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Estimates of transition burden, geographic distribution, and risk- stratified care for adolescent and young adult cancer survivors: A multi-centre analysis from a low- and middle-income country

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Background: Improved survival in low- and middle-income countries is generating a rapidly expanding population of childhood cancer survivors (CCS) who will transition to adult care. In India, the capacity and geographic distribution of long-term survivorship care remain poorly characterized.

Methods: We synthesized survivorship data from three tertiary pediatric oncology centres in North India. Transition-eligible survivors were those diagnosed before age 18 years, who completed cancer-directed therapy between January 2016 and December 2025 and had attained age >18 years by December 2025. We quantified the transition-eligible cohort, projected the transition burden through 2030, mapped adolescent and young adult (AYA) survivors by geographic distance from their treating centre, and risk-stratified survivors for survivorship care planning as per published diagnosis and exposure based criteria.

Results: Among 3,060 survivors, 398 (13.0%) were transition-eligible; 288 (72.4%) were male. Lymphomas (34.1%), solid tumors (29.1%), and acute lymphoblastic leukemia (27.8%) were the predominant diagnoses. The transition-eligible cohort is projected to increase to 1,071 by 2030 (+169.1%). Approximately 58% lived >50 km from their treating centre. Overall, 387 (97.2%) were classified as moderate (44.9%) or high risk (52.3%). Transition processes were absent (56%) or informal (33%); barriers included perceived lack of need (78%), unawareness of late effects (67%) and farther distance from treating centre (56%).

Conclusion: This study estimates that the transition-eligible CCS population is projected to nearly triple by 2030 and is predominantly composed of moderate- and high-risk survivors. A risk-stratified, geographically distributed survivorship model incorporating tele-support and shared care closer to home is urgently required.

KEYWORDS

adolescent and young adult (AYA), childhood cancer survivors (CCS), LMIC (low- and middle-income countries), survivorship, transition

Introduction

Advances in pediatric oncology in low- and middle-income countries (LMICs) such as India have resulted in a rapidly expanding population of childhood cancer survivors (CCS). The Indian Childhood Cancer Survivorship (C2S) cohort, established in 2016 and comprised of more than 5,400 survivors from 20 centres, highlights the growing scale of survivorship in the country (1). Long-term follow-up studies from India have demonstrated a substantial burden of treatment-related late effects and significant attrition from survivorship care (1–5), with one large institutional cohort reporting 22% of survivors lost to follow-up (2).

Despite increasing survival, survivorship care in India remains heterogeneous and is still evolving (3). Across Asia, models of long-term follow-up vary considerably, with barriers including geographic and financial constraints, limited survivor awareness, inadequate healthcare-provider knowledge, and fragmented health-system pathways (6). Transition from pediatric to adult-oriented care represents a distinct vulnerable point, requiring preparation, coordination, risk-based surveillance and mechanisms to maintain continuity of care in the years after completion of therapy (2, 6, 7).

In India and other LMICs, however, formal transition pathways are not routinely available, and the appropriate destination for survivors after pediatric oncology follow-up may vary from continued pediatric care to adult oncology, primary care, specialist-led care, or no structured follow-up. Consequently, the magnitude of the population approaching transition, their geographic distribution, and the capacity of local/ regional healthcare systems to provide appropriate survivorship care remain poorly characterized. At C2S study centres, enrolment in the registry is done within 6 months of therapy completion, although formal survivorship care occurs 2-years after completion of cancer therapy. Furthermore, to objectively understand the knowledge, awareness and availability of transition of care services for AYA survivors of childhood cancer, we surveyed transition practices among pediatric oncologists involved in survivorship care.

Hence, in the present study the authors endeavoured to assess the magnitude of age-based transition-eligible AYA population of CCS across three tertiary pediatric oncology centres in North India. We also aimed to characterize the geographic distribution of these AYA survivors with respect to their primary treating centre, to project the future transition burden, and propose a framework for risk stratified long-term survivorship care.

