

Conclusions and quality of the evidence of education and employment outcomes in survivors of childhood, adolescent, and young adult cancer

1. What is the risk of poor educational/employment outcomes?	
What is the risk of poor educational outcomes in childhood, adolescent and young adult (CAYA) cancer survivors?	
Survivors are at risk for lower educational achievement vs. controls	Level C [17-62]
Fewer survivors than comparisons have university/college education vs. controls	Level B [17, 18, 21, 22, 24-27, 29, 31, 35-37, 47, 49, 58, 63-69]
Survivors are at risk for completing their education with a delay vs. controls	Level A [29, 31, 32, 34, 60, 70-72]
Survivors are at risk for repeating a grade vs. controls	Level B [20, 38, 70, 73-78]
Survivors are less likely to attend mainstream education vs. controls	Level B [31, 36, 50, 51, 62, 69, 75, 77, 79]
CNS tumor survivors are at increased risk for lower educational achievement, not getting a college/university degree, or completing their education with a delay vs. controls	Level B-C [26, 37, 57, 58, 60, 61, 63, 67]
What is the risk of poor employment outcomes in CAYA cancer survivors?	
Increased risk of unemployment in CAYA cancer survivors vs. controls	Level B [14, 17, 19, 21-25, 28, 31-38, 52, 53, 59, 61-69, 71, 84-96]
CNS tumor survivors are at increased risk of unemployment vs. controls	Level A [14, 37, 61, 63, 67, 87, 88, 95]

2. What are the risk factors for poor educational/employment outcomes?				
	Lower educational achievement ^s	Repeating a grade ^s	Special education ^s	Unemployment ^s
Treatment-related risk factors				
Surgery	Yes ^{↑c} after an amputation [80]	-	-	Yes ^{↑c} after surgery ^d [22, 91, 97], after an amputation or limb-saving surgery vs. none ^c [80, 84, 85] and cerebral surgery ^c [84, 85]
	No ^{B,d} [26, 29]			
Chemotherapy	Yes ^{↑c} after treatment with alkylating agents [80]	-	No ^c after treatment with intrathecal methotrexate [75]	Yes ^{↑c} after treatment with alkylating agents or vincristine [80]
	Yes ^{↓c} after treatment with anthracyclines [80]			No ^{B,e} [17, 22, 91, 97]
	No ^{B,e} [17, 26, 29, 83]			
Radiotherapy		-	No ^{C,c} [75]	No ^{B,f} [17, 22, 91, 97]
Cranial radiotherapy (CRT)	Yes ^{↑c} [17, 26, 29, 37, 81, 83]	No ^{C,k} [73]	-	Yes ^{↑A,j} [14, 37, 81, 84, 85, 88, 91]
Stay at an intensive care unit	Yes ^{↑c} [22]	-	-	-
Stem cell transplantation	No ^c [29]	No ^B [73, 74]	-	No ^B [22, 97]
Treatment duration	No ^c [22]	-	-	No ^c [22]
Clinical risk factors				
Age at diagnosis	Yes ^{↑C,m} [17, 18, 22, 26, 29, 32, 81, 83]	Conflicting [73, 74]	-	Conflicting [17, 22, 61, 81, 84, 91]
Time since diagnosis	No ^c [17]	-	-	Yes ^{↑c} [17, 85]
Diagnosis	Yes ^{↑B} in CNS tumor survivors [17, 22, 24, 26, 29, 61]	No ^c [74]	Yes ^{↑c} for all diagnoses [75]	Yes ^{↑B} in CNS tumor survivors [17, 24, 61, 91]
	Yes ^{↑c} in leukemia survivors treated with CRT [24, 26]			Yes ^{↑c} in osteosarcoma survivors ⁸ [81]
	Yes ^{↓c} in Ewing's sarcoma survivors ⁸ [80]			No ^B [17, 22, 97]
Tumor location	Yes ^{↑c} in upper vs. lower extremity sarcoma survivors [80]	-	-	No ^c [81]
SMN or recurrence	Yes ^{↑c} [17, 22, 26, 29]	No ^c [73]	-	Yes ^{↑B} [22, 85, 91]
Late effects	Yes ^{↑c} with late effects ^h [17, 81], with psychological distress ^c [19], epilepsy/seizures ^c [26], or visual/hearing problems ^c [22, 26, 81]	No ^{C,e} [74]	-	Yes ^{↑A} with late effects ^h [17, 81, 97], or with neuropsychological functioning deficits [19, 22, 39, 82, 98]
	Yes ^{↑A} with neuropsychological functioning deficits [19, 22, 82]			Yes ^{↑B} with psychological distress [19, 39, 98], epilepsy/seizures [14, 91], or vision problems [81, 91]
Physical disability	-	-	-	Yes ^{↑B} [14, 39]
Quality of life	-	-	-	Yes ^{↑Cl} [98]

