

Original article

Working with cancer: health and employment among cancer survivors



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ARTICLE INFO

Article history:

Received 1 March 2015

Accepted 13 July 2015

Available online 4 August 2015

Keywords:

Cancer
Survivors
Survivorship
Employment
Epidemiology
Health policy

ABSTRACT

Purpose: Cancer affects a growing proportion of US workers. Factors contributing to whether they continue or return to work after cancer diagnosis include: age, physical and mental health, health insurance, education, and cancer site. The purpose of this study was to assess the complex relationships between health indicators and employment status for adult cancer survivors.

Methods: We analyzed pooled data from the 1997–2012 US National Health Interview Survey (NHIS). Our sample included adults with a self-reported physician diagnosis of cancer ($n = 24,810$) and adults with no cancer history ($n = 382,837$). Using structural equation modeling (SEM), we evaluated the relationship between sociodemographic factors, cancer site, and physical and mental health indicators on the overall health and employment status among adults with a cancer history.

Results: The overall model for cancer survivors fit the data well ($\chi^2(374) = 3654.7, P < .001$; comparative fit index = 0.98; root mean square error of approximation = 0.04). Although black cancer survivors were less likely to report good-to-excellent health, along with Hispanic survivors, they were more likely to continue to work after diagnosis compared with their white counterparts. Health insurance status and educational level were strongly and positively associated with health status and current employment. Age and time since diagnosis were not significantly associated with health status or employment, but there were significant differences by cancer site.

Conclusions: A proportion of cancer survivors may continue to work because of employment-based health insurance despite reporting poor health and significant physical and mental health limitations. Acute and long-term health and social support are essential for the continued productive employment and quality of life of all cancer survivors.

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Introduction

With major improvements in cancer detection and treatment, increasing numbers of cancer survivors return or continue to work after cancer diagnosis [1,2]. Recent literature reflects this trend among survivors, many of whom continue to work even during active cancer treatment [3]. However, cancer survivors' ability to work strongly depends on their overall health status which, in turn,

is influenced by age, cancer, stage at diagnosis, sequelae, treatment, access to health care, and health insurance [4–7].

Previous research has reported that most working cancer survivors in the United States are highly educated, middle-aged individuals reporting two or more functional limitations [8]. Because a large proportion of cancer survivors are of working age, understanding the impact of the physical and mental health status of this population on their employment is important for employers, health care providers, public health planners, and cancer patient advocates, as well as the survivors themselves and their families. Most studies of cancer survivorship lack in-depth examinations of the relationships between employment and reported health status, activities of daily living (ADLs), and physical and psychological

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limitations. Although these factors have been studied independently [3,9–11], their joint impact on health and employment status remain unknown. Thus, our main aim was to fill this gap by exploring the relationship between selected health indicators and health and employment status among adult cancer survivors.

Methods

Participants

We analyzed pooled data from the 1997–2012 US National Health Interview Survey (NHIS), merging data from the sample adult files, person files, and the cancer-control modules [12]. The NHIS collects demographic and health information from a representative sample of noninstitutionalized US civilian population on an annual basis. Information is collected by household; one adult per family is randomly selected and administered questions related to health, including questions about cancer history. Annual adult response rates to the NHIS data used in this study averaged 71.3% (range, 69%–80%) [13]. All data were self-reported, and participants with missing information were excluded.

Variables

Participants were categorized as individuals with a cancer history (or cancer survivors) if they responded “yes” to the question “Have you ever been told by a doctor or other health professional that you had cancer or a malignancy of any kind?” For this subsample, further questions permitted stratification by cancer site. For the purposes of this study, we looked at five of the most frequently diagnosed cancers within the United States (breast, prostate, lung, bladder, and colorectal cancers) [14]. The rest of reported cancer sites were grouped under “other” (referent). Persons with non-melanoma skin cancer were not included in the study population.

The outcome variables of interest were employment and health status. Employment was dichotomously coded as currently “employed” or “not employed,” determined by participants’ response as to whether they were working (paid and unpaid) during the week before their NHIS interview. Health status was defined by self-reported health status measured on a Likert scale. To facilitate comparison with previous research, scale values were combined to create a dichotomous variable where health status was classified as “poor-to-fair” and “good-to-excellent”.

