Health-Related Unmet Needs in Adult Survivors of Childhood Cancer

The proposed study will be developed through the Cancer Control Working Group, with secondary oversight by the Chronic Disease Working Group.

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BACKGROUND

The Childhood Cancer Survivor Study (CCSS) has contributed substantial information to our understanding of the burden of late-effects,[1,2] early-onset frailty,[3] and increased mortality.[4] However, little is known regarding how these health problems are managed at the survivor, provider, and health system levels. To date, CCSS surveys have asked only cursory questions regarding the care survivors have received. While these data have produced valuable insights regarding access, quality, and cost of survivors' care,[5-8] more detailed information is required to address questions about how to provide life-long, risk-adapted care to this population. These data are needed to evaluate current health service delivery for cancer survivors and to inform interventions to address cancer survivors' needs. Longer term, these data will allow the CCSS to investigate how the care that survivors receive mediates their risk for morbidity, reduced quality of life, and premature mortality.

To address the above need, the CCSS Follow-Up 8 (FU8) survey assessed survivors' perspectives of their unmet needs. Rather than relying on instruments that were not constructed for survivors, we built on prior CCSS surveys, specifically the *CCSS Needs Assessment Questionnaire* (CCSS NAQ), which was published in 2013.[10,11] The questionnaire includes nine subscales, that can be used as stand-alone assessments or as part of the entire questionnaire. At a population level, the CCSS NAQ can be used to document the needs of childhood cancer survivors as they age, assess whether these needs are met, enable comparisons of needs across survivor subgroups, and inform health system interventions to address identified needs. It can also be used at the individual level to identify specific patient's unmet needs so that they can be addressed.

CCSS NAQ

The CCSS NAQ development and validation study was conducted in a randomly selected, stratified sample of 1189 CCSS participants (mean [SD] current age, 39.7 [7.7], range =26–61 years; 60.9 % women; mean [SD] years since diagnosis, 31.6 [4.7]).[10] In this sample, higher need levels were associated with older age at diagnosis (10-20 years vs. 0-9 years), current age greater than 39 years, less than a college education, income less than $60,000, not living with a spouse or partner, and exposure to radiation therapy. In a follow-up analysis of this same sample that examined emotional, care/support, and informational needs specifically, proportions reporting unmet needs were 54% for psycho-emotional, 41% for coping, 35% for care/support, 51% for informational, 35% for health care system, and 33% for surveillance domains.[11]

The data from the CCSS NAQ development and validation provide a valuable basis for comparison, but only included a subsample of the CCSS population, experienced a 39% response rate, and are now over 10 years old. To update the prior CCSS NAQ findings and obtain an understanding of the contemporary landscape of unmet needs among CCSS survivors, we included 5 domains (58 items) in FU8. Specifically, we assessed the Health System Concerns, Cancer-related Health Information, Survivor Care and Support, Surveillance, and Fiscal Concerns domains. These questions focus on determining survivors' unmet health care needs and generating data about survivors' access (e.g., ability to see specialists), quality (e.g., knowing surveillance recommendations), and costs of care (e.g., affordability of medical treatments). Because we were primarily focused on issues related to access, quality, and costs of care, we did not include the Psycho-emotional, Coping, General Health, or Relationships domains.

For each of the 58 items, respondents were asked whether they had the need (no need existed, need was satisfied, low unmet need, moderate unmet need, high unmet need). Survivors who reported some level of unmet need (low, moderate, high) were asked when the need most recently occurred (current, within the last year, 1-2 years ago, >2 years ago).

The current concept will provide an overall overview of the FU8 CCSS NAQ findings. Future analysis concepts will explore more specific topics, including (1) associations between material hardship needs, insurance, and health service use/engagement, (2) associations between communication and unmet information needs, (3) unmet needs specifically in adolescent/young adult survivors, (4) unmet needs stratified by risk groups based on treatments received and need

for long-term follow-up, and (5) unmet needs in relation to cumulative chronic health conditions, as well as other key topics that emerge from this overview analysis.

