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Distinct health behavior and psychosocial profiles of young adult survivors of childhood cancers: a mixed methods study

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Abstract

Background—We used a mixed-methods approach to examine health behavior profiles of young adult cancer survivors and characterize related sociodemographic and psychosocial factors.

Methods—We conducted a mail-based survey assessing sociodemographics, cancer treatment, health behaviors (e.g., tobacco use, physical activity), healthcare provider interactions, and psychosocial factors (e.g., Profile of Moods States [POMS]) among 106 young adult survivors from a southeastern cancer center and semi-structured interviews among a subset of 26.

Results—A *k*-means cluster analysis using eight health behaviors yielded three distinct health behavior profiles: high risk ($n = 25$), moderate risk ($n = 39$), and low risk ($n = 40$). High risks had the highest current alcohol, tobacco, and marijuana use; physical activity; and number of sexual partners (p's < 0.001). They had higher symptoms of POMS tension-anxiety, depression-dejection, fatigue-inertia, and confusion-bewilderment (p's < 0.05). Moderate risks had lowest physical activity ($p < 0.05$) but otherwise had moderate health behaviors. Low risks had the lowest alcohol, tobacco, and marijuana use and fewest sexual partners (p's < 0.05). They had the lowest levels of tension-anxiety, depression-dejection, fatigue-inertia, and confusion-bewilderment (p's < 0.05). Qualitative interviews showed that cancer had a range of effects on health behaviors and variable experiences regarding how healthcare providers address these behaviors.

Conclusions—Assessing health behavior profiles, rather than individual health behaviors, is informative in characterizing young adult cancer survivors and targeting survivorship care.

Implications for Cancer Survivors—Young adult cancer survivors demonstrate distinct health behavior profiles and are differentially impacted by the experience of cancer. Healthcare

Conflict of interest

The authors declare that they have no competing interests.

Ethical approval of research involving human subjects

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The Emory University Institutional Review Board approved this study, IRB# 00055570. All participants provided written and/or oral consent.

providers should be consistently intervening to ensure that survivors understand their specific health risks.

Keywords

Health behaviors; Young adults; Childhood cancer; Cancer survivorship

Introduction

Improvements in diagnosing and treating cancer combined with relatively high rates of survival for adolescents and children have led to young adults with a prior cancer diagnosis comprising a growing proportion of the total cancer survivor community [1, 2]. The burden of childhood cancers, their subsequent long-term effects, and the growing need for survivorship care is substantial [1–3]. Young adult cancer survivors are at elevated risk for secondary cancers and developing late and long-term effects related to their primary cancer treatment [4]. Additionally, young adult cancer survivors have elevated risk for a spectrum of chronic illnesses following their cancer treatment that is disproportionate compared to the rates of chronic illness among those with no cancer treatment [5].

Lifestyle factors including health-related behaviors may have a synergistic effect on long-term health outcomes including late effects of cancer treatment or second cancer diagnoses [4]. Health behaviors influence long-term and chronic disease health outcomes among the general population, and it follows that the late effects of cancer treatment would also be influenced by health-related behaviors like physical activity, nutrition, tobacco use, and alcohol use [4, 6–9]. Most of the literature documents cancer survivors using tobacco at rates lower than or comparable to their healthy adolescent counterparts [10–13]. However, studies report a wide range of smoking prevalence. While prevalence of smoking among young adult and childhood cancer survivors is reported as low as 2 % when compared to 22 % of controls with no cancer diagnosis [13], even relatively low rates are problematic given the elevated risk for long-term health consequences among this cohort. The literature regarding alcohol use among young adult and childhood cancer survivors is mixed, with some studies finding higher rates among this group versus the general population [14] and others documenting lower rates of use among this population [6, 12]. Additionally, young adult cancer survivors are less likely to meet physical activity and nutrition guidelines [12, 15, 16]. As such, intervening on modifiable health risk factors is a priority.

The psychosocial profiles of young adult and childhood cancer survivors are associated with health-related behaviors [10, 12, 13, 16, 17]. In terms of intrapersonal factors, depressive symptoms are associated with greater health risk behaviors [13, 18, 19]. The Profile of Mood States (POMS) has been used to assess mental health states for young adult cancer survivors and cancer survivors broadly; this research indicated that increased psychological symptoms are associated with increased adverse health behaviors [20, 21]. In terms of interpersonal factors, greater social support is an important interpersonal predictor of more positive health behavior outcomes such as nutrition and physical activity [19], while lower social support is associated with tobacco use among young adult and childhood cancer survivors [13]. In addition, given the extensive and early experience with the healthcare

system, health behaviors of young adult and childhood cancer survivors may be influenced by their interactions with their physician. Survivorship protocols for young adult and childhood cancer survivors dictate ongoing interactions with physicians at a greater frequency than the typical healthy young adult [22]. There is little literature documenting the influence of this relationship on health behaviors but is a logical next step when framing social influences.

Given the complexity of survivorship issues, the Children's Oncology Group recommends that childhood and adolescent cancer survivors attend specialized follow-up care to manage the potential long-term implications of cancer, monitor for emerging side effects and new cancers, and receive health promotion strategies tailored to their unique needs [23]. This should involve a focus on health behaviors (e.g., substance use, physical activity) and the psychosocial factors that might foster improved health behavior.

Theoretical frameworks have been used to explain health behaviors in young adult cancer survivors [10], but there is little evidence in the literature of multi-level approaches addressing health behaviors in this population. The theory of triadic influence (TTI) is an integrated theoretical framework used to explain and predict health behaviors [24]. The TTI is commonly used among young adult and adolescent populations to explain, predict, or alter health risk behaviors including tobacco use [25, 26], alcohol use [27], and multiple substance use risk behaviors [28]. The TTI addresses intrapersonal, interpersonal, and sociocultural streams of influence [24]. The current study focuses on the intrapersonal and interpersonal factors that are associated with health behavior profiles among young adult cancer survivors.

Guided by the TTI, this study aimed to (1) define health behavior profiles of young adults diagnosed with cancer prior to age 18 and currently between 18 and 34 years of age using a cluster analysis; (2) document sociodemographic, intrapersonal, and interpersonal factors associated with cluster assignment; and (3) qualitatively assess intrapersonal and interpersonal factors that influence health behaviors as described by young adult cancer survivors representing different clusters.

Methods

Participants and procedures

The Emory University Institutional Review Board approved this study, IRB# 00055570. An explanatory sequential mixed methods approach was used, as this approach allows for in-depth exploration of quantitative findings through the use of subsequent qualitative interviews [29]. In Fall 2012, young adult survivors of childhood cancers were recruited from the medical records of a university-affiliated children's hospital and a National Cancer Institute-designated cancer center in the Southeastern US Eligibility requirements included being diagnosed with cancer before age 18 and being between 18 and 34 years old.

Research staff mailed packets, including a consent form and the survey. Of the 594 patients identified who had phone numbers on record, 225 had non-working numbers, 53 had incorrect phone numbers, 99 were unable to be reached via phone, 10 were ineligible (i.e.,

too old, disability), 6 were deceased, 5 were unable to be reached (i.e., family member declined on their behalf, lived internationally), and 5 declined participation. Of the 191 packets mailed, 106 (55.5 %) were completed. The survey included a question regarding participants' willingness to be contacted for a follow-up study involving a telephone-based semi-structured interview. Of the 106 participants, 60.4 % (n = 64/106) provided permission. Individuals who completed the survey were compensated with a $40 gift card.

In Spring 2013, we recruited a subset of 26 survey participants to participate in semi-structured interviews using purposive sampling to obtain representation of men and women with a range of cancer types and level of engagement with the healthcare system. These individuals were approached via email or telephone by research staff and informed about the nature and purpose of the qualitative study. Individuals who participated in the semi-structured interviews were compensated with an additional $80 gift card.

