Physical and Mental Health Status and Health Behaviors of Survivors of Multiple Cancers: A National, Population-Based Study

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Abstract

Background—Little is known about the unique experience of adults with a history of multiple cancer diagnoses (i.e, survivors of multiple cancers).

Purpose—This research assessed the health status and health behaviors of survivors of multiple cancers.

Methods—The health status and health behaviors of 8734 survivors of multiple cancers, 47562 survivors of a single cancer, and 348229 non-cancer controls were compared using weighted data from the 2009 Behavioral Risk Factor Surveillance System.

Results—Survivors of multiple cancers reported poorer physical and mental health status outcomes (e.g., more mental distress and greater activity limitations) than survivors of a single cancer (all p's < .001) who reported poorer outcomes than controls (all p's < .001). Survivors of multiple cancers reported unhealthier behaviors than survivors of a single cancer and healthier behaviors than controls on most health behavior outcomes (e.g., alcohol use, tobacco use, and diet) (all p's < .001).

Conclusions—Data suggest the need for clinical interventions to enhance physical and mental health status, and to increase adoption of healthier behaviors in survivors of multiple cancers.

The number of cancer survivors living in the United States is growing because of an increasing life expectancy, more effective approaches to cancer screening and early diagnosis, and advances in the efficacy of cancer treatments (1). Unfortunately, this very positive trend means some cancer survivors will live long enough to be diagnosed with yet another cancer, making them "survivors of multiple cancers". Currently, survivors of multiple cancers account for 8–16% of all cancer survivors living in the United States (1, 2), making their survivorship experience an issue of public health relevance.

The experience of cancer can be understood as a chronic stressor (3–5) that includes existential crisis, the difficulties of treatment decision-making, functional decline, financial burden, and changes in social relationships. Theoretically, as a chronic stressor, cancer can function in two important ways. First, cancer can lead to increased "allostatic load" and dysregulation of physiological systems, which can then negatively impact physical and

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mental health status (6). In fact, research has found many adults report declines in physical and mental health status following cancer diagnosis, declines that sometimes persist into the long-term cancer survivorship phase (7–9). As examples, cancer survivors can experience somatic problems (10), fatigue (11), cognitive impairment (12), distress (13), and depressive and anxiety symptoms (13). Second, cancer can serve as a "teachable moment" which results in increased motivation to adopt risk-reducing health behaviors (14). As evidence of this, some adults make healthy changes in their physical activity, diet, alcohol consumption, and tobacco use following cancer diagnosis (9, 15, 16). By viewing cancer as a chronic stressor, one might expect survivors of multiple cancers to experience greater changes in both health status and health behaviors than survivors of a single cancer, simply as a result of the former experiencing more cancer-related stressors than the latter.

While it is not unreasonable to anticipate changes due to cancer, both in health status and health behaviors, could be compounded with each new cancer diagnosis, only one published study has focused on the unique experience of survivors of multiple cancers. Gotay and colleagues (17) found survivors of multiple cancers reported lower global quality of life, less vitality, greater cancer-specific distress, and poorer existential wellbeing than matched survivors of a single cancer, with effect sizes ranging from small to medium. While this initial study provides some indication of the mental health status of survivors of multiple cancers it does possess some significant limitations. Neither physical health status nor health behaviors were assessed, a non-cancer control group was not included, and participants were limited to Hawaii residents, thereby limiting the generalizability of study findings. Clearly, much more can be learned about the burgeoning group of survivors of multiple cancers in the United States.

The Institute of Medicine and National Research Council recognizes the value of national surveys for advancing cancer survivorship research (18). In particular, priority is given to population-based research focusing on understudied cancer survivors (19), such as survivors of multiple cancers. In light of this, the current study uses the 2009 national, population-based Behavioral Risk Factor Surveillance System (BRFSS) survey (20) to examine the current physical and mental health status and health behaviors of survivors of multiple cancers. To elucidate more clearly the impact of multiple cancer diagnoses, current health status and health behaviors for survivors of multiple cancers are compared to those of survivors of a single cancer as well as non-cancer controls. It was hypothesized that survivors of multiple cancers would be characterized by poorer health status and healthier behaviors than both survivors of a single cancer and non-cancer controls.

