



Impact of COVID-19 pandemic on a large cohort of adult survivors of childhood cancer

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Abstract

Childhood cancer survivors may be differentially impacted by coronavirus disease 2019 (COVID-19). From April to June of 2020, we examined psychosocial/health concerns in 4148 adult survivors and 571 siblings. Although more survivors reported concerns about getting sick ($p = .002$) and needing hospitalization ($p = .003$) in general, survivors and siblings were comparably concerned about being infected with and the consequences of COVID-19. Cranial radiation was associated with social isolation (relative risk [RR] = 1.3, CI = 1.1–1.7), and central nervous system (CNS) tumors were associated with unemployment due to COVID-19 (RR = 1.7, CI = 1.2–2.2). Some survivors appear more vulnerable and may require more support to meet health care and vocational needs during COVID-19, though siblings also perceive substantial risk.

KEYWORDS

childhood cancer survivor, COVID-19, health concerns, psychosocial impact

1 | INTRODUCTION

Long-term childhood cancer survivors are at risk for chronic health conditions,¹ neurocognitive impairment,² limited physical mobility,³ psychosocial problems,⁴ financial toxicity,⁵ and early mortality. They often require higher frequency and complexity of medical care and supportive services and demonstrate lower educational attainment and employment.^{2,6} Such factors may result in survivors being more vulnerable to environmental stressors associated with the coronavirus disease 2019 (COVID-19) pandemic compared to the general population.

Childhood cancer survivors report more emotional distress than siblings,⁴ and limited access to health care and social support associated with the COVID-19 pandemic may exacerbate the emotional distress survivors already experience. To compound these stressors, survivors are at greater risk for lower educational attainment, which may result in employment in jobs that are vulnerable to economic

downturns.⁷ Lastly, some of the more prevalent chronic health conditions among survivors, including hypertension, diabetes, and pulmonary dysfunction, place them at higher risk for serious and life-threatening complications resulting from COVID-19 infection.

The current study presents results of a web-based survey of a large sample of long-term childhood cancer survivors and siblings of survivors enrolled in the Childhood Cancer Survivor Study (CCSS). The survey was conducted from April 13 to June 9, 2020 during the initial months of the COVID-19 pandemic.

2 | METHODS

2.1 | Participants

Participants were recruited from CCSS, a retrospectively identified cohort of survivors treated at one of the 31 institutions in North America between 1970 and 1999, who were ≥ 5 years from diagnosis at cohort recruitment.⁸ A sample of siblings of randomly identified

Abbreviations: CCSS, Childhood Cancer Survivor Study; CI, confidence interval; CNS, central nervous system; COVID-19, coronavirus disease 2019; CTCAE, Common Terminology Criteria for Adverse Events; RR, relative risk.

survivors is also included in the cohort. Participants are followed prospectively with serial surveys of physical, behavioral, and social factors. For the current study, survivors and siblings were asked to complete a brief web-based survey of psychosocial function and coping. Eligible participants included 7367 survivors and 945 siblings who previously downloaded a long-term follow-up app developed for CCSS. The survey was made available for 2 months, during which time 4148 survivors (56.3%) and 571 siblings (60.4%) submitted responses. Among survivors, nonresponders were more likely to be male (49.7% vs. 43.2%), less likely to be non-Hispanic White (81.1% vs. 86.3% White non-Hispanic), and more likely diagnosed with central nervous system (CNS) tumor (17.0% vs. 12.7%).

