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Characteristics of Responders to a Request for a Buccal Cell Specimen Among Survivors of Childhood Cancer and Their Siblings

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Abstract

Purpose—Analysis of biological samples in large cohort studies may provide insight into the mechanism of, and risk factors for, disease onset and progression.

Methods—This study describes the methods used to collect biological samples from a large multi-center cohort of childhood cancer survivors and siblings of childhood cancer survivors, and evaluates the predictors of a positive response among these individuals.

Results—Among survivors, female sex, white race/ethnicity, college graduation, never smoking, accessing the health care system in the past two years, and having a second malignant neoplasm were the strongest predictors of returning a sample. Among siblings, a similar demographic profile defined those likely to submit the requested sample.

Conclusion—To reduce selection bias and increase the value of these samples for future analysis, additional phone calls and reminders targeting non-responders are needed to improve response rates among those least likely to respond to a single mailed request.

MEDICAL SUBJECT HEADINGS (MeSH)

neoplasm; pediatric; buccal mucosa; cohort study; DNA

INTRODUCTION

Large scale cohort studies play an important role in identifying variability in risk factors that contribute to the onset and progression of disease in populations [1]. These investigations provide critical information about the contributions of personal and lifestyle factors to disease incidence, progression, and mortality. Among high risk populations where individuals are enrolled in a cohort based on the presence of or prior treatment for a specific

disease, longitudinal cohort studies also provide information about the contributions of disease and treatment factors to long-term medical, psychological, and social outcomes.

Collection of biological samples in epidemiologic studies notably increases the value of the study. Simple, reliable methods of collecting, mailing, and processing buccal cells now yield adequate quantities of DNA for genomic analyses [2,3]. Rapid advances in DNA collection and processing technology [4] allow researchers to examine the independent, additive, and interactive effect of genetics on disease etiology and long-term outcome in association with data regarding personal and lifestyle factors collected in questionnaires [5].

Genetic information is particularly valuable in our study investigating etiology of subsequent disease, second malignancy, and survival in children treated for childhood cancer. Access to DNA samples from survivors and siblings may help investigators identify genetic risk factors for both complications of therapy and secondary cancers in these survivors and their families. In addition, because childhood cancer survivors are at increased risk for chronic and serious medical conditions [6], and because not all excess risk can be explained by disease, treatment, lifestyle and personal factors, the availability of genetic information may help identify those cancer survivors who are at greatest risk for an adverse health outcome.

This manuscript describes the initial methods used to collect buccal cell blood samples from a large cohort of childhood cancer survivors. We report response rates and characteristics of both cancer survivors and their siblings who did and did not respond to a mailed request for a buccal cell sample, or who did and did not provide a blood sample after confirmation of a second malignancy.

METHODS

Study population

Participants eligible for this analysis were living survivor and sibling members of the Childhood Cancer Survivor Study (CCSS) Cohort. Detailed descriptions of the cohort have been published elsewhere [7–9]. Briefly, the CCSS is a retrospective cohort study of individuals who survived five or more years following a diagnosis of leukemia, central nervous (CNS) system malignancy, Hodgkin lymphoma, non-Hodgkin lymphoma, neuroblastoma, Wilms' tumor, soft tissue sarcoma, or bone malignancy before the age of 21 years. Survivor participants were diagnosed between 1970 and 1986 at one of 26 participating institutions. Sibling participants were enrolled by selecting a random sample of survivors from among those who reported having a sibling, asking the survivor to identify their closest age sibling, and then contacting that sibling to offer enrollment. Approval for human subjects research was obtained from each institution and informed consent was obtained from participants or, for those younger than 18 at study entry, their parents/guardians, prior to data collection. A separate consent was obtained for buccal cell and for blood collection. Language varied some from center to center based on institutional requirements and individual institutional review board requests, although consent forms all contained essentially the same information. Participants were told that their DNA would be stored and used along with information about them and their treatment exposures to help learn about the impact of genetics on cancer development, progression, and response to treatment. They were also told that their information would not be connected to their name, would always be presented in aggregate, and that the sample might not be used immediately, but stored and used in the future.

