

6 Socioeconomic Outcomes of Childhood Cancer Survivors in India: A Cross-Sectional Study From a Tertiary Care Childhood Cancer Survivorship Program

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ABSTRACT

PURPOSE Childhood cancer has high cure rates; however, data on long-term socioeconomic challenges faced by survivors, particularly in low- and middle-income countries, are limited. We aimed to identify issues related to educational disruption, employment, and financial hardship among childhood cancer survivors.

METHODS We conducted a cross-sectional study of survivors enrolled in the Childhood Cancer Survivorship Program at a tertiary cancer center in India (December 2020–March 2025). Eligible survivors were aged 21 years and younger at diagnosis and had completed therapy. Clinical and sociodemographic data were abstracted from records and structured proforma. Logistic regression with forward stepwise modeling was used to identify predictors of educational, financial, and employment challenges.

RESULTS We included 1,098 survivors. The median age was 16 years at evaluation, and 74.7% were male. Among those diagnosed at age 5–21 years ($n = 764$), 85% reported educational disruption (median 1.75 years). Relocation from the hometown for therapy (odds ratio [OR], 1.8; $P = .01$) and job loss within the family (OR, 2.1; $P = .01$) independently predicted educational disruption, whereas maternal education until or above high school was associated with lower odds of educational disruption (OR, 0.29; $P = .001$). Catastrophic health expenditure occurred in 91.3%. Younger age at diagnosis (OR, 1.03; $P = .003$) and relocation (OR, 1.61; $P = .001$) independently predicted higher treatment costs, $\geq \$3,385$ US Dollars. Cancer-related employment difficulties affected 30.2% of working-age survivors, with older age at diagnosis (OR, 1.15; $P < .001$) and longer time since treatment completion (OR, 1.08; $P = .02$) being independent predictors.

CONCLUSION For Indian childhood cancer survivors, cure carries hidden costs of disrupted education, financial strain, and workplace barriers. Survivorship care in resource-constrained settings should integrate school reintegration, financial protection, and vocational support.

ACCOMPANYING CONTENT

 [Data Supplement](#)

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INTRODUCTION

Advancements in the diagnosis and management of childhood cancers have led to remarkable improvements in survival rates, with long-term survival now exceeding 80% in developed nations. Consequently, there is a growing population of childhood cancer survivors.^{1–3} Similar temporal improvements in treatment outcomes are also being observed in resource-limited settings like India.^{4,5} However,

survival often comes at the cost of long-term socioeconomic disadvantage. A 2024 meta-analysis of 280 studies including nearly 390,000 childhood cancer survivors worldwide reported that survivors consistently have lower odds of completing secondary or tertiary education, higher unemployment, and delays in family formation compared with their peers.⁶ Evidence from large, population-based cohorts in high-income countries (HICs) reinforces these findings: the US Childhood Cancer Survivor Study has documented

CONTEXT

Key Objective

To evaluate the burden and predictors of educational disruption, financial hardship, and employment difficulties among childhood cancer survivors enrolled in a structured survivorship program at a tertiary care center in India.

Knowledge Generated

In this cross-sectional study of 1,098 survivors, socioeconomic challenges were substantial. Among survivors diagnosed at age 5-21 years, 85% reported educational disruption, with a median interruption of 1.75 years, and 3.1% never resumed education. Among families with available expenditure and income data, 91.3% experienced catastrophic health expenditure. Nearly one third of working-age survivors reported cancer-related employment difficulties. Relocation for treatment and family job loss were associated with higher odds of educational disruption, whereas younger age at diagnosis and relocation predicted higher treatment expenditure.

Relevance

For childhood cancer survivors in India, cure is often accompanied by major educational, financial, and occupational consequences. Survivorship care in low-resource settings should incorporate school reintegration, financial protection, and vocational support.

enduring gaps in education, employment, insurance coverage, and marriage, whereas Nordic register studies (SALiCCS/ALiCCS) reveal reduced secondary school completion and greater reliance on social welfare benefits among survivors of childhood cancer.^{7,8} On the other hand, data from low- and -middle income countries (LMICs) pertaining to socioeconomic challenges faced by childhood cancer survivors remain limited. This context is particularly relevant in India, where health care financing relies heavily on out-of-pocket expenditure.⁹ Although treatment at publicly funded tertiary hospitals is highly subsidized, families often incur substantial nonmedical costs, including travel, accommodation, and supportive care.^{10,11} Insurance coverage has historically been limited although recent initiatives, such as Ayushman Bharat-Pradhan Mantri Jan Arogya Yojana (AB-PMJAY), launched in 2018, aim to expand publicly funded hospitalization coverage for economically vulnerable households.¹² Therefore, there is an urgent need to systematically measure and address these socioeconomic vulnerabilities. Such evidence is critical to inform targeted interventions and strengthen survivorship care.

