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ALCOHOL CONSUMPTION PATTERNS AND RISK FACTORS AMONG CHILDHOOD CANCER SURVIVORS COMPARED TO SIBLINGS AND GENERAL POPULATION PEERS

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Abstract

Aims—This study describes alcohol consumption among adult survivors of pediatric cancer compared to sibling controls and a national sample of healthy peers. Risk factors for heavy drinking among survivors are described.

Design, Setting and Participants—Cross-sectional data were utilized from the Childhood Cancer Survivor Study including adult survivors of pediatric cancer (N=10,398), and a sibling cohort (n=3,034). Comparison data were drawn from the National Alcohol Survey (n=4,774).

Measurement—Alcohol consumption, demographic, cancer diagnosis, treatment and psychosocial factors were measured.

Findings—Compared to peers, survivors were slightly less likely to be risky (OR_{adj}=0.9; CI 0.8-1.0) and heavy drinkers (OR_{adj}=0.8; CI 0.7-0.9) and more likely to be current drinkers. Compared to siblings, survivors were less likely to be current, risky and heavy drinkers. Risk factors for survivors' heavy drinking included being age 18-21 (OR_{adj}=2.0; 95% CI 1.5-2.6), male (OR_{adj}=2.1; 95% CI 1.8-2.6), having high school education or less (OR_{adj}=3.4; 95% CI 2.7-4.4), and drinking initiation before age 14 (OR_{adj}=6.9; 95% CI 4.4-10.8). Among survivors, symptoms of depression, anxiety, or somatization, activity limitations and anxiety about cancer were associated with heavy drinking. Cognitively compromising treatment, brain tumors and older age at diagnosis were protective.

Conclusions—Adult survivors of childhood cancer show only a modest reduction in alcohol consumption compared to peers despite their more vulnerable health status. Distress and poorer health are associated with survivor heavy drinking. Screening for alcohol consumption should be instituted in long-term follow-up care and interventions among survivors and siblings should be established to reduce risk for early drinking.

Keywords

childhood cancer survivor; alcohol consumption; late-effects; risky drinking; long-term follow-up care

INTRODUCTION

Survival rates from childhood cancer have increased dramatically in the United States over the past three decades and 80% of childhood cancer patients look forward to long-term survival. (1) For the first time there is a large and growing population of adults who are cured of childhood cancer. However, it is becoming clear that these long-term survivors face physical (2-7) and mental health consequences(8,9) from their cancer and treatment. Research has focused on physical health obstacles experienced by survivors but psychological, behavioral and social consequences of childhood cancer have received less attention.

In general populations, heavy drinking is associated with health (10-12) and social problems. (13,14) In a meta-analysis, volume of alcohol consumption increased risk for a number of diseases including mouth, oropharyngeal, esophageal, breast and liver cancer, unipolar major depression, alcohol use disorders, epilepsy, hypertension, stroke and liver cirrhosis. Pattern of alcohol use along with volume is associated with other health problems including coronary heart disease and injuries.(15) (16) Drinking among survivors may be more risky than for their peers since alcohol exposes survivors to further toxins and mutagenic agents that may place individuals at risk for secondary cancers or organ complications.(17) (18) Furthermore, alcohol use may interact with prescribed medications, such as those used to treat cardiac problems from chemotherapy.(14)

Because of concerns related to late effects it has been recommended that survivors develop healthy lifestyles to minimize future health problems (19). It is recommended by some that childhood cancer survivors abstain from alcohol use(17,20) and by others that survivors limit their drinking (21) though the term “limited” was not defined.

Little research describes risk behaviors such as alcohol consumption, among childhood cancer survivors despite health concerns in this already vulnerable population.(18) Previous research has reported conflicting findings with some studies reporting higher alcohol consumption among young adult survivors (22-24) and others reporting lower alcohol use, mostly among younger adolescent survivors (22,25,26) but also among young adult survivors, (25) or similar alcohol use compared to self-referred and general population peers.(27-29)

Previous research used siblings,(23,25) friends,(28) or general population samples (22) (25) for comparative purposes. Our understanding of alcohol use in survivors is limited by small sample sizes, varying or limited alcohol measures, use of sibling controls and the frequent exclusion of adolescents and survivors with brain tumor diagnoses. The present study employs a large sample of survivors including a wide range of ages (birth to age 20), diagnoses and age of diagnoses. The survivor data employs controls from a national population-based survey of age-matched individuals as well as siblings. Prior studies did not use quantity and frequency measures of alcohol or assess current, risky and heavy drinking patterns.