Sample Collection

The primary outcome of interest for these analyses were whether or not eligible participants returned buccal cell collection kits or agreed to provide a blood sample. Buccal cell collection kits were mailed to all living participants and siblings who had a current address at the time of contact. The collection kit included a 45 ml sample of Scope® mouthwash, a collection jar, and a sealable plastic bag for the collection jar [10]. The packet also included directions for specimen collection, a letter of explanation, a consent form, and a postage-paid first class mailer with a Styrofoam® insert. Follow-up phone calls specific to biological specimen collection were not provided. Collection kits were resent if requested by the participant.

Blood samples were requested from survivors with confirmed second malignant neoplasms. A letter requesting a blood sample and a consent form were mailed to eligible participants. Two weeks after the letter was mailed, a trained interviewer called the individual to explain reasons for the request and answered questions about the collection process. After receiving the signed consent form, the coordinating center contacted a commercial home phlebotomy provider (Examination Management Services in the United States and Hooper Homes in Canada) to set up an appointment with the survivor and collect the blood specimen.

Independent variables

Diagnosis and treatment information were obtained from the medical record by trained abstractors. For these analyses, primary diagnosis was grouped as leukemia, CNS malignancy, Hodgkin disease, non-Hodgkin lymphoma, Wilms' tumor, neuroblastoma, soft tissue sarcoma, and bone cancer. Age at diagnosis was summarized in four groups: 1–5 years, 6–10 years, 11–15 years, and 16–20 years. Treatment for the primary diagnosis was classified as receiving or not receiving surgery, chemotherapy, and radiation, by three specific chemotherapeutic classes (anthracyclines, alkylating agents, epipodophyllotoxins), and three radiation sites (brain, chest, and gonads).

Demographic and personal data were obtained from the baseline questionnaire, available for viewing at www.stjude.org/ccss, and from a master database that documented collection kit mailing and return dates. Sex, race/ethnicity, age at sample request, educational attainment, marital status, smoking status, a visit to a health care provider in the two years preceding questionnaire completion, and perceived general health were evaluated as predictors of whether or not a sample was returned. Race/ethnicity was classified as black, Hispanic, white and other, and collapsed for multiple variable analyses into white and non-white. Age at sample request was summarized as 10–19 years, 20–29 years, 30–39 years, 40–49 years and 50 years or older. Educational attainment was classified as college graduate or non-college graduate. Marital status was grouped as divorced/separated/widowed, married or living as married, or never married. Contact with a health care provider in the two years preceding the baseline survey and smoking status were treated as dichotomous outcomes. Participants perceived general health was classified as excellent or good and fair or poor.

The presence of a second malignant neoplasm was also considered as a potential predictor of whether or not an individual returned a buccal cell sample, and was the primary eligibility criteria for whether or not an individual was asked to provide a blood sample. Second malignant neoplasms were confirmed by review of pathology reports provided by the institution where the second cancer was diagnosed. Informed consent for release of the pathology report was requested and obtained from individuals who reported a second malignant neoplasm prior to requesting the pathology report.

Statistical methods

The numbers and percentages of individuals who returned and did not return biological samples were calculated by demographic and treatment characteristics and compared in univariate models with Chi-square statistics, or when expected cell sizes were less than five, with Fisher's exact tests. Multiple variable logistic regression models were used to calculate the relative odds of returning a biological sample by diagnosis, treatment modality, demographics, smoking status, and second malignant neoplasm status among survivors, and by demographic and personal factors among the sibling comparison group. Analyses were done using SAS version 9.2 (Cary, N.C.)