We included health-related predictors referring to both physical and psychosocial health. A functional limitation results from a substantial impairment in an individual’s ability to complete a range of tasks or major life activities for daily functioning, whether simple or complex; as such, functional limitations form the link between impairment and disability [15]. Respondents were asked about the level of difficulty experienced when performing a named task by themselves without using any special equipment. The response categories (ranging from 1 to 5) were “not at all difficult,” “only a little difficult,” “somewhat difficult,” “very difficult,” and “cannot do at all.” Responses to these nine self-reported items (i.e., walking, standing, stooping, carrying, grasping, climbing, sitting, pushing, and reaching) were combined into a single “latent variable” (described below) measuring functional limitations. Three additional questions with the same response categories were captured by a second latent variable to assess performing instrumental activities of daily living (IADLs); these are complex skills needed for successful independent living, that is, social functions, relaxing, and shopping [16].

Limitations in performing basic activities and the effects of chronic conditions also encompass psychosocial factors, such as psychological distress, known to afflict cancer survivors. Based on

the Kessler 6 (K-6) scale of psychological distress [17], participant responses to six questions “How often did you feel ... (nervous, sad, restless, hopeless, worthless, or ‘that everything was an effort’)?” were measured by a single latent variable, psychological distress. The response options were “none of the time,” “a little of the time,” “some of the time,” “most of the time,” and “all of the time being,” yielding a score between 1 and 5.

Sociodemographic variables included gender, age, Hispanic origin and race, education, and health insurance status. Age was measured as a continuous variable in years. Education was treated as three-level categorical variable: less than high school (referent), high-school diploma or equivalent, and some college or higher education. Hispanic origin and race were divided into four mutually exclusive categories: non-Hispanic white (white; referent), non-Hispanic black (black), Hispanic, and non-Hispanic other or multi-race (other race). Based on their health insurance, participants were classified as privately insured (referent), publicly insured, and uninsured, using the definitions and classification commonly used by the National Center for Health Statistics [18].

Data analytic plan

For the analyses, we used structural equation modeling (SEM) because of the complexity of the examined pathways and variables (including latent variables). The use of SEM allowed the simultaneous evaluation of all variable relationships, as opposed to the individual effects of each predictor in separate multivariable logistic regression models. Also in SEM, latent variables may be used to measure multiple item scales independent of random measurement error, resulting in improved measurement reliability. Data management and descriptive analyses were conducted using (SAS/STAT, version 9.2; SAS Institute Inc., Cary, NC) [19], we used Mplus, version 5.2 (Muthén & Muthén, Los Angeles, CA) [20], to test study hypotheses within a SEM framework. Owing to the complex sample survey design, we performed all analyses adjusting for sample weights and design effects [12,21]. Records from each survey year were weighted according to person-level weights provided in annual NHIS data files. Weights were adjusted according to the number of representative years used in the analyses [12]. The distribution of the variables was examined through frequency tabulations to identify outliers and data errors, and variables were tested for collinearity.

As the focus of this study was on cancer survivors, the SEM analysis included only those individuals, aged 18 years and more, who both participated in the 1997–2012 NHIS surveys and had been diagnosed with cancer (except nonmelanoma skin cancer; $n = 24,810$). Figure 1 displays the measurement model examined in this study. First, using confirmatory factor analyses (CFAs), we estimated individual latent variable models. Second, we measured the fit of all three latent variables in a three-factor model to validate the latent variable measures using model fit indices. Third, we estimated the hypothesized structural equation model.

Preliminary analyses were conducted to determine whether there were sufficient associations (i.e., covariation) among the variables to permit model estimation, or if the correlations of these variables were high. Next, the distribution of antecedent variables (i.e., demographic and cancer-related characteristics), functional limitations, IADLs, and psychological distress among participants with and without a cancer history by employment status was examined (Table 1). CFAs were then fitted for each latent variable separately and together in a three-factor model. Finally, we estimated the hypothesized structural equation model (Fig. 1).

Model fit for latent variables and the full SEM was evaluated in terms of (1) the comparative fit index (CFI), which compares the hypothesized model to a null model with no paths or latent

