



Original Article

Chronic conditions and health status in older cancer survivors[☆]

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ABSTRACT

Background: With the aging population and improved cancer care, the number of cancer survivors is steadily increasing. Planning for their care requires an understanding of the impact of cancer and chronic conditions on quality of life. We sought to determine chronic conditions and health status in older cancer survivors compared to controls. **Methods:** In this retrospective cross-sectional study, we used survey data from 18,133 cancer survivors and 94,407 controls age 65 and older who participated in the Behavioral Risk Factor Surveillance System 2009 telephonic survey. Our main measures were chronic conditions (cardiovascular disease, hypertension, diabetes mellitus, high cholesterol, and arthritis) and poor health status (poor or fair self-rated health).

Results: Cancer survivors were older, more likely white, had higher education, and slightly more likely to have a healthcare provider and higher levels of emotional support. More survivors reported having 2 or more chronic conditions compared to controls (67.5% vs. 64.5%, respectively). Health status was lower for survivors, and was significantly different by racial/ethnic group. In a multivariable model for health status, having 2 or more chronic conditions was more strongly associated with poorer health status than cancer survivorship.

Conclusions: Cancer survivors had slightly higher numbers of chronic conditions and poorer health status than controls. However, chronic conditions were more strongly associated with poor health status than cancer. Monitoring for recurrence and second cancers is important in cancer survivors, but chronic conditions also need to be given priority due to their substantial impact on health status.

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1. Introduction

In the United States, nearly 1.6 million new cases of cancer were diagnosed in 2010 [1]. The number of cancer survivors in the United States was estimated at 13.7 million in 2012, or 4% of the US population [2], and is projected to increase to almost 18 million by 2022 [3]. The National Coalition for Cancer Survivorship defines a survivor as an individual diagnosed with cancer, from the moment of diagnosis and for the balance of life [4]. Due to improvements in early detection, treatment, and supportive care, the number of cancer survivors is steadily increasing. In fact, after initial diagnosis, 68.1% of cancer survivors live 5 or more years [3]. Cancer is a disease associated with aging, and the incidence of cancers is highest in people 65 and older [2]. As the population ages over the next few decades, the incidence of cancer thus will increase significantly [5]. Therefore, cancer and the effects of cancer on an aging population have a substantial long-term impact on the care of cancer survivors.

Cancer survivors have ongoing effects on their physical and mental health as a result of cancer and its treatment [6]. For example, there is an increased incidence of cardiac comorbidities and metabolic

syndrome from chemotherapy, hormonal anti-cancer therapy, and radiation treatment [7–10]. Cancer survivors have difficulties in adjusting to and coping with their illness, increasing psychological distress, and have diminished quality of life as a result of cancer and its treatment [11–13]. Cancer survivors have a high prevalence of comorbid illness and unhealthy behaviors [14,15].

Planning for the care of the growing number of cancer survivors requires an understanding of the additional illness burden related to cancer survivorship. Older persons with a history of cancer have a high prevalence of comorbid illness, physical limitations, and functional disability [16]. This is particularly important, as some cancer survivors are at increased risk of receiving suboptimal comorbidity care [17]. Our objective was to determine the prevalence of chronic conditions and poor health status in older cancer survivors compared to older persons without cancer. We hypothesized that older cancer survivors would have an increased physiologic and psychological toll as a result of cancer, and thus have higher rates of chronic illness and poorer health status.

2. Patients and methods

2.1. Data

We used results from the 2009 Behavioral Risk Factor Surveillance System (BRFSS) Questionnaire for respondents age 65 years and older.

[☆] All authors had access to the data and had a role in writing the manuscript.

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The BRFSS is an annual telephonic survey conducted on a representative sample of the United States population. All data from the BRFSS are self-reported, and the core questionnaire included items on health status, health behaviors, and chronic conditions. Details about the BRFSS and sampling techniques have been described elsewhere [18].

Participants in the BRFSS survey were asked about cancer history as part of the core modules administered to all participants. We used these questions to establish a population of cancer survivors and a population of controls 65 years and older without a history of cancer. We defined cancer survivors as participants who responded “yes” to the question “Have you ever been told by a doctor, nurse, or other health care professional that you have cancer?” We defined controls as persons who answered “no” when asked if they had cancer. Cancer survivors were also asked how many cancers they had, the type of their first cancer, and the age at first diagnosis of cancer.