RESULTS

Buccal cell samples

Between April 1996 and December 2007, buccal cell samples were requested from 12,495 survivor and 3154 sibling members of the CCSS cohort. Excluded from analyses were 449 (3.6%) individuals who could not be located, 1305 (10.4%) who did not have an available medical record, and because we used second malignant neoplasm as a predictor of response rate in our models, 385 (3.1%) who could not be confirmed to be free of a second malignant neoplasm. Samples were received from 5,537 (53.5%) of the 10,356 eligible survivors and 1230 (39.0%) of the 3154 siblings. The median time from completion of the baseline questionnaire to the sample request was 5.1 (range 0–11.4) years for survivors and 3.3 (range 0–10.4) years for siblings.

The characteristics of survivors who did and did not return buccal cell samples are shown in Table I by diagnosis and treatment, personal and demographic factors, and by second malignant neoplasm status. Initial univariate examination indicated small differences between the two groups by diagnosis, age at diagnosis, location of radiation exposure, current age, marital status, and perceived general health. However, these differences were small and either did not persist or did not improve the model fit in multiple variable models (Table II). In both univariate and multiple variable models, female sex, white race/ethnicity, college graduation, never-smoking status, recent contact with a health care provider, and having a confirmed second malignant neoplasm were associated with returning a buccal cell sample. Females were 1.2 (95% Confidence Interval (CI): 1.1, 1.3) times more likely to return a sample than were males. Individuals who reported their race/ethnicity as white were 1.9 (95% CI: 1.7, 2.2) times more likely to return a sample than those who reported their race/ethnicity as non-white, and participants with college degrees were 1.2 (95% CI: 1.1, 1.4) times more likely than those without college degrees to return a buccal cell sample. Never-smokers were 20% (95% CI: 10, 30%) more likely than smokers to return a sample. Individuals who had recent contact with a health care provider were 30% (95% CI: 10, 50%) more likely than those who had not had recent contact with a health care provider to return a sample, and those who had experienced a second malignant neoplasm were 40% (95% CI: 20, 70%) more likely than those who had not had a second malignancy to return a buccal cell sample.

The characteristics of siblings who returned and did not return a buccal cell sample are shown in Table I. Again, female gender, race/ethnicity, educational attainment, smoking status and contact with a health care provider were significant predictors of whether or not an individual returned a biological sample (Table II). Female siblings were 1.2 (95% CI: 1.1, 1.4) times likely than male siblings to return a sample. Like survivors, siblings who reported their race/ethnicity as white were 1.7 (95% CI: 1.2, 2.2) times more likely than those who reported their race as non-white to return a sample, and those with college degrees were 1.5 (95% CI: 1.3, 1.8) times more likely than those without college degrees to return a buccal

cell sample. Finally, non-smokers were 1.3 (95% CI: 1.1,1.5) times more likely than ever smokers, and those who had seen a health care provider in the two years preceding the baseline survey were 1.3 (95% CI: 1.1,1.6) times more likely than those who had not to return a biological sample.

Blood samples

From August 2001 to July 2007, blood samples were requested from 434 survivors who had a confirmed second malignancy and an available medical record, a median of 7.7 (range 2.9–13.4) years from completion of the baseline questionnaire. Samples were returned by 230 (53%) survivors. Blood sample return rates among survivors with a second malignancy differed only by race/ethnicity and treatment history. Responders were more likely to be white than non-white (Odds Ratio (OR): 2.8; 95% CI: 1.3, 6.2), and those who received anthracyclines were less likely than those who had not to return a blood sample (OR: 0.6; 95% CI: 0.4, 0.9).

DISCUSSION

The results of these analyses indicate that just over half of survivors and slightly more than one-third of sibling members of an ongoing cohort of long-term survivors of pediatric and adolescent cancer provided a buccal cell sample for DNA analysis via mail. Female non-smoking college graduates who report their race as white, and who have regular contact with their health care provider have the highest response rates among both survivors and siblings. Survivors who experience a second malignant neoplasm are also more likely to provide a sample. Among survivors with a second malignant neoplasm who are asked to provide a blood sample, white race is again predictor of participation.