The Department of Medical Oncology, Dr B.R.A. IRCH, All India Institute of Medical Sciences, New Delhi (AIIMS), runs a comprehensive and structured Childhood Cancer Survivorship Program (CCSP). This multidisciplinary initiative supports survivors from the end of treatment into long-term follow-up, offering holistic care that includes relapse surveillance, growth and nutrition monitoring, screening for late effects, immunization, psychological support, and quality-of-life assessments. As part of the CCSP at our institution, we sought to understand the socioeconomic challenges faced by survivors in a systematic way. We conducted this study to assess the prevalence and predictors of disruptions in education, financial hardships, and cancer-

related employment difficulties encountered during and after treatment by survivors.

METHODS

Study Design and Setting

This is a cross-sectional study of childhood and adolescent cancer survivors enrolled in the CCSP between December 1, 2020, and March 31, 2025.

Study Population

Eligible participants had a confirmed malignancy diagnosed at age ≤ 21 years, had completed all anticancer therapies, and had provided written informed consent (or parents/caregivers for those younger than 18 years, with assent from children 7 years and older). Survivors who declined consent or were unwilling to participate in long-term follow-up were excluded. The CCSP is registered with the Clinical Trials Registry of India (CTRI/2020/09/028093). The study was approved by the Institutional Ethics Committee (IEC-957/04.09.2020, RP-28/2020). Written informed consent was obtained from participants (or parents/caregivers for those younger than 18 years, with assent from children 7 years and older) for proforma and psychological assessments.

Data Collection

Baseline clinical and demographic information was obtained from clinic records at the time of entry into CCSP and supplemented, where available, with data from CanKids KidsCan, a national nongovernmental organization dedicated to childhood cancer care and support. The variables

collected included age at diagnosis, sex, primary diagnosis, cancer type (hematologic or solid), chemotherapy details, receipt and site of radiotherapy, age at proforma administration, and time since completion of therapy.

Residential status (urban or rural) was determined based on the patient's address, as defined in the National Census of India 2011.¹³ Distance of residence from the treating center (AIIMS, New Delhi) was estimated using Google Maps, assigning a minimum distance of 20 km for patients residing within Delhi. Distances were categorized as <100 km or ≥100 km, with the latter cutoff chosen based on the assumption that travel beyond 100 km generally necessitates an overnight stay and imposes higher out-of-pocket costs for families.

Family-level socioeconomic variables were extracted from the CanKids KidsCan database, which routinely documents parental education, paternal occupation, and monthly household income for children undergoing cancer treatment. Parental education was classified as <high-school or ≥high-school level. Paternal occupation was categorized according to the modified Kuppusswamy scale as professional/semiprofessional versus nonprofessional (clerical/shop/farm, skilled, semiskilled, unskilled, or unemployed).¹⁴ Monthly family income was recorded as reported in the database.

Socioeconomic data were collected through a structured proforma (see the Data Supplement Material, Appendix S1) developed as part of the CCSP at our institution, which is used for consistent documentation of survivorship-related outcomes. The proforma assessed socioeconomic challenges across three key domains: education, financial burden, and employment, along with an additional item to identify relocation from the hometown for seeking treatment. Detailed definitions and variable specifications for educational disruption, financial burden, and employment-related outcomes are provided in Data Supplement Material S2 (Supplementary methods).

Data were compiled onto Excel spreadsheet (Microsoft, Redmond, USA), and the analyses were performed using Stata version 14.1 (StataCorp, College Station, TX). Categorical variables were summarized as frequencies and percentages, and continuous variables as medians (IQR) or means (SD), as appropriate. Associations between clinical or sociodemographic factors and outcomes were explored using univariable and multivariable logistic regression. Candidate predictor variables for the regression models included age at diagnosis, sex, cancer type, residential location, distance from hospital, relocation for treatment, time since completion of therapy, and job loss in the family during treatment. Outcomes assessed included the occurrence of educational disruption, incurring high treatment costs (≥\$3,385 US dollars [USD]) and the presence of difficulties related to employment, all of which are represented in a dichotomous fashion (yes/no). For the subgroup of survivors

age 5–21 years with parental information available, maternal and paternal education and father's occupation were also included in a separate multivariable analysis for the outcome of educational disruption. Multivariable modeling used forward stepwise logistic regression, with variables eligible for entry if their *P*-values were <.10 and removed if ≥.10. Results are presented as odds ratios (ORs) with 95% CIs, and a two-sided *P* value <.05 was considered statistically significant. Records with missing data for any covariate were excluded by listwise deletion.