Method

Data Source and Sample Selection

Data for this study was provided by the 2009 BRFSS survey. The BRFSS survey is an annual, computer-assisted, telephone survey that is implemented by state health departments throughout the United States, the District of Columbia, Puerto Rico, Guam and the Virgin Islands. Random-digit telephone dialing methods are used to sample non-institutionalized individuals aged 18 years or older. Written informed consent is not required for participation in the BRFSS survey, but verbal consent was obtained. The BRFSS survey assesses preventive health practices and risk behaviors linked to chronic disease, infectious disease, and injury. For the 2009 BRFSS survey, the median Council of American Survey Research Organizations response rate was 52.5% and the median cooperation rate was 75.0% (21). A complete description of 2009 BRFSS survey design, questionnaire development, sample characteristics, data collection and procedures may be found elsewhere (www.cdc.gov/brfss). The Centers for Disease Control and Prevention Institutional Review Board approved the study prior to collection of data.

A population-based sample of 432,607 adults participated in the 2009 BRFSS survey. For the first time, questions regarding cancer survivorship (see "Measures" below) were included in the BRFSS core survey and were thus asked of all BRFSS participants. The initial question was "Have you ever been told by a doctor, nurse, or other health professional that you had cancer?" Previous population-based research has used similar methods to identify cancer survivors (22–26), and the test-retest reliability for this BRFSS question is excellent: $\kappa = .91$ (24). Consistent with previous research, participants who answered "no" to the above question were considered controls (80.5%; n = 348,229) and participants who answered "yes" were considered cancer survivors (13.7%; n = 59,173). Those participants who answered "don't know/not sure" or refused to answer were not considered for inclusion in the current study (5.8%; n = 25,205). Of those participants identified as cancer survivors, 2,877 were excluded because their first or only cancer was diagnosed in childhood (aged < 18 years old). Of the 56,296 adult cancer survivors who were retained for the current study, 84.5% (n = 47,562) reported only one lifetime cancer diagnosis, 12.9% (n = 7,278) reported two lifetime cancer diagnoses, and 2.6% (n = 1456) reported three or more lifetime cancer diagnoses. Thus, 84.5% (n = 47,562) of adult cancer survivors were categorized as survivors of a single cancer while the remaining 15.5% (n = 8,734) were classified as survivors of multiple cancers.

Measures

Personal history of cancer—Cancer survivors provided information about their age at cancer diagnosis as well as the number and type of their cancer diagnoses. In response to the question "How many different types of cancer have you had?," participants could answer "only 1," "2," "3 or more." They were then asked, "At what age were you told that you had cancer?" (If they were survivors of multiple cancers, they were asked "At what age was your first cancer diagnosis?") To this question, participants provided a specific age (e.g., "57" years). Finally, cancer survivors were asked, "What type of cancer was it?" (If they were survivors of multiple cancers, they were asked "With your most recent diagnosis of cancer, what type of cancer was it?"). For this last question, a list of options was provided if cancer survivors needed prompting.

Physical and mental health status—Participants rated their overall health on a scale from 1 = excellent to 5 = poor. In addition, responses were dichotomized into "excellent, very good, good" and "fair or poor." Frequency of physical and mental distress was assessed by asking participants to report the number of days in the past month when their physical and mental health (separately) was "not good." For these questions, number of days was recorded (range 0–30), in addition to dichotomizing responses into 0 to 13 (infrequent) and 14 to 30 (frequent) unhealthy days. For those participants who reported at least one day of physical or mental distress, activity limitations were measured by asking participants to report the number of days in the past month when their poor physical or mental health kept them from doing their usual activities. For this question, number of days was recorded (range 0–30), in addition to dichotomizing responses into 0 to 13 (infrequent) and 14 to 30 (frequent) activity limitations. Participants reported the number of days in the past month they did not get enough rest or sleep. The number of days was recorded (range 0–30), and responses were dichotomized into 0 to 13 (infrequent) and 14 to 30 (frequent) days of sleep problems. Finally, participants rated their current life satisfaction on a scale from 1 = very satisfied to 4 = very dissatisfied. All scoring of physical and mental health status variables was done in accordance with BRFSS guidelines (27).

Health behaviors—Participants were asked whether or not they had smoked ≥ 100 cigarettes in their lifetime and, if so, how often they currently smoked. Responses to these two questions were used to categorize respondents as current non-smokers (smoked < 100

cigarettes lifetime or smoked ≥ 100 cigarettes lifetime but currently do not smoke) or current smokers (smoked ≥ 100 cigarettes lifetime and now smoke some days or every day). Participants also reported whether they currently used chewing tobacco, snuff, or snus, and responses were used to classify participants as current non-smokeless tobacco users (not at all) or current smokeless tobacco users (every day or some days).