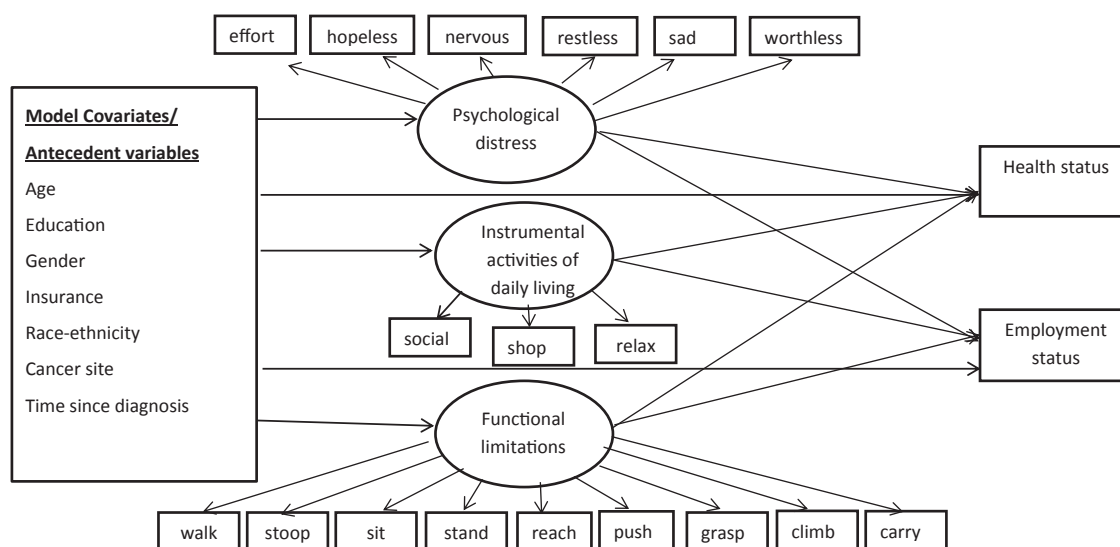


Fig. 1. Measurement model for SEM for adult cancer survivors: National Health Interview Survey 1997–2012.

variables; and (2) the root mean square error of approximation (RMSEA), which estimates the extent to which the covariance matrix specified in the model deviates from the covariance matrix observed in the data. CFI values of 0.95 or greater and RMSEA values of 0.05 or less were used as indicators of good model fit [22,23]. The chi-square statistic, although reported, was not used in model fit interpretation because of its sensitivity to testing the null hypothesis of perfect fit when the sample size is large [24,25]. Modification indices (which guide minor modifications to model specifications) were used to improve model fit in the measurement model by correlating error variances where appropriate. Unless otherwise stated, estimates were compared using two-sided *t* tests at the 0.05 level, assuming independence.

Confirmatory factor analysis

Instrumental activities of daily living. CFA identified three indicators that loaded significantly onto a single latent construct. The loadings (regression weights) were 0.80 for relaxing, 0.94 for shopping, and 0.98 for socializing. This model was saturated (i.e., the number of observed variables was equal to the number of parameters being estimated), therefore model fit statistics are not available.

Both the functional limitations and psychological distress latent variables had good model fit.

Functional limitations: $\chi^2(22) = 1116.56$, $P < .0001$; CFI = 0.99; RMSEA = 0.05. All nine indicators had statistically significant factor loadings with the latent construct; the loadings ranged from 0.76 (grasp) to 1.01 (stand). **Psychological distress:** $\chi^2(9) = 2304.05$, $P < .0001$; CFI = 0.98; RMSEA < 0.0001.

All six indicators had statistically significant factor loadings with the latent construct; the loadings ranged from 0.96 (restless) to 1.11 (hopeless).

The three latent variables (functional limitations, IADLs, and psychological distress) were combined into one model and evaluated. The model provided a good fit to the data: $\chi^2(125) = 3670.46$, $P < .0001$; CFI = 0.99; RMSEA = 0.03, indicating that all three factors (including ADL) were good representations of the data.

Measurement model

Overall, the measurement model depicted in Figure 1 provided an adequate fit to the data: $\chi^2(374) = 3654.73$, $P < .0001$; CFI = 0.98; RMSEA = 0.04. We tested our full model among all

cancer survivors only, with reported health status and employment status as the outcomes (Table 2).

These analyses of anonymized data were approved by the University of Miami School of Medicine Human Subjects Committee.

Results

Cancer survivors versus individuals without a cancer history

The overall study sample included all persons aged 18 years and more who participated in the 1997–2012 NHIS surveys and had been diagnosed with cancer ($n = 24,810$) as well as those without a previous cancer diagnosis ($n = 382,837$). Among those currently working, 13,773 were cancer survivors, and 283,767 were adults without a cancer history (Table 1).

The largest group of working cancer survivors (45.7%) was between 40 and 64 years of age versus 39.7% of working individuals with no cancer diagnosis in the same age range. White survivors (80.1%) were more likely to work than those without cancer (62.7%); Hispanic (8.3%) and black (9.4%) cancer survivors were less likely to work than those without a cancer history (18.4% and 14.5%, respectively). There were a comparatively higher percentage of survivors with some college or higher education among working cancer survivors compared to the not employed survivors (43.5% vs. 38.7%); this pattern was similar among individuals without a cancer history. Cancer survivors, both employed (11.2%) and not employed (5.4%), were less likely to be uninsured compared to those without cancer whether employed (15.3%) or not employed (14.8%).

