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Physical activity among Utah cancer survivors: analysis from a population-based statewide survey

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Abstract

Background: Regular physical activity improves cancer survivors' health-related quality of life and physical function. We estimated the proportion of Utah cancer survivors meeting U.S. Department of Health and Human Services guidelines for weekly physical activity (aerobic plus strength exercise) and identify sociodemographic, cancer, and health-related factors associated with meeting guidelines.

Methods: Survivors randomly sampled from Utah Cancer Registry records were surveyed from 2018–2022 to ascertain physical activity. We calculated the percent of survivors meeting guidelines and conducted logistic regression to assess predictors of meeting guidelines. Analyses were weighted to account for complex survey sample design and nonresponse, and age adjusted.

Results: 20.7% (95% confidence interval [CI]: 18.5%, 23.2%) of Utah cancer survivors met guidelines for both aerobic activity and strength exercise. 22.4% reported no aerobic exercise in a typical week, and 59.4% reported no strength exercise. Survivors 75 or older were less likely to meet physical activity guidelines than those under 55 (adjusted odds ratio [OR]: 0.40, 95% CI: 0.25, 0.65). Survivors with a bachelor's degree or higher were more likely to meet physical activity guidelines than those without a college degree. Individuals with poorer overall health were less likely to report sufficient physical activity. Individuals treated with both chemotherapy and radiation had decreased odds of meeting guidelines compared to no treatment (adjusted OR 0.54; 95% CI 0.29, 0.99).

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Conclusions: Most Utah cancer survivors, and particularly those who received multiple modes of adjuvant treatment, are not participating in sufficient physical activity to improve longevity and quality of life after cancer.

Keywords

exercise; physical activity; cancer; cancer registries; survivorship

Introduction

Regularly engaging in physical activity is a key health promotion factor[1] and lowers risk of colon, breast, kidney, endometrial, bladder, and stomach cancer.[2] Among cancer survivors, physical activity (defined as both aerobic and strength exercise/resistance training) is associated with higher health-related quality of life,[3–7] better physical function,[8] reduced depressive symptoms[9], and lower fatigue.[8,10] Pre-and post-diagnosis physical activity reduces all-cause and cancer-specific mortality among individuals with breast, colorectal, and prostate cancer.[2,11,12]

An American College of Sports Medicine roundtable of experts in cancer and exercise determined that cancer survivors should avoid inactivity, and that physical activity was associated in reductions in anxiety, depression, and fatigue, and increases physical functioning and health-related quality of life among survivors.[13] This roundtable concluded that adhering to guidelines for the general public could improve common cancer-related health outcomes. These guidelines, established by the U.S. Department of Health and Human Services (DHHS), recommend adults complete at least 150 minutes of moderate intensity (or 75 minutes of vigorous intensity) aerobic activity each week and muscle strengthening exercises for all major muscle groups at least two times per week.[14]

Estimates of the proportion of survivors who self-report meeting guidance for weekly physical activity vary widely. Some studies have reported fewer than 15% of survivors of any cancer get the recommended weekly amount of aerobic physical activity.[15] In other studies of multiple cancers, approximately half of survivors meet weekly aerobic physical activity guidance.[6,16] Adherence to strength training guidelines appears lower, with estimates as low as 10% in studies of hematologic[17] and breast cancer survivors[18] and 12% across cancer sites.[19] Findings pertaining to predictors of physical activity in cancer survivors are mixed. A variety of factors have been associated with insufficient physical activity, including age over 65,[16,20,21] elevated BMI,[6,16,18,20,21] lower baseline fitness,[21] arthritis,[16] and pain.[20] This variability in prior reserach may be due to variation across studies in populations, cancer sites, time since diagnosis or treatment, measures of self-reported physical activity, and definition of guideline adherence. Fewer studies focus on strength exercise among survivors. A 2014 systematic review of studies using varied physical activity modalities, including aerobic and strength training, concluded there is insufficient evidence for the association between physical activity and most demographic or clinical factors among cancer survivors, including inconsistent findings for age, gender, education, BMI, cardiovascular fitness, and baseline physical activity.[22]

Many prior cancer survivor physical activity studies focus solely on aerobic exercise, and many are dated, limited to specific cancer sites, and/or rely on non-population-based samples. This study evaluated physical activity among recent cancer survivors using a probability sample obtained from the Utah Cancer Registry, a population-based registry that collects data on all reportable cancers. We sought to: 1) determine the proportion of Utah cancer survivors meeting recommendations for aerobic exercise, strength training, and both combined 2) identify sociodemographic, cancer, and health-related factors associated with achieving the recommended amount of physical activity (both aerobic and strength training combined), and 3) evaluate meeting guidelines for aerobic exercise and strength training separately. In selecting covariates, we included demographic, cancer, and physical health/limitations-related variables consistent with existing literature.[6,16,22] We also evaluated indicators of access to care (rural residency, insurance coverage, primary care provider) and social connectedness, as these are core social determinants of health that can affect health behaviors but are understudied in this literature.[23]

Methods

Study design and participants

We used an annual sample survey of Utah survivors conducted in 2018–2022. Eligible survivors were identified via Utah Cancer Registry, a population-based central registry meeting standards for complete case ascertainment and follow-up set by the Centers for Disease Control and Prevention's National Program of Cancer Registries and the National Cancer Institute's Surveillance, Epidemiology, and End Results program.