RESULTS

Baseline Clinical and Socioeconomic Characteristics

Of 1,260 survivors screened in the survivorship clinic, 1,098 were included in the final analysis (Fig 1). The median age at diagnosis was 8 years (IQR, 4–13), and that at assessment was 16 years (IQR, 12–21), with a median off-therapy follow-up period of 5.8 years (IQR, 2.6–9). The cohort was predominantly male (*n* = 820; 74.7%) and urban (*n* = 278; 66.4%), with more than half (*n* = 612; 55.7%) residing over 100 km from the treating center (median distance 139 km; IQR, 20–676). Hematologic cancers accounted for two thirds of cases, predominantly acute lymphoblastic leukemia (*n* = 285; 26%) and Hodgkin lymphoma (*n* = 209; 19%), whereas the main solid tumors were retinoblastoma (*n* = 100; 9.1%), primitive neuroectodermal tumors (*n* = 67; 6.1%), and soft tissue sarcomas (*n* = 60; 5.5%). Among 422 families with available data, the median monthly income was approximately \$96 USD (Indian Rupee [INR] 8,500), IQR, 79–135 (7,000–12,000). More than two thirds of mothers and fathers received high school education or less, and 21% (*n* = 96) of mothers and 8% (*n* = 36) of fathers had received no formal education. Most fathers (*n* = 405; 91.6%) were employed in nonprofessional occupations, whereas only 8.4% (*n* = 37) held professional or semiprofessional roles. No mothers reported employment in professional or semiprofessional occupations. The baseline characteristics of the study cohort are summarized in Table 1.

The baseline characteristics of the subgroups analyzed for different socioeconomic outcomes (baseline family income, treatment expenditure, educational disruption, and employment issues) were broadly similar to those of the overall cohort. However, data completeness varied across these socioeconomic variables. Family income data were available for 422 survivors (38.4% of the cohort), maternal education for 457 (41.6%), paternal education for 452 (41.2%), and paternal occupation for 442 (40.3%). Analysis of catastrophic health expenditure, which required both income and treatment expenditure data, was available for 389 survivors (see Data Supplement S1, Table S1).

Social and Economic Outcomes of Cancer Care

Among 764 survivors diagnosed between age 5 and 21 years, educational disruption was reported in 85% (*n* = 649), most frequently during primary (*n* = 263; 34.4%) and secondary