Our overall response rate (53.5%) was lower than those reported in two large community- and profession-based cohort studies, and similar to those reported in a large population-based cohort study. LeMarchand et al. [11] successfully collected buccal cell samples from two-thirds of a Hawaiian cohort, and Hansen et al. [2] successfully collected saliva samples from 72% of persons in the Danish Nurses cohort study. Zheng et al. [12] reported a 49.3% participation rate for buccal cell collection in a population based cohort of urban Chinese women. Specific follow-up reminders were provided in both the Hawaiian and Dutch cohorts, but not in our study or in the Shanghai Women's Health Study. Routine phone contact after mailing a request may enhance participation, increase the available samples, and perhaps decrease potential bias when genetic analyses are done using samples from the study population.

The characteristics of participants who were most likely to provide a buccal cell sample in our study are similar to study responder characteristics in other studies where a biological specimen was requested. Engel et al. [13] reported that white, educated farmers with a history of melanoma were more likely to return a buccal cell sample than those who reported their race as non-white, who had less than a college degree, and who did not have a history of melanoma. Cozier [14] reported a buccal cell sample return participation rate of 37% among members of the Black Women's Health Study who had been diagnosed with cancer, and Garoufalidis et al. [15] reported that individuals with more severe myopia were more likely than those with less severe myopia to enroll in an observational trial when blood specimens for DNA analysis were collected. Like these investigators, we found that participation was better among white, educated individuals, and that responders were more likely to have a severe outcome, incident second cancers, than were non-responders.

The CCSS is a resource for research [9], and as such, is committed to providing quality, representative data and biological materials for future analyses. A representative sample

from this large cancer survivor population is essential to allow for an unbiased assessment of the complex relationships between genes, the environment, and disease. [16] A sample that includes survivors with diverse personal and demographic characteristics will optimize researchers' abilities to discover important genes that infer risk for either cancer or a poor outcome, and eventually will allow for tailored treatments and prevention plans. If a specific sub-group of the survivor population is not represented by their genetic material, findings that inform future health care and prevention measures will not be able to be generalized to them.

Investigators have recently begun a project to supplement and enhance the availability of the DNA samples. All living survivors and siblings in both the original (children diagnosed between 1970 and 1986) and the expansion cohorts (children diagnosed between 1987 and 1999) are being asked to provide additional saliva sample. Original cohort participants who return the 2007 follow-up questionnaire, and expanded cohort participants who return their baseline questionnaire, are mailed an Oragene® saliva collection kit with a consent form, an instruction sheet, a plastic biohazard bag to place the sample in, and a return pre-paid padded envelope. If the sample has not been returned within three weeks, up to ten phone call attempts are made to speak with the participant to encourage them to return the sample. Phone call attempts are made at different times of the day and on different days of the week. Up to three verbal messages are left if study personnel are confident that they have the correct contact information for a particular survivor. A second collection kit is mailed if the participant has not received or has misplaced the original kit. The saliva collection kit and phone call attempts are repeated after six months for initial non-responders. Using this multiple contact technique, with a phone call, a potential additional mailing, and a re-contact attempt six months after the initial mailing should improve response rates. Preliminary phone interactions between study participants and research personnel have primarily involved answering questions and/or clarifying information on the consent form (Figure 1). Qualitative responses in these conversations have been positive.

LIST OF ABBREVIATIONS

DNA	Deoxyribonucleic Acid
CCSS	Childhood Cancer Survivor Study
CNS	Central Nervous System

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WHY DO YOU NEED MY DNA?

The results of your DNA analysis will be combined with the results of other participants in the study. The results will then be reviewed by our researchers to determine whether there is a currently known genetic marker that may be useful in predetermining certain cancers, tumors, or similar illnesses. Researchers are also looking at variations of genes that may influence the development of late effects of cancer and its treatment.