As all participants are part of the established CCSS cohort, existing data from prior medical record abstraction were used to identify cancer diagnosis and treatment exposures in survivors. Survivors and siblings completed the follow-up 5 survey to report on symptoms and patterns of chronic health conditions. These reports were taken from the most recent survey and graded using the Common Terminology Criteria for Adverse Events (CTCAE) version 4.03, with grades 1–4 (mild, moderate, severe, or life-threatening, respectively) coded by organ system.⁹

2.2 | Survey questions

Participants completed a brief 24-item web-based survey comprised of questions previously used in the CCSS cohort (<https://ccss.stjude.org/tools-and-documents/questionnaires.html>) and questions taken from published resources. Demographic and social attainment items included changes in employment status, recent hospitalizations, and household size. Questions related to general psychosocial function were taken from the PROMIS item banks for Social Roles/Activities, Emotional Distress-Anxiety, Emotional Impact, Emotional Well-Being, Positive Affect, Perceived Stress, Social Isolation, and Self Efficacy.¹⁰ Questions were also selected from a survey of COVID-19-related risk perception and coping in the general population.¹¹

2.3 | Statistical analyses

Descriptive statistics characterized survivors and siblings. Among survivors, cancer treatment was dichotomized (yes/no). Maximum grade of CTCAE conditions were identified by organ system and dichotomized (grades 2–4 vs. <2). All psychosocial and coping survey items were asked using their standard 5-point Likert scale. Responses in the two most problematic scale ratings were identified as impaired. Frequency of impairment, unemployment, and general health measures were compared between survivors and siblings using multivariable generalized linear models with a log-link and robust sandwich variances both overall and by diagnosis, adjusting for age, sex, race, and household size. Where numbers were small, Fisher's exact tests were used. Among survivors, associations between treatment and CTCAE conditions with employment, general health, and psychosocial outcomes were examined in separate models, adjusted for age, sex, race, and household size. *p*-Values are not adjusted for multiple comparisons.

3 | RESULTS

Survivors (56.8% female; median [interquartile range] age 41 [35–49] years) were comparable to siblings (59.5% female, age 46 [38–53] years), though had higher frequency of chronic health conditions.

Compared with siblings, more survivors reported concerns about getting sick (relative risk [RR] = 1.5, 95% confidence interval [CI] = 1.1–1.9), needing to go to the hospital (RR = 1.9, CI = 1.2–3.0), feeling left out of social interactions (RR = 1.4, CI = 1.0–2.0), and expectations of worsening health (RR = 1.5, CI = 1.2–1.8) (Table 1). Survivors and siblings were equally worried about COVID-19 (41.9% vs. 44.6%, *p* = 0.14), including becoming infected (32.4% vs. 30.4%, *p* = 0.62). More survivors reported being admitted to the hospital in the past 4 months (RR = 2.3, CI = 1.4–3.8), with eight survivors and no siblings having a COVID-19-related admission, and slightly more reported being laid off or unemployed due to COVID-19 (RR = 1.3, CI = 1.0–1.6), most elevated for those diagnosed with CNS tumors (RR = 1.7, CI = 1.2–2.2) or Hodgkin lymphoma (RR = 1.5, CI = 1.1–2.1) compared to siblings.

Among survivors, those treated with chest radiation were more likely to be concerned about needing to go to the hospital (RR = 1.6, CI = 1.1–2.2) and their future health (RR = 1.3, CI = 1.2–1.4) (Table S1). Survivors treated with cranial radiation reported more feelings of being left out (RR = 1.3, CI = 1.1–1.7). Psychosocial problems were associated with chronic health conditions, particularly cardiac and neurologic conditions (Figure 1). Higher COVID-19-related unemployment was identified in survivors treated with cranial radiation (RR = 1.3, CI = 1.1–1.5) and those reporting neurologic chronic conditions (RR = 1.7, CI = 1.4–2.0).

4 | DISCUSSION

In the midst of the COVID-19 pandemic, which has limited access to health care, economic resources, and social interactions, we found long-term survivors of childhood cancer report greater stress over future status and general health needs, though both survivors and siblings were comparably concerned about being exposed to and the consequences of COVID-19 infection. Long-term survivors of childhood cancer are a vulnerable population, more prone to chronic conditions than their siblings. It is thus surprising that they are not more concerned about COVID than their siblings. Unemployment due to COVID-19 was identified more often by survivors of CNS tumors, those treated with cranial radiation, and those who develop neurologic chronic conditions. These brain-based cancer-related factors are more frequently associated with neurocognitive problems and subsequently lower educational attainment,² both of which increase the likelihood of being employed in jobs that may be more vulnerable to economic fluctuations.¹²