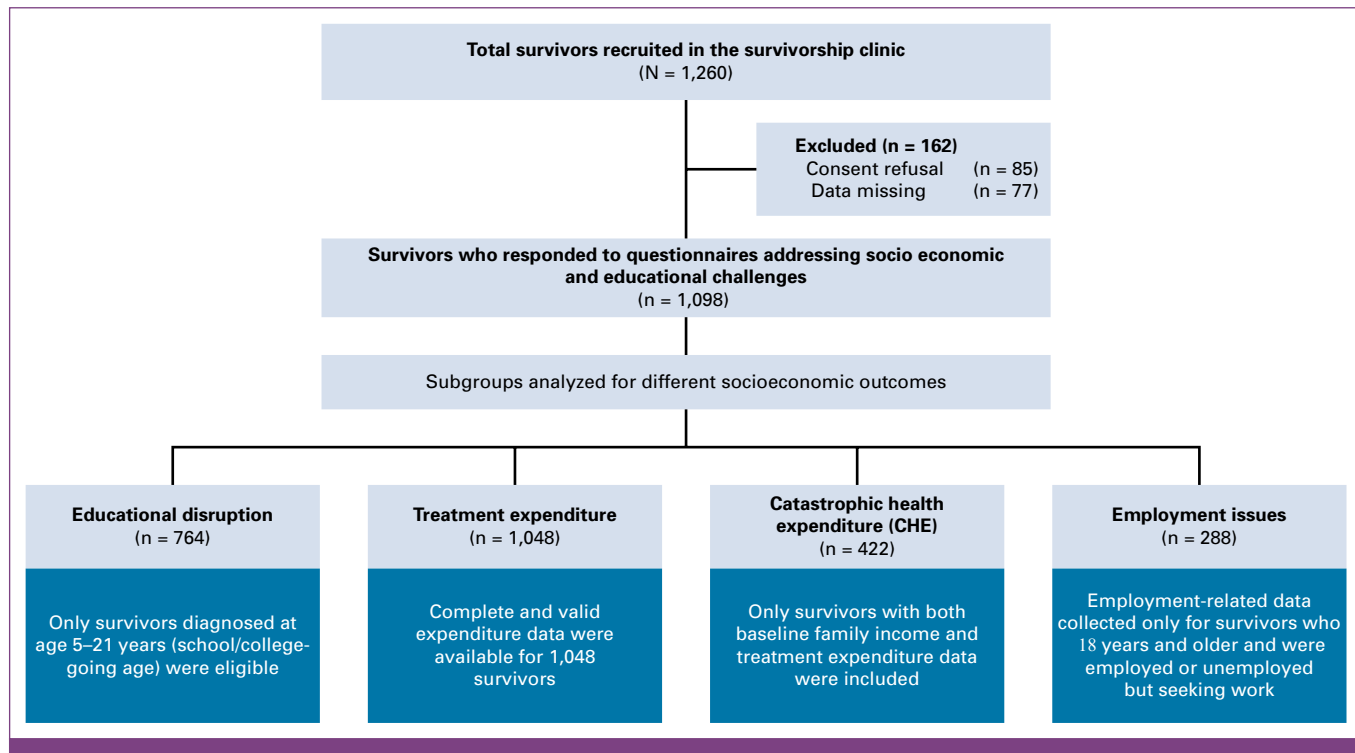


FIG 1. Study profile. Of 1,260 survivors screened, 162 were excluded (85 declined consent, 77 because of incomplete data), leaving 1,098 for final analysis. Subgroups were analyzed for educational disruption ($n = 764$; age 5-21 years), treatment expenditure ($n = 1,048$), catastrophic health expenditure ($n = 422$), and employment issues ($n = 288$).

($n = 279$; 36.5%) schooling, with 10.9% ($n = 83$) affected at the university level. A minority of survivors ($n = 24$; 3.1%) never resumed education. The median duration of interruption was 1.75 years (IQR, 1–2). Hematologic malignancies accounted for most interruptions (89%; Table 2 and Data Supplement S1, Fig S1).

Among 1,048 survivors with available financial data, nearly half of the families (50.9%) incurred treatment expenses exceeding \$3,385 USD (INR 300,000), with a median expenditure of \$3,385 USD (INR 300,000), IQR 1,692–5,641 (150,000–500,000). Costs were notably higher in acute leukemia, with both ALL and AML cohorts showing a median expenditure of \$3,385 USD (INR 300,000), IQR, 2,257–5,641 (200,000–500,000; see Data Supplement 1, Fig S2). Costs were primarily met through personal income or savings in 47.4% ($n = 520$) families, followed by borrowing from relatives ($n = 296$; 27%) and loans ($n = 283$; 25.8%). Asset liquidation was required in 294 families (26.8%), most commonly through sale of land ($n = 132$; 12%) or jewelry ($n = 103$; 9.4%). Job loss during treatment was reported in 272 households (26.6%). Among 389 survivors with available data on baseline family income and treatment expenditure, catastrophic health expenditure was documented in 91.3% (355 of 389 survivors; Table 2).

Among participants who were employed or unemployed but seeking work, 30.2% (87 of 288 survivors) reported cancer-

related employment difficulties. The issues identified included rejection during job interviews ($n = 29$), limited opportunities for career progression ($n = 41$), insufficient cancer awareness in the workplace ($n = 17$), concerns about disclosing their cancer history ($n = 17$), and workplace discrimination ($n = 10$). Relocation for treatment was reported by 77.1% ($n = 736$) of survivors (Table 2).

Predictors of Social and Economic Outcomes

On multivariable analysis, relocation from the hometown for therapy and job loss within the family were independently associated with higher odds of educational disruption (OR, 1.8 [95% CI, 1.1 to 2.7]; $P = .01$ and OR, 2.1 [95% CI, 1.2 to 3.7]; $P = .01$, respectively; Table 3).