Participants reported how frequently they drink fruit juices, and eat fruit, green salads, potatoes (not including French fries, fried potatoes, or potato chips), carrots, and other vegetables. Based on their responses, the typical number of servings of fruits and vegetables consumed per day was calculated.

Participants were asked whether or not they had consumed any alcoholic beverage in the past month. If yes, they reported the number of days they drank in the past month and the typical number of drinks consumed each day when drinking. With this information, a positive versus negative point prevalence of alcohol use was determined, as well as the total number of alcoholic drinks consumed in the past month.

Participants' provided the number of days per week and number of minutes per day they typically engaged in moderate (e.g., brisk walking, bicycling) and vigorous (e.g., running, aerobics) physical activity outside of work. Based on their responses, participants' total minutes of moderate and vigorous physical activity were calculated for a typical week. Physical inactivity, defined as no moderate or vigorous physical activity, was also considered.

Demographic variables—Sex was recorded as male or female and participants reported their current age in years. Self-reported race and ethnicity, as well as marital/partner status, was recorded. Educational attainment was assessed by participants' reports of their highest grade or year of school completed. Body mass index was calculated as participants' self-reported weight in kilograms divided by the square of their height in meters.

Statistical Analyses

To account for the BRFSS' complex sampling design, weighted data were used in all statistical analyses. Continuous (e.g., life satisfaction, fruit and vegetable consumption, and moderate physical activity) and dichotomous (e.g., frequent physical distress, cigarette smoking, and physical inactivity) outcome measures were scored such that higher scores indicated poorer outcomes. Chi-square analyses and analyses of variance were used to identify any significant differences among the three study groups (non-cancer controls, survivors of a single cancer, and survivors of multiple cancers) on demographic variables (e.g., age, sex). When significant group differences were identified, that variable was treated as a covariate in the remaining tests of group differences. Analyses of covariance were used to identify overall group differences on continuous outcomes. When a statistically significant overall group effect was obtained, Tukey's Honestly Significant Difference tests were done to identify precisely where group differences existed. Effect sizes for continuous outcome variables were calculated as the difference between covariate-adjusted group means divided by the pooled standard deviation for the two groups being compared. Binomial logistic regression analyses, adjusted for covariates, tested group differences in categorical outcomes. Ninety-five percent confidence intervals for adjusted means and odds ratios were calculated. The criterion for statistical significance was set conservatively at p < .01. Data analysis was performed using the Statistical Package for the Social Sciences (28).

Results

Sample Characteristics

There were significant group differences on all demographic variables (see Table 1). Controls were less likely than both survivors of a single cancer and survivors of multiple cancers to be female (χ^2 (2) = 345007.11, p < .001) and married/partnered (χ^2 (6) = 4.76E6, p < .001). In addition, controls were less likely than survivors of a single cancer and survivors of multiple cancers to have graduated high school (χ^2 (2) = 101564.80, p < .001) and be White, non-Hispanic (χ^2 (2) = 2.73E6, p < .001). Finally, controls were younger than survivors of a single cancer and survivors of multiple cancers (F (2, 214543232) = 1.07E7, p < .001) and had a slightly higher body mass index (F (2, 2207651520) = 1704.02, p < .001).

The clinical characteristics of all cancer survivors are shown in Table 2. The proportion of various cancer diagnoses differed between survivors of a single cancer and survivors of multiple cancers (χ^2 (10) = 163833.45, p < .001) (see Table 2). In addition, survivors of multiple cancers were more likely to have been diagnosed with their first cancer at an earlier age (t (19707970) = 104.19, p < .001) and more likely to be further from their initial cancer diagnosis (t (18532338) = 842.46, p < .001) than survivors of a single cancer.

Group Differences in Physical and Mental Health Status

Significant group differences were found for all categorical health status variables (Table 3). In all cases (poor overall health status, frequent physical distress, frequent mental distress, frequent activity limitations, and frequent sleep problems), survivors of multiple cancers were significantly more likely to report poorer health status than survivors of a single cancer (all p's < .001) who in turn were significantly more likely to report poorer health status than controls (all p's < .001). The mean odds ratio for the comparison of survivors of a single cancer and survivors of multiple cancers on these five health indices was 1.48 (range = 1.29–1.63) while the mean odds ratio for the comparison of survivors of a single cancer and controls was 1.41 (range = 1.18–1.63).