2. What are the risk factors for poor educational/employment outcomes? (continued)				
	Lower educational achievement ^s	Repeating a grade ^s	Special education ^s	Unemployment ^s
Demographic risk factors				
Sex	Yes ^{↑c} for females [17, 19, 22, 26, 29, 61, 80, 81]	Yes ^{↑c} for males [73]	No studies	Yes ^{↑B} for females [14, 17, 19, 22, 61, 80-82, 84, 85, 88, 91, 97]
Age	Yes ^{↓c} with older age at follow-up [17, 19, 22, 26, 29, 80, 81]	-		Yes ^{↑c} for survivors with younger age at follow-up [14, 17, 19, 22, 80-82, 84, 85, 91, 97]
Race/ ethnicity/ immigration status	Yes ^{↑A} for non-white survivors, and survivors with a migration background [17, 29, 80]	-		Yes ^{↑c} for non-white survivors, and survivors with a migration background [17, 80, 84, 85]
Educational achievement	-	-		Yes ^{↑A} with lower educational achievement [14, 17, 97]
Parents' education	Yes ^{↓B} with parents' higher level of education [29, 61]	Yes ^{↑B} with parents' lower level of education [73, 74]		Yes ^{↑c} with lower parents' education [61]
Sibling status	No ^c [29]	-		-
Financial difficulties ^l	-	Yes ^{↑c} [73]		-
History of repeating a grade	-	Yes ^{↑c} [73]	-	
Help at school	-	Conflicting [73, 74]	-	

Marital status	-	-		Yes ↓ ^c in unmarried survivors [17]
Having children	-	-		Yes ↑ ^c for survivors with children [22]
IQ	-	-		Yes ↑ ^c with lower IQ [14]

3. Which interventions can improve educational/employment outcomes among childhood cancer survivors?

No studies evaluating interventions to improve education or employment outcomes in survivors of childhood, adolescent and young adult cancers identified.

No studies

Note: Dark blue indicates Level A evidence; medium blue indicates Level B evidence; light blue indicates Level C evidence; light grey indicates conflicting evidence. **Abbreviations:** CAYA=childhood, adolescent, and young adult; CNS=central nervous system; CRT=cranial radiotherapy; IQ=intelligence quotient; SMN=second malignant neoplasm

^A Level A evidence

^B Level B evidence

^C Level C evidence

^SConflicting=Conflicting evidence; No=No statistically significant association; Yes=statistically significant association: ↑ increased risk for/ ↓ decreased risk for; -=not tested

^dsurgery (not further specified)

^echemotherapy (not further specified)

^fradiotherapy (not further specified)

^gvs. soft-tissue sarcoma survivors

^hlate effects (not further specified)

ⁱfinancial difficulties at diagnosis

^jafter higher doses of cranial radiation

^kamong ALL and AML survivors

^llower quality of life associated with increased risk for unemployment

^myounger age at diagnosis associated with increased risk for unemployment