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Topic: Special Education

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98-15

CHILDHOOD CANCER SURVIVOR STUDY
Analysis Concept Form

1. STUDY TITLE - Utilization of Special Education Services Among Adult Long-Term Survivors of Childhood Cancer

2. WORKING GROUP AND INVESTIGATORS: This proposed publication will be within the Neurologic/Psychosocial Working Group. Proposed investigators (name/email/fax) will include:

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3. BACKGROUND AND RATIONALE: In 1994, approximately 8,000 new cases of cancer were diagnosed in the U.S. in children under the age of 15. It is expected that more than 6,500 of these children will become long-term survivors. With the introduction of mulitmodal therapy in the early 1970s, five year survival rates for most childhood cancers have improved drastically. Data from the Surveillance, Epidemiology, and End Results (SEER) Program show five year survival rates for all childhood cancers have increased from 45% in 1970-1973 to 71% by 1986-1992 with current five year survival rates for acute lymphoblastic leukemia at 79%, Hodgkin's disease at 92%, and Wilms tumor at 93%.

As more and more children become long-term survivors, it is necessary to identify the degree to which late effects of therapy impact the quality of life of these survivors. The purpose of this analysis is to describe the self-reported (respondent reported) utilization of special education (SE) services among these long-term survivors in terms of diagnosis, age of diagnosis, and type of treatment received.

Many studies of long-term survivors of childhood acute lymphoblastic leukemia (ALL) and central nervous system (CNS) tumors have identified deficiencies in IQ scores, cognition, and educational attainment. Though most did not look specifically at the area of enrollment into special education programs, these studies give us insight into potential risk factors and areas of difficulties long-term survivors of childhood cancer may face. Risk factors identified by such studies include administration of cranial radiation, especially at higher doses, early age of treatment, and sex. Areas often affected include behavioral deficits such as shortened attention spans, poor concentration, distractibility, short term memory problems, memory for processes, and sequencing order of events.

4. SPECIFIC AIMS/OBJECTIVES/RESEARCH HYPOTHESES: The specific aims of this proposed research include: AIM 1 - To identify whether the rate of special education services differs by cancer type in survivors diagnosed with cancer as children. AIM 2 - To identify whether treatment is associated with the need for special education services among survivors diagnosed with cancer as children.

The five primary hypotheses to be addressed by this analysis include:

1. Younger age at diagnosis will be associated with a higher utilization rate of special education services.
2. Utilization of special education services will differ across cancer types:
   (a) Patients diagnosed with brain tumors and leukemias will most often need special education due to problems with learning and concentrating and low test scores.
   (b) Patients diagnosed with bone tumors will most often need special education due to absence from school.
3. The use of special education services will increase 2 years after diagnosis for those cancer survivors who were diagnosed with leukemia or CNS tumors.
4. Patients treated with cranial radiation, alone or in combination with methotrexate will utilize special education services more than patients not treated with cranial radiation.
5. Aside from methotrexate, no other forms of chemotherapy will be associated with the utilization of special education services.

5. ANALYSIS FRAMEWORK:

   (a) Outcome(s) of interest: whether patient was enrolled in special education, grades in special education classes.

   (b) Subject population: Patients who were at least 18 at completion of questionnaire that have completed medical record abstraction forms.

   (c) Explanatory variables: survival, gender, race, diagnosis, age at diagnosis, cranial radiation (y/n), dose of cranial radiation, methotrexate (y/n), dose of methotrexate.

   (d) Specific tables: This analysis was run on the first 5,774 completed over 18 questionnaires. Tables describing the results from this preliminary analysis are provided.

   (e) Further analysis: This preliminary analysis identified a protetive effect between the need for special education services and doses of intrathecal methotrexate (IT MTX) greater than or equal to 108 mg. There is evidence that the administration of IT MTX prior to cranial radiation may in fact be protective. With this dataset, we would like to look further into this relationship, spefically looking at the need for special education among those who received IT MTX prior to cranial radiation versus those who received it after cranial radiation.

6. SPECIAL CONSIDERATION: Preliminary analysis was conducted on the first 5,774 completed over 18 questionnaires for Pauline Mitby's master's project, with the understanding that the analysis would be re-run and proposed for publication when the entire cohort dataset is completed.