A number of factors are associated with heavy drinking in national population studies including being male, being young, having lower education(30) and early initiation of drinking.(31,32) It is unclear whether these risk factors apply equally to cancer survivors. Cancer-related risk factors have been less explored but knowledge of these factors is equally crucial to improve early identification of survivors at elevated risk for heavy drinking. In the present study four

cancer related factors were explored: diagnosis during adolescence, psychiatric distress, cognitive impairment and diagnosis. Adolescents diagnosed with cancer have been identified as being at higher risk for psychiatric distress, low self-esteem and social concerns.(33-35) In general population and treatment surveys, (36) higher stress and distress, including anxiety and depression (37) and post traumatic stress disorder (38,39) are associated with increased alcohol dependence. Higher rates of psychological distress are described by childhood cancer survivors, (3,9,40) placing this group at risk for alcohol dependence. Cognitive impairment has been described as being associated with poorer quality decision making which is, in turn associated with increased risk behaviors.(41,42) More work needs to be done to understand whether cognitive compromising treatments are direct risk factors for later substance use.

Despite concerns about the effects of alcohol consumption on cancer survivors, general guidelines for alcohol use and screening in this population have not been established.(18) The present study has two primary aims. First, current drinking practices are described among survivors compared to siblings and to peers from an age-matched national population-based survey. Second, general and cancer-related predictors for risky and heavy drinking are examined, including diagnosis during adolescence, psychological distress, chronic illness, treatments associated with cognitive impairment, and cancer diagnosis.

METHODS

Sample

The current analysis utilizes data from two sources: the Childhood Cancer Survivor Study (CCSS) and the National Alcohol Survey 2000 (NAS). The CCSS is a National Cancer Institute funded study conducted at 26 institutions in the United States and Canada. It is a retrospectively ascertained cohort study of individuals under the age of 21 years old with a confirmed diagnosis of cancer between 1970 and 1986 and who have survived five or more years after diagnosis. Of the 20,720 eligible childhood cancer survivors (based on hospital records), 3,017 (14.6%) were not reachable. The remaining 17,703 were approached and 14,516 (82%) participated. This analysis selected participants who were ages 18-48. Data was used on a comparison group of 3,034 nearest age siblings who were randomly selected from the list of participating survivors. There were 4,782 eligible siblings of whom 3,846 (80.4%) agreed to participate. Of those 3,034 were aged 18 to 48, matching the age range of survivors. Details of the study sample and procedures have been described elsewhere.(43) The CCSS data in this analysis are from a 24-page baseline mailed questionnaire completed by self-report or by telephone with a trained interviewer. Data was collected primarily between 1995 and 1996.

The NAS collected data from November 1999 to June 2001 using random digit dial techniques and employing Computer Assisted Telephone Interview in English or Spanish on 7,612 adults in all 50 states of the U.S and Washington D.C. The NAS oversampled African Americans, Hispanics and residents in 13 low-population states, and then weighted to the 2000 Census. (44) NAS participants matching the CCSS age range of 18-48 (N=4,774) were selected for this study. Interviews took an average of 45 minutes with a 58% completion rate.

Measures

The primary outcomes for the study are current (past year) alcohol consumption, risky drinking and heavy drinking. These measures are constructed from data using standard measures gathered on usual daily drinking (0-6+ drinks) and monthly frequency of alcohol consumption.

Risky drinking is that which exceeds the National Institute for Alcohol Abuse and Alcoholism (NIAAA) Physicians' guidelines defined by the United States Department of Health and Human Services (referred to as NIAAA risky drinking). These guidelines include limits on

both daily and weekly alcohol intake and define risky drinking for women to exceed three drinks per day or seven drinks per week and for men, more than four drinks per day or fourteen drinks per week.(45) Heavy drinking captures the largest daily drinking measure and is defined as 5 or more drinks per day for women and 6 or more drinks per day for men at least once a month in the past year. This heavy drinking measure is consistent with the amount it takes to feel drunk, providing the respondents are not regular heavy drinkers.(46)