Quantitative survey

The survey included questions regarding sociodemographics, cancer-related factors, intrapersonal variables, and interpersonal factors.

Measures

Sociodemographic characteristics: We assessed age, gender, ethnicity, education level, marital status, and employment status (part-time employment, full-time employment, student, and other [unable to work, disabled, homemaker]).

Cancer diagnosis and treatment: We assessed type of cancer, time (month/year) of cancer diagnosis, prior cancer diagnoses, treatment received (chemotherapy, surgery, radiation), and type of insurance.

Health behaviors: We asked, "In the past 30 days, on how many days did you drink alcohol? drink 5 or more drinks on one occasion? smoke a cigarette (even a puff)? use cigars, little cigars, or cigarillos? use smokeless tobacco, such as snus or chew? use hookah? use marijuana (pot, weed, hashish, hash oil)?" [30, 31]. We dichotomously categorized each of these behaviors as either not engaging in the behavior or having engaged in that behavior in the past 30 days. To assess physical activity, we asked, "During the past 7 days, on how many of those days did you do moderate intensity cardio or aerobic exercise (caused a noticeable increase in heart rate, such as a brisk walk) for at least 30 min? do vigorous intensity cardio or aerobic exercise (caused large increases in breathing or heart rate, such as jogging) for at least 20 min? do 8–10 strength training exercises (such as resistance weight machines) for 8–12 repetitions?" [30, 31]. Based on CDC recommendations [32], we created two variables (1) engaging in *either* 2 h and 30 min (150 min) of moderate-intensity aerobic activity (i.e., brisk walking) every week *or* 1 h and 15 min (75 min) of vigorous-intensity aerobic activity (i.e., jogging or running) and (2) strength training at least 2 days per week [32]. To assess fruit and vegetable (FV) intake, participants were asked, "Over the past 7 days, on average how many servings of fruit did you eat per day? how many servings of vegetables did you eat per day?" We classified participants who consumed an average of at

least 5 FV per day as meeting CDC recommendations [33]. Finally, we assessed number of sex partners in the past year [30, 31].

Patient Health Questionnaire–9 item (PHQ-9): Participants completed the PHQ-9 [34], a 9-item assessment of depressive symptoms (e.g., feeling depressed or blue, little interest or pleasure). Each item is scored on a 4-point Likert scale (0 = not at all to 3 = nearly every day). Cronbach's alpha in the current study was 0.89. Participants with scores ≥10 were categorized as demonstrating moderate to severe depressive symptoms.

Profile of Mood States (POMS): Participants completed the POMS, which was developed to assess transient distinct mood states [35, 36]. The original form of the measure consisted of 65 adjectives that were rated on a 5-point scale (not at all to extremely). Developed on the basis of a series of factor analytical studies [35], six factor-based subscales were derived: tension-anxiety, depression-dejection, anger-hostility, fatigue-inertia, vigor-activity, and confusion-bewilderment. Cronbach's alpha in the current study was 0.89, 0.90, 0.90, 0.91, 0.91, and 0.87, respectively.

Multidimensional Scale of Perceived Social Support (MSPSS): Perceived social support was assessed using the MSPSS [37], a 12-item measure comprising three subscales: support from friends, family, and significant others. There are four items per subscale rated on a 7-point Likert scale (1 = very strongly disagree to 7 = very strongly agree). Cronbach's alpha in the current study was 0.93, 0.95, and 0.96 for family, friends, and significant other, respectively.

Healthcare provider interaction: Participants were asked, "During your last doctor's visit, did a healthcare provider discuss any of the following with you: Your smoking status? Your level of alcohol use? Any illicit drug use? Your weight? Your nutrition? Your level of physical activity? Any mental health issues, such as high stress levels or depression? Your level of social support?" These were newly developed items to capture patients' self-reported experiences with healthcare providers in relation to these issues.

Data analysis—Participant characteristics were summarized using descriptive statistics. Then, we conducted *k*-means cluster analysis using participants' health risk behaviors (i.e., alcohol use, binge drinking, tobacco use, marijuana use, physical activity, FV consumption, number of sex partners) as the clustering variables to characterize potential subgroups of young adult cancer survivors. We used the pseudo *F* statistic to indicate the number of clusters [38]. We examined sociodemographic, cancer-related, and psychosocial factors in relation to the clusters using ANOVAs for continuous variables and chi-square tests for categorical variables. Post hoc comparisons were also conducted (noted below Tables 1 and 2). SPSS 21.0 was used for all data analyses. Statistical significance was set at $\alpha = .05$ for all tests.

Qualitative semi-structured interviews

Participant interviews were telephone-facilitated, audio-recorded, lasted about 60 min, and were conducted one time only. Prior to beginning the semi-structured interviews,

participants were read an informed consent script and provided oral consent. A female, MPH-level, trained interviewer (the project coordinator) facilitated all interviews. The interviewer was experienced in qualitative methodology and was familiar with topics in cancer survivorship research.

Measures—The interview guide was pilot tested through mock interviews among research staff members and focused on various topics. The current study focused on the following: (1) engagement in health risk behaviors (e.g., alcohol, tobacco, other drug use) and health promoting behaviors (e.g., physical activity, nutrition) and (2) participants' perceptions of their interactions with healthcare providers regarding their health behaviors. For example, to assess engagement in health behaviors, we asked, "How do you think your earlier health problems impacted your tobacco use? Alcohol use? Marijuana use? Physical Activity? Nutrition?" and "What kinds of things do you do to protect your health?" To assess provider interactions around health behaviors, we asked, "What information did your healthcare providers give you about your specific risks as a cancer survivor?"; "What have your doctors told you about the risks of smoking among cancer survivors compared to people who haven't had cancer? Alcohol? Marijuana?"; and "What have your doctors told you about the specific needs for good nutrition among cancer survivors? Physical activity?" The interviewer recorded field notes to aid in data analysis. After the initial 26 interviews planned were completed, the research team determined that saturation was reached, and recruitment was discontinued.

Data analysis—Recorded interviews were transcribed verbatim by a professional transcription service, and text files were imported into qualitative analysis software. NVivo 10.0 (QSR International, Cambridge, MA) was used for text coding and to facilitate the organization, retrieval, and systematic comparison of data. Transcripts were independently reviewed by the PI (the last author, C.J.B.), an MPH level staff (the interviewer), and an MPH graduate student to generate preliminary codes. The study team refined the definition of primary (i.e., major topics explored) and secondary codes (i.e., recurrent themes within these topics) and independently coded each transcript. The independently coded transcripts were compared, and consensus for coding was reached. Two coders independently coded 25 % of the narratives. Intra-class correlations for context were 0.92 for the initial 25 % of transcripts. The remaining narratives were coded by one of the coders. Grounded theory was used to identify themes [39]; representative quotes were selected.

Results

Quantitative survey

Of 106 participants, two surveys were not included in this analysis because they had missing data regarding health behaviors that was necessary to conduct the cluster analyses. For the quantitative survey study (Table 1), participants were on average 22.13 (SD = 3.18) years old, 51.0 % (n = 53) male, and 78.8 % (n = 82) White. In terms of cancer diagnosis, participants had the following: Hodgkin's lymphoma (n = 24; 23.1 %), non-Hodgkin's lymphoma (n = 9; 8.7 %), Burkitt's lymphoma (n = 4; 3.8 %), acute lymphoblastic leukemia (n = 17; 16.3 %), acute myelogenous leukemia (n = 3; 2.9 %), blastoma (n = 6; 5.8 %),

sarcoma (n = 11; 10.6 %), thyroid cancer (n = 10; 9.6 %), and other (n = 20; 19.2 %). In terms of treatment, 82.7 % (n = 86) had chemotherapy, 77.9 % (n = 81) had surgery, and 55.8 % (n = 58) had radiation. Average time since diagnosis was 8.42 (SD = 5.73) years.