Eligible survivors included adults diagnosed with any invasive cancer between 2012–2020 (approximately 2–6 years post-diagnosis) residing in Utah. We used stratified random sampling to select individuals for study inclusion, oversampling survivors living in areas with higher prevalence of uninsured residents (2018–2019) and Hispanic survivors (2019–2022). The questionnaire included a variety of topics, including general health, pain, survivorship care, financial impacts of healthcare, and health behaviors (See Supplementary File for Questionnaire). Most questions were modeled on existing items from established surveys such as the Behavioral Risk Factors Surveillance System.[24] The sample design, recruitment methods, and further study design details have previously been reported.[25–29] This study was reviewed by the Utah Department of Health and Human Services Institutional Review Board. Informed consent was obtained from participants.

Physical activity measures

The study questionnaire included three physical activity questions from the Health Information National Trends Survey (HINTS).[30,31] Two questions asked survivors to report: 1) the number of days per week and 2) the number of minutes or hours per day they engage in aerobic activity or exercise of at least moderate intensity in a typical week. A third question asked for the typical number of days per week survivors engaged in physical activities designed to strengthen muscles (see Supplemental File for questions). The aerobic activity items are similar to several physical activity instruments demonstrating at least moderate reliability and validity.[32–34] HINTS questionnaire items were adapted from

existing validated measures and were cognitively tested to ensure they are psychometrically sound.[31] To determine if survivors met the guideline for aerobic exercise, we multiplied the number of active days by the number of minutes per day. Any values of 150 minutes or greater were considered meeting the recommend amount of aerobic activity.[14] Individuals reporting two or more days per week of activities to strengthen muscles were coded as meeting guidelines for strength training.[14] We created a composite variable representing whether survivors met both aerobic exercise and strength training guidelines as our primary outcome measure. Individuals missing data on the combined physical activity measure were excluded from analyses (n=78).

Additional variables

We obtained survivors' sex, age, urban or rural residence at diagnosis, cancer site, stage at diagnosis, and cancer treatment type from registry records. Cancer treatment was coded as chemotherapy, radiation, both radiation and chemotherapy, or neither. Survivor race and ethnicity were obtained from survey responses when available, or from registry records if not available from the survey. Due to small numbers of individuals identifying as a race other than White, we categorized race and ethnicity as Hispanic, any race; non-Hispanic, White; and Non-Hispanic, any race other than White.

We obtained indicators of education, employment, and current health insurance from survey responses. We utilized survey measures of self-reported health and health behaviors, including overall health, experiencing limitations due to physical or mental health, cancer-related pain, having a primary care provider, and body mass index (BMI). We measured degree of social connectedness using a four-item scale from the National Social Life, Health, and Aging Project (NSHAP). Responses were summed and summary scores were categorized into four categories for analysis, using the 25^{th}, 50^{th}, and 75^{th} percentile of response scores for category cut points.

Data analysis

For objective 1, we calculated weighted percentages with 95% confidence intervals to estimate the proportion of survivors meeting physical activity guidelines for aerobic activity, strength training, and both combined, overall and by age (under 65, 65 or older), as physical activity tends to decline with age.[35] We then assessed the association between each predictor variable and our primary outcome variable of meeting physical activity guidelines for both aerobic and strength exercise using crude and adjusted logistic regression models (objective 2). We calculated weighted percentages and crude and adjusted logistic regression models predicting aerobic activity and strength training separately (objective 3). Multivariable models adjusted for sex, age, BMI, education, and cancer site. All analyses were weighted to account for the complex survey sample design and survey nonresponse, and age-adjusted to reflect the age distribution of the Utah cancer survivor population. Analyses were performed in SAS 9.4 and visuals were created using R version 4.3.1.

We excluded survivors who reported that they were still undergoing cancer treatment, who likely face significant impediments to engaging in regular physical activity. As such, we conducted unconditional subpopulation analyses using SAS's domain statement

on the subgroup of individuals who have completed treatment or did not undergo treatment.[36,37] To ensure accurate variance estimation through Taylor series linearization, as implemented by the survey procedures in SAS, non-missing values were analyzed as a domain (subpopulation) of interest, considering that the entire population of respondents encompasses both non-missing and missing domains.[37] All analyses were carried out under the assumption that data are not missing completely at random.

Results

A total of 2005 survivors completed the survey. Of these, 1643 had completed treatment, and of those, 1565 fully answered the physical activity questions, constituting the subpopulation of interest for our analysis. Only respondents in this subpopulation were used to derive estimates, but all 2005 respondents were used in standard error estimations for accurate inferences. Weighted results showed that females comprised 52.7% of survivors, the most common age was between 65–74 (29.3%), and 90.5% were non-Hispanic White (Table 1). Twenty percent of survivors were diagnosed with breast cancer, and most were diagnosed with local stage disease (67.5%).