SPECIFIC AIMS

In this initial analysis of the FU8 unmet needs assessment data, we will provide an overview of the prevalence, burden, and timing of unmet needs in long-term survivors of childhood cancer. Aim 1 will describe the unmet needs and their timing (past year vs. longer ago) using four different variables. Aims 2-4 will then examine three of those variables (dichotomous measure of unmet needs, burden of unmet needs at the individual survivor level, and unmet need domain scores) by specific subgroups based on socio-demographic and clinical variables. Aims 2-4 will focus on current needs (in the past year). Analyses of needs from earlier than the previous year will be considered if descriptive analyses show substantial prior needs.

The Specific Aims are as follows:

1. To describe the unmet needs of the population overall, including summarizing:
    a. The most prevalent unmet needs and their timing in terms of
        i. Presence of an unmet need (yes/no) and percentage of unmet needs that were low, moderate, high
        ii. Of those with any unmet need, whether the need was within the last year (current + within the last year) or longer ago (1-2 years ago + more than 2 years ago)
    b. Dichotomous measure of unmet need overall and by domain per survivor (any unmet need vs. no unmet need overall and for each domain)
    c. Burden of unmet needs at the individual survivor level overall and by domain (burden is defined as the count of individual items for which a survivor reports an unmet need and will be summarized across survivors as mean (SD) overall and by domain)
    d. Mean (SD) domain scores, calculated using the same methods as Cox et al.[11]

2. Compare presence vs. absence of unmet needs overall and by domain per survivor by specific subgroups
    a. Socio-demographics (age, sex, race/ethnicity, education, income, marital status, insurance, living in a metropolitan are vs. not [if available], social vulnerability index [if available])
    b. Diagnosis
        i. Age at
        ii. Years since
        iii. Primary cancer diagnosis
    c. Treatments
        i. Chemo (any exposure [yes/no], anthracycline exposure [yes/no], alkylating agent [yes/no], platinum [yes/no])
        ii. Radiation (any exposure [yes/no], cranial [yes/no], chest [yes/no], abdomen/pelvis [yes/no])
        iii. Surgery (yes/no)

d. Chronic health conditions based on Cumulative Incidence Rating Scale-Geriatric (CIRSG):
    i. any severe or extremely severe problem vs. none/mild/moderate only

We hypothesize that greater prevalence of unmet needs will be found in survivors who were older at survey completion, female sex, from a minority race/ethnicity, with less than a college education, with income less than <$80,000, not living as married, older at diagnosis, living in higher socially vulnerable neighborhoods or non-metropolitan area, exposed to any chemotherapy, exposed to any radiation therapy, and with any severe or very severe chronic health condition.

3. Compare the burden of unmet needs at the individual survivor level overall and by domain by specific subgroups
    a. Socio-demographics (age, sex, race/ethnicity, education, income, marital status, insurance, living in a metropolitan are vs. not [if available], social vulnerability index [if available])
    b. Diagnosis
        i. Age at
        ii. Years since
        iii. Primary cancer diagnosis
    c. Treatments
        i. Chemo (any exposure [yes/no], anthracycline exposure [yes/no], alkylating agent [yes/no], platinum [yes/no])
        ii. Radiation (any exposure [yes/no], cranial [yes/no], chest [yes/no], abdomen/pelvis [yes/no])
        iii. Surgery (yes/no)
    d. Chronic health conditions based on Cumulative Incidence Rating Scale-Geriatric (CIRSG):
        i. any severe or extremely severe problem vs. none/mild/moderate only

We hypothesize that more unmet needs at the individual survivor level will be found in survivors who were older at survey completion, female sex, from a minority race/ethnicity, with less than a college education, with income less than <$80,000, not living as married, living in higher socially vulnerable neighborhoods or non-metropolitan area, older at diagnosis, exposed to any chemotherapy, exposed to any radiation therapy, and with any severe or life-threatening chronic problems.