Eighty-three percent of working survivors reported good-to-excellent health; this was approximately 15% higher than the not employed survivors, but 10% lower than working persons with no previous cancer diagnosis. A significantly larger proportion of cancer survivors reported having two or more functional limitations compared to those without cancer; the percentage of functional limitations reported among not employed survivors (61.6%) was almost twice that of employed survivors (36.0%), and more than twice that of not employed persons without a cancer history (26.3%). The level of reported psychological distress (14%) was similar among employed cancer survivors and not employed persons without cancer, although less than that of not employed cancer survivors (17%).

Table 1

A comparison of employment and sociodemographic characteristics of persons in the United States with and without a previous cancer diagnosis: National Health Interview Survey, 1997–2012

Demographic characteristics	Persons with cancer diagnosis <i>n</i> = 24,810				Persons without cancer <i>n</i> = 382,837			
	Not employed ^a (<i>n</i> = 11,037)		Employed ^a (<i>n</i> = 13,773)		Employed ^a (<i>n</i> = 283,767)		Not employed ^a (<i>n</i> = 99,070)	
Age (yr)								
18–39	3086	22.4% (20.90–23.90)	947	8.6% (7.11–10.09)	147,984	52.2% (50.18–54.22)	35,499	35.8% (33.79–37.81)
40–64	6293	45.7% (44.98–46.42)	2721	24.7% (22.31–27.09)	110,865	39.0% (37.02–40.98)	28,237	28.5% (26.57–30.43)
≥ 65	4394	31.9% (31.27–32.53)	7369	66.7% (64.15–69.25)	24,918	8.8% (6.93–10.67)	35,334	35.7% (33.48–37.92)
Gender								
Male	5115	37.2% (34.41–39.99)	3801	34.4% (32.53–36.27)	136,429	48.1% (45.64–50.56)	40,595	41.0% (38.63–43.37)
Female	8658	62.8% (60.24–65.36)	7236	65.6% (63.58–67.62)	147,338	51.9% (48.71–55.09)	58,475	59.0% (56.56–61.44)
Race/ethnicity								
Hispanic	1139	8.3% (7.36–9.24)	821	7.4% (6.12–8.68)	52,248	18.4% (15.98–20.82)	18,853	19.0% (17.07–20.93)
Non-Hispanic White	11,046	80.1% (76.98–83.22)	8780	79.6% (74.84–84.36)	177,879	62.7% (59.47–65.93)	57,908	58.5% (56.36–60.64)
Non-Hispanic Black	1272	9.4% (9.24–9.56)	1156	10.5% (9.48–11.52)	41,127	14.5% (11.27–17.73)	17,005	17.1% (15.23–18.97)
Non-Hispanic Other [†]	316	2.2% (2.15–2.25)	280	2.5% (2.37–2.63)	12,513	4.4% (3.41–5.39)	5304	5.4% (4.69–6.11)
Education								
<High school	3680	29.2% (24.90–33.50)	3075	29.4% (26.17–32.63)	77,367	34.0% (32.01–35.99)	30,814	37.4% (35.59–39.21)
High school/GED	3437	27.3% (24.88–29.72)	3344	31.9% (29.87–33.93)	51,151	22.5% (20.42–24.58)	23,351	28.4% (26.53–30.27)
Some college/higher	5476	43.5% (40.26–46.74)	4056	38.7% (36.67–40.73)	99,024	43.5% (41.08–45.92)	28,109	34.2% (32.24–36.16)
Health insurance status								
Private	9323	70.0% (65.99–74.01)	1754	16.2% (14.23–18.17)	208,918	75.9% (72.65–79.15)	32,774	34.0% (32.25–35.75)
Public	2490	18.7% (18.02–19.38)	8488	78.4% (74.33–82.47)	23,947	8.7% (6.82–10.58)	49,354	51.2% (49.16–53.24)
Uninsured	1492	11.2% (8.41–13.99)	584	5.4% (4.08–6.72)	42,114	15.3% (13.24–17.36)	14,266	14.8% (14.32–15.28)
Difficulty with instrumental activities of daily living								
Yes	399	2.9% (2.17–3.63)	671	6.1% (5.20–7.00)	2783	1.0% (0.96–1.04)	3599	3.6% (3.58–3.62)
No	13,374	97.1% (93.36–100.84)	10,366	93.9% (90.00–97.80)	280,984	99.0% (95.76–102.2)	95,471	96.4% (93.92–98.88)
≥2 functional limitations								
Yes	4959	36.0% (32.78–39.22)	6799	61.6% (58.39–64.81)	11,635	4.1% (3.58–4.62)	26,055	26.3% (25.01–27.59)
No	8815	64.0% (60.63–67.37)	4238	38.4% (35.90–40.90)	272,132	95.9% (92.06–99.74)	73,015	73.7% (71.16–76.24)
Psychological distress								
Yes	1939	14.1% (12.30–15.90)	1931	17.5% (16.23–18.77)	24,809	8.7% (7.75–9.65)	14,207	14.3% (12.44–16.16)
No	11,874	85.9% (82.74–89.06)	9106	82.5% (78.69–86.31)	258,958	91.3% (87.85–94.75)	84,863	85.7% (83.22–88.18)
Health status								
Good–excellent	11,362	82.5% (79.62–85.38)	7285	66.1% (63.59–68.61)	265,173	93.5% (90.20–96.80)	78,635	79.3% (77.28–81.32)
Poor–fair	2401	17.5% (15.58–19.42)	3734	33.9% (31.87–35.93)	18,479	6.5% (6.37–6.63)	20,366	20.7% (19.63–21.77)
Time since diagnosis of cancer (yr)								
0–5	4759	42.4% (40.30–44.50)	7627	39.0% (35.75–42.25)	—	—	—	—
6–10	2,362	21.2% (19.10–23.30)	3803	20.4% (18.00–22.80)	—	—	—	—
>10	4076	36.4% (33.52–39.28)	7976	40.6% (38.00–43.20)	—	—	—	—
Cancer site								
Bladder	227	2.3% (1.74–2.86)	546	2.9% (2.85–2.95)	—	—	—	—
Breast	2189	18.3% (15.31–21.29)	4386	20.9% (18.42–23.38)	—	—	—	—
Colorectal	605	5.4% (3.47–7.33)	1885	9.4% (8.23–10.57)	—	—	—	—
Lung	241	2.1% (0.78–3.42)	881	4.5% (4.04–4.96)	—	—	—	—
Prostate	980	9.7% (7.79–11.61)	2904	16.2% (14.35–18.05)	—	—	—	—
Other cancers [‡]	6955	62.2% (57.54–66.86)	8804	46.1% (43.56–48.64)	—	—	—	—