We excluded from survivors or controls people who answered “don’t know/not sure” regarding a cancer history. We also excluded survivors with more than one cancer, because we would be unable to be certain about the timing of cancer diagnosis, and could include people actively receiving treatment for a newer cancer. We excluded survivors who had a cancer diagnosis within 2 years, because we were unable to determine whether they were actively receiving treatment for cancer. We excluded people with non-melanoma skin cancer. Finally, we excluded adult survivors of childhood cancer, because they would have different cancers and treatments, and hence, different long-term survivorship issues that have been described elsewhere [19].

This study was approved by the Institutional Review Board of the University of Texas MD Anderson Cancer Center, with a waiver of informed consent.

2.2. Measures

2.2.1. Chronic conditions

All participants in the BRFSS were asked about a select number of chronic conditions. These conditions were high blood pressure, high cholesterol, cardiovascular disease (which included heart attack, coronary heart disease, or stroke), diabetes mellitus, or arthritis (which included arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia).

2.2.2. Poor health status

Health status was part of the core questionnaire of the BRFSS. Participants were asked to rate their general health as excellent, very good, good, fair or poor. We defined poor health status as a rating of fair or poor on this item.

2.2.3. Independent variables

We included demographic factors possibly associated with comorbidity and/or health status, including sex, race/ethnicity, educational level, marital status, employment, and income. We also used responses related to healthcare access, including having one or more healthcare providers and deferring medical care due to cost, as potential predictors of comorbidity or health status. Finally, we used participants’ responses regarding the levels of emotional support and life satisfaction as possible factors associated with poor health status.

2.3. Statistical analysis

The sampling design of BRFSS was accounted for and we used SAS survey procedures in all analyses. Each respondent in the BRFSS is assigned a final sample weight according to the probability of selection, number of phones and adults in the household, and population estimates for age, sex, and race/ethnicity by United States region or state [18]. We determined the prevalence and 95% confidence interval (CI) for survivors and controls for all independent variables. Given the relationship between increasing age with increasing likelihood of chronic conditions, we determined the age-adjusted prevalence for each of the

five chronic conditions, using population based estimates for prevalence of age groups from the United States Census data for 2010. We examined the association between cancer history and poor health status. Due to a significant relationship between race/ethnicity and health status in bivariate analysis, we also presented the prevalence of poor health status stratified across different racial/ethnic groups, adjusted for age. We constructed a multivariable model controlling for socio-demographic factors for the association between independent variables and poor health status, treating the number of chronic conditions and cancer survivorship as independent variables in the model. We also constructed separate multivariable models for cancer survivors and for controls for the association between independent variables and poor health status to determine whether the association with chronic conditions and poor health status was different in the two groups. All analyses were completed using SAS software (SAS Institute, Cary, SD).

3. Results

The 2009 BRFSS survey included 136,270 respondents who were 65 years and older at the time of the survey. After excluding people who were not sure about a diagnosis of cancer ($n = 7567$), those with more than one type of cancer or missing cancer type ($n = 6606$), those diagnosed with cancer within 2 years of the survey ($n = 4264$), cancer survivors with non-melanoma skin cancer ($n = 5228$), and adult survivors of childhood cancer ($n = 65$), our final sample comprised 18,133 cancer survivors representing 5,364,042 persons and 94,407 controls representing 27,273,521 persons 65 years and older in the United States. Most survivors (78.8%) were diagnosed with cancer 5 or more years prior to the survey, and the median time since diagnosis was 9.6 years. The characteristics of respondents with population estimates for cancer survivors and controls without cancer are shown in Table 1. A higher proportion of cancer survivors was older, white, and reported a college education. Survivors were more likely to have at least one healthcare provider and less likely to defer medical care due to cost; although these differences were significant, they were small. Survivors were also slightly more likely to report higher levels of emotional support. There were no substantial differences in marital status or life satisfaction between survivors and controls.