For financial outcomes, younger age at diagnosis was significantly associated with higher treatment expenditure ($\geq \$3,385$ USD [INR 300,000]; OR, 1.03 [95% CI, 1.01 to 1.06]; $P = .003$). In addition, relocation from the hometown for therapy further emerged as an independent predictor of higher treatment costs (OR, 1.61 [95% CI, 1.22 to 2.13]; $P = .001$; Table 4). In the cohort with available baseline family income data, catastrophic health expenditure was reported in 91.3% of families. On multivariable analysis, no demographic or clinical factors were significantly associated with catastrophic health expenditure (Data Supplement S1, Table S2).

TABLE 1. Baseline Characteristics of Childhood Cancer Survivors (n = 1,098)

Patient Characteristic	n = 1,098
Age at diagnosis (years), median (IQR)	8 (4-13)
Age at administration of proforma	16 (12-21)
Time since completion of therapy (years), median (IQR)	5.8 (2.6-9)
Sex, No. (%)	
Male	820 (74.7)
Female	278 (25.3)
Residence type ^c	
Urban	729 (66.4)
Rural	367 (33.6)
Distance from hospital ^c (km), median (IQR)	139 (20-676)
>100 km, No. (%)	612 (55.7)
<100 km, No. (%)	486 (44.3)
Baseline diagnosis, No. (%)	
Hematologic malignancies	745 (67.8)
Acute lymphoblastic leukemia	285 (26)
Hodgkin lymphoma	209 (19.0)
Non-Hodgkin lymphoma	119 (10.8)
Acute myeloid leukemia	102 (9.3)
Langerhans cell histiocytosis	30 (2.7)
Solid malignancies	353 (32.2)
Retinoblastoma	100 (9.1)
Primitive neuroectodermal tumor	67 (6.1)
Osteosarcoma	59 (5.4)
Soft tissue sarcoma	60 (5.5)
Others ^a	67 (6.1)
Family-related variables	
Family monthly income, median (IQR, n = 422)	\$96 USD (79-135) (INR 8,500 [7,000-12,000])
Mother education, No. (%; 457)	
High school and below	326 (71.3)
Above high school	131 (28.7)
Mother occupation, No. (%; 414)	
Professional/semiprofessional	0 (0)
Nonprofessional ^b	414 (100)
Father education, No. (%; 452)	
High school and below	299 (66.1)
Above high school	153 (33.9)
Father occupation, No. (%; 442)	
Profession/semiprofessional	37 (8.4)
Nonprofessional ^b	405 (91.6)

NOTE. Data are presented as median (IQR) or No. (%). Family-related variables were available for subsets (income, n = 422; maternal education, n = 457; paternal education, n = 452; paternal occupation, n = 442).

Abbreviations: INR, Indian national rupee; USD, US dollar.

^aOther tumors include neuroblastoma (n = 14), germ cell tumor (n = 26), Wilms tumor (n = 17), ependymoma (n = 1), Rosai-Dorfman disease (n = 1), hepatocellular carcinoma (n = 1), medulloblastoma (n = 1), atypical teratoid/rhabdoid tumor (n = 1), clear cell sarcoma of the kidney (n = 1), pleuropulmonary blastoma (n = 2), and pilocytic astrocytoma (n = 1).

^bClerical, shop owner, skilled worker, semiskilled worker, unskilled worker, or unemployed.

^cResidence data available for 1,096 survivors.

TABLE 2. Socioeconomic Challenges Among Childhood Cancer Survivors

Educational Outcome ^a	Survivors (N = 1,098)
Education disruption, No. (%)	649 (85)
Primary education	263 (34.4)
Secondary education	279 (36.5)
University	83 (10.9)
Did not get back to education	24 (3.1)
No education disruption, No. (%)	115 (15.1)
Median duration of education disruption (years), median (IQR) (n = 604)	1.75 (1-2)
Financial burden	
Total expenditure on treatment ^b (/INR ^a), median (IQR)	3 (1.5-5)
<\$3,385 USD (INR 300,000)	515 (49.1)
≥\$3,385 USD (INR 300,000)	533 (50.9)
Catastrophic health expenditure, ^c No. (%)	355 (91.3)
Yes	34 (8.7)
No	
Source of treatment funding, No. (%)	
Saving/salary	520 (47.4)
Borrowed from relatives	296 (27.0)
Loan	283 (25.8)
NGO support	198 (18.0)
Government schemes ^d	52 (4.8)
Insurance	16 (1.5)
Liquidation of assets, No. (%)	
Yes ^e	294 (26.8)
No	804 (73.2)
Job loss in the family during treatment, No. (%)	
Yes	292 (26.6)
No	806 (73.4)
Employment	
Cancer-related employment difficulties, No. (%)	
Not relevant	810 (73.8)
No	201 (18.2)
Yes ^f	87 (8.0)
Rejection from job interview ^f	29
Lack of career opportunities ^f	41
Lack of cancer awareness at workplace ^f	17
Concern about revealing diagnosis at workplace ^f	17
Discrimination at workplace ^f	10
Others	
Relocated from the hometown for treatment, No. (%)	
Yes	736 (77.1)
No	362 (32.9)

Abbreviations: INR, Indian national rupee; USD, US Dollars.