Objective 1: 44.7% (95% confidence interval [CI]: 41.9%, 47.5%) of Utah cancer survivors met recommendations for weekly aerobic physical activity and 30.3% (95% CI: 27.8%, 33.0%) met strength training guidelines (Figure 1a). Only 20.7% (95% CI: 18.5%, 23.2%) of survivors met recommendations for both aerobic activity and strength training. Furthermore, 22.4% of survivors reported no aerobic activity in a typical week, and 59.4% reported no strength training (Table 2). While fewer survivors aged 65 or older met physical activity guidelines compared to younger survivors, this difference was not statistically significant (Figure 1b).

Objective 2: in assessing predictors of meeting physical activity guidelines for both aerobic and strength training, survivors aged 75 or older were less likely to meet physical activity guidelines than survivors under age 55 (adjusted odds ratio [OR]: 0.40, 95% CI: 0.25, 0.65), see Table 1. Individuals with a college degree were more likely to report getting sufficient physical activity than those with some college education or less (adjusted OR: 1.51, 95% CI: 1.13, 2.03). No other demographic or cancer variables were significantly associated with meeting physical activity guidelines in adjusted models. In unadjusted models, females were less likely than males, and breast cancer survivors were less likely than melanoma survivors, to meet physical activity guidelines.

Individuals whose general health was fair or poor (12.2% of survivors) were less likely to meet physical activity guidelines than individuals with good, very good, or excellent health (adjusted OR: 0.45, 95% CI: 0.24, 0.82; Table 3). Individuals who experience limitations due to their physical or mental health, 43.5% of survivors, were less likely to meet physical activity guidelines than those without health limitations (adjusted OR: 0.64; 95% CI: 0.47, 0.89). There was no significant association between cancer-related pain and getting sufficient physical activity. None of the measures of access to care (rural residence, insurance coverage, having a primary care provider) nor level of social connection were significantly associated with physical activity.

Individuals who received chemotherapy plus radiation were less likely to meet physical activity guidelines than individuals who did not receive either treatment modality (adjusted odds ratio 0.54; 95% CI 0.29, 0.99). Individuals who received only one treatment type were no more or less likely to obtain adequate physical activity than individuals without either treatment. Whereas individuals with a BMI classified as overweight or obese were less likely to meet physical activity guidelines than survivors with a BMI under 25 in unadjusted models, this association was not statistically significant after accounting for age, sex, education level, and cancer site.

Objective 3: We examined whether variables associated with meeting guidelines for both types of activity combined were associated with aerobic activity and strength exercises separately (Table 4). Females were less likely than males to meet guidelines for aerobic exercise and less likely than males to obtain sufficient strength exercise, but these differences were not statistically significant in adjusted models. Age was not significantly associated with meeting either strength or aerobic exercise guidelines in separate adjusted models. In the unadjusted model, individuals aged 55–64 were less likely than survivors under 55 years to meet strength training recommendations (unadjusted OR: 0.70; 95% CI: 0.49, 0.99), as were individuals 75 or older (unadjusted OR: 0.56; 95% CI: 0.39, 0.82). Receiving both chemotherapy and radiation was associated with lower odds of strength training and lower odds of aerobic exercise in unadjusted models. Radiation therapy decreased odds of adhering to aerobic exercise guidelines (adjusted OR: 0.58; 95% CI: 0.41, 0.83). Higher BMI was associated with decreased odds of both strength training and aerobic exercise in unadjusted models, but in adjusted models the only significant finding was that individuals with overweight BMI were less likely than those without elevated BMI to meet strength training guidelines. Experiencing health limitations decreased the odds of meeting guidelines for aerobic (adjusted OR: 0.52; 95% CI 0.41, 0.67) and strength exercise (adjusted OR: 0.72; 95% CI: 0.55, 0.94).

Discussion

Physical activity is one of the most important ways to promote health.[14] Based on self-reported data, just over 20% of Utah cancer survivors meet guidelines to get at least 150 minutes per week of aerobic exercise plus perform muscle strengthening exercises two times per week, and nearly 80% of survivors do not. Furthermore, nearly a quarter of survivors do not typically get any aerobic exercise and almost 60% do not perform any muscle strengthening exercises.

These findings are discouraging given the benefits physical activity affords cancer survivors.[3,4,8,13] However, the proportion of Utah cancer survivors meeting physical activity guidelines, 20.7%, is only slightly lower than among the Utah general population (25.0% in 2019).[38] The DHHS' Healthy People 2030 initiative includes objectives focused on increasing physical activity in the American population, including increasing adherence to recommended aerobic and strength training activity from 25.2% in 2020 to 29.7% by 2030.[23] Our results indicate that efforts to improve physical activity among U.S. adults should not overlook the cancer survivor population.