4. Compare unmet need domain scores (mean[SD]) by specific groups
    a. Socio-demographics (age, sex, race/ethnicity, education, income, marital status, insurance, living in a metropolitan are vs. not [if available], social vulnerability index [if available])
    b. Diagnosis
        i. Age at
        ii. Years since
        iii. Primary cancer diagnosis
    c. Treatments

i. Chemo (any exposure [yes/no], anthracycline exposure [yes/no], alkylating agent [yes/no], platinum [yes/no])
ii. Radiation (any exposure [yes/no], cranial [yes/no], chest [yes/no], abdomen/pelvis [yes/no])
iii. Surgery (yes/no)

d. Chronic health conditions based on Cumulative Incidence Rating Scale-Geriatric (CIRSG):
    i. any severe or extremely severe problem vs. none/mild/moderate only

We hypothesize that worse domain scores will be found in survivors who were older at survey completion, female sex, from a minority race/ethnicity, with less than a college education, with income less than <$80,000, not living as married, older at diagnosis, living in higher socially vulnerable neighborhoods or non-metropolitan area, exposed to any chemotherapy, exposed to any radiation therapy, and with any severe or very severe chronic health condition.

Population

The population for the primary analysis will include all FU8 survivors who completed the needs assessment. There were 11,612 respondents to FU8, of whom 10,248 completed the needs assessment.

In a sensitivity analysis (descriptive only), we will exclude all of the following:

- survivors enrolled in the St. Jude Lifetime Cohort, given the substantial free medical resources provided that are consistent with the Children's Oncology Group Long-Term Follow-up Guidelines for Children, Adolescents and Young Adults and consistent with Cox et al[11]
- survivors living in Canada, given the difference in national context
- survivors younger than age 26 (as this group may still be covered by their parents' insurance)

In a subanalysis (descriptive only), we will examine:

- survivors for whom a proxy completed FU8, given the possible differences in support

Dependent Variables

The dependent variables for these analyses include:

- Individual needs assessment items: Any unmet need (yes/no), level of each unmet need (low, moderate, high), timing of each unmet need (in the past year vs. longer ago)
- Dichotomous measure of unmet needs overall and at the domain level per survivor (any unmet need vs. no unmet need overall and for each domain)
- Burden of unmet needs defined as number of unmet needs (any unmet need vs. no unmet need) overall and within each domain per survivor
- Domain scores for unmet needs scored as in Cox et al[11]:
    - Each item of a domain receives score of 0-5, based on Likert responses "None" to "High Need", respectively. Within each domain, for each survivor, the score is the sum of its item scores.
    - We will check for underutilized rating scale categories to see if collapsing adjacent categories is needed. In the original CCSS NAQ development paper based on n=1178

CCSS survivor participants, there were underutilized categories.[11] This resulted in collapsing adjacent categories as: no need=1; need is satifisfied or low need=2; and moderate or high need=3, before summarizing.

For missing items in domains:

- If at least half the items in the domain were completed, calculate the mean number of unmet needs/mean domain score using the number of completed items in the domain as the denominator
- If more than half the items in a domain are missing, count as missing

Independent Variables

We will examine the unmet need outcomes based on the following independent variables:

a. Socio-demographics (age, sex, race/ethnicity, education, income, marital status, insurance).
    i. Education, insurance, and income were not captured on FU8, and a subset of approximately 600 survivors did not complete a survey with information on marital status. In these cases, last known status from prior follow-up surveys will be used.
    ii. If available for FU8, we will also examine metropolitan residence vs. not using RUCA and the social vulnerability index.
b. Diagnosis
    i. Age at
    ii. Years since
    iii. Primary cancer diagnosis
c. Treatments
    i. Chemo (any exposure [yes/no], anthracycline exposure [yes/no], alkylating agent [yes/no], platinum [yes/no])
    ii. Radiation (any exposure [yes/no], cranial [yes/no], chest [yes/no], abdomen/pelvis [yes/no])
    i. Surgery (yes/no)

    (Note: we are using these basic measures of treatment in this analysis because a separate concept will examine unmet needs using risk-stratified characterizations of prior treatments.)
d. Chronic health conditions: We will use the CIRSG included on FU8. This measure includes 14 categories of health conditions for which the participant is asked to provide a severity rating of 'No problem' to 'Very severe problem' for the most severe problem in the category. We will compute any severe/very severe condition per participant.
    i. If the survivor did not specify a severity rating for a category, we will assume it is not "severe" or "very severe." However, if over half the items on the CIRSG are missing, we will consider the survivor to have "unknown" health conditions.