The age-adjusted prevalence of chronic conditions is shown in Table 2. The prevalence of cardiovascular disease and arthritis was slightly but significantly higher in survivors. Hypertension, high cholesterol, and diabetes mellitus prevalence were similar in both groups. More survivors reported having two or more chronic conditions compared to controls (67.5% vs. 64.5%, respectively). Among the cancer survivors only, survivors who were 80 years and older had a higher prevalence of cardiovascular disease (32.8% vs. 28.3%, respectively) and arthritis (60.2% vs. 56.2%, respectively) compared to those who were 65 to 79 years of age. There was no difference in the prevalence of 2 or more chronic conditions in the older vs. younger groups (67.9% vs. 68.0%, respectively). The prevalence of chronic conditions varied by cancer type, but among the most common cancers, the prevalence of 2 or more chronic conditions ranged from 60.1% for lung cancer to 69.2% for melanoma.

Cancer survivors had poorer health status compared to controls. Overall, before adjustment for age, 29.7% (95% CI 28.5–30.9%, population estimate 1,593,120) of cancer survivors reported fair or poor self-rated health compared to 25.0% (95% CI 24.5–25.5%, population estimate 6,818,380) of controls. The relationship between cancer survivorship and poor health status was substantially different across different racial/ethnic categories (Table 3). Survivors who were white, black, or Asian had significantly worse self-rated health compared to controls, but this relationship was reversed for Hispanics and Native Americans, in whom controls had worse self-rated health. Poor health status was associated with older age and with type of cancer among cancer survivors. A higher proportion of cancer survivors 80 years and older reported poor health status compared to survivors 65 to 79 years of age, 32.8%

Table 1
Characteristics of cancer survivors and controls.

Characteristic	Group	Cancer survivors		Controls	
		Population estimate	Percent (95% CI)	Population estimate	Percent (95% CI)
Age	65–69	1,225,090	22.8 (21.7–24.0)	8,726,587	32.0 (31.5–32.5)
	70–74	1,233,037	23.0 (21.9–24.1)	6,583,469	24.1 (23.6–24.6)
	75–79	1,332,406	24.8 (23.7–26.0)	5,576,125	20.4 (20.0–20.9)
	80+	1,573,510	29.3 (28.1–30.5)	6,387,339	23.4 (22.9–23.9)
Sex	Female	2,917,266	54.4 (53.1–55.7)	16,133,541	59.2 (58.6–59.7)
	Male	4,483,617	84.1 (82.7–85.5)	21,157,078	78.1 (77.5–78.7)
Race	White	384,043	7.2 (6.2–8.2)	2,401,065	8.9 (8.5–9.3)
	Black	271,479	5.1 (4.1–6.0)	2,225,607	8.2 (7.8–8.6)
	Hispanic	56,107	1.1 (0.7–1.4)	544,368	2.0 (1.8–2.3)
	Asian	38,192	0.7 (0.5–1.0)	235,078	0.9 (0.7–1.0)
	Native American	97,538	1.8 (1.4–2.3)	518,812	1.9 (1.7–2.1)
	Other	3,150,368	58.8 (57.6–60.1)	15,779,930	58.0 (57.4–58.5)
Marital Status	Married	510,835	9.5 (8.8–10.3)	2,851,746	10.5 (10.1–10.8)
	Divorced/separated	1,498,764	28.0 (26.9–29.1)	7,527,232	27.7 (27.2–28.1)
	Widowed	194,316	3.6 (3.2–4.1)	1,058,104	3.9 (3.7–4.1)
Education	Single	233,435	4.4 (3.9–4.9)	1,831,998	6.7 (6.4–7.1)
	<HS	400,123	7.5 (6.8–8.2)	2,290,433	8.4 (8.1–8.7)
	Some HS	3,084,722	57.7 (56.3–59.0)	15,784,425	58.1 (57.5–58.6)
	HS Grad	1,632,882	30.5 (29.2–31.8)	7,283,459	26.8 (26.3–27.3)
College Grad	5,183,333	96.9 (96.4–97.4)	25,661,489	94.3 (94.0–95.6)	
Has 1 or More Health Care Providers	Yes	204,138	3.8 (3.3–4.3)	1,260,701	4.6 (4.4–4.9)
Has Deferred Medical Care Due to Cost	Yes	2,852,770	54.3 (53.0–55.7)	13,820,922	52.0 (51.4–52.6)
Emotional Support	Always	1,260,541	24.0 (22.9–25.1)	6,366,149	24.0 (23.5–24.4)
	Usually	636,790	12.1 (11.2–13.1)	3,515,340	13.2 (12.8–13.6)
	Sometimes	199,290	3.8 (3.3–4.3)	1,128,993	4.2 (4.0–4.5)
	Rarely	300,798	5.7 (5.1–6.3)	1,737,865	6.5 (6.2–6.9)
Satisfied With Life	Never	2,563,181	48.1 (46.8–49.5)	13,148,090	48.6 (48.1–49.2)
	Very satisfied	2,548,661	47.9 (46.5–49.2)	12,874,906	47.6 (47.0–48.2)
	Satisfied	169,404	3.2 (2.7–3.6)	819,828	3.0 (2.8–3.2)
	Dissatisfied	43,577	0.8 (0.6–1.0)	196,461	0.7 (0.6–0.8)