The physical activity guidelines do not specify different target amounts of exercise by age. However, engagement in aerobic and strengthening activities tends to decrease with age[35] and the guidelines recommend older adults should aim for the standard recommendations, adjusting as needed based on limitations. We observed a decline in physical activity only for the oldest age group; those aged 75 and older were less likely than survivors under age 55 to meet physical activity guidelines.

Survivors with a bachelor's degree or higher were more likely to meet guidelines than survivors with less education. It is plausible that in our analyses educational attainment is operating as an indicator of multiple social determinants of health[23] that can affect individuals' opportunities to be physically active. Highly educated survivors may have better access to the conditions and resources that facilitate maintaining an active lifestyle, such as safe and accessible outdoor recreation spaces, flexible work schedules, economic stability, and the ability to afford gym memberships.

We did not observe a significant relationship between social connectedness and physical activity. Some prior research has indicated that perceived levels of social support can be helpful for cancer survivors in making adaptive health behavior changes[39] and engaging in physical activity.[40] Other studies have not found a link between social support and engaging in adequate physical activity.[22,41] Our study measured frequency of engaging in social activities, thus our findings may differ from prior research examining perceived support. More research is needed to understand the relationship between social connection and physical activity.

Physical activity may be particularly challenging for survivors experiencing health complications from cancer or its treatment. Cancer survivors have reported pain,[42] fatigue,[43–45] and ongoing treatment side effects[45] as barriers to physical activity. The DHHS' physical activity guidelines acknowledge such difficulties, noting that individuals with chronic conditions should be as physically active as their conditions allow. We found that lower overall health and experiencing health limitations were both significantly associated with decreased odds of meeting physical activity guidelines. Additionally, like prior research,[18] we found that survivors treated with both chemotherapy and radiation had decreased odds of meeting physical activity recommendations compared to those who received neither treatment. This could be a result of increased side effects from undergoing multiple treatment modalities. In sum, these findings confirm the difficulty of maintaining physical activity while health is compromised. Unlike prior research, pain was not significantly associated with physical activity in our analyses. This may be due to differences in measurement or the low prevalence of cancer-related pain in our population. It is important to note that most Utah cancer survivors (87.8%) reported good, very good, or excellent health. Therefore, poor health alone cannot explain why most survivors are not getting sufficient physical activity. In prior studies, cancer survivors reported barriers that are not necessarily cancer-related, including lack of time[44,45] and motivation.[44] There is also evidence that oncologists do not regularly council cancer patients on physical activity[46] and need additional training and knowledge for incorporating physical activity counseling into practice.[47]

Multiple physical activity interventions have been studied among cancer survivors. A systematic review found that behavior change techniques accompanied by pedometers or accelerometers was the most effective intervention for breast cancer survivors.[48] Another review found strong evidence for effectiveness of mobile health interventions, such as activity trackers, combined with personal contact.[49] Importantly, interventions to address physical activity and nutrition in older cancer patients can improve quality of life.[50]

While such studies show promising results, scaling up interventions to reach more survivors remains a major obstacle. A variety of strategies are needed to reach the larger population of survivors. Furthermore, interventions to address individual-level behavior change are unlikely to be sustainable when community and structural level factors create significant barriers to maintaining an active lifestyle.[51] Large-scale public health initiatives to increase physical activity nationwide, such as Healthy People 2030[23] and Active People, Healthy Nation,[52] include evidence-based strategies to increase physical activity at the community level. Additional support for local communities to implement effective strategies is needed to reduce larger-scale physical activity barriers that cancer survivors face.

Key strengths of this study include a focus on all cancer sites, using a population-based registry, and incorporating survey weighting to obtain representative estimates. However, while population-based, this study was conducted in a single state whose population is predominantly non-Hispanic White and younger than the rest of the country.[53] From 2012–2020, non-Hispanic Black individuals comprised only 0.8% of those diagnosed with cancer in Utah, compared to 10.8% nationwide.[54] Also, individuals under 40 comprised 10.0% of Utah cancer diagnoses compared to 5.2% nationwide.

Limitations include that we did not include a measure of balance exercises, which are recommended for older adults. Our measure of aerobic activity did not distinguish between moderate and vigorous exercise. This could have resulted in an underestimate of physical activity adherence if some individuals get 75 minutes per week of vigorous aerobic exercise. Our measure of strength training was generic and did not assess which muscle groups were involved. Our analyses utilized the full sample of survivors to compute standard errors, which can increase precision of estimates. As the study was cross-sectional, this evaluation does not account for variation over time.