Regarding health behaviors, 59.6 % (n = 62) currently used alcohol. Among current alcohol users, participants reported drinking an average of 6.37 (SD = 5.79) days in the last 30 days among users (Table 1). Additionally 22.1 % (n = 23) of participants reported binge drinking. Among binge drinkers, participants reported binge drinking an average of 3.27 (SD = 2.75) days in the last 30 days. Tobacco users reported no use of smokeless forms of tobacco. Current tobacco use prevalence was 19.2 % (n = 20), with smokers reporting with an average of 10.95 (SD = 13.51) days smoked in the last 30 days and an average of 3.35 (SD = 5.06) cigarettes smoked per day. The proportion of participants engaging in the recommended aerobic physical activity, strength training, and FV intake was 50 % (n = 52), 29.8 % (n = 31), and 41.3 % (n = 43), respectively. Finally, the average number of sexual partners in the past year was 0.59 (SD = 0.49). Regarding psychosocial factors (Table 2), 20.4 % (n = 21) reported significant depressive symptoms. Other psychosocial characteristics are noted in Table 2.

The cluster analysis indicated three distinct clusters based on health behavior profiles that corresponded to high-, moderate-, and low-risk behaviors. The clusters differed significantly in relation to current alcohol use (p < .001), binge drinking (p < .001), tobacco use (p < .001), marijuana use (p < .001), aerobic physical activity (p < .001), strength training (p = .019), and number of sex partners (p < .001), but not FV consumption (p = .098).

High-risk cluster—Compared to the other two groups, the high-risk group (n = 25) were more likely to be binge drinkers (p < .001) and current users of tobacco (p < .001) and marijuana (p < .001; see Table 1). They also were more likely to be current alcohol users (p < .001) and had more past-year sexual partners (p < .001) compared to the low-risk group. However, they were more likely to meet the recommended aerobic physical activity (p < .001) and strength training (p = .019) than the other two groups. Regarding sociodemographics, compared to the other two groups, the high-risk cluster was significantly older than the low-risk cluster but younger than the moderate-risk cluster (p < .001). The high-risk group was significantly more likely to be male compared to the moderate-risk group (p = .005). Compared to the other groups, the high-risk cluster had higher scores on the PHQ-9 (p = .020) and POMS confusion-bewilderment (p = .022; see Table 2). They also had higher POMS scores for tension-anxiety (p = .004), depression-dejection (p = .018), and fatigue-inertia (p = .033) compared to the low-risk group.

Moderate-risk cluster—The moderate-risk group (n = 39) was less likely than the other two groups to achieve the recommended levels of aerobic physical activity (p < .001) and strength training (p = .019) but was not distinct regarding the other health behaviors. Versus the other two groups, they were older (p < .001), more likely to be female (p = .005), and had significantly more time lapse since their initial diagnosis (p < .001). They were also more likely to be employed compared to the other groups (p = .012).

Low-risk cluster—Compared to the other two groups, the low-risk group ($n = 40$) reported lower current alcohol use ($p < .001$), binge drinking ($p < .001$), tobacco use ($p < .001$), and marijuana use ($p < .001$), as well as fewer sexual partners in the last year ($p < .001$). However, they reported lower FV intake ($p = .098$). Compared to the other two groups, this group was younger ($p < .001$), more likely to be students ($p = .012$), and more recently diagnosed with cancer ($p < .001$). Compared to the high-risk group, this cluster had fewer reported symptoms of depression per the PHQ-9 ($p = .020$) and significantly lower POMS scores for tension-anxiety ($p = .004$), depression-dejection ($p = .018$), fatigue-inertia ($p = .033$), and confusion-bewilderment ($p = .022$).

Qualitative semi-structured interviews

Interview participants were a purposively sampled subgroup ($n = 26$) of survey participants and were on average 21.73 (SD = 2.96) years old, 53.8 % ($n = 14$) female, 100.0 % ($n = 26$) non-Hispanic, 84.6 % ($n = 22$) White. Additionally, 26.9 % ($n = 7$) were married or living with a partner, 38.5 % ($n = 10$) were employed at least part-time, and 42.3 % ($n = 11$) were college students. Interview participants had the following cancer diagnoses: Hodgkin's lymphoma ($n = 7$), non-Hodgkin's lymphoma ($n = 2$), acute lymphoblastic leukemia ($n = 4$), sarcoma ($n = 6$), thyroid cancer ($n = 3$), and other ($n = 4$). Average time since diagnosis was 6.69 (SD = 3.08) years. Overall, 88.5 % ($n = 23$) had chemotherapy, 69.2 % ($n = 18$) had surgery, and 57.7 % ($n = 15$) had radiation. Table 3 summarizes representative sample quotes of the major qualitative themes that arose.

Impact of cancer on substance use—A proportion of participants reported that their experience with cancer decreased their substance use, some reported an increase, and some reported no difference (see Table 3 for representative quotes). Among those who said that it reduced their substance use, there were a range of reasons. For example, a low-risk male indicated that his negative experiences with cancer treatment-related drugs caused him to avoid recreational drug use:

> Also I remember…they gave me IV Ativan….That really had a tremendous effect upon me in terms of mind-altering substances. Because of that, I still don't drink caffeine regularly at all. I barely drink alcohol at all, and I don't use any mind-altering substances or drugs, marijuana or anything like that because I remember that experience….I realized that I really didn't like not being fully capable to do whatever I wanted to do and not being able to account for myself and what kind of state I was in.

Other themes that emerged as reasons for improved substance use behavior included aiming to keep oneself feeling healthy and a desire to reduce the risk of cancer recurrence through abstaining from drugs and alcohol or through limited use of alcohol.

In contrast, some individuals indicated that their cancer diagnosis increased their substance use. Three major themes emerged regarding reasons for cancer may have increased substance use behaviors. First, some reported that having cancer seemed to legitimize their use of marijuana. For example, one high-risk female cited the use of therapeutic marijuana use among cancer patients as a reason for her continued marijuana use after treatment.

Second, some participants said that they were “making up for lost time”; that is, they felt as though they had missed out on regular adolescent and young adulthood experiences and increased their substance use to make up for those lost experiences with their peers. One moderate-risk male said, “Honestly, at first it was bad. It kind of made me want to drink, just because I felt like I was cheated out of my teenage years, so I had a couple of months where we partied….” Third, a few participants expressed that psychological distress was related to their use of substances. For example, anxiety and hopeless were eluded to frequently. Additionally, using substances to cope with distress was also noted. For example, one low-risk male said:

> The risk of smoking and everything, they tell me it’s not good for me….The nicotine in there does calm my stress level down and it does help me. Yes, I know there’s a risk of me getting another type of cancer. I’ve known it for a while…As some people say, I’m already on death row; I’m just waiting for the gavel of whatever God chooses to take me home. That’s all I’m waiting for.

Impact of cancer on physical activity and nutrition—Regarding physical activity, some cancer survivors indicated that their experience with cancer positively impacted their physical activity. Two major themes emerged regarding reasons for this positive impact. First, many indicated gratitude for the ability to be active after experiencing restrictions or impediments to being active. One high-risk female said:

> I know the times that I was in the hospital…I would get out and I’d feel so weak….That always makes me think, on days that I don’t want to exercise, ‘Well, I actually have the ability to.’ It feels wrong for me to just sit on my butt when I have muscular ability to do it. I think about the kids who are just lying in bed, getting all that medicine and they can’t go exercise. It’s kind of like motivation, and I feel like I’m doing it for them.