Material and methods

Methods/data

We synthesized institutional cohort data from three premier tertiary pediatric oncology units in North India to estimate the magnitude and geographic distribution of CCS approaching transition from pediatric to adult-oriented healthcare. The participating centres were selected because of their established pediatric oncology programs, substantial longitudinal survivor

cohorts, and availability of treatment and follow-up records extending beyond completion of cancer-directed therapy. They were coded as C1 (All India Institute of Medical Sciences), C2 (Rajiv Gandhi Cancer Institute and Research Centre) and C3 (King George's Medical University).

Institutional Review Board approval was obtained by all participating centres and all data was de-identified as per our local privacy policy and data-governance requirements. The analysis was designed to provide a pragmatic estimate of the emerging transition burden rather than to generate population-based incidence estimates.

Study population and definition of transition eligibility

The study cohort comprised CCS who were diagnosed with cancer prior to 18 years of age, had completed their cancer treatment between January 2016 and December 2025, and attained transition-eligible age of >18 years as of December 2025. The survivors were stratified as being at low, moderate or high risk of late effects based on diagnosis and exposure (8, 9).

For each participating centre, we quantified the number of survivors becoming eligible for transition annually. Where longitudinal data were available, the number of survivors reaching the predefined transition threshold was assessed across successive calendar years from 2016 to 2025. Temporal trends were evaluated to estimate the projected transition cohort and anticipated annual transition burden over the subsequent five years (2026–2030). The age of each survivor as of December 2025 was used as baseline for projecting the transition cohort through 2030. The analysis also examined age at diagnosis, cancer diagnosis, age at completion of therapy, time since completion of therapy, and major treatment exposures, where available.

Geographic distribution and survivor dispersion

The most recent documented residential address was used to characterize survivor distribution. Residential locations were coded by state/union territory and, where feasible, by district/city as pin codes were not universally available. Survivors were categorized according to whether they resided within or outside the state of their treating institution. This enabled assessment of the extent to which tertiary pediatric oncology centres function as regional or national referral hubs and the degree to which survivors disperse geographically following completion of treatment.

Geographic mapping was used to visualize the distribution of transition-eligible survivors and identify distance of current residence from the treating institution.

Distances were calculated from district headquarters to the respective treatment centre. They were grouped as residing within 50 km, 100 km, 200 km, 300 km or beyond 300 km—radius from their treating institution (1 km, kilometer = 0.62 miles).

Assessment of current practice of transition care

A cross-sectional, multi-centre digital survey was conducted to evaluate transition of care infrastructure and services for childhood cancer survivors (CCS). The target cohort exclusively comprised practicing pediatric oncologists engaged in long-term survivorship care. To ensure content validity, an expert panel developed a structured questionnaire evaluating three core domains: awareness (familiarity with national/international AYA transition guidelines), availability (institutional infrastructure and formal adult transfer mechanisms), and access (perceived financial, geographical, and systemic barriers).

The survey primarily utilized fixed-response formats and multiple-choice matrices, supplemented by optional open-ended prompts for qualitative center-specific insights.

Results

A total of 3,060 survivors who had completed cancer treatment between 2016 and 2025 were identified across the three participating centres (Table 1): C1 ($n = 1,338$), C2 ($n = 928$), and C3 ($n = 794$). Of these, 398 survivors were aged >18 years as of December 2025 and constituted the transition cohort, representing 13.0% of the total survivor population. Overall, males predominated (288/398, 72.4%), with females accounting for 110 (27.6%). The median age at diagnosis was 13.7 years (IQR, 11.2–16.2) while the median interval from diagnosis to transition was 5.2 years (IQR, 2.6–8.3) and the median interval from treatment completion to transition was 3.9 years (IQR, 1.5–7) for the entire transition cohort. The median age and intervals differed considerably between centres, reflecting differences in institutional policy regarding the upper age limit for registration of newly diagnosed patients in the pediatric oncology department (15 years for C1 and C3, and 18 years for C2).

The spectrum of cancer diagnosis revealed that among the AYA survivors, lymphoma was the most frequent diagnosis (136/398), followed by solid tumors (116/398) and acute lymphoblastic leukemia (ALL; 111/398). The numbers of CNS tumors were very few due to local/regional referral patterns.