^aFor 5-21 years (n = 764).

^bn = 1,048 for total treatment expenditure.

^cn = 389 for catastrophic health expenditure.

^dGovernment schemes include national-/state-level financial aid.

^eAsset liquidation includes partial or complete sale of household assets (eg, land, jewelry, or other property) to finance treatment-related expenses.

^fCounts for individual cancer-related employment difficulties are not mutually exclusive. Survivors could report more than one difficulty; thus, summed frequencies are >87.

^gConversion rate: INR 88.6 = \$1 USD.

Older age at diagnosis (OR, 1.15 [95% CI, 1.09 to 1.22]; $P < .001$) and longer time since treatment completion (OR, 1.08 [95% CI, 1.01 to 1.15]; $P = .02$) were independent predictors of cancer-related employment difficulties (Data Supplement S1, Table S3).

Among survivors with parental data, maternal education below high school was independently associated with educational loss (OR, 0.29 [95% CI, 0.14 to 0.60]; $P = .001$; Data Supplement S1, Table S4).

DISCUSSION

In this large cross-sectional study of survivors enrolled in a structured CCSP, we observed a substantial burden of socioeconomic challenges. The study was based at AIIMS, New Delhi, a publicly funded national referral center with a wide catchment area spanning northern and north-western states, including Delhi, Uttar Pradesh, Haryana, Bihar, Rajasthan, and parts of Punjab and Madhya Pradesh. These regions together accounted for approximately 42.5% of the Indian population based on the 2011 census.¹³ More than half of survivors in our cohort resided over 100 km from the treating center, and many families reported relocation for treatment, further supporting the geographic diversity of the population captured. A significant proportion of caregivers had limited or no formal education. None of the mothers were engaged in professional/semiprofessional employment, whereas the majority of fathers were engaged in unskilled or informal sectors. These figures are comparable with the National Family Health Survey-5 national averages for male and female illiteracy and for engagement in professional or technical roles.¹⁵

Educational disruption emerged as a striking challenge, affecting 85% of school-age survivors. However, encouragingly, only 3% of survivors did not resume education after such an interruption. Cohorts from high-income countries demonstrate educational attainment comparable with siblings, with only modest impairments, usually limited to survivors of CNS tumors or those exposed to cranial irradiation.¹⁶ The high burden of treatment-induced disruption in our cohort likely reflects systemic educational barriers like long treatment timelines, deprioritization of education by families in the setting of chronic disease, and limited institutional or policy support for school reintegration.

Relocation from the hometown for treatment and job loss within the family were independently associated with higher odds of educational disruption, whereas maternal education at or above high school level was associated with lower odds of educational disruption. Frequent relocation for treatment and family job loss likely disrupted schooling and financial

TABLE 3. Factors Associated With Educational Disruption Among Survivors Age 5-21 Years (n = 764)

Characteristic	Loss of Education (n = 649)	No Loss of Education (n = 115)	Univariable Analysis		Multivariable Analysis	
			OR (95% CI)	P	OR (95% CI)	P
Age at diagnosis (years), median (IQR)	11 (8-15)	10 (8-16)	0.96 (0.92 to 1.00)	.11		
Time since completion of therapy (years), median (IQR)	5.5 (2.58-9)	5 (2-9)	0.99 (0.95 to 1.04)	.94		
Sex, No. (%)			1.05 (0.78 to 1.92)	.37		
Male	499 (76.9)	84 (73.0)				
Female	150 (23.1)	31 (27.0)				
Cancer type, No. (%)			0.88 (0.56 to 1.39)	.59		
Hematologic	470 (72.4)	86 (74.8)				
Solids	179 (27.6)	29 (25.2)				
Residence type ^a , No. (%)			0.97 (0.64 to 1.48)	.9		
Urban	430 (66.3)	75 (65.2)				
Rural	218 (33.7)	39 (33.8)				
Distance from the hospital, No. (%)			1.7 (1.2 to 2.6)	.007		
>100 km	375 (57.8)	51 (44.3)				
<100 km	274 (42.2)	64 (55.7)				
Relocation from the hometown for treatment, No. (%)			1.98 (1.32 to 2.97)	.0009	1.8 (1.1 to 2.7)	.01
Yes	449 (69.2)	61 (53.0)				
No	200 (30.8)	54 (47.0)				
Job loss in the family, No. (%)			2.23 (1.31 to 3.79)	.001	2.1 (1.2 to 3.7)	.01
Yes	190 (29.3)	18 (15.7)				
No	459 (70.7)	97 (84.3)				