Another commonly reported reason for increased physical activity was protecting one’s health in order to avoid future cancer recurrences and other negative health experiences.

Several participants described how cancer delayed or worsened their physical activity due to treatment-related inactivity. One high-risk female said:

> At the time when I had cancer, I had lost all of my muscle. I had to learn how to run again because I had been in bed a lot and couldn’t do that. I actually had to learn how to run again, so I think I would be in better shape if I wouldn’t have had cancer, or if I would have had somebody to exercise with me when I was younger after I had cancer or something because I lost all my muscles. I had a bunch of muscles because I was playing softball and doing weightlifting, but then when I got sick I had to stop, so I went down some.

Finally, several participants said that their experiences with cancer had little impact on their physical activity. This was reported across participants with various levels of physical activity prior to having cancer, whether it was limited or no physical activity or consistent physical activity.

Similar reports were given regarding the impact of cancer on nutrition behaviors. Many participants noted that they were more vigilant about the nutritional value of their diets and the impact on their health. One high-risk female reported:

> I eat a lot better since I had cancer. I would say my eating habits kind of changed. I don't want to eat too bad because I feel like I was blessed to be able to live through that, so I don't like to take advantage of it by eating crappy foods all the time. My family is pretty nutritious anyways. We always eat greens and fruits and stuff with our dinners.

Others reported that cancer had little impact on their diet, regardless of their dietary habits prior to having diagnosis.

Healthcare providers' interactions regarding substance use—Regarding substance use, some participants said there was minimal or no assessment or intervention related to substance use. One low-risk male said:

> Due to my age, they haven't really discussed [smoking] much, and since I've indicated that in no possible way am I going to ever think about smoking, they haven't really gone into great detail about it.

On the other hand, some reported that providers assessed and intervened on substance use. One moderate-risk female said:

> I think it's just the general talk you get. Don't smoke, don't drink and don't use illicit drugs.

In relation to alcohol, several indicated that their provider emphasized moderation. For example, a high-risk female indicated:

> I drink. Yeah, I'm a college student, but [my doctors] haven't… They said, "Don't go crazy." It really can't do anything, unless you're taking your [medication], if you're taking your medication with the alcohol.

Healthcare provider interactions regarding physical activity and nutrition—Regarding physical activity and nutrition behaviors, one theme that emerged was lack of education regarding the importance of these factors in maintaining health. Several participants said that they could not comment on that or could not remember, and several noted that these discussions with providers in general did not take place because of a lack of opportunity, as several noted not having recent clinic visits.

On the other hand, several participants noted that their providers did thoroughly discuss the importance of physical activity and nutrition. One low-risk female said:

> They've definitely emphasized the specifics like fruits and vegetables, and eating well and getting exercise, and a specific amount over a week and different things along those lines. They've definitely emphasized it.

Potential resources to address health-related behaviors—Regarding potential resources to address health-related behaviors, many participants expressed interest in having

up-to-date information and education available through various credible, reliable sources. One low-risk male reported a desire for “having a resource, whether it’s a person on an online community, to help me make informed decisions and follow good practices for managing my health…”

A high-risk male also noted:

> Just the talking to the doctor has been the most important thing for me. It’s everything I expected and wanted, so it’s been good.

Others expressed interest in accessing other resources for addressing specific health behavior challenges; for example, having access to pharmacotherapy for smoking cessation or a gym membership to promote physical activity. They discussed resources to address targeted health behaviors that may be of concern to young adult cancer survivors.

Discussion

This study drew from the TTI [24] and aimed to identify segments of young adult survivors of childhood cancers with distinct health behavior profiles and to qualitatively examine the impact of cancer on their health behaviors. While previous studies have used a segmentation approach to identify college students with similar psychosocial characteristics and distinct health behavior profiles [40–42] and have used the TTI [43] to inform such work, no prior research has leveraged this approach within a young adult cancer survivor population.

We identified three groups (high risk, moderate risk, low risk) that not only had distinct health behavior profiles but also had distinct sociodemographic and psychosocial characteristics. The high-risk group demonstrated a co-occurrence of high-risk behavior [8, 9] and had the highest mental health symptoms across several domains of the POMS. This is consistent with prior research documenting an association between poorer mental health and risky health behaviors, particularly in this population [8, 17, 44]. Despite having the highest risky health behaviors and mental health symptoms, the high-risk group also had the highest level of physical activity. This finding resonates with segmentation research among the general population of young adult college students, indicating that the segment at the highest risk for substance use was also the most physically active [41, 42]. Conversely, the low-risk group was at the lowest risk for engaging in substance use and had the lowest mental health symptoms. This group was younger, more likely to be in college, and therefore are a part of a distinct social environment compared to the other groups. For example, this group may have more recently been under parental supervision and may be naïve to substance use or only now be in the process of experimenting with substance use. As such, they may be establishing their health behavior patterns in this new social and developmental context. Interestingly, social support did not differ across clusters, which is in contrast to prior research [10, 13, 19]. This may be related to the social environment changing substantially during the life stages reflected in our sample (e.g., transitioning in and out of college and the workforce).

Interview data indicated that participants’ experiences with cancer may impact health-related behaviors in a variety of ways and differed across and within the groups identified through

cluster analysis. A major theme that emerged regarding reasons for improved health behaviors was a desire to reduce their risk of cancer recurrence and to maintain feeling healthy currently. Another theme that emerged in the context of physical activity was that their gratitude for being able to be active motivated them to be physically active. Many individuals reported that they were more cognizant of nutrition and its impact on health post cancer diagnosis.

One important consideration was the individual's behaviors prior to cancer diagnosis. Several said that there was no difference in how they managed their health, as they behaved in relatively healthy ways prior to having cancer. However, several others said that they did not change their behavior post diagnosis because they did not feel motivated to make consistent and sustainable health behavior improvements.

Finally, several participants reported an adverse impact on their health behaviors after their experiences with cancer. In relation to physical activity, several participants noted the negative toll that having cancer and its treatment had on their strength and endurance and the challenge of re-engaging in physical activity or in starting a physical activity regimen post treatment. Regarding substance use, some participants felt the need to "make up for lost time" during their adolescent and young adult years when their peers were experimenting with substance use. Mental health was also a major factor. Several participants reported feelings of anxiety, stress, and fatalistic views regarding the likelihood of future health problems and indicated that they used substances to cope with these psychological distresses, which aligns with prior research [13, 18–21].

Notably, several individuals reported that their healthcare providers did address these concerns, while others noted little attention to these topics in the clinical encounter. However, several participants indicated that either of their providers did not address these topics, that they could not remember these discussions specifically, or that they did not have an opportunity to talk with their provider because they had not recently been to a doctor. These findings suggest that, while the majority of young survivors did report their providers addressing the range of health behaviors during their last clinic visit, this might not routinely occur across clinicians, patients, or practices [45]. Moreover, our prior research indicated that healthcare providers reported intervening with patients whom they believed were at risk [46]; however, these data suggest no difference in frequency of assessment or tailored intervention approaches across these groups. Thus, providers may not accurately identify those at highest risk and should be more frequently intervening on these behaviors across all groups. Qualitative findings reflected these quantitative findings with a proportion of interview participants indicating little or no intervention. Participants said that when their provider discussed health behaviors, messages were framed around abstinence from tobacco and other drugs, whereas the messages regarding alcohol commonly focused on moderation in consumption, which is consistent with the dietary guidelines for Americans [47].