The transition cohort was predominantly classified as requiring moderate- or high-intensity survivorship care, with relatively few survivors categorized as low risk. Among the reported cohort, 11(3%) survivors were classified as low risk, 179 (45%) as moderate risk, and 208 (52%) as high risk. Thus, the majority of survivors would potentially require more than routine primary healthcare, emphasizing the importance of risk-adapted survivorship services following transition.

The five-year temporal projection demonstrated a progressive increase in the number of survivors reaching >18 years of age across all three centres (Table 2). Using 2025 as the baseline, the total cohort increased from 398 survivors in 2025 to 1,071 in 2030, representing a cumulative increase of 169.1%. A higher proportional increase was projected for centres C1 and C3 (253.9%, 248.8%) compared to C2 where the increment was a modest 115.3%. This being explained once again by the difference in upper age limit for registration of newly diagnosed patient in the pediatric oncology department.

Geographically, the transition cohort was predominantly concentrated in North India (Supplementary Table S1) although there was considerable geographic dispersion within the area. The states of Uttar Pradesh (142/398, 35.7%) and Delhi NCR (80, 20.1%), had the highest distribution, as the primary treating centres were located in these states. Based on the distance between current residence of AYA survivors and the treating centre, 58% of CCS resided at a distance more than 50 km from

TABLE 1 Demographic and clinical profile of AYA survivors (>18 yrs) who completed treatment between January 2016 and December 2025.

Parameter	C1	C2	C3	Total
Cohort Overview				
Total No. of survivors (completing treatment between 2016 and 2025)	1338	928	794	3060
No of survivors > 18 yrs as of December 2025	115	242	41	398
Demographics of AYA Survivors				
Male, n (%)	88 (77.0%)	173 (71.5%)	27 (65.9%)	288 (72.3%)
Female, n (%)	27 (23.0%)	69 (28.5%)	14 (34.1%)	110 (27.6%)
Age at diagnosis, median (IQR)	12 (10–13.1)	15.0 (13.0–17.0)	13 (11–14)	13.7 (11.2–16.2)
Years from diagnosis to transition median (IQR)	8.5 (6.9–10)	3.3 (1.3–5.2)	8 (7–8)	5.2 (2.6–8.3)
Years from treatment completion to transition median (IQR)	7.3 (5.9–8.7)	2.1 (0.3–3.9)	6 (5–7)	3.9 (1.5–7.0)
Primary Cancer Diagnosis, n (%)				398
ALL	46 (40.0%)	49 (20.2%)	16 (39.0%)	111 (27.8%)
AML	8 (7.0%)	12 (4.9%)	2 (4.9%)	22 (5.5%)
Lymphoma	45 (39%)	83 (34.2%)	8 (19.5%)	136 (34.1%)
CNS tumor	1 (0.9%)	5 (2.0%)	0 (0.0%)	6 (1.5%)
Solid tumor	11 (9.6%)	90 (37.1%)	15 (36.6%)	116 (29.1%)
Other	4 (3.5%)	3 (1.2%)	0 (0.0%)	7 (1.7%)
Risk Group, n (%)				
Low	5 (4.3%)	6 (2.5%)	0 (0.0%)	11 (2.7%)
Moderate	21 (18.3%)	136 (56.2%)	22 (53.7%)	179 (44.9%)
High	89 (77.4%)	100 (41.3%)	19 (46.3%)	208 (52.25)

Values are presented as n (%) unless otherwise indicated. Percentages may not total 100% because of rounding.

ALL, acute lymphoblastic leukemia; AML, acute myeloid leukemia; CNS, central nervous system; IQR, interquartile range.

TABLE 2 Temporal projection of cumulative burden of transition-eligible AYA survivors.

Parameter	2025	2026	2027	2028	2029	2030
C1 N = 1328	115	158 (37.4%)	196 (70.4%)	257 (123.5%)	324 (181.7%)	407 (253.9%)
C2 N = 928	242	286 (18.2%)	349 (44.2%)	404 (66.9%)	464 (91.7%)	521 (115.3%)
C3 N = 794	41	53 (29.3%)	65 (58.5%)	91 (122.0%)	113 (175.6%)	143 (248.8%)
Total	398	497 (24.9%)	610 (53.3%)	752 (88.9%)	901 (126.4%)	1071(169.1%)

Using 2025 as the baseline (0% increase), the incremental percentage increase for each subsequent yr is calculated as: % increase = [(Year value–2025 value)/2025 value] × 100.

the primary treating centre while 27% of them were farther than 100 km away (Supplementary Table S2 and Supplementary Figure S1).

