in the association between SPD and cancer.

This study has several important strengths. The sample size is large. We used HINTS 2003, 2005 and 2007 datasets. We provide the first national prevalence estimates for SPD in cancer patients, using 3 nationally representative samples of US adults. Also, we were able to adjust for potential confounders. Furthermore, we examined interactions between SPD and demographic factors. Longitudinal studies of examining whether mental health problems cause the risk of cancer may better specify the type of exposure (e.g., depression and anxiety) and outcome (e.g., breast cancer and color cancer).

One limitation of this study is the cross-sectional study design, which limited the ability to establish causality. Further limitations include possible recall and differential misclassification biases, as well as the effects of differences in how respondents interpreted survey questions.

## Conclusions

The prevalence of SPD in US adults was 6.7% (5.4% for males and 7.9 % for females), and decreased with increasing age. SPD affect persons with cancer and should be addressed in their treatment. Unresolved SPD manifests as clinical depression or anxiety in the post-treatment phases of cancer and can interfere with follow-up screening and preventative health behavior. As more cancer cases are diagnosed in the coming decades and increasing financial pressure is placed on health-care systems, proposals for psychological interventions in routine clinical care will need to demonstrate cost effectiveness to service providers. In addition, elderly (65+) and being female were associated with an increased likelihood of cancer.

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