An identical pattern of results was found for all continuous health status variables (see Table 4). For these indices (overall health status, physical distress, mental distress, activity limitations, sleep problems, and life satisfaction), survivors of multiple cancers reported poorer health status than survivors of a single cancer (all p's < .001) who in turn reported poorer health status than controls (all p's < .001). Notably, for the six continuous indices of health status, the mean effect size for differences between survivors of a single cancer and survivors of multiple cancers was .12 (range = 0.05–0.21) and the mean effect size for differences between survivors of single cancers and controls was .13 (range = 0.02–0.24). Considering results for both categorical and continuous health status variables, the typical magnitude of difference between the two groups of cancer survivors is equal to or larger than the mean difference between survivors of a single cancer and controls.

Group Differences in Health Behaviors

Survivors of multiple cancers differed from survivors of a single cancer and controls on all health behavior indices (see Tables 3 and 4). Compared to both survivors of a single cancer and controls, survivors of multiple cancers had a lower likelihood of alcohol use, more fruit and vegetable consumption, and a greater likelihood of physical inactivity (all p's < .001). Group differences for the other health behavior variables were inconsistent. Although survivors of multiple cancers had a greater likelihood of cigarette smoking, a greater likelihood of smokeless tobacco use, greater alcohol consumption when drinking, and less moderate and vigorous physical activity than survivors of a single cancer (all p's < .001), the opposite was true when comparing survivors of multiple cancers to controls (all p's < .001).

In sum, survivors of multiple cancers differed from survivors of a single cancer and controls in ways that were in both the positive and negative direction.

Discussion

This study examined the current health status and health behaviors of survivors of multiple cancers using a national, population-based survey. With regard to physical and mental health status, a very clear and consistent pattern of results emerged in covariate-adjusted analyses: survivors of multiple cancers reported poorer health status relative to survivors of a single cancer who in turn reported poorer health status relative to non-cancer controls. Notably, the magnitude of group differences between survivors of multiple cancers and survivors of a single cancer either equaled or exceeded the magnitude of group differences between survivors of a single cancer and non-cancer controls for both categorical and continuous health status outcomes. While it is well known a single cancer diagnosis can negatively impact both physical and mental health status in both the short and long term (7–10, 23, 29, 30), our results extend previous research with survivors of multiple cancers (17) by suggesting additional cancer diagnoses beyond an initial cancer diagnosis have an additive impact on physical and mental health status.

The mechanisms by which multiple cancer diagnoses, and subsequent changes in one's life, influence physical and mental health status are likely to be complex and multiplicatively determined. Posited earlier is the idea that the cancer experience is a chronic stressor that leads to increased "allostatic load" and physiological system dysregulation, which then leads to declines in health status (6). Lending support to this idea, recent research with cancer survivors has found evidence of dysregulation across multiple physiological systems (4, 5, 31). For example, depression was significantly correlated with autonomic nervous system dysregulation in women with metastatic breast cancer (31). What is not understood at present, though, is whether the physiological pathways from cancer-related stress to declines in physical and mental health status are stronger in survivors of multiple cancers compared to survivors of a single cancer. Consequently, future research with survivors of multiple cancers will need to assess a much broader array of variables than what was considered here.

With regard to health behaviors, significant differences were observed across survivors of multiple cancers, survivors of a single cancer, and non-cancer controls in covariate-adjusted analyses. Unlike what was found for physical and mental health status, however, close examination of the effect sizes suggests observed differences in health behaviors are not likely to be of great clinical significance. That said, a clear pattern did emerge: With only one exception (physical inactivity), all group differences in health behaviors were in the direction of cancer survivors reporting healthier behaviors than controls. In this way, our data are consistent with previous research suggesting a cancer diagnosis may be associated with positive changes in some health behaviors, particularly volitional behaviors unrelated to physical health status (15, 16, 32, 33). Of note, though, is research with survivors of a single cancer that has found the occurrence of both positive (e.g., smoking cessation) and negative (e.g., reduced physical activity) health behavior changes following cancer diagnosis (7, 15, 33). This finding, along with evidence that cancer survivors' health behavior change may be both limited and transient (34), might explain the small group differences between the health behaviors of cancer survivors and non-cancer controls at the population level (30).