Analytic Approach

- For Aim 1, we will summarize patient characteristics (**Table 1**) and describe each outcome variable with N(%) for categorical variables and means/standard deviations for continuous variables (or medians/range as appropriate), overall and by domain **(Tables 2-3).**

- For Aim 2, our goal is to model the presence/absence of an unmet need overall and by domain. We will evaluate relative risks of the outcomes using generalized linear models with Poisson error, log link, and robust variances for key variables described above.[12] Initial models will be univariable (**Table 4**).

- For Aim 3, our goal is to model the mean number of unmet needs, overall and by domain. We will evaluate the distribution of individual outcome values to determine whether linear models or Poisson models will be more appropriate. We will summarize predicted mean number of unmet needs overall and by domain along with the impact of variables described above (Independent Variables) on the mean, initially in univariable models **(Table 5).**

- For Aim 4, linear models will be used for domain scores (i.e., continuous outcomes), after examination of distributional assumptions. Predicted mean scores and impact of independent variables will be reported, initially from univariable models. **(Table 6)**

For Aims 2-4, based on the univariate model results, we will explore multivariable analyses, taking into consideration the overall relevance of variables, potential collinearities, model fit, and statistical significance in the univariate analyses. *(NOTE: additional tables and figures will be developed based on the results of the univariate analyses and plans for multivariable analyses).*

Analysis Considerations

To our knowledge, this analysis provides the largest, most detailed examination of unmet needs in adult survivors of childhood cancer. We included 5 of the 9 CCSS NAQ domains that focus on needs most related to access, quality, and costs of care. Therefore, we do not have updated information on the Psycho-emotional, Coping, General health, and Relationships domains. For the 5 domains we did assess, we will be able to compare our findings to those reported in the report of the CCSS NAQ's development and validation.[10]

It should be noted that the CCSS respondents to the needs assessment survey may not be representative of survivor populations more generally. In particular, we would expect that CCSS participants would be more engaged and more knowledgeable than survivors who have not been participating in a longitudinal cohort study focused on survivors. Thus, the level of unmet needs found in this analysis are likely substantially lower than the overall survivor population.

The results of these analyses will provide valuable insights to inform future intervention studies in the CCSS, and in childhood cancer survivors more generally. Identifying the issues that are most prevalent and have the greatest level of unmet need overall and by specific subgroups will enable us to deploy existing interventions to, and develop new interventions as required for, relevant populations.

Table 1. Demographic and Clinical Characteristics of Survivors Who Completed Needs assessment (N=10,248)

		N(%)
Current age	<39	
	40-49	
	50+	
Sex	Female	
	Male	
Race and ethnicity	Non-Hispanic White	
	Other race/Ethnicity	
	Unknown	
Education[1]	<College graduate	
	College graduate	
Household income[1]	<20,000	
	20,000-39,999	
	40,000-79,999	
	≥80,000	
	Unknown	
Marital status[2]	Married or living as married	
	Living alone	
	Unknown	
Private insurance[1]	Yes	
	No	
	Unknown	
Residence[3]	Metropolitan	
	Nonmetropolitan	
	Unknown	
Social vulnerability index	Quartile 1 (most vulnerable)	
	Quartile 2	
	Quartile 3	
	Quartile 4 (least vulnerable)	
Age at diagnosis	0-4 years	
	5-9 years	
	10-14 years	
	15-20 years	
Years since diagnosis	22-29	
	30-37	
	38-45	
	46-54	
Primary cancer diagnosis	Leukemia	
	Central nervous system tumor	
	Hodgkin lymphoma	
	Non-Hodgkin lymphoma	
	Wilms	