The current study has implications for research and practice. For future study, there is a significant need to better understand the underlying mechanisms that distinguish those patients with high-risk health behavior profiles versus those with lower risk profiles and how the cancer experience may shift the trajectory of health behavior in this population.

Moreover, research is needed to better document actual clinical practice and develop interventions that support providers serving this complex and vulnerable population. In practice, there is a need to better define the role of providers in addressing health promotion during follow-up care [45] and in survivor-ship care plans [48]. Furthermore, participants reported that the amount of information available and the rapidly changing nature of health-related information is difficult to navigate and were interested in trusted resources, such as healthcare providers or online resources that were science-based and up-to-date. Programs or clinics to address the long-term health needs of young adult survivors could address these issues [49]. In addition, prior research has shown that using technology-based health promotion programs has appeal among young adult cancer survivors [50].

Limitations

Limitations include the recruitment for this study being limited to those with whom we had current addresses and telephone numbers. Moreover, the sample being drawn exclusively from one children's hospital and one cancer center limits generalizability to other parts of the country or to other groups of young adult cancer survivors. Other limitations to the current study include the following: self-report nature of prior health behaviors, interactions with healthcare providers, and other concepts; the use of newly developed and non-validated measures regarding healthcare provider interactions; and the lack of historical information about how health behaviors changed over time.

Conclusions

This research used a novel approach to identifying segments of young adult cancer survivors with distinct health behavior profiles and demonstrated that life stage and psychosocial characteristics were also distinct across these groups. Greater efforts should be made by providers to routinely and systematically examine substance use, physical activity, and nutrition as well as mental health and social support among this population. In addition, scalable and cost-effective programs to support providers in doing so are needed.

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References

1. American Cancer Society. Cancer facts & figures 2013. Atlanta: American Cancer Society; 2013.
2. American Cancer Society. Cancer facts and figures 2014. Atlanta: American Cancer Society; 2014.
3. National Cancer Institute. Office of Cancer Survivorship Fact Sheet. Department of Health and Human Services; 2013.
4. Schwartz CL. Long-term survivors of childhood cancer: the late effects of therapy. Oncologist. 1999; 4(1):45–54. [PubMed: 10337370]

5. Oeffinger KC, Mertens AC, Sklar CA, Kawashima T, Hudson MM, Meadows AT, et al. Chronic health conditions in adult survivors of childhood cancer. N Engl J Med. 2006; 355(15):1572–82. [PubMed: 17035650]
6. Klosky JL, Howell CR, Li J, Foster RH, Mertens AC, Robison LL, et al. Risky health behavior among adolescents in the childhood cancer survivor study cohort. J Pediatr Psychol. 2012; 37(6): 634–46. [PubMed: 22427699]
7. Schultz KA, Chen L, Chen Z, Zeltzer LK, Nicholson HS, Neglia JP. Health and risk behaviors in survivors of childhood acute myeloid leukemia: a report from the Children's Oncology Group. Pediatr Blood Cancer. 2010; 55(1):157–64. [PubMed: 20232426]
8. Tercyak KP, Donze JR, Prahlad S, Mosher RB, Shad AT. Multiple behavioral risk factors among adolescent survivors of childhood cancer in the Survivor Health and Resilience Education (SHARE) program. Pediatr Blood Cancer. 2006; 47(6):825–30. [PubMed: 16333821]
9. Blanchard CM, Courneya KS, Stein K. Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: results from the American Cancer Society's SCS-II. J Clin Oncol. 2008; 26(13):2198–204. [PubMed: 18445845]
10. Bauld C, Toumbourou J, Anderson V, Coffey C, Olsson CA. Health-risk behaviours among adolescent survivors of childhood cancer. Pediatr Blood Cancer. 2005; 45(5):706–15. [PubMed: 16007604]
11. Emmons K, Li FP, Whitton J, Mertens AC, Hutchinson R, Diller L, et al. Predictors of smoking initiation and cessation among childhood cancer survivors: a report from the childhood cancer survivor study. J Clin Oncol. 2002; 20(6):1608–16. [PubMed: 11896111]
12. Rabin C. Review of health behaviors and their correlates among young adult cancer survivors. J Behav Med. 2011; 34(1):41–52. [PubMed: 20683649]
13. Tyc VL, Kloskey JL, Lensing S, Throckmorton-Belzer L, Rai SN. A comparison of tobacco-related risk factors between adolescents with and without cancer. J Pediatr Psychol. 2007; 30(4):359–70. [PubMed: 15863432]
14. Rebholz CE, Kuehni CE, Strippoli MF, Rueegg CS, Hengartner H, Bergstraesser E, et al. Alcohol consumption and binge drinking in young adult childhood cancer survivors. Pediatr Blood Cancer. 2012; 58(2):256–64. [PubMed: 22162398]
15. Florin TA, Fryer GE, Miyoshi T, Weitzman M, Mertens AC, Hudson MM, et al. Physical inactivity in adult survivors of childhood acute lymphoblastic leukemia: a report from the childhood cancer survivor study. Cancer Epidemiol Biomarkers Prev. 2007; 16(7):1356–63. [PubMed: 17627001]
16. Ness KK, Leisenring WM, Huang S, Hudson MM, Gurney JG, Whelan K, et al. Predictors of inactive lifestyle among adult survivors of childhood cancer: a report from the Childhood Cancer Survivor Study. Cancer. 2009; 115(9):1984–94. [PubMed: 19224548]
17. Klosky JL, Tyc VL, Garces-Webb DM, Buscemi J, Klesges RC, Hudson MM. Emerging issues in smoking among adolescent and adult cancer survivors: a comprehensive review. Cancer. 2007; 110(11):2408–19. [PubMed: 17932906]
18. Berg CJ, Ritschel LA, Swan DW, An LC, Ahluwalia JS. The role of hope in engaging in healthy behaviors among college students. Am J Health Behav. 2011; 35(4):402–15. [PubMed: 22040587]
19. Coleman S, Berg CJ, Thompson NJ. Social support, nutrition intake, and physical activity in cancer survivors. Am J Health Behav. 2014; 38(3):414–9. [PubMed: 24636037]
20. Yeh ML, Chung Y, Hsu MF, Hsu C. Quantifying psychological distress among cancer patients in interventions and scales: a systematic review. Curr Pain Headache Rep. 2014; 18(3):399. [PubMed: 24500637]
21. Glover DA, Byrne J, Mills JL, Robison LL, Nicholson HS, Meadows A, et al. Impact of CNS treatment on mood in adult survivors of childhood leukemia: a report from the Children's Cancer Group. J Clin Oncol. 2003; 21(23):4395–401. [PubMed: 14645430]
22. Landier, W. Establishing and enhancing services for childhood cancer survivors: long-term follow-up program resource guide. Children's Oncology Group; 2007.
23. Landier W, Bhatia S, Eshelman DA, Forte KJ, Sweeney T, Hester AL, et al. Development of risk-based guidelines for pediatric cancer survivors: The Children's Oncology Group long-term follow-up guidelines from the Children's Oncology Group Late Effects Committee and Nursing Discipline. J Clin Oncol. 2004; 22(24):4979–90. [PubMed: 15576413]