Another key finding regarding the health behaviors of cancer survivors in this study is that survivors of multiple cancers were observed to have unhealthier behaviors than survivors of a single cancer. For example, in adjusted analyses, survivors of multiple cancers had 1.19 times higher odds of being a current cigarette smoker than survivors of a single cancer. Again, the average effect sizes for the health behavior outcomes are small. But, it is possible

the "teachable moment" (14) associated with cancer is actually a window of opportunity that closes after receipt of an additional cancer diagnosis. With cancer being a chronic stressor (3–5), it may be that survivors of multiple cancers encounter unique barriers against initiating and/or maintaining positive health behavior change, such as strong fatalistic beliefs or serious doubts about one's ability to reduce cancer risk via health behavior change. As research has found fatalism (35) and risk reduction beliefs (36, 37) predict health behaviors in survivors of a single cancer, it is possible these variables might help explain the health behaviors of survivors of multiple cancers as well. That said, replication of significant group differences across the health behaviors of survivors of multiple cancers, survivors of a single cancer, and non-cancer controls is certainly needed.

The current study has some limitations. First, the response rate of 53% may limit the generalizability of study findings. However, this response rate is typical of random-digit dial telephone surveys (38) and the quality of data is most likely unaffected (39). Second, the cross-sectional design makes it impossible to know to what extent the health status and health behaviors of survivors of multiple cancers change over time. As a result, little remains known about when in their cancer trajectory survivors of multiple cancers might be at greatest risk for poor health status and unhealthy behaviors. Third, reliance on self-reported cancer diagnosis, as is commonly done in population-based research (22, 23, 25, 26), carries with it some risk for misclassification of controls, survivors of a single cancer, and survivors of multiple cancers (40, 41). Previous research, though, has documented reasonable reliability and validity for self reports of cancer diagnosis (42, 43). Fourth, the BRFSS core survey provides very little data pertaining to cancer survivors' diagnoses and absolutely no data about cancer treatment. Consequently, this study is not suited to explore the impact of multiple cancer diagnoses over and above other potentially important factors, including disease stage, type of cancer diagnoses, treatment modalities, and time since most recent cancer diagnosis and treatment. Fifth, by excluding survivors of cancer diagnosed during childhood, the generalizability of study findings is limited to survivors of cancer diagnosed during adulthood and adults without a cancer history. Finally, it is possible inclusion of participants with a diagnosis of non-melanoma skin cancer in either of our two survivor groups might cloud our ability to discern differences among the study groups. Such relatively benign, non-melanoma skin cancers may not impact health status and health behaviors to the same degree as other invasive cancers. Though that may be, the inclusion of non-melanoma skin cancer survivors in our two survivor groups is a conservative approach that is consistent with other epidemiological studies of cancer (24, 43).

In conclusion, our data suggest multiple cancer diagnoses are associated with risk for poor physical and mental health status significantly beyond the well-known risks associated with a single diagnosis of cancer (7, 8, 10, 23, 25, 29). In addition, there was some evidence to suggest survivors of multiple cancers engage in unhealthier behaviors than survivors of a single cancer. The net result is that the burden of illness associated with an initial cancer diagnosis (10) may be compounded by any subsequent cancer diagnoses. Thus, there is the need for clinical interventions to enhance physical and mental health status, and to increase adoption of healthier behaviors in survivors of multiple cancers. While there is empirical support for interventions to improve physical and mental health status (44–46) and health behaviors in survivors of a single cancer (44, 47), one cannot assume that what works for survivors of a single cancer will work equally well for survivors of multiple cancers. Thus, further research is needed to identify the unique aspects and needs associated with the experience of multiple cancers. This information can then be used to tailor and disseminate efficacious interventions to minimize the chronic stressors associated with multiple cancer diagnoses and to foster the adoption of healthier lifestyle behaviors in this growing group of cancer survivors.