		N(%)
	Neuroblastoma	
	Soft tissue cancer	
	Bone cancer	
Chemotherapy	Any exposure	
	Anthracycline exposure	
	Alkylating agent exposure	
	Platinum exposure	
Radiation	Any exposure	
	Cranial exposure	
	Chest exposure	
	Abdomen/Pelvis exposure	
Surgery	Any surgery	
Chronic health conditions (based on CIRSG)[4]	Any severe or very severe	
	No severe or very severe	
	Unknown	

[1] Not captured in FU8, so based on last known

[2] Approximately 600 survivors did not complete a FU8 survey that asked about marital status, so data is based on last known

[3] Based on Rural-Urban Commuting Area (RUCA) codes of metropolitan vs. micropolitan/small town/rural

[4] If over half of the CIRSG is missing, we will consider the survivor as having unknown chronic health condition

Table 2. Description of the Prevalence and Timing of Unmet Needs Overall (N=10,248)

NOTE: needs will be listed from highest to lowest % of unmet need; each need will be color coded based on its domain

Unmet Need	N(%) with Any Unmet Need	N(%) with Low Unmet Need[1]	N(%) with Moderate Unmet Need[1]	N(%) with High Unmet Need[1]	N(%) of Unmet Need within the Last Year[1]

[1]Denominator is those with any unmet need. Within the last year includes "Current" and "<1 year ago".

Table 3. Descriptive Analysis of Unmet Needs: Prevalence, Burden, and by Domain Score

	In the Past Year	> 1 Year Ago
Prevalence of Any Unmet Need Overall and by Domain	**N(%) with Any Unmet Need**	
Overall		
Health System Concerns		
Cancer-related Health Information		
Survivor Care and Support		
Surveillance		
Fiscal Concerns		
Analysis of Burden at the Individual Survivor Level	**Mean (SD) of Number of Unmet Needs**	
Overall		
Health System Concerns		
Cancer-related Health Information		
Survivor Care and Support		
Surveillance		
Fiscal Concerns		
Analysis of Domain Scores	**Mean (SD) Domain Scores**	
Health System Concerns		
Cancer-related Health Information		
Survivor Care and Support		
Surveillance		
Fiscal Concerns		

Table 4. Univariate Analysis of Prevalence of Unmet Needs Overall and by Domain at the Individual Survivor Level by Socio-demographic and Clinical Variables

		Relative Risks (95% Confidence Intervals)					
Characteristic[1]		**Overall**	**Health System Concerns**	**Cancer-related Health Information**	**Survivor Care and Support**	**Surveillance**	**Fiscal Concerns**
Current age	<39	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
	40-49						
	50+						
Sex	Female (vs. Male)						
Race and ethnicity	Non-Hispanic White (vs. Other)						
Education	College graduate (vs. not)						
Household income	≥80,000 (vs. not)						
Marital status	Married or living as married (vs. not)						
Private insurance	Yes (vs. no)						
Residence	Metropolitan (vs. not)						
Social Vulnerability	Quartile 1 (most vulnerable)						
	Quartile 2						
	Quartile 3						
	Quartile 4 (least vulnerable)	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
Age at diagnosis	0-4 years	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
	5-9 years						
	10-14 years						
	15-20 years						
Years since diagnosis	22-29	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
	30-37						
	38-45						
	46-54						
Primary cancer diagnosis	Leukemia	*ref*	*ref*	*ref*	*ref*	*ref*	*ref*
	Central nervous system tumor						