Self-reported measures of physical activity may be subject to social desirability bias, wherein participants overreport socially valued behaviors. Additional assessments of the psychometric properties of such items, particularly measures of strength training, are needed.[55] Accelerometers offer more objective measurement and are increasingly used to measure aerobic activity. Comparisons of self-report and accelerometer data show correlation but indicate the two cannot be used interchangeably,[56] as they measure different constructs.[55] Studies vary in terms of whether self-report or accelerometer produce higher physical activity estimates.[57,58] Despite their limitations, self-reported questionnaires remain the most common and feasible method of collecting physical activity data and are used for nationwide estimates. Self-reported physical activity data are significantly more reliable at the group level rather than the individual level.[59] Concerns about social desirability would lead us to believe individuals overestimate their physical activity in self-reports. If this is the

case, our conclusions do not change: our results show that most cancer survivors in Utah are not obtaining sufficient physical activity. Increasing survivors' engagement in physical activity should be a priority to improve health and quality of life outcomes after cancer.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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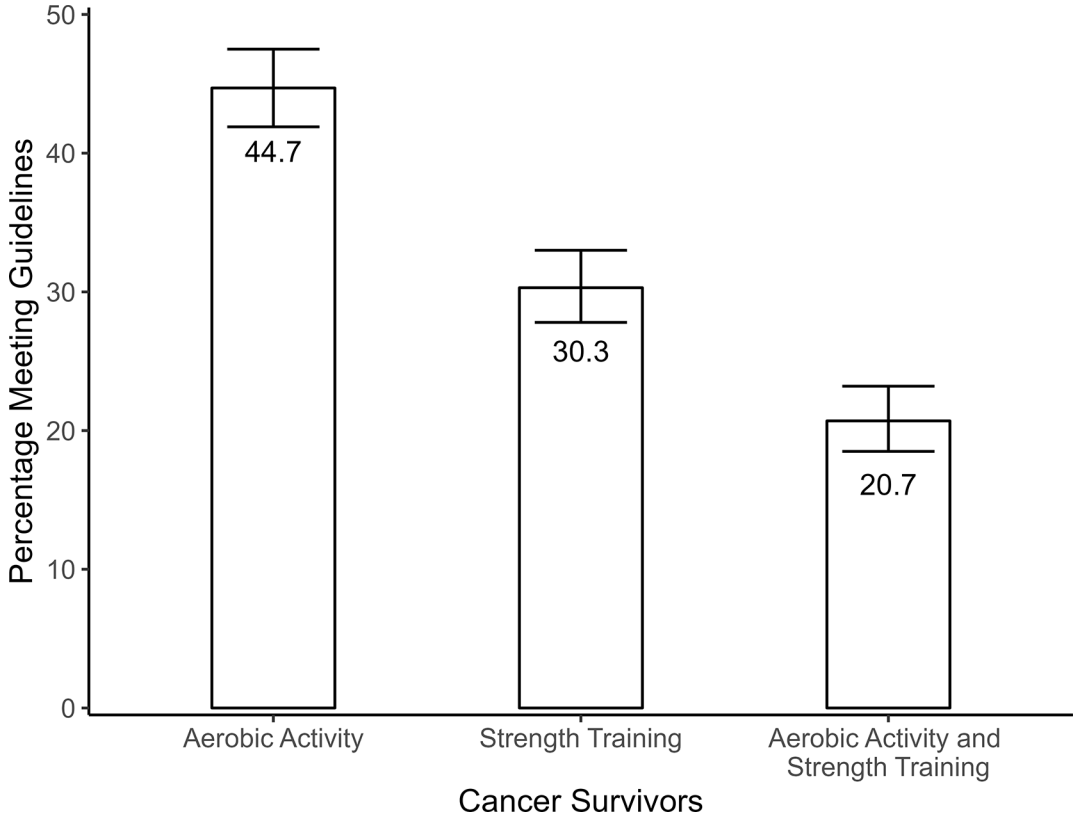