The cancer-related alcohol consumption risk factors include age of cancer diagnosis, adverse health or mental health status, having a history of cognitive compromising treatments such as cranial radiotherapy and intrathecal methotrexate, and cancer diagnosis. Cancer diagnosis was obtained from the treating institution along with treatment information for all participants after signing a medical release form. Adverse health or mental health status is assessed over five domains in the CCSS questionnaire and has been described elsewhere.(3) 1) The 18-item Brief Symptom Inventory (BSI) contains three subscales that assess depression, somatization and anxiety and allow for an overall T score for a Global Severity Index.(47) A T-score of 63 or higher captures the upper 10% of scores which are considered elevated; 2) an assessment of pain perceived as a result of the cancer or treatment, 3) anxiety or fears as a result of the cancer or its treatment, 4) a general measure of self-assessed health, 5) functional status and limitations of activity. The CCSS questionnaire used in this report is available for review and downloading at www.stjude.org/ccss.

Analysis

Data were analyzed from the 10,398 survivors and 3,034 siblings from the CCSS sample and 4,774 participants from the NAS. Two different weights were applied to the NAS sample, first census and sampling weights and secondly weights to reflect the distribution of the sample of survivors by age, race, and gender. Distributions for both weights are shown. Statistical procedures involving comparisons between survivors and siblings were done employing generalized estimating equation (GEE) models to correct for correlated errors using STATA, version 9. For all statistical comparisons between survivors and peers we used data weighted to match survivors and either chi square or logistic regression models, (described above). For the remaining analyses SPSS 12.0 (SPSS Inc. Chicago, IL) was used.

The sample description, the prevalence of drinking types and risk factors for heavy drinking and NIAAA risky drinking (supplemental data available) were examined for each population. $OR_{s_{adj}}$ and 95% CIs were calculated controlling for age, race, gender, education, and age of first alcoholic drink. A second analysis was done where survivor and peer samples were combined to assess the interaction effect of age of first drink on later heavy drinking (supplemental data available). The final series of analyses were done calculating $OR_{s_{adj}}$ using only survivor data to examine cancer-related factors associated with heavy drinking. $OR_{s_{adj}}$ were calculated for each factor separately, controlling for the identified risks in Table 3. The same models were created and reported for NIAAA risky drinking (supplemental data available).

RESULTS

The three samples are described in Table 1. Some noteworthy differences exist between these samples. The CCSS survivor sample, compared to the NAS, was more dominantly white (87% vs. 68%), young (24% vs. 12%) and male (54% vs. 50%). The survivor sample had less people in the lowest income group (9% vs. 12%), living as a married couple (39% vs. 63%) and having high school education or less (34% vs. 63%). Compared to survivors, the siblings were more likely to be white, to have higher household incomes, to be employed, to have a college education, and to be married.

There were significant differences between the three samples according to two key alcohol consumption parameters; usual daily quantity and frequency of alcohol consumed (Table 1). In bivariate analyses of usual drinking quantities and frequencies, survivors were more likely to drink in the moderate categories compared to peers. For instance, survivors were more likely to drink in the mid-categories of 2-4 usual drinks per day compared to their peers and significantly less likely to report usual daily drinking of 0 or 6 drinks. Again, survivors were most likely to drink in the mid-frequency groups, 1-3 times per month and 1-2 times per week and less likely to drink infrequently. Survivors were equally likely to drink in the two most frequent categories. Compared to siblings, survivors were more likely to drink 0 usual drinks and equally or less likely to drink at all other quantities. Survivors were more likely to drink at the lowest frequency and equally or less likely to drink at all other frequencies.

Survivors were slightly more likely to be current drinkers ($OR_{adj}=1.1$, 95% CI, 1.0-1.2), and slightly less likely to be risky ($OR_{adj}=0.9$; CI 0.8-1.0) and heavy drinkers compared to peers. ($OR_{adj}=0.8$, 95% CI, 0.7-1.0). Survivors, compared to their siblings, were significantly less likely to be current, risky and heavy drinkers.