I DON'T WANT MY DNA "OUT THERE". HOW DO I KNOW THAT MY DNA WON'T FALL INTO THE WRONG HANDS?

We can assure you that once we receive your sample, your name will be removed from the sample and assigned a random number, which will de-identify your sample. This way, researchers will not be able to link your sample to you. There are additional safeguards as well. The de-identified samples will be stored in a secured facility to which only our researchers have access. Additionally, the de-identified results from the analysis will be available only to our researchers. This information is kept in a password protected database to which only a few researchers have access. Finally, researchers are required to submit an application to the IRB (Institutional Review Board) in order to conduct any type of research. The purpose of this is to ensure your confidentiality, as well as the integrity of the research. The research is not approved if the IRB is unconvinced that participant confidentiality may be compromised.

WILL MY DNA BE USED FOR CLONING OR STEM CELL RESEARCH?

No, your DNA will not be used for cloning or for stem cell research.

I REMEMBER PROVIDING A DNA SAMPLE A WHILE BACK IN WHICH I USED A SWAB INSIDE MY CHEEK. IS THIS THE SAME THING?

It is similar in that we are still collecting DNA. However, the current DNA collection method we have provided you has a longer life span, meaning there is less chance your sample would expire before it is analyzed.

I AM (OR MY CHILD IS) UNABLE TO PROVIDE A SALIVA SAMPLE, BUT I WOULD STILL LIKE TO PARTICIPATE. WHAT CAN I DO TO HELP?

We will send you a swab kit that won't require a saliva sample. There are instructions provided with the kit illustrating how to swab your cheek and return the sample.

I AM PREGNANT CAN I STILL PARTICIPATE?

Yes, you may still participate. Just follow the directions as provided and send the kit back with the signed consent form.

I AM SICK. CAN I STILL PARTICIPATE?

Yes, you may still participate. Just follow the directions as provided and send the kit back with the signed consent form.

WILL I BE NOTIFIED IF THE RESEARCHERS FIND SOMETHING STRANGE WITH MY DNA?

Due to the fact that your DNA has been de-identified it is highly unlikely that anyone would notify you in the event something unusual is found with your sample. The study is not designed to identify genetic abnormalities on an individual basis.

WILL I BE GIVEN THE RESULTS FROM MY DNA STUDIES?

You will not be given individual results. The way we typically share results with our participants are through medical journal articles and newsletters that are sent twice a year. Information provided in these formats describes groups of participants. Information that identifies individuals will not appear in articles, newsletters, or other published reports.

WHY WON'T I BE GIVEN MY INDIVIDUAL RESULTS OF THE DNA STUDIES?

Researchers won't look for genetic markers for specific conditions from your DNA sample. The information researchers will learn from your DNA will be used to determine whether there are currently any known genetic markers that may be useful in predetermining certain cancers, tumors, or similar illnesses. Researchers are also looking at variations of these potential genes that may influence the development of late effects of cancer and its treatment.

ARE YOU DOING ANY OTHER TESTING WITH MY SALIVA?

Some people have concerns that we will test for sensitive information, such as genetic markers for specific illnesses, illegal drug use, smoking habits etc. that may result in negative consequences for them. We want to remind you that the information you provide in this study is confidential. Your sample will only be identified by a unique random number, ensuring that your sample not be linked to you. Additionally, your sample will NOT be released to unauthorized individuals.

WHAT DOES IT MEAN WHEN YOU SAY THE SAMPLE WAS DEPLETED?

You may have been asked to provide a DNA sample in the past. If this is the case, it is possible the researchers used the entire sample for their studies. This means the sample has been depleted. In order to conduct further research using your DNA, we are asking that you provide us with another sample. Because technology has improved since we asked you the first time, we now have the ability to use a smaller amount of your sample for one type of analysis. Researchers can then develop DNA call lines from your sample, which they can store for future research.