vs. 28.3%, respectively. Among the most common cancer types, poor health status ranged from 24.7% for breast cancer survivors to 45.4% for lung cancer survivors.

The multivariable model for factors associated with poor health status (Table 4) included the 107,120 respondents (95.2% of the selected study population) who had complete data for health status and all covariates. Of the total 112,540 respondents, 887 had missing data for health status, and 67 were missing complete data for chronic conditions. Poor health status was more strongly associated with having 2 or more chronic conditions than with cancer history. Poor health status was also strongly associated with increasing age, lower educational level, and deferring medical care due to cost. Respondents who were black or Hispanic also had poorer health status compared to whites. Poor health status was also associated with male sex, being unmarried, and with lower levels of emotional support. In separate multivariable models for poor health status among survivors only and controls only (data not shown), having 2 or more chronic conditions was more strongly associated with poor health status in controls than in survivors, adjusting for the same factors in Table 4; the odds ratio (OR) for poor health status associated with higher numbers of chronic conditions was 3.07 (95% CI 2.89–3.31) for controls and 2.38 (95% CI 2.07–2.74) for survivors.

Table 2
Age-adjusted prevalence of chronic conditions in older cancer survivors and controls.

Chronic condition	Cancer survivors percent (95% CI)	Controls percent (95% CI)
Hypertension	60.4 (59.0–61.7)	59.1 (58.6–59.7)
Cardiovascular disease	24.5 (23.4–25.7)	22.9 (22.5–23.4)
High cholesterol	54.7 (53.3–56.1)	53.2 (52.6–53.7)
Diabetes mellitus	20.6 (19.5–21.7)	19.8 (19.4–20.3)
Arthritis	56.8 (55.5–58.2)	52.8 (52.2–53.3)
≥2 Chronic conditions	67.5 (66.2–68.8)	64.5 (64.0–65.0)

4. Discussion

We found a higher prevalence of chronic conditions in older cancer survivors compared to controls without cancer. Although small, these differences were statistically significant and suggest that older cancer survivors have a higher burden of chronic conditions than the general population. Higher numbers of chronic conditions in cancer survivors could be the result of long-term effects of cancer treatment or could be comorbid conditions not related to survivorship.

We found a strong association between chronic conditions and poor health status. We hypothesized that cancer survivors would have poorer health status than controls; however, we found that having 2 or more chronic conditions was more strongly associated with poor health status than cancer survivorship was. Thus, while addressing the

Table 3
Age-adjusted prevalence of poor health status in cancer survivors and controls by race/ethnicity.