Abbreviation: OR, odds ratio.

^an = 762.

stability, contributing to educational discontinuity among survivors. Although literature from India specifically addressing predictors of educational disruption among childhood cancer survivors is sparse, evidence from general adolescent cohorts has consistently shown maternal education to be a strong safeguard against school dropout.¹⁷ Notably, low maternal education has also been identified as a key determinant of treatment abandonment among patients with childhood cancer in India.^{18,19} These observations underscore how maternal education reflects the broader social health of families, shaping both treatment adherence and educational continuity. In this context, national initiatives aimed at improving girls' education such as the *Beti Bachao, Beti Padhao* (Save the Daughter, Educate the Daughter) program are important structural efforts that are expected to enhance educational outcomes for vulnerable groups, including childhood cancer survivors.^{20,21}

Our center, being an apex publicly funded hospital, provides most basic treatment either free or at subsidized rates. Yet, half of families in our cohort incurred costs $\geq$ \$3,385 USD (INR 3 lakh) and an overwhelming 91% of families in our cohort experienced catastrophic health expenditure, a burden higher than the figures noted from other LMICs in South Asia.²²⁻²⁴ In HICs, catastrophic health expenditure is

substantially lower; a meta-analysis estimated a pooled prevalence of 47% across middle- and high-income settings.²⁵ Most survivors in this cohort initiated treatment before or during the early phase of the national rollout of AB-PMJAY, launched in 2018 to provide cashless coverage up to \$5,645.73 USD (INR 500,000) per family per year for in-hospital care, including cancer.²⁶ Recent evaluations of the impact of AB-PMJAY indicate meaningful reductions in in-patient out-of-pocket costs and catastrophic spending, reflecting its growing role in strengthening financial protection for families requiring high-cost cancer care.^{12,27-29} Thus, future survivor cohorts treated under a mature AB-PMJAY framework may face a lower risk of financial toxicity than that observed in our study. In parallel, initiatives such as the WHO–St. Jude Global Platform for Access to Childhood Cancer Medicines could potentially improve the availability and lower the cost of essential anticancer drugs in resource-challenged settings like ours.³⁰ Cost-effectiveness analyses in the local context may allow selective inclusion of essential treatments under public insurance schemes.³¹⁻³³

Younger age at diagnosis and relocation from the hometown independently predicted high treatment expenditure. The association of younger age with greater spending may be a consequence of additional childcare and supportive care

TABLE 4. Clinical and Socioeconomic Factors Associated With Higher Treatment Expenditure (n = 1,048)

Characteristic	Money Spent <\$3,385 USD (INR 300,000; ^a n = 661)	Money Spent ≥\$3,385 USD (INR 300,000; ^a n = 387)	Univariable Analysis		Multivariable Analysis	
			OR (95% CI)	P	OR (95% CI)	P
Age at diagnosis (years), median (IQR)	7 (6-9)	9 (7-10)	1.02 (1.0 to 1.09)	.003	1.03 (1.01 to 1.06)	.003
Time since completion of therapy, median (IQR)	5.75 (6.25)	5.41 (6.75)	0.99 (0.96 to 1.02)	.4	—	—
Sex, No. (%)						
Male	499 (75.5)	288 (74.4)	0.94 (0.70 to 1.26)	.70	—	—
Female	162 (24.5)	99 (25.6)				
Cancer type, No. (%)						
Hematologic	431 (65.2)	275 (71.1)	1.31 (1.00 to 1.70)	.05	1.31 (0.99 to 1.72)	.054
Solid	230 (34.8)	112 (28.9)				
Residence, No. (%)						
Urban	441 (66.7)	248 (64.1)	1.12 (0.86 to 1.46)	.40	—	—
Rural	219 (33.3)	138 (35.9)				
Distance from the hospital, No. (%)						
>100 km	352 (53.2)	237 (61.2)	1.38 (1.07 to 1.79)	.012	—	—
<100 km	309 (46.8)	150 (38.8)				
Relocation from the hometown for treatment, No. (%)						
Yes	424 (64.1)	286 (73.9)	1.58 (1.20 to 2.09)	.001	1.61 (1.22 to 2.13)	.001
No	237 (35.9)	101 (26.1)				
Job loss in the family, No. (%)						
Yes	166 (25.1)	120 (31.0)	1.34 (1.02 to 1.77)	.04	—	—
No	495 (74.9)	267 (69.0)				