The survey was completed by 25/30 eligible National pediatric oncology centres yielding an 83.3% (25/30) institutional response rate. It revealed that at most centres once survivors attain transition age, either they continue follow-up in pediatric oncology centres/survivorship clinics or are lost to follow-up (Supplementary Figure S2). The transition process is either non-existent (56%) or informal and *ad hoc* (33%). Most clinics (66%) prepare end of treatment summaries which included diagnosis and treatment exposures. The main barrier to continuity of care was lack of perceived need (78%) lack of awareness about late effects (67%), travel burden (56%) and competing priorities (55%).

Discussion

To our knowledge, this is the first multicentre collaboration from India to quantify a transition-eligible childhood cancer survivor population, rather than the entire survivor population, in the context of geographic location. The study cohort comprised 3,060 survivors from three tertiary pediatric oncology centres in North India who completed therapy between 2016 and 2025, and already have 398 survivors who are >18 years of age. Three observations dominate. First, this cohort is not static and based on current institutional trajectories will reach 1,071 by 2030, a cumulative increase of 169% in five years. Second, it is not a low-acuity cohort — with 387 of 398 survivors (97.2%) classified as moderate- or high-risk for adverse outcomes. Third, it is not a local cohort with approximately 58% of survivors residing more than 50 km from their treating centre and in at least nine states and across an international border, suggesting that lifelong follow-up at their treating centre is not realistic for most. Taken together, these findings describe the trajectory of an AYA survivorship demand that is rising steeply concurrent with deficits in capacity and infrastructure required to address the needs of this medically vulnerable population.

A transition burden that is accelerating, and larger than it appears

The projected growth from 398 to 1,071 survivors over five years is driven by an arithmetic that is unavoidable in a

maturing pediatric oncology program: cure rates have improved, cohorts treated in the 2016–2025 window predominate in the adolescent age range, and each successive calendar year features adolescents transitioning into adults. The increase was consistent across all three centres despite very different case mixes and registration policies (C1 253.9%, C2 115.3%, C3 248.8% by 2030), which argues that this is a structural rather than an institutional phenomenon. Centre-level differences in the median interval from diagnosis to transition — 8.5 years at C1, 3.3 years at C2 and 8 years at C3 — reflect the upper age limit for registration in pediatric oncology (15 years at C1 and C3, 18 years at C2) rather than any difference in biology or outcome and are themselves an argument for a nationally agreed definition of transition age.

Several features suggest our estimate is conservative. It is restricted to three centres in one region of a country that treats childhood cancer across several hundred units. In addition, the estimate is anchored to a 10-year treatment window that excludes survivors treated before 2016 who are already adults and uses a chronological threshold of 18 years, that does not consider developmental factors influencing transition readiness (7, 10). The recently reported Indian C2S cohort of more than 5,400 survivors across 20 centres (1) and the 30-year single-institution experience from Prasad *et al.* (2) both point to a denominator considerably larger than the one modelled here. If a 169% five-year growth applies even approximately at national scale, India is approaching a survivorship demand of a magnitude that the European PanCareSurFup consortium (11) and the North American CCSS (12) took decades of dedicated infrastructure to serve without an equivalent long-term follow-up architecture.

Burden must also be weighted by acuity, not counted by head. That only 11 survivors (2.7%) were low-risk, while 208 (52.3%) were high-risk, means that the great majority of this cohort requires structured, exposure-based surveillance of the kind recommended by the Children's Oncology Group and harmonized internationally (13, 14) rather than reassurance. Lymphoma (34.1%), solid tumours (29.1%) and ALL (27.8%) predominated — diagnostic groups carrying anthracycline, alkylator, radiation and, in the case of solid tumours, surgical and site-specific late-effect risks that may manifest decades after treatment (15–17). A cohort that is 97% moderate- or high-risk cannot be discharged to unsupported general practice, yet it is also far too large and too dispersed to be retained indefinitely in three tertiary pediatric units.