Race/Ethnicity	Group	Fair or poor self-rated health percent (95% CI)
Overall	Survivors	29.3 (28.1–30.5)
	Controls	25.2 (24.7–25.7)
White	Survivors	27.4 (26.3–28.6)
	Controls	21.6 (21.1–22.1)
Black	Survivors	40.2 (33.0–47.3)
	Controls	35.6 (33.4–37.9)
Hispanic	Survivors	41.2 (33.4–49.0)
	Controls	47.3 (44.5–50.1)
Asian	Survivors	42.6 (25.1–60.0)
	Controls	21.7 (16.6–26.8)
Native American	Survivors	18.5 (9.3–27.6)
	Controls	31.4 (25.5–37.3)
Other	Survivors	36.7 (26.9–46.6)
	Controls	28.8 (24.5–33.2)

Table 4
Multivariable model for odds of poor health status (fair or poor self-rated health).

Characteristic	Category	Odds ratio ^a (95% CI) for fair or poor self-rated health
Age	65–69	Reference
	70–74	1.07 (0.99–1.15)
	75–79	1.29 (1.19–1.40)
	80+	1.44 (1.33–1.55)
Sex	Female	Reference
	Male	1.10 (1.03–1.16)
Race/Ethnicity	White	Reference
	Black	1.34 (1.20–1.49)
	Hispanic	2.15 (1.90–2.43)
	Asian	1.29 (0.95–1.75)
	Native American	1.04 (0.78–1.38)
	Other	1.32 (1.01–1.73)
Marital Status	Married	Reference
	Divorced/Separated	1.41 (1.29–1.55)
	Widowed	1.15 (1.08–1.23)
	Single	1.19 (1.03–1.38)
Educational Level	College	Reference
	High School Grad	2.03 (1.89–2.18)
	Some High School	3.77 (3.39–4.20)
	Less than High School	4.80 (4.19–5.49)
Having 1 or more HC providers	No	Reference
	Yes	1.10 (0.96–1.26)
Deferring care due to cost	No	Reference
	Yes	2.43 (2.15–2.74)
Emotional support	Always	Reference
	Usually	1.03 (0.97–1.10)
	Sometimes	1.68 (1.54–1.82)
	Rarely	1.79 (1.57–2.04)
	Never	1.36 (1.21–1.53)
Number of Chronic Conditions	0–1	Reference
	2–5	2.93 (2.75–3.13)
Cancer Survivor	No	Reference
	Yes	1.36 (1.27–1.46)

^a Adjusted for all other variables in the table.

special needs of cancer survivors is important, our study highlights the need to address chronic conditions and focus on chronic disease control to improve health of older survivors.

We found a very high number of BRFSS respondents with poor health status, with higher rates among cancer survivors. We found important disparities in health status between cancer survivors and controls. The associations between poor health status and cancer survivorship were substantially different across racial and ethnic groups, differences that were attenuated when controlling chronic conditions, along with other demographic variables, healthcare access, and emotional support.

One reason for the small differences seen between survivors and controls in this study is that chronic conditions that may be more common or more burdensome in cancer survivors were not included in the BRFSS questionnaire. Participants were only asked about hypertension, cardiovascular disease, high cholesterol, diabetes mellitus, and arthritis, problems known to be common in the general population [20]. Other conditions, such as emphysema, may be more common in persons diagnosed with cancer due to common risk factors. Conditions such as heart failure or neuropathy may be more common in cancer survivors, depending on cancer type and treatment regimen. Other chronic conditions and symptoms that may be unique to cancer survivorship were not assessed in the BRFSS.

While other studies have found a higher prevalence of chronic conditions in cancer survivors, the magnitude of the association has varied depending on the age of the population studied and the comorbidities assessed. Seo, et al., found that the prevalence of chronic conditions was largely similar between older cancer survivors and controls, with the exception of a significantly higher prevalence of coronary artery disease and emphysema in cancer survivors [21]. Older persons with a recent diagnosis of cancer had higher hospitalization and nursing home admission rates compared to those without cancer. The authors

concluded that healthcare resources should be focused more on comorbidity burden rather than cancer survivorship per se in older persons [21]. Using the Medicare Health Outcomes Survey, Smith, et al. found that cancer survivors reported significantly higher numbers of several chronic conditions and worse physical health compared to controls [12]. In a survey of 289 cancer survivors and 262 age- and sex-matched controls found that survivors had more chronic conditions than controls, with a mean of 1.74 vs. 1.31, respectively ($p = 0.012$) [22]. However, the mean age in this study was 63 years, and persons older than 80 years were excluded. Associations between comorbidity and cancer survivorship may be less substantial in older adults, because of the strong impact that increasing age has on the accumulation of chronic illness.