Although more survivors reported concerns over social exclusion impact from COVID-19 on employment compared to siblings, they did not report more general fears or worries during this pandemic. This is consistent with an earlier report that nearly one-third of long-term

TABLE 1 Frequency and relative risks of symptoms reported by survivors and siblings

	Survivors Imp N (%)	Siblings Imp N (%)	RR (95% CI)	p-Value
I felt fearful	425 (10.3)	44 (7.7)	1.3 (0.9, 1.7)	.11
My worries overwhelmed me	341 (8.2)	30 (5.3)	1.3 (0.9, 1.9)	.12
I can keep up with my work and responsibilities (include work at home)	192 (4.6)	17 (3)	1.4 (0.9, 2.3)	.18
How much did you worry about getting sick?	675 (16.3)	59 (10.4)	1.5 (1.1, 1.9)	.002
How often were you worried about needing to go to the hospital?	283 (6.9)	20 (3.5)	1.9 (1.2, 3.0)	.003
I felt hopeful	476 (11.5)	51 (8.9)	1.2 (0.9, 1.6)	.24
How often have you felt nervous or "stressed"?	1464 (35.4)	189 (33.2)	1.0 (0.9, 1.1)	.56
I feel left out	420 (10.1)	37 (6.5)	1.4 (1.0, 2.0)	.030
I feel isolated from others	872 (21.0)	98 (17.2)	1.1 (0.9, 1.4)	.21
Please rate how concerned you are about your future health	1744 (42.2)	175 (30.7)	1.4 (1.2, 1.6)	<.001
I expect my health to get worse	948 (22.9)	95 (16.7)	1.5 (1.2, 1.8)	<.001
If I need help, I can find someone to take me to the doctor's office	179 (4.3)	13 (2.3)	1.7 (1.0, 3.0)	.062
How likely do you think it is that you might become infected with COVID-19 in the near future?	480 (11.6)	62 (10.9)	0.9 (0.7, 1.2)	.67
How likely do you think it is that people in your family and friends might become infected with COVID-19?	663 (16.1)	102 (17.9)	0.8 (0.7, 1.0)	.039
How likely do you think it is to get COVID-19?	1118 (27.2)	146 (25.7)	0.9 (0.8, 1.1)	.48
If I become infected with COVID-19, I could die	1416 (34.3)	202 (35.4)	1.0 (0.9, 1.2)	.68
COVID-19 worries me	1729 (41.9)	254 (44.6)	0.9 (0.8, 1.0)	.14
I am afraid of being infected by COVID-19	1336 (32.4)	173 (30.4)	1.0 (0.9, 1.2)	.62
Have you been admitted to the hospital in the past 4 months for any reason?	270 (6.5)	18 (3.2)	2.3 (1.4, 3.8)	.001
The reason for this hospitalization was related to COVID-19	8 (0.2)	0	NA	.61 ^a
Have you been recently laid off or unemployed due to COVID-19 (novel coronavirus)?	666 (16.5)	67 (12.3)	1.3 (1.0, 1.6)	.051
Have you been exposed to someone close (i.e., family member, friend, coworker) who has been diagnosed with COVID-19?	275 (6.7)	34 (6)	1.0 (0.7, 1.5)	.94
Have you been told by a doctor or other health care worker that you have or have had COVID-19?	38 (0.9)	3 (0.5)	NA	.47 ^a

Note: Imp, impaired on item as reflected by a response in one of the two most extreme scores. Relative risk (RR), 95% confidence intervals (CI), and p-value adjusted for age, sex, race, and household size except where indicated by^a. NA, relative risk not able to be calculated.

^ap-Value from Fisher's exact test.