Acknowledgments

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Table 1

Demographic Characteristics

Variable	Controls (n = 348229)	Survivors of a Single Cancer (n = 47562)	Survivors of Multiple Cancers (n = 8734)
Sex			
Male (%)	49.1	41.8	45.1
Female (%)	50.9	58.2	54.9
Marital/partner status			
Married/partnered (%)	64.4	67.4	65.5
Separated/divorced (%)	10.3	12.6	11.9
Widowed (%)	5.3	14.2	18.1
Single/never married (%)	20.0	5.8	4.5
Level of education completed			
Didn't graduate high school (%)	10.4	8.2	8.0
Graduated high school (%)	89.6	91.8	92.0
Race and ethnicity			
White, non-Hispanic (%)	68.2	84.2	90.1
Black, non-Hispanic (%)	10.2	6.3	1.9
Asian (%)	3.3	1.0	0.2
Native Hawaiian or Pacific Islander (%)	0.3	0.2	0.0
American Indian or Alaskan Native (%)	1.0	0.8	1.1
Hispanic (%)	14.8	5.5	3.9
Multiracial (%)	1.6	1.6	2.0
Other (%)	0.6	0.4	0.8
Body mass index (M ± SD)	27.58 ± 6.00	27.55 ± 5.76	27.38 ± 5.64
Current age in years (M ± SD)	44.91 ± 16.99	62.41 ± 14.87	67.55 ± 13.36

Note. M, mean; SD, standard deviation.

Table 2

Clinical Characteristics of Survivors of a Single Cancer and Survivors of Multiple Cancers

Variable	Survivors of a Single Cancer (n = 47562)	Survivors of Multiple Cancers (n = 8734)
Cancer diagnosis [a]		
Breast (female) (%)	16.3	13.2
Female reproductive [b] (%)	12.1	8.0
Gastrointestinal [c] (%)	6.3	9.2
Head and neck [d]	3.6	3.4
Leukemia/lymphoma [e] (%)	3.9	3.9
Male reproductive [f] (%)	12.3	9.3
Melanoma (%)	9.8	9.2
Non-melanoma skin (%)	23.3	25.8
Other [g] (%)	7.6	8.7
Thoracic [h] (%)	2.0	4.1
Urinary [i] (%)	2.9	3.8
Age at diagnosis in years [j] (M ± SD)	52.00 ± 15.98	50.94 ± 15.94
Time since initial diagnosis in years [k] (M ± SD)	11.12 ± 10.22	16.88 ± 12.43

Note. M, mean; SD, standard deviation;

[a]For survivors of multiple cancers, data corresponds to their most recent cancer diagnosis;

[b]Includes cervical, endometrial, and ovarian cancer;

[c]Includes colon, liver, pancreatic, rectal, stomach, and esophageal cancer;

[d]Includes head and neck, thyroid, oral, and pharynx cancer;

[e]Includes Hodgkin's Lymphoma, non-Hodgkin lymphoma, and leukemia;

[f]Includes prostate and testicular cancer;

[g]Includes bone, brain, and neuroblastoma cancer;

[h]Includes lung and heart cancer;

[i]Includes bladder and renal cancer;

[j]For survivors of multiple cancers, data corresponds to age at first cancer diagnosis;

[k]For survivors of multiple cancers, data corresponds to time since first cancer diagnosis

Table 3

Comparison of Non-Cancer Controls, Survivors of a Single Cancer, and Survivors of Multiple Cancers on Categorical Outcomes

Variable	Controls (CON; n ≈ 348229)[a]	Survivors of a Single Cancer (SSC; n ≈ 47562)[a]	Survivors of Multiple Cancers (SMC; n ≈ 8734)[a]	Odds Ratio (95% Confidence Interval) [b, c]		
				CON vs SSC	CON vs SMC	SSC vs SMC
Health Status						
Poor overall health status ("fair" or "poor")	14.6	26.2	35.3	1.63 (1.63–1.63)	2.36 (2.36–2.37)	1.57 (1.57–1.58)
Frequent physical distress (≥ 14 days in past month)	9.9	18.8	26.5	1.56 (1.56–1.57)	2.24 (2.23–2.24)	1.63 (1.63–1.64)
Frequent mental distress (≥ 14 days in past month)	10.4	11.0	13.0	1.24 (1.24–1.25)	1.57 (1.57–1.58)	1.50 (1.49–1.50)
Frequent activity limitations (≥ 14 days in past month)	12.3	21.0	26.3	1.43 (1.43–1.44)	1.75 (1.74–1.76)	1.41 (1.41–1.42)
Frequent sleep problems (≥ 14 days in past month)	27.7	24.8	25.1	1.18 (1.18–1.18)	1.36 (1.35–1.36)	1.29 (1.29–1.29)
Health Behaviors						
Alcohol use (past month)	52.5	48.2	45.5	0.96 (0.96–0.96)	0.86 (0.86–0.87)	0.91 (0.93–0.92)
Physical inactivity (typical week)	12.1	15.8	19.1	1.03 (1.03–1.03)	1.23 (1.23–1.24)	1.15 (1.14–1.15)
Cigarette smoker (current)	18.4	13.5	12.9	0.93 (0.93–0.93)	0.89 (0.88–0.89)	1.19 (1.18–1.19)
Smokeless tobacco user (current)	3.7	1.8	1.9	0.78 (0.77–0.78)	0.81 (0.80–0.81)	1.07 (1.06–1.08)