Geography as the organising principle of survivorship planning

The geographic findings of our study reframe the problem. Uttar Pradesh contributed the largest share of survivors (142/398, 35.7%), followed by Delhi NCR (80, 20.1%), Haryana (38, 9.5%) and Bihar (34, 8.5%); 27 survivors (6.8%) reside in Nepal. These centres function as national and cross-border referral hubs, and the population they must plan to serve are often residing some distance away from them. The distance analysis makes this concrete: only 42% of survivors with mappable addresses live within 50 km of their treating institution, while 27.4% live more than 100 km away, 18.3% beyond 200 km, and a further group outside the country altogether.

Distance is not a soft barrier. Travel burden, cost and time away from work are among the most consistently reported determinants of long-term follow-up attendance internationally, and in Asian surveys distance, transportation and competing priorities are cited by providers as principal obstacles to survivorship participation (6, 18). Our own survey of 25 Indian survivorship clinics found geographic distance dominated as a barrier endorsed by 56% of centres, behind only lack of perceived need (78%) and lack of awareness of late effects (67%). Notably, these three barriers compound one another: a survivor who feels well, has not been told what to watch for, and lives 200 km from the clinic has no reason to make the journey. This is the mechanism that produces the 22% loss to follow-up reported from a large Indian cohort (2), and it will not be solved by expanding clinic capacity at the hub.

The corollary is that survivorship planning in LMICs should be organised geographically from the outset rather than retrofitted. If 58% of a transition cohort will predictably live beyond a day's return travel, then the default care location for most survivors must be near their home, and the tertiary centre's role must shift from provider to custodian — of the risk stratum, the surveillance plan, the treatment summary, and the specialist opinion when a late effect emerges. Our survey suggests this shift has not begun: transition was non-existent at 56% of centres and informal or *ad hoc* at 33%, no centre used a defined transition age, and survivors typically stopped attending once they judged themselves cured, even though 66% of centres did generate end-of-treatment summaries.

Towards a risk-stratified, geographically distributed model

These data support development of a model in which risk stratum and distance are treated as two axes of a single allocation decision rather than as separate considerations. Low- and moderate-risk survivors living within reach of a district or secondary facility can reasonably be followed there under a shared-care arrangement anchored by a portable treatment summary and an exposure-based surveillance schedule, with the hub reachable by teleconsultation — an approach endorsed for limited-resource settings, where oncology-led care is reserved for high-risk survivors while nurse-led, primary-care-led or shared models absorb the remainder (3, 19). High-risk survivors living

close to a hub should retain hub-based, risk-based adult follow-up of the kind long advocated in high-income systems (7). The genuinely difficult quadrant — high-risk survivors living far from any hub, which in our cohort is a substantial group — requires an explicit networked solution: designated spoke centres with a named contact, navigator scheduled tele-survivorship review, locally available surveillance investigations, and hub review at defined intervals rather than on demand.

Three enablers make this feasible. The treatment summary, already produced by two-thirds of surveyed centres, becomes the transferable instrument of care rather than a discharge formality, and should be issued to the survivor as well as to the receiving clinician. Initially, a named transition coordinator drawn from existing staff would provide the structural accountability whose absence is the commonest reason transition fails (3, 19). Given the large projected increase in CCS numbers, the multifaceted demands of risk-based surveillance, the intensive patient education required during care transition, and the need for meticulous, ongoing communication between the primary oncology center and regional clinics, full-time, independent personnel are essential to sustain these heavy demands. And transfer should be triggered by an assessment of readiness — health literacy, autonomy, pubertal and growth status, psychological preparedness — rather than by a birthday alone (7, 10, 19) which also resolves the inter-centre inconsistency our data exposed. Existing national infrastructure can carry much of this: the C2S registry (1) already links these centres on a common database and could plausibly host the risk stratum, surveillance schedule and transition status as registry fields, converting a research cohort into an operational recall system.