		Relative Risks (95% Confidence Intervals)					
Characteristic[1]		**Overall**	**Health System Concerns**	**Cancer-related Health Information**	**Survivor Care and Support**	**Surveillance**	**Fiscal Concerns**
	Hodgkin lymphoma						
	Non-Hodgkin lymphoma						
	Wilms						
	Neuroblastoma						
	Soft tissue cancer						
	Bone cancer						
Chemotherapy	Any exposure (vs. none)						
	Anthracycline exposure (vs. none)						
	Alkylating agent exposure (vs. none)						
	Platinum exposure (vs. none)						
Radiation	Any exposure (vs. none)						
	Cranial exposure (vs. none)						
	Chest exposure (vs. none)						
	Abdomen/pelvis exposure (vs. none)						
Surgery	Any surgery (vs. none)						
Chronic health conditions (based on CIRSG)	Any severe or very severe (vs. none)						

Table 5. Univariate Analysis of Burden of Unmet Needs at the Individual Survivor Level by Socio-demographic and Clinical Variables

		Mean (SD) Number of Unmet Needs					
Characteristic[1]		**Overall**	**Health System Concerns**	**Cancer-related Health Information**	**Survivor Care and Support**	**Surveillance**	**Fiscal Concerns**
Current age	*a* <39						
	b 40-49						
	c 50+						
Sex	Female (vs. Male)						
Race and ethnicity	Non-Hispanic White (vs. Other)						
Education	College graduate (vs. not)						
Household income	≥80,000 (vs. not)						
Marital status	Married or living as married (vs. not)						
Private insurance	Yes (vs. no)						
Residence	Metropolitan (vs. not)						
Social Vulnerability	*a* Quartile 1 (most vulnerable)						
	b Quartile 2						
	c Quartile 3						
	d Quartile 4 (least vulnerable)						
Age at diagnosis	*a* 0-4 years						
	b 5-9 years						
	c 10-14 years						
	d 15-20 years						
Years since diagnosis	*a* 22-29						
	b 30-37						
	c 38-45						
	d 46-54						
Primary cancer diagnosis	*a* Leukemia						
	b Central nervous system tumor						

		Mean (SD) Number of Unmet Needs					
Characteristic[1]		**Overall**	**Health System Concerns**	**Cancer-related Health Information**	**Survivor Care and Support**	**Surveillance**	**Fiscal Concerns**
	c Hodgkin lymphoma						
	d Non-Hodgkin lymphoma						
	e Wilms						
	f Neuroblastoma						
	g Soft tissue cancer						
	h Bone cancer						
Chemotherapy	Any exposure (vs. none)						
	Anthracycline exposure (vs. none)						
	Alkylating agent exposure (vs. none)						
	Platinum exposure (vs. none)						
Radiation	Any exposure (vs. none)						
	Cranial exposure (vs. none)						
	Chest exposure (vs. none)						
	Abdomen/pelvis exposure (vs. none)						
Surgery	Any surgery (vs. none)						
Chronic health conditions (based on CIRSG)	Any severe or very severe (vs. none)						

[1] Italicized letters assigned to each variable category. Italicized letters after mean(SD) indicate that the mean differs significantly (P<0.05 after Bonferonni correction) from the mean of the category indicated by the letter.

* P<0.05 in univariable regression models.

Table 6. Univariate Analysis of Mean (SD) Domain Scores by Socio-demographic and Clinical Variables

		Mean (SD) Domain Score				
Characteristic[1]		**Health System Concerns**	**Cancer-related Health Information**	**Survivor Care and Support**	**Surveillance**	**Fiscal Concerns**
Current age	*a* <39					
	b 40-49					
	c 50+					
Sex	Female (vs. Male)					
Race and ethnicity	Non-Hispanic White (vs. Other)					
Education	College graduate (vs. not)					
Household income	≥80,000 (vs. not)					
Marital status	Married or living as married (vs. not)					
Private insurance	Yes (vs. no)					
Residence	Metropolitan (vs. not)					
Social Vulnerability	*a* Quartile 1 (most vulnerable)					
	b Quartile 2					
	c Quartile 3					
	d Quartile 4 (least vulnerable)					
Age at diagnosis	*a* 0-4 years					
	b 5-9 years					
	c 10-14 years					
	d 15-20 years					
Years since diagnosis	*a* 22-29					
	b 30-37					
	c 38-45					
	d 46-54					
Primary cancer diagnosis	*a* Leukemia					
	b Central nervous system tumor					
	c Hodgkin lymphoma					