Note.

[a] Weighted data are unadjusted percentages;

[b] For each comparison, the first group in each pair is the reference group;

[c] Data shown are adjusted for the following covariates: age (years), sex (male *vs*. female), race/ethnicity (White *vs*. other), marital/partner status (married/partnered *vs*. other), body mass index, and education (high school graduate *vs*. other), all associated *p*'s < .001

Table 4

Comparison of Controls, Survivors of a Single Cancer, and Survivors of Multiple Cancers on Continuous Outcomes

Variable	Controls (CON; n = 348229) a, b	Survivors of a Single Cancer (SSC; n = 47562) a, b	Survivors of Multiple Cancers (SMS; n = 8734) a, b	F (df) c	Effect Size (CON vs SSC) d	Effect Size (CON vs SMC) d	Effect Size (SSC vs SMC) d
Health Status							
Overall health status e (1–5 scale)	2.41 (2.41–2.41)	2.67 (2.67–2.67)	2.91 (2.91–2.91)	763340.18 (2, 204452800)	.24	.47	.21
Physical distress (days in past month)	3.41 (3.41–3.41)	4.99 (4.98–4.99)	6.84 (6.83–6.85)	516844.27 (2, 203494493)	.20	.45	.17
Mental distress (days in past month)	3.41 (3.41–3.41)	3.98 (3.98–3.99)	4.55 (4.54–4.56)	64657.07 (2, 204045345)	.08	.15	.07
Activity limitations f (days in past month)	4.10 (4.10–4.10)	5.43 (5.42–5.43)	6.62 (6.61–6.63)	161525.48 (2, 108442445)	.16	.31	.12
Sleep problems (days in past month)	8.37 (8.37–8.37)	9.08 (9.07–9.09)	9.89 (9.86–9.90)	62349.49 (2, 203764417)	.07	.15	.08
Life satisfaction e (1–4 scale)	1.62 (1.62–1.62)	1.63 (1.63–1.63)	1.66 (1.65–1.66)	6320.35 (2, 205315306)	.02	.06	.05
Health Behaviors							
Fruit and vegetable consumption (per day)	3.80 (3.80–3.80)	3.89 (3.89–3.90)	3.97 (3.97–3.97)	13344.24 (2, 196820695)	.02	.07	.03
Alcohol consumption (drinks in past month)	11.75 (11.74–11.75)	11.12 (11.09–11.13)	11.73 (11.70–11.78)	2276.49 (2, 203225143)	.04	.00	.02
Vigorous physical activity (minutes in a typical week)	112.05 (112.01–112.08)	117.72 (117.60–117.85)	117.36 (117.07–117.65)	4067.81 (2, 203686386)	.02	.02	.00
Moderate physical activity (minutes in a typical week)	267.91 (267.84–267.97)	274.32 (274.11–274.54)	267.99 (267.47–268.50)	1526.06 (2, 201130718)	.02	.00	.02

Note.

[a] Weighted data are adjusted for the following covariates: age (years), sex (male vs. female), race/ethnicity (White vs. other), marital/partner status (married/partnered vs. other), body mass index, and education (high school graduate vs. other);

[b] Data shown are means (95% confidence interval);

[c] F-value (degrees of freedom) for omnibus test of group differences, all associated p's < .001;

[d] Effect size in standard deviation units for comparison of adjusted means; All group comparisons are significant at $p < .001$ using Tukey's HSD test;

[e] Higher values represent poorer status;

[f] Asked only of participants who reported at least 1 day of physical or mental distress in the past month