WHO ARE THE DOCTORS DOING THE RESEARCH?

Since the Long-Term Follow-Up Study has such a large and unique population, it attracts top researchers from some of the best institutions nationwide. Any proposed research is first submitted to a committee where the proposal is carefully reviewed to determine whether the project aims to help our mission to understand, cure, and prevent cancer.

Figure 1.

Frequently Asked Questions Regarding Oragene® Saliva Collection and Usual Research Staff Responses

Table 1
 Characteristics of Survivors and Siblings Who Did and Did Not Return a Buccal Cell Sample by Demographic and Treatment Information

	Survivors				Siblings			
	Returned sample (N=5537)	Refused or non-responder (N=4819)	p-value [§]		Returned sample (N=1230)	Refused or non-responder (N=1924)	p-value [§]	
	N	%	N	%	N	%	N	%
Gender								
Male	2776	(50.1)	2633	(54.6)	556	(45.2)	977	(50.8)
Female	2761	(49.9)	2186	(45.4)	674	(54.8)	947	(49.2)
Race								
Black	125	(2.3)	222	(4.6)	17	(1.4)	60	(3.1)
Hispanic	186	(3.4)	286	(5.9)	31	(2.5)	83	(4.3)
White	5080	(91.6)	4113	(85.4)	1096	(89.1)	1656	(86.1)
Other	128	(2.3)	177	(3.7)	34	(2.8)	59	(3.1)
Not reported	18	(0.3)	21	(0.4)	52	(4.2)	66	(3.4)
Age at buccal request (years)								
10 – 19	832	(15.0)	637	(13.2)	5	(0.4)	8	(0.4)
20 – 29	2345	(42.4)	2185	(45.3)	224	(18.2)	276	(14.4)
30 – 39	1837	(33.2)	1605	(33.3)	404	(32.8)	748	(38.9)
40 – 49	511	(9.2)	381	(7.9)	395	(32.1)	643	(33.4)
50 +	12	(0.2)	11	(0.2)	183	(14.9)	230	(12.0)
Educational attainment								
Less than college	3911	(70.6)	3583	(74.4)	19	(1.5)	19	(1.0)
College graduate	1389	(25.1)	958	(19.9)	773	(62.9)	1367	(71.1)
Not reported	237	(4.3)	278	(5.8)	404	(32.9)	462	(24.0)
Marital status								
Divorced/Separated/Widowed	292	(5.3)	275	(5.7)	53	(4.3)	95	(4.9)
Married/Living as married	1684	(30.4)	1295	(26.9)	77	(6.3)	140	(7.3)
Never married	3329	(60.1)	3036	(63.0)	530	(43.1)	762	(39.6)

	Survivors				Siblings			
	Returned sample (N=5537)	Refused or non-responder (N=4819)	p-value ^{\$}		Returned sample (N=1230)	Refused or non-responder (N=1924)	p-value ^{\$}	
	N	%	N	%	N	%	N	%
Not reported	232	(4.2)	213	(4.4)	563	(45.8)	952	(49.5)
Smoking status								
Ever	1143	(20.6)	1136	(23.6)	60	(4.9)	70	(3.6)
Never	4175	(75.4)	3517	(73.0)	351	(28.5)	639	(33.2)
Not reported	219	(4.0)	166	(3.4)	816	(66.3)	1216	(63.2)
Accessed health care in the last 2 years								
No	491	(8.9)	570	(11.8)			63	(5.1)
Yes	5045	(91.1)	4248	(88.2)	187	(15.2)	385	(20.0)
Not reported	1	(0.0)	1	(0.0)	1043	(84.8)	1539	(80.0)
General health								
Excellent/Good	5078	(91.7)	4368	(90.6)	1169	(95.0)	1824	(94.8)
Fair/Poor	415	(7.5)	405	(8.4)	47	(3.8)	83	(4.3)
Not reported	44	(0.8)	46	(1.0)	14	(1.1)	17	(0.9)
Cancer Type								
Leukemia	1846	(33.3)	1712	(35.5)				
Central nervous system	695	(12.6)	578	(12.0)				
Hodgkin disease	768	(13.9)	523	(10.9)				
Non-Hodgkin lymphoma	397	(7.2)	387	(8.0)				
Kidney (Wilms)	540	(9.8)	425	(8.8)				
Neuroblastoma	392	(7.1)	343	(7.1)				
Soft tissue sarcoma	471	(8.5)	431	(8.9)				
Bone cancer	428	(7.7)	420	(8.7)				
Age at diagnosis (years)								
0 – 5	2595	(46.9)	2370	(49.2)				
6 – 10	1038	(18.8)	952	(19.8)				
11 – 15	1180	(21.3)	937	(19.4)				