Limitations

This analysis has important limitations. It is a synthesis of institutional cohort data from three centres in North India and is not population-based; the projections extrapolate observed institutional trends and assume stable treatment volumes, survival and registration policy. Geographic coding relied on the most recent documented residential address, which may be outdated and, in the absence of universally available pin codes, permitted only state- and district-level resolution. Risk classification was applied to available treatment-exposure data and did not include complications encountered during therapy. The transition-practice survey reflects the perceptions of 25 centres with existing survivorship clinics, which probably overstates the readiness of the wider system; furthermore, it lacks the patient's voice regarding perceived barriers to transition. Finally, we quantified those who become eligible for transition, not those who actually transitioned, and we did not measure outcomes after transfer.

Conclusion

The transition-eligible childhood cancer survivor population at these three centres will nearly triple by 2030, is predominantly moderate- or high-risk, and lives largely beyond the practical reach of the institutions that treated it. Planning survivorship care

around the hub, and around chronological age alone, will not meet this demand. A pragmatic model for India and comparable LMIC settings should allocate survivors by risk stratum and distance simultaneously, devolve routine surveillance to the survivor's own region under shared care, use tele-survivorship and a portable treatment summary to preserve continuity. The window to build this architecture is open now, while the cohort is still counted in hundreds rather than thousands.

Data availability statement

The original contributions presented in the study are included in the article/[Supplementary Material](#), further inquiries can be directed to the corresponding author.

Ethics statement

Institutional Review Board approval was obtained by all participating centres: Rajiv Gandhi Cancer Institute and Research Centre, Delhi, India; All India Institute of Medical Sciences, Delhi, India and King George's Medical University, Lucknow, India. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

Author contributions

GK: Data curation, Software, Visualization, Writing – original draft, Writing – review & editing, Conceptualization, Methodology, Supervision, Formal analysis. RS: Writing – review & editing, Methodology, Supervision, Data curation. NV: Writing – review & editing, Methodology, Data curation, Supervision. SJ: Writing – review & editing, Methodology, Conceptualization. PM: Data curation, Writing – review & editing, Validation, Formal analysis.

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References

- Seth R, Kapoor G, Moulik NR, Kaushik P, Verma N, Mahajan A, et al. Long term outcomes of the Indian childhood cancer survivorship (C2S) cohort: a multicentre study (2016–2024). *Lancet Regional Health–Southeast Asia*. (2026) 45:100727. doi: 10.1016/j.lansea.2026.100727
- Prasad M, Goswami S, Chinnaswamy G, Banavali SD, Kurkure PA. Long-term outcomes in survivors of childhood cancer: a 30-year experience from India. *JCO Global Oncology*. (2022) 8:e2200044. doi: 10.1200/GO.22.00044
- Arora RS, Arora PR, Seth R, Sharma S, Kumar C, Dhamankar V, et al. Childhood cancer survivorship and late effects: the landscape in India in 2020. *Pediatr Blood Cancer*. (2020) 67(9):e28556. doi: 10.1002/pbc.28556
- Seth R, Singh A, Seth S, Sapra S. Late effects of treatment in survivors of childhood cancers: a single centre experience. *Indian J Med Res*. (2017) 146(2):216–23. doi: 10.4103/ijmr.IJMR_196_16
- Agarwal A, Kapoor G, Jain S, Malhotra P, Sharma A. Metabolic syndrome in childhood cancer survivors: delta BMI a risk factor in lower-middle-income countries. *Support Care Cancer*. (2022) 30(6):5075–83. doi: 10.1007/s00520-022-06910-0
- Cai J, Cheung YT, Hudson MM. Care models and barriers to long-term follow-up care among childhood cancer survivors and health care providers in Asia: a literature review. *JCO Global Oncology*. (2024) 10:e2300331. doi: 10.1200/GO.23.00331

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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The author(s) declared that generative AI was used in the creation of this manuscript. It was mainly used for formatting and language.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fradm.2026.1982235/full#supplementary-material>