24. Flay BR, Snyder F, Petraitis J. The theory of triadic influence. Emerging Theories in Health Promotion Practice and Research. 2009:451–510.
25. Flay BR. Understanding environmental, situational and intrapersonal risk and protective factors for youth tobacco use: the theory of triadic influence. Nicotine Tob Res. 1999; 1(Suppl 2):S111–4. discussion 569–70. [PubMed: 11768166]
26. Bricker JB, Rajan KB, Zalewski M, Andersen MR, Ramey M, Peterson AV. Psychological and social risk factors in adolescent smoking transitions: a population-based longitudinal study. Health Psychol. 2009; 28(4):439–47. [PubMed: 19594268]
27. Donath C, Gräßel E, Baier D, Pfeiffer C, Bleich S, Hillemacher T. Predictors of binge drinking in adolescents: ultimate and distal factors—a representative study. BMC Public Health. 2012; 12:263. [PubMed: 22469235]
28. Sussman S, Gunning M, Lisha NE, Rohrbach LA. Concurrent predictors of drug use consequences among U.S. and Russian adolescents. Salud Drogas. 2009; 9(2):129–48. [PubMed: 20628474]
29. Ivankova NV, Creswell JW, Stick SL. Using mixed-methods sequential explanatory design: from theory to practice. Field Methods. 2006; 18(1):3–20.
30. American College Health Association. Results of the National College Health Association Survey. American College Health Association; 2012.
31. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance: National College Health Risk Behavior Survey— United States, 1995. MMWR Surveillance Summaries. 1997; 46:1–54.
32. Centers for Disease Control and Prevention. 2008 physical activity guidelines for Americans. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention; 2008.
33. U.S. Department of Agriculture, U.S.D.o.H.a.H.S. Dietary guidelines for Americans 2010. 7. Washington: GPO; 2010.
34. Kroenke K, Spitzer RL. The PHQ-9: a new depression diagnostic and severity measure. Psychiatr Ann. 2002; 32(9):1–7.
35. McNair, D.; Lorr, M.; Droppleman, L. Manual for the Profile of Mood States. San Diego: Educational and Industrial Testing Service; 1971.
36. Yokoyama K. Production of the Japanese edition of Profile of Mood States (POMS): assessment of reliability and validity. Nippon Koshu Eisei Zasshi. 1990; 37(11):913–8. [PubMed: 2132363]
37. Zimet GD, Dahlem NW, Zimet SG, Farley GK. The multidimensional scale of perceived social support. J Pers Assess. 1988; 52:30–41.
38. Finch H. Comparison of distance measures in cluster analysis with dichotomous data. J Data Sci. 2005; 3:85–100.
39. Corbin, J.; Strauss, A. Basics of qualitative research: techniques and procedures for developing grounded theory. 4. Thousand Oaks: Sage Publications, Inc; 2015.
40. Berg CJ, Ling PM, Guo H, Klatt CM, Thomas JL, Ahluwalia JS, et al. Using market research to understand health behaviors among college students. Coll Stud J. 2011; 45(4):726.
41. Berg CJ, Ling PM, Guo H, Windle M, Thomas JL, Ahluwalia JS, et al. Using market research to characterize college students and identify potential targets for influencing health behaviors. Soc Mark Q. 2010; 16(4):41–69.
42. Suragh TA, Berg CJ, Nehl EJ. Psychographic segments of college females and males in relation to substance use behaviors. Soc Mark Q. 2013; 19(3):172–87.
43. Lippke S, Nigg CR, Maddock JE. Health-promoting and health-risk behaviors: theory-driven analyses of multiple health behavior change in three international samples. Int J Behav Med. 2012; 19(1):1–13. [PubMed: 21234735]
44. Prokhorov AV, Warneke C, de Moor C, Emmons KM, Mullin Jones M, Rosenblum C, et al. Self-reported health status, health vulnerability, and smoking behavior in college students: implications for intervention. Nicotine Tob Res. 2003; 5(4):545–52. [PubMed: 12959792]
45. Stovall, E.; Greenfield, S.; Hewitt, M. From cancer patient to cancer survivor: lost in transition. National Academies Press; 2005.

46. Berg CJ, Stratton E, Esiashvili N, Mertens AC, Vanderpool RC. Providers' perspectives of survivorship care for young adult survivors of childhood cancer. J Cancer Educ. 2015

47. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary guidelines for Americans, 2010. 7. Washington: U.S. Government Printing Office; 2010.

48. Jacobs LA, Palmer SC, Schwartz LA, DeMichele A, Mao JJ, Carver J, et al. Adult cancer survivorship: evolution, research, and planning care. CA Cancer J Clin. 2009; 59(6):391–410. [PubMed: 19897841]

49. Oeffinger KC, Eshelman DA, Tomlinson GE, Buchanan GR. Programs for adult survivors of childhood cancer. J Clin Oncol. 1998; 16(8):2864–7. [PubMed: 9704740]

50. Nagler RH, Puleo E, Sprunck-Harrild K, Emmons KM. Internet use among childhood and young adult cancer survivors who smoke: implications for cessation interventions. Cancer Causes Control. 2012; 23(4):647–52. [PubMed: 22370697]

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Table 1

Participant characteristics and health behaviors across the three segments of young adult cancer survivors identified

Variable	Total N (%) or M (SD) *N* = 104	High risk N (%) or M (SD) *N* = 25	Moderate risk N (%) or M (SD) *N* = 39	Low risk N (%) or M (SD) *N* = 40	*p* value
Sociodemographics					
Age (SD)	22.13 (3.18)	22.12 (2.52)	24.08 (3.36)	20.23 (2.06)	<.001
Gender (%)					
Male	53 (51.0)	17 (68.0)	12 (30.8)	24 (60.0)	.005
Female	51 (49.0)	8 (32.0)	27 (69.2)	16 (40.0)	
Ethnicity (%)					
Hispanic or Latino	5 (4.8)	2 (8.0)	1 (2.6)	2 (5.0)	.610
Not Hispanic or Latino	99 (95.2)	23 (92.0)	38 (97.4)	38 (95.0)	
Race (%)					
White	82 (78.8)	18 (72.0)	33 (84.6)	31 (77.5)	.378
Black	21 (20.2)	6 (24.0)	6 (15.4)	9 (22.5)	
Other	1 (1.0)	1 (4.0)	0 (0.0)	0 (0.0)	
Relationship status (%)					
Married/living with partner	19 (18.3)	3 (12.0)	11 (28.2)	5 (12.5)	.127
Other	85 (81.7)	22 (88.0)	28 (71.8)	35 (87.5)	
Employment status (%)					
Employed part- or full-time	35 (34.0)	9 (37.5)	20 (51.3)	6 (15.0)	.012
Student	52 (50.5)	13 (54.2)	14 (35.9)	25 (62.5)	
Other	16 (15.5)	2 (8.3)	5 (12.8)	9 (22.5)	
Health-related factors					
Healthcare coverage (%)					
Private-parent's	58 (55.8)	15 (60.0)	19 (48.7)	24 (60.0)	.012
Public	13 (12.5)	1 (4.0)	2 (5.1)	10 (25.0)	
No health insurance	10 (9.6)	3 (12.0)	4 (10.3)	3 (7.5)	
Private-other	23 (22.1)	6 (24.0)	14 (35.9)	3 (7.5)	
Years since diagnosis (SD)	8.34 (5.71)	7.08 (4.39)	11.08 (6.78)	6.45 (4.15)	<.001
Health behaviors					

Variable	Total N (%) or M (SD) *N* = 104	High risk N (%) or M (SD) *N* = 25	Moderate risk N (%) or M (SD) *N* = 39	Low risk N (%) or M (SD) *N* = 40	*p* value
Current alcohol use (%)	62 (59.6)	25 (100.0)	37 (94.9)	0 (0.0)	<.001
Current binge drinking (%)	23 (22.1)	19 (76.0)	4 (10.3)	0 (0.0)	<.001
Current tobacco use (%)	20 (19.2)	15 (60.0)	3 (7.7)	2 (5.0)	<.001
Current marijuana use (%)	12 (11.5)	10 (40.0)	2 (5.1)	0 (0.0)	<.001
≥5 days of aerobic PA (%)	52 (50.0)	20 (80.0)	11 (28.2)	21 (52.5)	<.001
≥2 days of strength training (%)	31 (29.8)	12 (48.0)	6 (15.4)	13 (32.5)	.019
≥5 servings FV per day (%)	43 (41.3)	10 (40.0)	21 (53.8)	12 (30.0)	.098
Number sex partners past year (SD)	0.59 (0.49)	0.84 (0.37)	0.72 (0.46)	0.30 (0.46)	<.001