Other studies have shown similar associations between cancer survivorship and health status. In a study of older cancer survivors using data from the Medicare Current Beneficiary Survey, cancer survivors had higher odds of poor self-rated health compared to controls without cancer [23]. The impact of cancer was similar to our findings, with an OR for poor self-rated health in cancer survivors compared to controls of 1.46 (95% CI 1.30–1.64). A study using data from the National Health Interview Survey found that cancer survivors had lower health utility, more lost productivity, and more health limitations compared to controls [11]. However, this study included adults of all ages with cancer, and the impact of cancer on quality of life and productivity measures was more significant for younger cancer survivors than older survivors. Another study using the National Health Interview Survey found a significant impact of cancer on health status, particularly among cancer survivors with other chronic conditions [24]. A study using data from the Surveillance, Epidemiology, and End Results registry linked with the Medicare Health Outcomes Survey found that older cancer survivors had significant declines in physical and mental health adjusting for comorbid conditions, with significantly different results by cancer type [25]. Smith, et al., found that in addition to higher comorbidity and poorer physical health, cancer survivors reported worse mental health and poorer health status [12]. Similar to our findings, however, the association with poor health status was stronger for respondents with higher numbers of chronic conditions. In contrast, one study found that survivors of colorectal cancer had similar health status and symptom burden to the non-cancer population up to 10 years after cancer treatment, regardless of whether chemotherapy was part of the initial treatment provided [26]. A systematic review of studies of unmet needs in cancer concluded that there was a high level of psychological, informational, and physical needs with a significant impact of comorbid conditions on unmet needs [27]. Having a better understanding whether diminished health status is due to cancer or comorbidity and whether poor health status persists long into survivorship is an area needing further research [28].

Our study has a number of limitations. The BRFSS is a telephonic survey, which may have led to selection bias. Variables are determined by self-report, and recall bias may thus make estimates of cancer and chronic conditions inaccurate. Due to lack of follow-up questions on cancer in the BRFSS, we were unable to explore the impact of cancer stage and treatment on chronic conditions or health status. Poor health-related quality of life in cancer survivors may be more impacted by the presence of disease progression rather than long-term effects of treatment [29]. We excluded survivors who were within 2 years of initial cancer diagnosis, thus excluding persons with cancers that are more life-limiting and possibly more likely to diminish health status. Despite these limitations, notable strengths of this study are the size and generalizability to the US population, as the survey is conducted on a representative population from all states.

Our findings have important implications for the long-term care of cancer survivors. Cancer survivors and respondents with higher numbers of chronic conditions reported poorer health status. The differences in health status by racial and ethnic groups suggest burdens and disparities that require further exploration. Poorer health status among blacks

and Hispanics, even when adjusting for cancer survivorship, chronic conditions, education, and healthcare access suggests other unmet factors that impair quality of life that may not be related to a history of cancer. There may be unmeasured effects of cancer or comorbid conditions and unmeasured symptom burden that needs to be addressed in cancer survivors. The risk of chronic conditions and effects on health status are at least as high, if not higher, in cancer survivors than the general population. Thus, this study supports the notion that healthcare providers should evaluate the burden of chronic conditions and health status regardless of cancer history in older patients. While surveillance for cancer recurrence and second cancers is an important component of survivorship care, common chronic conditions have a significant impact on health status and need to be a focus of survivorship care. Due to the prevalence and burden of comorbidity, primary care providers are particularly needed in the long-term management of survivors.

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Conflicts of interest

All authors report no financial relationships or conflicts of interest that are relevant to the manuscript under consideration. Dr. Escalante has served on a scientific advisory committee for Ortho McNeil Janssen Pharmaceuticals and UpToDate, Inc. and has been a consultant and speaker for Eisai Medical Research, Inc. Dr. Elting has received research grant funding from Helsinn Therapeutics, Inc. Dr. Holmes, Dr. Nguyen, Ms. Nayak, and Dr. Oh report no conflicts of interest or financial relationships or activities.

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