Risk factors for heavy drinking were examined separately for survivors and peers (Table 3). These risk factors were similar for both heavy and NIAAA risky drinking (supplemental data available). Being ages 18 to 21 years old, male, and having lower education were independent predictors of heavy drinking for both cancer survivors and their peers. Among survivors, significant risk factors for heavy drinking included being young ($OR_{adj}=2.0$), male ($OR_{adj}=2.1$), having less than a high school education ($OR_{adj}=3.4$), and drinking initiation at a young age ($OR_{adj}=6.9$). Differences between the samples were greatest in age of drinking initiation, where survivors who first drank alcohol under age 14 had an odds ratio of 6.9 for later heavy drinking (compared to drinking initiation at age 21 years or older) and their peers had 3.2 times the odds for later heavy drinking when they initiated drinking at the same age. Interaction models confirm the results suggested by Table 3 where survivors who initiated drinking under age 14 more than doubled ($OR_{adj}=2.4$; CI 1.4-4.3) their risk for later heavy drinking compared to their peers who initiated drinking at the same age.

Table 4 shows cancer related risk factors for heavy drinking among survivors, controlling for key variables. Four groups of risk factors were explored in relationship to heavy drinking: age of diagnosis, distress, treatment with cognitive compromising agents, and cancer diagnosis. Contrary to our hypothesis, diagnosis during late adolescence (ages 15 to 21) did not result in heavier drinking but appeared to be protective ($OR_{adj}=0.7$; 95% CI 0.5-1.0). Fair or poor self-assessed health, depression, anxiety, somatization, abnormal global severity score, activity limitations and cancer-related anxiety were all significantly associated with heavy drinking. Use of potential cognitive compromising agents resulted in lower risk for heavy drinking ($OR_{adj}=0.7$; CI 0.5-0.8). Lastly, a diagnosis of Hodgkin disease, Wilm's tumor, neuroblastoma, and bone cancer were associated with higher risk for heavy drinking compared to leukemia. In addition, brain tumors (central nervous system) were protective for risky drinking.

DISCUSSION

Childhood cancer survivors, despite their more vulnerable health status, demonstrate only a modest reduction in risk for unhealthy drinking compared to their peers, and a slight increase in risk for current drinking. Due to the large sample size, even small differences in drinking patterns are statistically significant though meaningful differences are small. Sub-groups (such as those with lymphoma, fair or poor health and activity limitations) may not be aware of increased health risks related to alcohol or may not see themselves as being vulnerable. "Limited" alcohol consumption is recommended for survivors at risk for osteoporosis, secondary cancers, hepatic fibrosis and related conditions, bladder malignancy, and oral

cancers.(21) Risky drinking is associated with worse health outcomes and is discouraged in healthy populations(10) and should be discouraged in these sub-groups of survivors. Previous research has generally described lower risk behavior such as smoking, alcohol and illicit drug use among survivors of childhood cancer. (41,42,48) In contrast, findings from the current study describe drinking patterns between survivors and peers that are not very different.

A number of factors were associated with heavy drinking. As in general populations, psychological distress was associated with heavy drinking as were worries about cancer and activity limitations. On the other hand among survivors diagnosed in late adolescence, limited exposure to peers during the formative drinking period (late adolescence and early adulthood) may be protective by interrupting the establishment of heavier drinking. While late adolescents show more signs of distress related to their illness, there may be counterbalancing forces that minimize drinking. The constraints of treatment and illness may make adolescent patient-survivors more connected to parents and the adult world and therefore less often in unsupervised heavy drinking settings typical of their age.(29) In addition, cancer treatment may disrupt a survivor from establishing a pattern of drinking.

Because many of the previous studies excluded survivors diagnosed during late adolescence, (23,25,28) and with brain tumors (central nervous system tumors) (25,26) the present study provides unique information in these areas. Our data indicate that these two groups drink somewhat less than other survivors. These sample omissions may account for instances where reported alcohol consumption is higher compared to the present findings. In addition, the frequent use of sibling controls could bias studies toward showing less drinking among survivors since siblings appear to be heavier drinkers.