		Mean (SD) Domain Score				
Characteristic[1]		**Health System Concerns**	**Cancer-related Health Information**	**Survivor Care and Support**	**Surveillance**	**Fiscal Concerns**
	d Non-Hodgkin lymphoma					
	e Wilms					
	f Neuroblastoma					
	g Soft tissue cancer					
	h Bone cancer					
Chemotherapy	Any exposure (vs. none)					
	Anthracycline exposure (vs. none)					
	Alkylating agent exposure (vs. none)					
	Platinum exposure (vs. none)					
Radiation	Any exposure (vs. none)					
	Cranial exposure (vs. none)					
	Chest exposure (vs. none)					
	Abdomen/pelvis exposure (vs. none)					
Surgery	Any surgery (vs. none)					
Chronic health conditions (based on CIRSG)	Any severe or very severe (vs. none)					

[1] Italicized letters assigned to each variable category. Italicized letters after mean(SD) indicate that the mean differs significantly ($P<0.05$ after Bonferonni correction) from the mean of the category indicated by the letter.

* $P<0.05$ in univariable regression models.

REFERENCES

1. Gibson TM, Mostoufi-Moab S, Stratton KL, et al: Temporal patterns in the risk of chronic health conditions in survivors of childhood cancer diagnosed 1970-99: a report from the Childhood Cancer Survivor Study cohort. Lancet Oncol 19:1590-1601, 2018
2. Oeffinger KC, Mertens AC, Sklar CA, et al: Chronic health conditions in adult survivors of childhood cancer. N Engl J Med 355:1572-82, 2006
3. Hayek S, Gibson TM, Leisenring WM, et al: Prevalence and Predictors of Frailty in Childhood Cancer Survivors and Siblings: A Report From the Childhood Cancer Survivor Study. J Clin Oncol 38:232-247, 2020
4. Armstrong GT, Yasui Y, Robison LL: Reduction in Late Mortality after Childhood Cancer. N Engl J Med 375:290-2, 2016
5. Yan AP, Chen Y, Henderson TO, et al: Adherence to Surveillance for Second Malignant Neoplasms and Cardiac Dysfunction in Childhood Cancer Survivors: A Childhood Cancer Survivor Study. J Clin Oncol:JCO1901825, 2020
6. Caplin DA, Smith KR, Ness KK, et al: Effect of Population Socioeconomic and Health System Factors on Medical Care of Childhood Cancer Survivors: A Report from the Childhood Cancer Survivor Study. J Adolesc Young Adult Oncol 6:74-82, 2017
7. Nathan PC, Ford JS, Henderson TO, et al: Health behaviors, medical care, and interventions to promote healthy living in the Childhood Cancer Survivor Study cohort. J Clin Oncol 27:2363-73, 2009
8. Ford JS, Tonorezos ES, Mertens AC, et al: Barriers and facilitators of risk-based health care for adult survivors of childhood cancer: A report from the Childhood Cancer Survivor Study. Cancer 126:619-627, 2020
9. Bhatia S, Gibson TM, Ness KK, et al: Childhood cancer survivorship research in minority populations: A position paper from the Childhood Cancer Survivor Study. Cancer 122:2426-39, 2016
10. Cox CL, Sherrill-Mittleman DA, Riley BB, et al: Development of a comprehensive health-related needs assessment for adult survivors of childhood cancer. J Cancer Surviv 7:1-19, 2013
11. Cox CL, Zhu L, Ojha RP, et al: The unmet emotional, care/support, and informational needs of adult survivors of pediatric malignancies. J Cancer Surviv 10:743-58, 2016
12. Zou G. A modified Poisson regression approach to prospective studies with binary data. Am J Epidemiol 159:702–6, 2004