Bonferroni post hoc comparisons indicated the following group differences: age: high vs. moderate $p = .018$, high vs. low $p = .022$, moderate vs. low $p < .001$; years since diagnosis: high vs. moderate $p = .013$, moderate vs. low $p = .001$; number of sex partners: high vs. low $p < .001$, moderate vs. low $p < .001$. Group comparisons of categorical variables indicated significant differences across the following: gender: high vs. moderate $p = .010$, moderate vs. low $p = .018$; employment: high vs. moderate $p = .050$, high vs. low $p = .038$, moderate vs. low $p = .015$; current alcohol use: high vs. low $p < .001$, moderate vs. low $p < .001$; current binge drinking: high vs. moderate $p < .001$, high vs. low $p < .001$, moderate vs. low $p = .050$; current tobacco use: high vs. moderate $p < .001$, high vs. low $p < .001$; current marijuana use: high vs. moderate $p < .001$; high vs. low $p < .001$; aerobic physical activity: high vs. moderate $p < .001$, high vs. low $p = .033$, moderate vs. low $p = .049$; strength training: high vs. moderate $p = .005$; high vs. low $p = .044$; moderate vs. low $p = .039$; FV intake: moderate vs. low $p = .042$

Table 2

Psychosocial characteristics across the three segments of young adult cancer survivors identified

Variable	Total N (%) or M (SD) *N* = 104	High risk N (%) or M (SD) *N* = 25	Moderate risk N (%) or M (SD) *N* = 39	Low risk N (%) or M (SD) *N* = 40	*p* value
Psychosocial factors					
PHQ-9 (SD)	5.36 (5.76)	8.21 (5.89)	4.54 (5.01)	4.45 (5.96)	.020
POMS, tension-anxiety (SD)	4.78 (5.02)	7.24 (5.34)	4.92 (4.87)	3.10 (4.38)	.004
POMS, depression-dejection (SD)	4.36 (5.05)	6.76 (5.14)	3.97 (5.15)	3.23 (4.47)	.018
POMS, anger-hostility (SD)	5.33 (5.04)	7.04 (5.60)	4.56 (4.98)	5.00 (5.04)	.139
POMS, fatigue-inertia (SD)	8.13 (5.99)	10.84 (6.34)	7.33 (5.71)	7.22 (5.66)	.033
POMS, vigor-activity (SD)	10.61 (5.51)	10.36 (5.66)	10.08 (5.32)	11.28 (5.67)	.611
POMS, confusion-bewilderment (SD)	4.15 (4.81)	6.44 (5.48)	3.54 (4.22)	3.33 (4.58)	.022
Social support, MSPSS (SD)	68.72 (15.72)	66.12 (16.31)	69.26 (16.79)	69.83 (14.43)	.633
Provider discussed during last clinic visit (%)					
Alcohol use	59 (56.7)	17 (68.0)	25 (64.1)	17 (42.5)	.065
Smoking	61 (58.7)	16 (64.0)	27 (69.2)	18 (45.0)	.075
Illicit drug use	48 (46.2)	11 (44.0)	22 (56.4)	15 (37.5)	.234
Weight	69 (66.3)	15 (60.0)	28 (71.8)	26 (65.0)	.606
Physical activity	74 (71.2)	15 (60.0)	31 (79.5)	28 (70.0)	.239
Nutrition	73 (70.2)	16 (64.0)	31 (79.5)	26 (65.0)	.275
Mental health	50 (48.1)	12 (48.0)	20 (51.3)	18 (45.0)	.855
Social support	40 (38.5)	5 (20.0)	15 (38.5)	20 (50.0)	.054

Bonferroni post hoc comparisons indicated the following group differences: PHQ-9: high vs. moderate $p = .039$, high vs. low $p = .032$; POMS, tension-anxiety: high vs. low $p = .003$; POMS, depression-dejection: high vs. low $p = .017$; POMS, fatigue-inertia: high vs. low $p = .050$; POMS, confusion-bewilderment: high vs. moderate $p = .049$, high vs. low $p = .031$. Group comparisons of healthcare provider categorical variables indicated no significant differences across groups

Table 3

Themes and sample responses regarding impact of cancer on health-related behaviors, interactions with healthcare providers regarding these behaviors, and potential resources for addressing health-related behaviors across the three segments of young adult cancer survivors identified

Theme	Gender, cluster assignment	Sample quote
Impact of cancer on health-related behaviors		
Substance use		
Better		
Avoidance of mind-altering effects of drugs	Male, low risk	Also I remember…they gave me IVAtivan. It's an anti-depressant. I don't remember exactly what it is. Some people take it to help them get to sleep, and that had a depressing effect on my system like being drunk or something….That really had a tremendous effect upon me in terms of mind-altering substances. Because of that, I still don't drink caffeine regularly at all. I barely drink alcohol at all, and I don't use any mind-altering substances or drugs, marijuana or anything like that because I remember that experience. It had a pretty profound effect. I don't know if it was necessarily scary. I realized that I really didn't like not being fully capable to do whatever I wanted to do and not being able to account for myself and what kind of state I was in.
Desire to feel healthy	Male, low risk	Now that I've been through chemotherapy and been through all of that, I know what it's like to feel very crappy and not feel like myself and feel very unhealthy as a result of something I really had no control over. There is nothing that I could have done while I was going through chemotherapy that would have made me feel like myself again. When you're being administered that type of drug, there's not much you can do. So now I make sure that I take the time to keep myself feeling good because I know what it's like to not feel good at all, and I don't like it.
Reducing risk of recurrence	Female, high risk	I guess I just saw all the stuff that could happen with cancer and I don't want to do anything that could increase my risk of getting it. I don't want to go through that again.
No significant impact		
Only short term during treatment	Female, high risk	I don't think [having cancer] really did [impact substance use]. Well, just for that six weeks or whatever it was, but after that, you know, I got back into my old way of doing things, and the way I live my life now doesn't have much to do with, you know, cancer.
Excusing use for stress management	Female, high risk	[Having cancer] should impact it by me saying 'just absolutely not,' but it's… you know, I've dabbled in a couple different things, and everything's been easy for me to put aside except the smoking. So that's just… it's my one crutch that I can't just seem to get a handle on… I know smoking is really bad for you and I know that it can cause cancer, but I picked it up anyways. It's kind of like it helps me with my stress.
	Female, high risk	I do smoke marijuana. My husband calls me a worry bee. I worry about everything and it helps me not worry about a lot, like keep a lot of things off my mind. I wouldn't say that cancer is the reason why I smoke. I wouldn't blame it on cancer.
Low perceived risk of alcohol use	Male, high risk	I'm the typical college student. [Drinking alcohol] doesn't really bother me. I don't see the risk in it.
Worse		
Marijuana use was legitimized	Female, high risk	Well, I felt licensed to smoke pot. I smoked pot a lot. But it just kind of [laughs]. It's ridiculous, but cancer patients smoke pot, so I felt… I was fine with that.
Making up for lost time	Male, moderate risk	Honestly, at first it was bad. It kind of made me want to drink, just because I felt like I was cheated out of my teenage years, so I had a couple of months where we partied, and then after that, I got my head on straight, and just played strong football and other things that kept me going.
Psychological distress and coping	Female, high risk	I do smoke marijuana. My husband calls me a worry bee. I worry about everything and it helps me not worry about a lot, like keep a lot of things off my mind. I wouldn't say that cancer is the reason why I smoke. I wouldn't blame it on cancer.