	Survivors				Siblings			
	Returned sample (N=5537)	Refused or non-responder (N=4819)	p-value ^{\$}		Returned sample (N=1230)	Refused or non-responder (N=1924)	p-value ^{\$}	
	N	%	N	%	N	%	N	%
16 – 20	724	(13.1)	560	(11.6)				
Treatment for primary diagnosis*								
Surgery	4464	(80.6)	3839	(79.7)	0.20			
Chemotherapy	4408	(79.6)	3884	(80.6)	0.21			
Anthracyclines	2160	(39.0)	1963	(40.7)	0.08			
Alkylating agents	2842	(51.3)	2457	(51.0)	0.72			
Epipodophyllotoxins	450	(8.1)	351	(7.3)	0.11			
Radiation	3650	(65.9)	3122	(64.8)	0.23			
Cranial	1718	(31.0)	1537	(31.9)	0.14			
Chest	1139	(20.6)	863	(17.9)	<0.01			
Gonads	609	(11.0)	447	(9.2)	<0.01			
Second malignancy[#]								
None	4934	(89.1)	4466	(92.7)	<0.001			
Non-Malignant Skin Cancer	304	(5.5)	177	(3.7)				
Breast	79	(1.4)	37	(0.8)				
Central Nervous System	25	(0.5)	7	(0.2)				
Leukemia/ Lymphoma	26	(0.5)	16	(0.3)				
Meningioma	5	(0.1)	2	(0.0)				
Thyroid	56	(1.0)	45	(0.9)				
Other	107	(1.9)	69	(1.4)				

* Categories are not mutually exclusive

[#] First second malignancy

^{\$} P-value does not account for group who did not report the variable, all P-values are two-sided

Percentages of Childhood Cancer Survivors and Siblings Who Returned a Buccal Cell Sample With Relative Odds and 95% Confidence Intervals From Multiple Variable Models

Table II

	Childhood Cancer Survivors			Siblings		
	Percent returned	Odds ratio	95% CI	Percent returned	Odds ratio	95% CI
Gender						
Male	51.5	1.0		35.6	1.0	
Female	56.1	1.2	1.1, 1.3	41.4	1.2	1.1, 1.4
Race/ethnicity						
non-white	38.7	1.0		27.6	1.0	
white	55.5	1.9	1.7, 2.2	39.7	1.7	1.2, 2.2
Highest Education level						
College graduate	59.1	1.2	1.1, 1.4	46.6	1.5	1.3, 1.8
Non-college graduate	51.9	1.0		35.2	1.0	
Never Smoked						
No	50.3	1.0		34.6	1.0	
Yes	54.7	2.0	1.1, 1.4	40.5	1.3	1.1, 1.5
Accessed health care in last 2 years						
Yes	54.6	1.3	1.1, 1.5	40.0	1.3	1.1, 1.6
No	46.1	1.0		32.2	1.0	
Second malignant neoplasm						
No	52.6	1.4		Not Applicable		
Yes	64.2	1.0	1.3, 1.7			

CI=confidence interval