General risk factors appear to be similar across both populations. Previous research in general populations describes early drinking as a risk factor for later alcohol dependence(31) and continued alcohol use.(32) However, this study shows that early drinking among survivors is even more predictive of later heavy drinking than among a general population sample. Despite often increased parental supervision and increased health concerns, those survivors who initiate drinking at a young age may be especially motivated to do so, and may be turning to alcohol out of anger or distress related to the diagnosis, treatment or other related family or social problems that were heightened in the context of cancer. Heavy drinking may also occur among survivors who behave recklessly as a result of experiencing life-threatening trauma (often a symptom of post traumatic stress). The relationship between posttraumatic stress and alcohol consumption among survivors should be examined in future studies. It should be noted that heavy drinking in this young age group is associated with changes in brain functioning(38) and with cognitive impairment, (51), which may have a greater impact among a subgroup of survivors who are already at risk for cognitive sequelae from disease or treatment.

Survivors with cognitively compromising treatments had lower odds for NIAAA risky drinking and heavy drinking. This finding differs from earlier findings that describe poorer decision making(41) which was in turn associated with increased substance use among less resilient teens.(41,42) These lower drinking rates among survivors with cognitive impairments may also be explained by closer parental monitoring or increased adult presence in these survivors' lives.

Certain cancer diagnoses were associated with higher risk for heavy drinking. Unmeasured factors relating to these diagnoses could be playing a role in increasing risk for heavier drinking rather than the diagnosis itself.

Sibling alcohol consumption in excess of both survivor and peer drinking warrants further investigation in a separate study with siblings as the focus. This current finding points to considerable distress in a population that has been described as having higher rates of anxiety,

distress, academic problems, loneliness, conflicted feelings, isolation, and physical health problems (49) (50). Siblings, who often have reduced parental supervision during their sister/brother's treatment, may initiate alcohol use at younger ages and thereby be at higher risk for unsafe drinking in adolescence and longer term problematic use.

The present study addresses a number of shortcomings in the published literature on alcohol use in survivors including small sample sizes, use of sibling controls, varying and limited alcohol measures, and the exclusion of those diagnosed during later adolescence or with brain tumors. The survivor data is compared to a national population-based survey of age-matched individuals as well as to sibling controls, providing two comparison groups and considerably larger sample sizes than before. Previous studies used a variety of samples such as those being treated for alcoholism,(23) and different measures including lifetime alcohol consumption, (25,26) current alcohol use(22,26) and binge drinking. (22,25,26,28) The current study captures these measures, along with more detailed information on drinking quantity and frequency, allowing for the assessment of risky and heavy drinking patterns. Only one previous study employed both general population peers and siblings. (25) Findings from that study are consistent with findings from the current study where survivors were less likely to engage in binge drinking compared to siblings. The CCSS sibling cohort allows for more direct adjustment for sociodemographic factors and may indirectly control for factors such as family drinking history and other relevant confounders. However, sibling controls have also been exposed to the family disruption caused by cancer, an experience that has been associated with considerable stress and negative psychological outcomes in siblings.(40,50,52)

When interpreting the results of this study it is important to consider some methodological issues. Demographic differences existed between samples. Measures were taken to equalize samples differences by weighting peers to survivors by age, race and gender and statistical adjustments were made for these sociodemographic differences. It is possible that other factors, not controlled for in the analysis, could influence the results. The mode of questioning was different between the CCSS and NAS samples, with the CCSS using both telephone and mailed surveys, while the NAS used a telephone-only survey. It is possible that respondents may provide different responses to the questions based upon the two methods of data collection. The timing of the surveys is not identical. The bulk of NAS data was collected in 2000 and CCSS participant data was collected primarily between 1995 and 1996. Since per capita drinking differences between these dates are negligible (53), it is unlikely that this would create a cohort bias effect and therefore substantially influence the conclusions from the study. The creation of key variables such as NIAAA risky drinking and heavy drinking based on usual daily drinking is likely to be an underestimate of these two drinking measures(54,55) which are designed to be formulated based on a question about maximum drinking. However, since both drinking measures are based on closely comparable questions for usual drinking, the use of this variable should be valid for comparisons between survivors and peers.

In conclusion, this is a large study examining drinking among survivors that includes comprehensive measures of alcohol consumption, a wide array of cancer diagnoses, and two comparison groups. Based on the findings from these analyses, it is recommended that general guidelines be established to assess alcohol consumption among adolescent survivors of cancer to identify those at risk and prevent the early initiation of drinking. In addition, alcohol and mental health assessments should be instituted at long-term follow up clinics to capture individuals who may be drinking above the recommended levels or be demonstrating risk factors for heavy drinking. Smoking interventions have been implemented and successfully reduced smoking in survivors.(56) These interventions might serve as a model for reducing alcohol consumption.