Theme	Gender, cluster assignment	Sample quote
Physical activity		
Better		
Gratitude for ability to be active	Female, high risk	I know the times that I was in the hospital, like for two weeks or a week or whatever, I would get out and I'd feel so weak. I couldn't even bend over without assistance. That always makes me think, on days that I don't want to exercise, I'm like, 'Well, I actually have the ability to.' It feels wrong for me to just sit on my butt when I have muscular ability to do it. I think about the kids who are just lying in bed, getting all that medicine and they can't go exercise. It's kind of like motivation and I feel like I'm doing it for them.
Protecting health	Male, low risk	It made me want to do more physical stuff, because I was a football player before treatment. I got diagnosed my freshman year, so I couldn't play high school football. Now that I'm off treatment I take every opportunity I can to get out and do something. I jog; I work out. I mess around with my friends and wrestle, stuff like that. I want to make sure that I take care of my health so that I never go through that [cancer] again.
Delayed or worsened due to treatment-related inactivity	Male, moderate risk	At first it limited my physical activities because at first my parents didn't want me to do things. I went to a private high school and because the administration viewed my health history, I don't think they really wanted me to be involved with sports, so I gravitated towards music and had fun with that. That created a situation where in college I just found music and art stuff. It hasn't been until after college that I explored exercise options and found some things that I really enjoy.
	Female, high risk	At the time when I had cancer, I had lost all of my muscle. I had to learn how to run again because I had been in bed a lot and couldn't do that. I actually had to learn how to run again, so I think I would be in better shape if I wouldn't have had cancer, or if I would have had somebody to exercise with me when I was younger after I had cancer or something because I lost all my muscles. I had a bunch of muscles because I was playing softball and doing weightlifting, but then when I got sick I had to stop, so I went down some.
Little impact	Female, low risk	Even the year after I did my chemo, I was on dance line, because whenever I got sick, I was on dance line, so it didn't really keep me from doing anything. I did dance line; I think I did swim team like right after chemo, so it didn't really affect me that much at all. I really like to run.
Nutrition		
Attend to nutrition on health and body	Female, high risk	I eat a lot better since I had cancer. I would say my eating habits kind of changed. I don't want to eat too bad because I feel like I was blessed to be able to live through that, so I don't like to take advantage of it by eating crappy foods all the time. My family is pretty nutritious anyways. We always eat greens and fruits and stuff with our dinners.
	Male, low risk	I think I would have to say I guess my diet got better. Then again, I was younger back then, so I did already tend to eat junk food, and stuff like that. Already, as I was getting older, I was getting out of that stage. But definitely now, it makes me watch my diet more than what I would, and kind of stay away from fast foods and things like that. I'm assuming, because since I've had it since fifteen, or fourteen, or however old. I don't know how to really answer that, but I guess it's made me keep more of an eye on things and watch what I put into my body, watch how I treat my body more than what I would have than if I didn't have the cancer, basically.
	Female, low risk	It definitely makes me more aware of the benefits of nutrition and being able to focus on that as a way of promoting good health.
No impact	Female, low risk	I don't eat as healthy as I should. They tell me that I definitely need to take a vitamin, because I'm just like the world's pickiest eater. I don't eat vegetables. I just started trying to eat some fruit and stuff like that.
Healthcare providers' interactions regarding health-related behaviors		
Substance use		
Minimal or no assessment or intervention	Female, high risk	I don't remember them every saying nothing but I'm sure I have a higher risk of getting cancer than a normal person does with smoking.

Theme	Gender, cluster assignment	Sample quote
	Male, low risk	Due to my age, they haven't really discussed [smoking] much, and since I've indicated that in no possible way am I going to ever think about smoking, they haven't really gone into great detail about it.
	Female, high risk	I'm not a huge drinker, but I don't think it's ever been approached.
Assessment and intervention	Female, moderate risk	They would ask me did I smoke, and I told them no, and he was saying that you shouldn't smoke. He's like, 'your chances of getting lung cancer is a lot greater than any other person, so just don't do it.' He tried to scare me into it, but I don't smoke, so it doesn't really matter.
	Female, moderate risk	I think it's just the general talk you get. Don't smoke, don't drink and don't use illicit drugs.
	Female, low risk	They asked me if I do marijuana. I said I didn't. They said 'good.' They didn't give any negative reasons for smoking marijuana or taking pills. They didn't specifically mention 'hey, this isn't good for you.'
Emphasizing moderation	Female, high risk	They probably just said moderation. They thought it was so funny because I turned 21 in July and I had liver problems previously and I was like, 'Would it be okay for me if I have some alcohol on my birthday?' They just thought it was so funny that I asked and I was like, 'Well, I don't want to mess everything up now that I'm healthy!' But they said just as long as I don't go binge drinking, which is fine and I didn't do that. They said one or two is fine, every once in a while.
	Female, high risk	I drink. Yeah, I'm a college student, but [my doctors] haven't… They said, 'Don't go crazy.' It really can't do anything, unless you're taking your [medication], if you're taking your medication with the alcohol.
Physical activity and nutrition		
Education	Female, low risk	They've definitely emphasized the specifics like fruits and vegetables, and eating well and getting exercise, and a specific amount over a week and different things along those lines. They've definitely emphasized it.
	Female, high risk	They talk about that and how important it is to stay healthy. Right when I finished treatment, they were telling me that my bones were probably really weak and that it would be important to do weight bearing activities, so I run a lot. They talk about that a lot and ask me about that.
No opportunity because no recent clinic visits	Male, low risk	[I've heard nothing about health-risk behaviors, physical activity or nutrition], and of course, there hasn't really been much of a context for that to come up because I haven't seen a doctor regularly in a while, and I didn't go through any exit counseling I suppose you could call it after I completed treatment because I stopped going to see the oncologist flat out.
Potential resources to address health-related behaviors		
Information and education through various reliable sources	Male, low risk	Having a resource, whether it's a person on an online community, to help me make informed decisions and follow good practices for managing my health, like knowing good ways to exercise and use my time effectively to exercise, and exercise right so I don't hurt myself or do something stupid like that. Having resources that help me figure out how to incorporate healthier eating into my day-to-day life without impacting my time tremendously, like figuring out a good way to eat healthy without taking even more time to cook and prepare food. Having a good resource that I'm comforting using, consulting with, and helping incorporate healthier practices into my day-to-day life.
	Male, high risk	Just the talking to the doctor has been the most important thing for me. It's everything I expected and wanted, so it's been good.
	Female, low risk	Health information keeps updating every day. One day tea leaves are good for you and the next day they're poison. Updated information on what is healthy and what is no longer considered healthy.
Other resources for addressing specific health behavior challenges	Female, high risk	Probably some kind of medication [for smoking cessation]. I forget there's this new medicine that's out—that was new; it's not new anymore, something, I forget what it's called but I want to try it. It's some kind of medicine that you take for like so many days and you can still smoke on it but it makes you not want a cigarette. I don't remember what it's called. That would probably help me. I've tried chewing gum. I've tried the electric cigarettes, and it's just really hard.
	Male, high risk	Maybe having access to a gym membership that you wouldn't have to pay a monthly fee, or get a discounted monthly fee; that would definitely be really helpful, just because I'm not so motivated that I want to spend forty

Theme	Gender, cluster assignment	Sample quote
		dollars a month to be able to go to a gym. In that case, I would rather just jog around the block or something. If I did have access to that kind of thing for free or for a discount, I might take advantage of that.