GED = General Education Development certificate.

^a Unweighted frequencies, column percentage (95% confidence interval).

[†] Non-Hispanic other is a very broad and varied category of persons from a variety of races and ethnicities, including persons of multiple races. This group may be more diverse than the other race-ethnicity groups.

[‡] All other cancer sites not listed, excluding nonmelanoma skin cancer.

Cancer survivors only

Among employed cancer survivors, 42% were diagnosed 5 years or less before the NHIS interview, 21.2% were diagnosed 6–10 years before their interview, and 36.4% had a cancer diagnosis over 10 years before the interview. The distribution of time since diagnosis was similar among not employed cancer survivors. However, whereas less than 40% of employed cancer survivors had one of the five most frequently diagnosed cancers, 60% of their not employed peers had been diagnosed with one of these cancers.

Health status

As Table 2 lists, female cancer survivors were significantly more likely to report good-to-excellent health status compared with male survivors (odds ratio (OR) = 1.3; 95% confidence interval (CI) =

1.22–1.28). There were notable differences between Hispanic origin and race groups with regards to good-to-excellent health status among cancer survivors compared with whites, blacks (OR = 0.6; 95% CI = 0.62–0.66), and persons of other races (OR = 0.8; 95% CI = 0.71–0.80) were significantly less likely to report good-to-excellent health. Education was positively associated with health status: survivors with a high-school diploma or General Education Development certificate (OR = 1.6; 95% CI = 1.49–1.75) and those with at least some college education (OR = 2.2; 95% CI = 2.07–2.35) were significantly more likely to report good-to-excellent health compared to survivors with less than a 12th grade-level education. Survivors with public insurance (OR = 0.5; 95% CI = 0.49–0.57) and those who were uninsured (OR = 0.9; 95% CI = 0.81–0.91) were significantly less likely to report good-to-excellent health compared to those with private insurance. Having a functional limitation (OR = 0.6; 95% CI = 0.55–0.61), trouble performing IADLs

Table 2
Estimates of the effects of demographic factors, and functioning and limitation variables on Health status and Employment among US adult cancer survivors: National Health Interview Survey, 1997–2012 ($n = 24,810$)