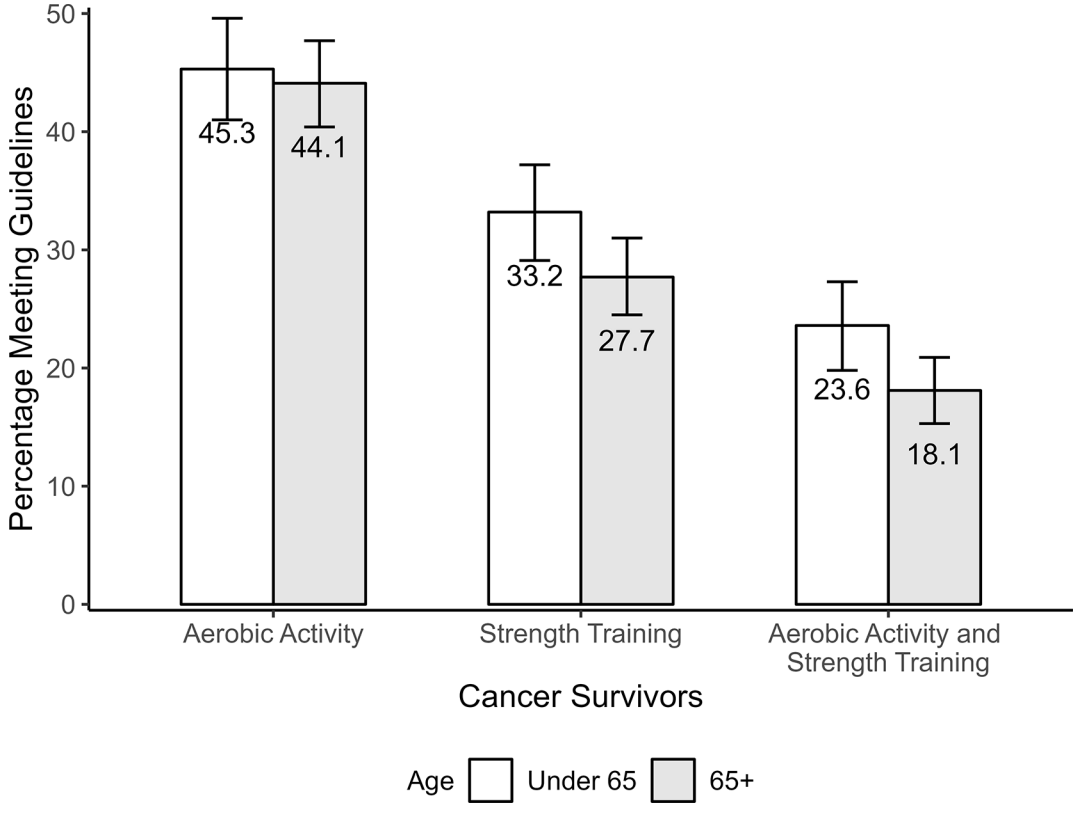

Figure 1. Adherence to physical activity guidelines among Utah cancer survivors*: a) overall and b) by age

*Percentages weighted to account for survey sample design and nonresponse.

Table 1.

Adherence to physical activity recommendations among Utah cancer survivors by demographic and cancer variables

	Met recommendations for both aerobic activity and strength training						
	Total[1]	No[1]	Yes[1]	Unadjusted OR[2]	95% CI[3]	Adjusted OR[2,4]	95% CI[3]
Sex							
Male	721 (47.3%)	558 (45.8%)	163 (53.1%)	Referent	-	Referent	-
Female	844 (52.7%)	691 (54.2%)	153 (46.9%)	0.75	(0.56, 0.99)	0.82	(0.55, 1.21)
Age at survey							
<55	338 (27.0%)	258 (25.1%)	80 (34.2%)	Referent	-	Referent	-
55–64	372 (21.5%)	294 (21.6%)	78 (20.9%)	0.71	(0.47, 1.06)	0.72	(0.46, 1.12)
65–74	515 (29.3%)	405 (29.2%)	110 (29.9%)	0.75	(0.52, 1.09)	0.69	(0.46, 1.03)
75+	340 (22.2%)	292 (24.1%)	48 (15.0%)	0.46	(0.29, 0.72)	0.40	(0.25, 0.65)
Race and Ethnicity							
Hispanic, any race	186 (5.7%)	157 (6.1%)	29 (4.4%)	0.71	(0.30, 1.68)	0.83	(0.30, 2.34)
Non-Hispanic, White	1344 (90.5%)	1063 (90.2%)	281 (91.7%)	Referent	-	Referent	-
Non-Hispanic, any other	^ (3.7%)	^ (3.7%)	^ (4.0%)	1.05	(0.40, 2.78)	1.10	(0.39, 3.10)
Education							
Some college or less	957 (59.7%)	804 (62.5%)	153 (49.2%)	Referent	-	Referent	-
4-year college or more	596 (40.3%)	436 (37.5%)	160 (50.8%)	1.72	(1.29, 2.30)	1.51	(1.13, 2.03)
Employment status							
Employed	635 (42.6%)	496 (42.1%)	139 (44.8%)	Referent	-	Referent	-
Unemployed/retired/other	916 (57.4%)	742 (57.9%)	174 (55.2%)	0.89	(0.67, 1.19)	1.24	(0.88, 1.76)
Insurance status							
Insured	1323 (84.3%)	1071 (85.1%)	252 (81.1%)	Referent	-	Referent	-
Uninsured/Unknown	242 (15.7%)	178 (14.9%)	64 (18.9%)	1.33	(0.93, 1.90)	1.04	(0.67, 1.59)
Geographic region							
Urban	1325 (86.0%)	1056 (85.7%)	269 (87.2%)	1.14	(0.76, 1.71)	1.12	(0.74, 1.68)
Rural	240 (14.0%)	193 (14.3%)	47 (12.8%)	Referent	-	Referent	-
Stage at diagnosis							
Local	899 (67.5%)	714 (67.0%)	185 (69.5%)	Referent	-	Referent	-
Regional	292 (24.0%)	241 (24.2%)	51 (23.4%)	0.93	(0.62, 1.40)	0.97	(0.62, 1.53)