Abbreviations: INR, Indian national rupee; OR, odds ratio; USD, US Dollars.

^aConversion rate: INR 88.6 = \$1 USD, as of October 14, 2025.

expenses. Relocation is intuitively associated with increased out-of-pocket costs because of travel, lodging, and prolonged family displacement. Comparable trends have been described in low-income countries and LMICs like Bangladesh, Rwanda, and Egypt, where families living farther from treatment centers face nearly double the expenditure, largely driven by nonmedical costs such as travel and accommodation.³³⁻³⁵ Qualitative evidence from India further echoes this trend, with caregivers describing long, fragmented diagnostic pathways and repeated referrals that amplify travel requirements and substantially inflate non-medical costs.^{11,36} In HICs, the impact of distance is mitigated by availability of widespread specialized health care centers that are located closer to patients' residences.³⁷ Indeed, relocation for cancer care has been associated with poorer survival outcomes in a SEER database analysis, highlighting the severity of socioeconomic disturbance generated by the need to avail treatment away from home.³⁸ Recognizing this structural barrier, India has initiated a rapid expansion of public tertiary care infrastructure including new AIIMS and AIIMS-like institutes and regional cancer centers across multiple states with the explicit aim of decentralizing advanced care beyond a few metropolitan hubs.^{39,40} With this expansion, the reliance on long-distance relocation and the financial and psychosocial strain it imposes on families is

expected to lessen for future cohorts of children with cancer in India.

In our cohort, nearly one third of survivors reported cancer-related employment difficulties, an outcome seldom quantified in Indian pediatric survivorship studies. Studies have shown that survivors often face stigma, rigid workplace structures, health limitations, and fear of disclosure, whereas supportive supervision, graded return, and vocational counseling act as important facilitators.⁴¹⁻⁴³ In India, the predominance of informal employment may amplify this vulnerability. Older age at diagnosis and longer time since therapy were associated with cancer-related employment challenges, likely reflecting disruptions during adolescence and young adulthood, which is the critical period for skill development in colleges and vocational course and, in turn, may impair employability over the long term. Embedding vocational assessment within survivorship care and sensitizing primary care providers and employers may facilitate better survivor integration into the workplace.⁴⁴

The strengths of our study include the large, systematically assessed cohort; integrated evaluation of educational, financial, and occupational outcomes; inclusion of parental education and occupation; and structured regression

modeling across multiple domains. However, this study has several limitations. Its single-center cross-sectional design limits generalizability and precludes causal inference. Although conducted at a large tertiary referral center, the primary catchment population largely represents northern and north-western India, and the findings may not fully reflect survivorship experiences in other regions of the country. The analysis included survivors actively attending a structured survivorship program, introducing potential selection bias as those lost to follow-up—particularly individuals facing financial hardship, geographic barriers, or social marginalization—may be under-represented. The cohort also demonstrated a male predominance; prior studies from our center have documented gender disparities in access to childhood cancer care and survivorship follow-up in India, suggesting possible under-representation of female survivors.^{18,45,46} In addition, several socioeconomic variables were self-reported and may be subject to recall or reporting bias and some parental

socioeconomic indicators were available only for a subset of participants, which might have limited statistical power for certain analyses. Despite these limitations, this study represents one of the largest systematically evaluated cohorts of childhood cancer survivors from a low- and middle-income country and provides important insights into the socioeconomic consequences of survivorship in resource-constrained settings.

In conclusion, for many childhood cancer survivors, cure comes with the hidden costs of disrupted education, financial devastation, and limited employment opportunities. Government-initiated nationwide public insurance schemes may aid in mitigating financial toxicity. However, there is also a need to reduce social stigma through awareness and to provide holistic psychosocial support to survivors to facilitate social reintegration. Prospective qualitative studies and clinical trials exploring the impact of social interventions in improving survivorship care are the need of the hour.

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