Demographic characteristics	Instrumental activities of daily living	Functional limitation	Psychological distress	Health status	Employed status
	β (95% CI)	β (95% CI)	β (95% CI)	OR	OR
Demographics					
Age	<0.01 (0.002–0.002)***	0.02 (0.020–0.020)***	–0.01 (–0.010 to 0.010)***	1.0 (0.91–1.13)	<1.0 (0.94–0.96)***
Male (referent)	1.00	1.00	1.00	—	—
Female	0.03 (0.027–0.029)***	0.25 (0.240–0.260)***	0.11 (0.104–0.116)***	1.3 (1.22–1.28)***	<1.0 (0.88–1.02)
Race—ethnicity					
Non-Hispanic white (referent)	1.00	1.00	1.00	—	—
Non-Hispanic black	0.08 (0.079–0.081)***	0.37 (0.360–0.380)***	0.07 (0.057–0.077)***	0.6 (0.62–0.66)***	1.1 (1.01–1.11)**
Hispanic	0.05 (0.035–0.055)***	0.18 (0.166–0.194)***	0.12 (0.112–0.128)***	0.9 (0.88–1.02)	1.2 (1.11–1.25)*
Non-Hispanic other/multirace	0.04 (0.032–0.044)*	0.12 (0.106–0.134)*	0.09 (0.077–0.097)*	0.8 (0.71–0.80)*	0.9 (0.83–0.93)*
Education					
Less than high school (referent)	1.00	1.00	1.00	—	—
High school/GED	–0.10 (–0.102 to 0.102)***	–0.45 (–0.464 to 0.436)***	–0.22 (–0.226 to –0.214)***	1.6 (1.49–1.75)***	2.0 (1.88–2.04)***
Some college/college degree	–0.16 (–0.157 to 0.155)***	–0.72 (–0.739 to 0.701)***	–0.34 (–0.340 to –0.340)***	2.2 (2.07–2.35)***	2.6 (2.56–2.70)***
Health insurance					
Private insurance (referent)	1.00	1.00	1.00	—	—
Public insurance	0.05 (0.042–0.058)***	0.24 (0.222–0.258)***	0.19 (0.187–0.191)***	0.5 (0.49–0.57)***	0.3 (0.28–0.32)***
Uninsured	0.003 (0.003–0.003)***	0.002 (0.001–0.003)***	0.002 (0.002–0.002)***	0.9 (0.81–0.91)**	1.0 (0.99–1.03)
Cancer history					
Time since diagnosis	<0.01 (0.000–0.002)***	0.01 (0.003–0.011)***	<0.01 (–0.004 to 0.008)***	1.0 (0.91–1.09)	1.0 (0.98–1.02)
Other cancers (referent)	1.00	1.00	1.00	—	—
Bladder cancer	0.02 (0.024–0.024)	0.16 (0.143–0.173)*	<0.01 (0.001–0.008)	1.0 (0.87–1.03)	1.0 (0.85–1.15)
Breast cancer	–0.01 (–0.009 to 0.010)	0.02 (0.009–0.037)	–0.07 (–0.082 to –0.058)***	1.0 (0.89–1.11)	1.0 (0.82–1.24)
Colorectal cancer	0.05 (0.042–0.058)***	0.21 (0.196–0.232)***	–0.01 (–0.014 to 0.006)	1.0 (0.89–1.09)	0.8 (0.70–0.82)**
Lung cancer	0.17 (0.154–0.186)***	0.08 (0.077–0.081)***	0.16 (0.159–0.161)***	0.8 (0.72–0.84)**	0.7 (0.69–0.79)**
Prostate cancer	–0.02 (–0.042 to –0.002)**	–0.12 (–0.128 to 0.112)***	–0.08 (–0.122 to –0.118)**	1.1 (1.06–1.18)*	0.8 (0.69–0.81)***
Difficulty with functioning and limitations					
Instrumental activities of daily living	—	—	—	0.9 (0.79–0.91)***	0.8 (0.75–0.83)***
Functional limitation	—	—	—	0.6 (0.55–0.61)***	0.8 (0.74–0.82)***
Psychological distress	—	—	—	0.5 (0.50–0.58)***	0.9 (0.93–0.99)***
Health status	—	—	—	—	2.2 (2.21–2.25)***

* $P < .05$, ** $P < .01$, *** $P < .001$.

95% CIs presented for beta values and ORs.

(OR = 0.9; 95% CI = 0.79–0.91) and psychological distress (OR = 0.5; 95% CI = 0.50–0.58) were all significantly inversely related to health status.