	Met recommendations for both aerobic activity and strength training						
	Total[1]	**No[1]**	**Yes[1]**	**Unadjusted OR[2]**	**95% CI[3]**	**Adjusted OR[2,4]**	**95% CI[3]**
Distant	90 (6.7%)	74 (6.8%)	16 (6.3%)	0.89	(0.47, 1.69)	0.88	(0.44, 1.78)
Not staged/unknown	^ (1.7%)	^ (1.9%)	^ (0.9%)	0.44	(0.09, 2.13)	0.32	(0.05, 1.94)
Cancer site							
Breast	338 (19.9%)	285 (21.5%)	53 (13.7%)	0.47	(0.30, 0.74)	0.60	(0.36, 1.01)
Prostate	306 (18.1%)	240 (17.8%)	66 (19.3%)	0.80	(0.52, 1.22)	0.98	(0.60, 1.59)
Melanoma	237 (16.3%)	171 (15.2%)	66 (20.7%)	Referent	-	Referent	-
Colorectal	102 (7.4%)	83 (7.3%)	19 (7.5%)	0.75	(0.38, 1.46)	1.00	(0.49, 2.01)
Other	570 (38.3%)	461 (38.1%)	109 (38.9%)	0.75	(0.50, 1.12)	0.83	(0.55, 1.26)
Survey year							
2018–2019	779 (48.8%)	626 (49.2%)	153 (47.4%)	Referent	-	Referent	-
2020–2022	786 (51.2%)	623 (50.8%)	163 (52.6%)	1.08	(0.81, 1.43)	1.10	(0.82, 1.48)

[1] Counts and weighted percentages. Percentage weighted to account for survey sample design and nonresponse.

[2] OR=odds ratio.

[3] CI=confidence interval.

[4] Adjusted for sex, age, BMI, education, and cancer site.

^ Cell suppressed due to small count, in accordance with confidentiality guidelines from the Utah Department of Health and Human Services.

Table 2.

Self-Reported Physical Activity among Utah Cancer Survivors by Age group, 2018–2022

	Age groups			
	Total[1]	**Under 65**[1]	**65+**[1]	**p-value**
Days per week with moderate-intensity physical activities				<0.001[2]
None	374 (22.4%)	134 (16.9%)	240 (27.4%)	
1–2	348 (21.8%)	181 (25.4%)	167 (18.6%)	
3–4	459 (28.9%)	217 (30.2%)	242 (27.6%)	
5–7	434 (26.9%)	198 (27.4%)	236 (26.4%)	
Duration of moderate-intensity physical activities (minutes)				0.07[3]
Mean (standard error)	55.2 (2.2)	56.9 (3.6)	53.6 (2.6)	
Median (quartile 1, quartile 3)	32.1 (14.0, 58.3)	35.6 (27.2, 56.2)	29.9 (0.0, 58.4)	
Days per week with muscle-strengthening physical activity				<0.001[2]
None	982 (59.4%)	417 (54.8%)	565 (63.7%)	
1–2	299 (20.2%)	170 (25.8%)	129 (15.1%)	
3–4	223 (14.0%)	104 (14.4%)	119 (13.7%)	
5–7	105 (6.3%)	36 (5.0%)	69 (7.5%)	

[1]Counts and weighted percentages. Percentages weighted to account for survey sample design and nonresponse.

[2]Chi-squared test with Rao & Scott's second-order correction.

[3]Complex survey Wilcoxian rank sum test of medians.

Table 3.

Association of health indicators with adherence to physical activity guidelines among Utah cancer survivors by demographic and cancer variables

	Met recommendations for both aerobic activity and strength training						
	Total[1]	No[1]	Yes[1]	Unadjusted OR[2]	95% CI[3]	Adjusted OR[2,4]	95% CI[3]
General health							
Good, very good, or excellent	1354 (87.8%)	1057 (86.0%)	297 (94.8%)	Referent	-	Referent	-
Fair or poor	197 (12.2%)	181 (14.0%)	16 (5.2%)	0.34	(0.18, 0.63)	0.45	(0.24, 0.82)
Experiences limitations							
Yes	676 (43.5%)	573 (46.7%)	103 (31.3%)	0.52	(0.39, 0.70)	0.64	(0.47, 0.89)
No	881 (56.5%)	668 (53.3%)	213 (68.7%)	Referent	-	Referent	-
Physical Pain							
Pain due to cancer	95 (5.8%)	79 (6.1%)	16 (4.4%)	Referent	-	Referent	-
No pain or pain under control	1470 (94.2%)	1170 (93.9%)	300 (95.6%)	1.42	(0.71, 2.83)	1.21	(0.62, 2.39)
Has primary care provider							
Yes	1414 (89.8%)	1124 (90.0%)	290 (89.0%)	Referent	-	Referent	-
No	139 (10.2%)	113 (10.0%)	26 (11.0%)	1.11	(0.67, 1.84)	0.73	(0.42, 1.27)
Cancer Treatment							
No Chemotherapy or Radiation	774 (55.6%)	593 (54.0%)	181 (61.7%)	Referent	-	Referent	-
Chemotherapy only	154 (10.8%)	128 (10.7%)	26 (11.0%)	0.90	(0.50, 1.62)	1.04	(0.54, 2.00)
Radiation only	294 (21.2%)	245 (22.0%)	49 (18.1%)	0.72	(0.49, 1.05)	0.72	(0.47, 1.11)
Chemotherapy and Radiation	177 (12.4%)	148 (13.3%)	29 (9.2%)	0.60	(0.37, 0.99)	0.54	(0.29, 0.99)
Social connectedness							
Least connected	296 (19.5%)	246 (20.0%)	50 (17.6%)	Referent	-	Referent	-
Moderately connected	435 (26.9%)	348 (27.4%)	87 (25.2%)	1.05	(0.66, 1.68)	1.11	(0.66, 1.84)
Connected	348 (21.8%)	281 (22.4%)	67 (19.6%)	0.99	(0.61, 1.62)	1.01	(0.59, 1.74)
Most connected	455 (31.8%)	344 (30.3%)	111 (37.6%)	1.41	(0.90, 2.23)	1.27	(0.76, 2.13)
Body mass index							
Normal weight or less (<25)	443 (30.0%)	307 (26.1%)	136 (45.0%)	Referent	-	Referent	-
Overweight (25-<30)	564 (36.3%)	446 (36.9%)	118 (34.0%)	0.53	(0.39, 0.74)	0.62	(0.38, 1.00)
Obese (30+)	520 (33.7%)	464 (37.1%)	56 (21.0%)	0.33	(0.22, 0.49)	0.53	(0.22, 1.30)