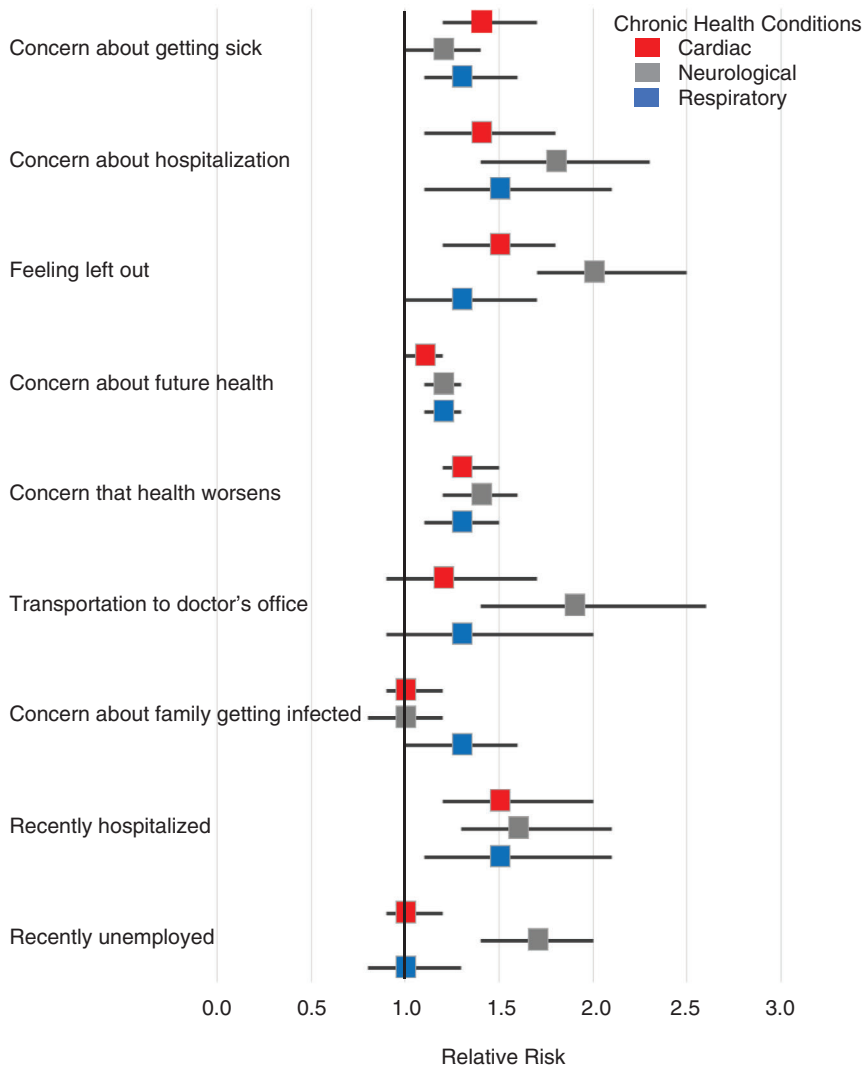


FIGURE 1 Relative risk of significant concerns about getting sick, needing to go to the hospital, feeling left out of social interactions, future health status, health getting worse, having someone available to drive to the doctor's office, and having a family member infected by COVID-19, as well as risk for recently being admitted to the hospital and being unemployed due to COVID-19. Risk ratios presented for moderate/severe/life-threatening chronic health conditions compared to mild/no conditions for cardiac, neurological, and respiratory systems

adult survivors of childhood cancer were not concerned about their future health.¹³ Also, fewer survivors reported concerns about themselves or family members getting COVID-19 compared to their siblings. This pattern may be due to heightened fears and worries over COVID-19 in the broader population,¹⁴ as well as siblings reporting greater concern for their sibling survivor.

Long-term survivors of childhood cancer require higher frequency and complexity of health care,⁶ services that are more difficult to obtain during this pandemic.¹⁵ Survivors are more likely to experience conditions like cardiopulmonary disease, and may be at greater risk to consequences of COVID. They also experience more economic problems and require increased vocational support, particularly those survivors who may be experiencing neurologic and cognitive impairment.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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