Employment status

Black (OR = 1.1; 95% CI = 1.01–1.11) and Hispanic cancer survivors (OR = 1.2; 95% CI = 1.11–1.25) were somewhat more likely to be employed compared with white cancer survivors. Education was positively associated with current employment: survivors with a high-school diploma or General Education Development certificate (OR = 2.0; 95% CI = 1.88–2.04) and those with at least some college education (OR = 2.63; $P < .001$) were more likely to be employed compared to survivors with less than a 12th grade-level education. Survivors with public health insurance were less likely to be employed compared to those with private health insurance (OR = 0.3; 95% CI = 0.28–0.32). Persons with functional limitations (OR = 0.8; 95% CI = 0.74–0.82), IADLs (OR = 0.8; 95% CI = 0.75–0.83), and psychological distress (OR = 0.9; 95% CI = 0.93–0.99) were significantly less likely to be employed. Adults who reported good-to-excellent health had an increased likelihood of current employment (OR = 2.2; 95% CI = 2.21–2.25) compared with those who reported poor-to-fair health.

Cancer history

For every increase in year since diagnosis, the reported impacts on a cancer survivors' IADLs, functional limitations, and psychological distress worsened significantly in terms of statistical sig-

nificance, but the changes in these health indicators were not substantial ($\beta = 0.001$, $P < .001$; $\beta = -0.01$, $P < .001$; and $\beta = -0.002$, $P < .01$, respectively). There was no observable difference in time since diagnosis and a survivors' reported health status (OR = 1.0; 95% CI = 0.91–1.09) or employment status (OR = 1.0; 95% CI = 0.98–1.02; Table 2).

Compared to survivors of "other" cancers, colorectal and lung cancer survivors were significantly more likely to have difficulty performing IADLs ($\beta = 0.05$, $P < .001$; and $\beta = 0.17$, $P < .001$; respectively) and to have functional limitations ($\beta = 0.21$, $P < .001$; and $\beta = 0.08$, $P < .001$; respectively), but lung cancer survivors did report more psychological distress ($\beta = 0.16$, $P < .001$). Prostate cancer survivors were significantly less likely to have difficulty in performing IADLs, functional limitations, and psychological distress ($\beta = -0.02$, $P < .01$; $\beta = -0.12$, $P < .001$; and $\beta = -0.08$, $P < .01$; respectively). Bladder cancer survivors were more likely to have functional limitations ($\beta = 0.16$, $P < .05$), and breast cancer survivors were significantly less likely to report psychological distress ($\beta = -0.07$, $P < .001$).

Compared with survivors of other cancers, survivors with a history of lung cancer were significantly less likely to have good-to-excellent health (OR = 0.8; 95% CI = 0.72–0.84), whereas prostate cancer survivors were more likely to report good-to-excellent health (OR = 1.1; 95% CI = 1.06–1.18). Survivors of lung (OR = 0.7; 95% CI = 0.69–0.79), colorectal (OR = 0.8; 95% CI = 0.70–0.82), and prostate cancer (OR = 0.8; 95% CI = 0.69–0.81) were significantly less likely to be employed compared with survivors of other cancers (Table 2).

Discussion

Although factors such as age, cancer site, time since diagnosis, and gender may have an independent impact on an individual cancer survivor's potential to continue to work during or after cancer diagnosis and treatment, our research suggests that educational level and private health insurance coverage may have a greater influence on employment decisions. During the study period, the mixed health insurance system in the United States was predominantly employment based. Our model examining the effects of insurance on cancer survivors indicated that publicly insured survivors were significantly less likely to report good-to-excellent health or being employed compared with the privately insured. These findings support previous studies reporting that most survivors elect to return, and/or continue to, work to have access to affordable health care and thus afford cancer treatment [26,27]. A greater disparity was undoubtedly diluted by access to public insurance, such as Medicaid among the older and qualified disabled cancer survivors [28].

Cancer survivors with at least some college education or a college degree were less likely to report functional limitations, trouble with performing IADLs, and psychological distress compared to those with lower education level. These findings are similar to past research reporting a positive link between higher education and lower levels of psychological distress [29] or functional limitations [30]. When considering all other variables in the model, higher educational level had a significant and positive association with both good-to-excellent health status and with employment among cancer survivors. Education may influence psychosocial and behavioral mechanisms throughout life, including the prevention of physical and mental functional disorders; in fact, higher education has been associated with engaging in preventive health measures and healthy behaviors [31]. Although the model did not investigate type of job, it is very likely that higher educated survivors have access to occupations with lower physical demands and greater likelihood of accommodation in the workplace [3,32,33] thus facilitating a higher rate of return to worker compared with survivors in less accommodating blue collar jobs.