7. Henderson TO, Friedman DL, Meadows AT. Childhood cancer survivors: transition to adult-focused risk-based care. *Pediatrics*. (2010) 126(1):129–36. doi: 10.1542/peds.2009-2802
8. Seth R, Prasad M, Kapoor G, Das G, Prasanth S, Dhamankar V, et al. Establishing childhood cancer survivorship clinics in India: a consensus statement. *Pediatr Hematol Oncol J*. (2024) 9(3):138–42. doi: 10.1016/j.phoj.2024.02.002
9. Dinan MA, Stratton KL, Leisenring WM, Yasui Y, Chow EJ, Tonorezos ES, et al. Treatment exposure-based risk-stratification for care of survivors of childhood cancer: a report from the childhood cancer survivor study. *J Natl Cancer Inst*. (2025) 117(12):2580–90. doi: 10.1093/jnci/djaf268
10. Otth M, Wechsler P, Denzler S, Koehler H, Scheinemann K. Determining transition readiness in Swiss childhood cancer survivors—a feasibility study. *BMC Cancer*. (2021) 21(1):84. doi: 10.1186/s12885-021-07787-8
11. Grabow D, Kaiser M, Hjorth L, Byrne J, Alessi D, Allodji RS, et al. PanCareSurFup consortium. The PanCareSurFup cohort of 83,333 five-year survivors of childhood cancer: a cohort from 12 European countries. *Eur J Epidemiol*. (2018) 33(3):335–49. doi: 10.1007/s10654-018-0370-3
12. Robison LL, Armstrong GT, Boice JD, Chow EJ, Davies SM, Donaldson SS, et al. The childhood cancer survivor study: a national cancer institute-supported resource for outcome and intervention research. *J Clin Oncol*. (2009) 27:2308–18. doi: 10.1200/JCO.2009.22.3339
13. DeVine A, Landier W, Hudson MM, Constine LS, Bhatia S, Armenian SH, et al. The children's oncology group long-term follow-up guidelines for survivors of childhood, adolescent, and young adult cancers: a review. *JAMA Oncol*. (2025) 11(5):544–52. doi: 10.1001/jamaoncol.2024.6812
14. Kremer LCM, Mulder RL, Oeffinger KC, Bhatia S, Landier W, Levitt G, et al. International late effects of childhood cancer guideline harmonization group. A worldwide collaboration to harmonize guidelines for the long-term follow-up of childhood and young adult cancer survivors: a report from the international late effects of childhood cancer guideline harmonization group. *Pediatr Blood Cancer*. (2013) 60(4):543–9. doi: 10.1002/pbc.24445
15. Byrne J, Schmidtman I, Rashid H, Hagberg O, Bagnasco F, Bardi E, et al. PanCareSurFup consortium. Impact of era of diagnosis on cause-specific late mortality among 77,423 five-year European survivors of childhood and adolescent cancer: the PanCareSurFup consortium. *Int J Cancer*. (2022) 150(3):406–19. doi: 10.1002/ijc.33817
16. Allodji RS, Hawkins MM, Bright CJ, Fidler-Benaoudia MM, Winter DL, Alessi D, et al. PanCareSurFup consortium. Risk of subsequent primary leukaemias among 69,460 five-year survivors of childhood cancer diagnosed from 1940 to 2008 in Europe: a cohort study within PanCareSurFup. *Eur J Cancer*. (2019) 117:71–83. doi: 10.1016/j.ejca.2019.05.013
17. Oeffinger KC, Mertens AC, Sklar CA, Kawashima T, Hudson MM, Meadows AT, et al. Chronic health conditions in adult survivors of childhood cancer. *N Engl J Med*. (2006) 355(15):1572–82. doi: 10.1056/NEJMsa060185
18. Rathore V, Taluja A, Arora PR, Bagai P, Kapoor G, Seth R, et al. Delivery of services to childhood cancer survivors in India: a national survey. *Indian J Med Paediatr Oncol*. (2020) 41(5):707–17. doi: 10.4103/ijmpo.ijmpo_6_20
19. Jefford M, Howell D, Li Q, Lisy K, Maher J, Alfano CM, et al. Improved models of care for cancer survivors. *Lancet*. (2022) 399(10334):1551–60. doi: 10.1016/S0140-6736(22)00306-3