[1]Counts and weighted percentages. Percentage weighted to account for survey sample design and nonresponse.

[2]OR=odds ratio.

[3]CI=confidence interval.

[4]Adjusted for sex, age, body mass index, education, and cancer site.

Table 4.

Adherence to physical activity guidelines for aerobic activity and strength training separately

	Met recommendations for aerobic activity					Met recommendations for muscle strengthening activity				
	Yes[1]	Un-adjusted OR[2]	95% CI[3]	Adjusted OR[2,4]	95% CI[3]	Yes[1]	Un-adjusted OR[2]	95% CI[3]	Adjusted OR[2.4]	95% CI[3]
Sex										
Male	358 (52.6%)	Referent	-	Referent	-	248 (53.4%)	Referent	-	Referent	-
Female	340 (47.4%)	0.68	(0.54, 0.85)	0.80	(0.58, 1.10)	231 (46.6%)	0.69	(0.54, 0.89)	0.80	(0.57, 1.12)
Age										
<55	146 (26.6%)	Referent	-	Referent	-	118 (32.2%)	Referent	-	Referent	-
55–64	173 (22.4%)	1.09	(0.78, 1.54)	1.50	(0.88, 2.56)	114 (20.4%)	0.70	(0.49, 0.99)	0.90	(0.51, 1.58)
65–74	241 (31.5%)	1.17	(0.85, 1.59)	1.75	(0.86, 3.56)	162 (29.3%)	0.74	(0.54, 1.03)	0.96	(0.46, 2.00)
75+	138 (19.5%)	0.80	(0.56, 1.12)	1.39	(0.52, 3.73)	85 (18.0%)	0.56	(0.39, 0.82)	0.81	(0.29, 2.23)
Treatment										
No chemo or radiation	385 (61.4%)	Referent	-	Referent	-	257 (59.1%)	Referent	-	Referent	-
Chemotherapy only	62 (10.2%)	0.77	(0.50, 1.17)	0.90	(0.55, 1.48)	45 (12.2%)	1.10	(0.70, 1.73)	1.25	(0.76, 2.06)
Radiation only	112 (17.8%)	0.63	(0.46, 0.85)	0.58	(0.41, 0.83)	81 (19.0%)	0.78	(0.56, 1.08)	0.86	(0.59, 1.25)
Chemotherapy and Radiation	72 (10.5%)	0.64	(0.43, 0.94)	0.62	(0.38, 1.00)	47 (9.7%)	0.64	(0.42, 0.97)	0.65	(0.39, 1.07)
Body mass index										
<25	255 (37.9%)	Referent	-	Referent	-	178 (39.8%)	Referent	-	Referent	-
25-<30	282 (39.8%)	0.75	(0.56, 0.99)	0.88	(0.61, 1.26)	179 (35.8%)	0.63	(0.47, 0.84)	0.68	(0.46, 0.99)
30+	141 (22.3%)	0.33	(0.24, 0.44)	0.59	(0.32, 1.09)	110 (24.4%)	0.42	(0.30, 0.58)	0.59	(0.30, 1.14)
Experienced limitations										
Yes	234 (33.0%)	0.46	(0.36, 0.57)	0.52	(0.41, 0.67)	168 (35.2%)	0.61	(0.47, 0.78)	0.72	(0.55, 0.94)
No	462 (67.0%)	Referent	-	Referent	-	308 (64.8%)	Referent	-	Referent	-

[1] Counts and weighted percentages. Percentage weighted to account for survey sample design and nonresponse.

[2] OR=odds ratio.

[3] CI=confidence interval.

[4] Adjusted for sex, age, body mass index, education, and cancer site.