Independently, functional limitations and psychological distress were significant predictors of health status among cancer survivors and were strong predictors of employment in this and other research [8,34]. Although simultaneously considering the other sociodemographic factors examined, time since diagnosis did not have the expected inverse relationship associated with difficulty performing IADLs, having functional limitations, or experiencing psychological distress; this may be due to the fact that there was non participation in the NHIS by those hospitalized or very sick and who had recently died as a result of the disease.

This suggests that other sociodemographic factors may play a greater role in a survivor's limitations, overall health status, and the ability to continue working after cancer diagnosis. It is possible that many survivors return to work of necessity, and encounter factors which make their work environment less conducive to work and recovery. Although many survivors who return to work may have a reduced workload, the stress of trying to prove they are able to perform their assigned tasks, whereas recuperating from the disease or even undergoing treatment may be daunting [9,35]. The physical and psychological impacts on health and employment vary by cancer site. Furthermore, a combination of sociodemographic factors (e.g. education) may increase or decrease the negative associations between type of cancer (e.g. lung cancer) and reported health status or current employment for different individuals.

Our results indicate that when all other factors were considered, the associations between education, or race, and health and employment status differed between persons with and without a

cancer history. It is possible that the ethnic disparities in reported health status and current employment among survivors may reflect the unequal distribution of employment benefits (such as early retirement packages and disability benefits) usually associated with certain occupations, higher education, and better insurance plans. These employment benefits have been shown to be better among whites compared to other race and ethnic groups [36,37]. Despite a greater proportion of diagnoses at a later stage of cancer [38], black and Hispanic cancer survivors are as likely to remain in the workforce as their counterparts with no cancer diagnosis despite their reports of poorer health compared to whites.

Our findings provide an example of the underestimated inequalities present in the United States [39,40] and highlight the need to simultaneously investigate factors that may mediate the relationships between sociodemographic factors, poor health, and employment among cancer survivors. In addition, it will be important to monitor the implementation of the Affordable Care Act as to whether the ability to retain or gain health coverage despite having cancer as a pre-existing condition is associated with an increase in the number of lower income Americans who can afford insurance coverage and thus return to work for reasons other than an insurance-based access to care.

Additionally, this study illustrates the need for workplace interventions to facilitate cancer survivors staying in or returning to work after a cancer diagnosis and treatment. Effective interventions would reduce workdays lost, increase productivity, and reduce psychosocial stresses associated with unemployment and treatment costs among cancer survivors.

Limitations

These findings should be interpreted in the context of the study's limitations. The NHIS data are cross-sectional, which preclude the differentiation between correlative associations and causal relationships when examining persons with a history of cancer. Although the NHIS survey asks persons to report a physician diagnosis of cancer, the data were self-reported and, thus, contingent on participant recall and willingness to report this diagnosis; thus, current employment and cancer diagnosis were not validated. Important clinical variables (such as stage at diagnosis or recurrences of cancer) were also not available; and type of treatment received was made available only in the 2010 NHIS cancer-control module.

Nevertheless, the NHIS is representative of the entire US civilian population; as such, there are significant strengths to the conclusions derived from these analyses. Our analyses span 14 years of data thus providing a large sample size and allowing for the estimation of outcomes among a variety of population subgroups. Furthermore, our findings are generalizable to the US population. Although we did not model all possible associations between health indicators and employment, the use of SEM allowed the simultaneous evaluation of all the relationships of the variables completely and simultaneously.

Conclusions

In summary, overall most of survivors return to or continue to work after cancer diagnosis. As cancer control and treatment continue to improve and more people work past the traditional retirement age, the number of cancer survivors in our rapidly aging workforce will continue to increase. Health policy analysts, oncologists, epidemiologists, employers, the US Department of Labor, and insurance companies will have to work collectively on various aspects of improving access to and extent of health insurance coverage for persons diagnosed with cancer across all occupational sectors. Our findings clearly point to the need for further research

on access to health care and disability benefits available to cancer survivors within the workplace. If working cancer survivors experience better health, improved benefits, and worksite-accommodations among those jobs or occupations that do not usually offer these services, the burden on the individual and the health care system would be reduced as more survivors would have the ability to return to work or to continue to work throughout their treatment.

Acknowledgments

The work was supported in part by a National Cancer Institute (NCI) fellowship at the National Institutes of Health (1F31CA153937); the National Institute for Occupational Safety and Health (NIOSH R01 OH03915); and the European Regional Development Fund Programme and European Social Fund Convergence Programme for Cornwall and the Isles of Scilly (the University of Exeter Medical School).

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