Since alcohol consumption has been associated with risk of cancer including head/neck, bladder, liver and breast, survivors specifically at high risk for these cancers should be warned against drinking.

Human participant protection statement

This secondary data analysis was approved under Categories Exempt from IRB Review at 45 CFR 46.101(b) by the Public Health Institute, IRB protocol #I04-001.

Ethical statement on behalf of all authors

Title of the article: (Alcohol consumption patterns and risk factors among childhood cancer survivors compared to siblings and general population peers)

On behalf of, and having obtained permission from all the authors, I declare that:

- a. the material has not been published in whole or in part elsewhere;
- b. the paper is not currently being considered for publication elsewhere;
- c. all authors have been personally and actively involved in substantive work leading to the report, and will hold themselves jointly and individually responsible for its content
- d. all relevant ethical safeguards have been met in relation to patient or subject protection, or animal experimentation.

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Table 1

Demographics by survivor, sibling and peers. Percents, and weighted percents for national data reflecting survivors by gender, age and race/ethnicity.

Variable	Survivors	Siblings	National	National
	N=10,398 Percent	N=3,034 Percent	N=4,774 % wtd ^c to Survivors	Actual %
Gender ^b				
Female	46.2	52.9	46.2	50.4
Male	53.8	47.1	53.8	49.6
Race/ethnicity ^b				
White and Other	90.3	94.4	90.3	74.4
Black	4.5	2.3	4.5	12.8
Hispanic	5.2	3.3	5.2	12.8
Age at interview ^c				
18-21	24.1	17.6	24.1	12.4
22-26	30.0	22.3	30.0	14.3
27-31	23.3	23.2	23.3	15.2
32-48	22.5	36.5	22.5	58.0
Household Income ^{a b}				
lt 10K	9.2	4.8	14.8	11.8
10-20K	13.8	8.1	15.4	14.4
20-40K	30.1	24.8	30.7	29.0
40-60K	21.9	24.9	16.1	18.6
gt 60K	25.1	37.4	23.0	26.1
Current employ ^{a b}				
No	14.9	7.9	22.4	20.5
Yes	85.1	92.1	77.6	79.5
Education ^{a b}				
Grades 0-12	34.1	24.9	43.9	43.0
Some post HS	37.4	36.4	31.6	29.3
College grad	28.4	38.6	24.4	27.7
Marital Status ^{a b}				
Married/live w	38.9	55.8	53.1	63.4
sep/div/widow	8.2	9.2	5.6	9.1
never married	53.0	35.0	41.3	27.5
Usual # drinks when drinking ^{a b}				
0	25.7	15.7	29.5	33.4
1	22.7	25.1	23.2	25.8
2	20.9	26.2	19.4	19.9
3	12.6	12.5	10.9	8.6
4	7.5	7.4	4.9	3.9
5	3.5	4.3	2.9	2.3
6+	7.0	8.7	9.0	6.2
Drinking frequency ^{a b}				
LT monthly	39.6	31.4	44.6	49.5
1-3 x/mo	23.4	25.2	21.8	20.8
1-2 x/wk	21.3	23.7	17.8	15.6
3-4 x/wk	9.5	11.5	8.8	7.6
Daily	6.2	8.3	7.0	6.5

^a Differences are significant between survivors and NAS/peers.

^b Differences are significant between survivors and siblings.

^c This percents have been weighted to match the age, gender and race of the survivor sample.

Table 2

Percentages of cancer survivors, their siblings and national peers reporting current drinking, risky drinking and heavy drinking, as well as adjusted odds ratios for each drinking category

Variable	CCSS- Survivors N=10,398	CCSS- Siblings N=3,034	National- Peers N=4,774	Adjusted OR* Survivor vs. Peer OR _{adj} (95% CI)	Adjusted OR* Survivor vs. Sibling OR _{adj} (95% CI)
	%	%	Wtd ^c %		
Current Drinker ^{ab}					
No	26.7	17.2	29.0	p<.01	p<.001
Yes	73.3	82.8	71.0	1.1 (1.0-1.2)	0.6 (0.5-0.6)
Risky Drinking, NIAAA- w/ daily & weekly limit ^{ab}					
No	83.8	79.7	82.0	p<.01	p<.001
Yes	16.2	20.3	18.0	0.9 (0.8-1.0)	0.7 (0.6-0.8)
Heavy drinking, 5+/6+ ^{ab}					
No	91.7	89.6	90.0	p<.01	p<.001
Yes	8.3	10.4	10.0	0.8 (0.7-0.9)	0.7 (0.6-0.8)

* GEE models were used to adjust for clustering of sibling within survivor, for exchangeable correlation error structure. Error correlation for GEE models for sibling current drinking is 0.14, for risky drinking is 0.12, and for heavy drinking is 0.07.

^a Differences are significant between survivors and NAS/peers.

^b Differences are significant between survivors and siblings.

^c These percents are weighted to match the age, gender and race of the survivor sample.

Table 3

Factors associated with heavy drinking (5+ women/6+ men) among survivors and peers.

Total Population	CCSS Survivors N= 6,904	National-Peer N = 3,328
	OR _{adj} (95% CI)	OR _{adj} (95% CI)
Age at interview		
18-21	2.0 (1.5-2.6) ***	2.7 (1.9-3.9) ***
22-26	1.9 (1.5-2.4) ***	2.4 (1.7-3.3) ***
27-31	1.3 (1.0-1.7)	1.5 (1.0-2.1) *
32-48 (ref)		
Race/ethnicity		
White and other (ref)		
Black, non-Hispanic	0.6 (0.4-1.1)	0.7 (0.4-1.2)
Hispanic	1.0 (0.7-1.4)	1.0 (0.6-1.6)
Gender		
Female (ref)		
Male	2.1 (1.8-2.6) ***	1.8 (1.5-2.3) ***
Education		
Grades 0-12	3.4 (2.7-4.4) ***	2.7 (2.0-3.7) ***
Some post HS	2.2 (1.7-2.8) ***	1.8 (1.3-2.6) **
College grad (ref)		
Age of first drink		
Le 14	6.9 (4.4-10.8) ***	2.8 (1.9-4.1) ***
15-16	5.3 (3.5-8.1) ***	1.5 (1.0-2.2) *
17-20	2.9 (1.9-4.4) ***	1.0 (0.7-1.5)
21+ (ref)		

*
p ≤ .05**
p < .01***
p < .001

Table 4

Risk factors for heavy drinking among survivors. The Adjusted Odds Ratio describes the association between each factor and heavy drinking, controlling for well known risk factors for heavy drinking including age, gender, race/ethnicity, education, and age of first drinking.

Total Population N=10,398	Heavy Drinking
	OR_{adj} (95% CI)
Age at diagnosis	
0-4	0.9 (0.7-1.2)
5-9 (ref)	
10-14	1.1 (0.9-1.4)
15-21	0.7 (0.5-1.0)*
General Health	
Exc/Very Good/Good (ref)	
Fair/Poor	1.5 (1.1-1.9)**
Depression	
Normal (ref)	
Abnormal	1.7 (1.4-2.2)***
Anxiety	
Normal (ref)	
Abnormal	1.4 (1.1-1.9)*
Somatization	
Normal (ref)	
Abnormal	1.7 (1.3-2.2)***
GSI Score	
Normal (ref)	
Abnormal	1.9 (1.5-2.4)***
Functional Impairment	
No Impairment (ref)	
Impairment	1.0 (0.7-1.3)
Activity Limitations	
Not limited at all (ref)	
Limited	1.3 (1.1-1.5)*
Pain from Cancer	
None (ref)	
Some+	1.2 (1.0-1.5)
Anxiety about Cancer	
None (ref)	
Some+	1.2 (1.0-1.4)*
IT Methotrexate or Cranial radiation	
Yes	0.7 (0.5-0.8)***
No (ref)	
Cancer Diagnosis	
Leukemia (ref)	
Central Nervous System	0.9 (0.7-1.3)
Hodgkin disease	1.4 (1.0-1.8)*
Non-hodgkin Lymphoma	1.2 (0.9-1.6)
Wilms Tumor	1.5 (1.1-2.1)*
Neuroblastoma	1.6 (1.1-2.3)*
Sarcoma	1.3 (0.9-1.7)
Bone	1.7 (1.2-2.2)***

*
p < .05

**
p < .01

p < .001