TABLE 1
Characteristics of Study Participants

Characteristic	Participants n (%)
Survival	
Alive	5494 (95.2)
Dead	280 (4.8)
Gender	
Male	3035 (52.6)
Female	2738 (47.4)
Race	
White, non-Hispanic	5017 (91.5)
Black, non-Hispanic	160 (2.9)
Hispanic	206 (3.8)
Other	101 (1.8)
Diagnosis	
Leukemia	1785 (30.9)
CNS	794 (13.8)
Hodgkin's Disease	1018 (17.6)
Non-Hodgkin's Lymphoma	474 (8.2)
Kidney	304 (5.3)
Neuroblastoma	225 (3.9)
Soft Tissue Sarcoma	527 (9.1)
Bone Cancer	647 (11.2)
Age at Diagnosis	
0-5	1662 (28.8)
6-10	1358 (23.5)
11-15	1668 (28.9)
16-20	1086 (18.8)
Special Education	
Yes	1279 (25.3)
No	3736 (74.0)
Don't know	37 (0.7)

TABLE 2
Reasons for Special Education Services
by Age at Diagnosis

Age at Diagnosis	Had Special Education		Number who responded Yes or No to Specific Reason[1]							
			Missed School		Low Tests		Learning/ Concentrating		Emotional/ Behavioral	
	Y	N	Y	N	Y	N	Y	N	Y	N
0-5	510 (35.0)	946 (65.0)	89 (20.8)	339 (78.2)	237 (56.0)	186 (44.0)	360 (84.1)	68 (15.9)	44 (10.5)	376 (89.5)
6-10	347 (30.0)	810 (70.0)	111 (38.5)	177 (61.5)	131 (47.3)	146 (52.7)	215 (75.7)	69 (24.3)	26 (9.4)	251 (90.6)
11-15	281 (19.4)	1167 (80.6)	68 (39.5)	104 (60.5)	54 (31.8)	116 (68.2)	123 (70.7)	51 (29.3)	29 (17.1)	141 (82.9)
16-20	141 (14.8)	813 (85.2)	11 (18.0)	50 (82.0)	17 (27.9)	44 (72.1)	43 (68.3)	20 (31.7)	3 (5.1)	56 (94.9)
χ^2	173.13		39.18		38.63		19.14		9.33	
	p<.01		p<.01		p<.01		p<.01		p=.025	

[1] Results based on 1,279 participants who indicated they were in special education
Participants who answered "don't know" or who did not indicate specific reasons are not represented in this table

TABLE 3
Reasons for Special Education Services
by Diagnosis

Diagnosis	Had Special Education		Number who responded Yes or No to Specific Reason[1]							
			Missed School		Low Tests		Learning/ Concentrating		Emotional/ Behavioral	
	Y	N	Y	N	Y	N	Y	N	Y	N
Leukemia	455 (29.8)	1071 (70.2)	99 (28.0)	254 (72.0)	183 (52.3)	167 (47.7)	297 (83.2)	60 (16.8)	35 (10.0)	316 (90.0)
CNS	333 (47.3)	371 (52.7)	72 (25.3)	213 (74.7)	132 (47.3)	147 (52.7)	242 (85.8)	40 (14.2)	26 (9.5)	247 (90.5)
Hodgkin's Disease	158 (17.7)	733 (82.3)	28 (37.8)	46 (62.2)	29 (41.4)	41 (58.6)	44 (57.9)	32 (42.1)	8 (11.1)	64 (88.9)
Non-Hodgkin's Lymphoma	78 (19.1)	331 (80.9)	19 (32.8)	39 (67.2)	25 (42.4)	34 (57.6)	36 (63.2)	21 (36.8)	9 (16.1)	47 (83.9)
Kidney	42 (16.3)	216 (83.7)	6 (18.8)	26 (81.2)	17 (53.1)	15 (46.9)	27 (84.4)	5 (15.6)	4 (13.3)	26 (86.7)
Neuroblastoma	44 (22.7)	150 (77.3)	10 (33.3)	20 (66.7)	12 (44.4)	15 (55.6)	18 (62.1)	11 (37.9)	3 (10.3)	26 (89.7)
Soft Tissue Sarcoma	86 (18.2)	387 (81.8)	21 (32.8)	43 (67.2)	24 (38.7)	38 (61.3)	42 (65.6)	22 (34.4)	8 (12.7)	55 (87.3)
Bone Cancer	83 (14.8)	477 (85.2)	24 (45.3)	29 (54.7)	17 (32.7)	35 (67.3)	35 (67.3)	17 (32.7)	9 (17.3)	43 (82.7)
χ^2	294.26		14.29		11.84		55.24		4.93	
	p<.01		p=.046		p=.106		p<.01		p=.668	

[1] Results based on 1,279 participants who indicated they were in special education
Participants who answered "don't know" or who did not indicate specific reasons are not represented in this table

TABLE 4
Demographic Data by Treatment Type

	Neither	Cranial XRT	IT Methotrexate	Both
Age at diagnosis				
0-5	306 (33.6)	131 (14.4)	26 (2.9)	447 (49.1)
6-10	206 (32.6)	128 (20.3)	49 (7.8)	249 (39.4)
11-15	372 (53.1)	112 (16.0)	42 (6.0)	175 (25.0)
16-20	320 (75.1)	42 (9.9)	9 (2.1)	55 (12.9)
Diagnosis				
Leukemia	27 (2.7)	102 (10.0)	30 (3.0)	858 (84.4)
CNS	24 (7.6)	280 (88.6)	1 (0.3)	11 (3.5)
Hodgkin's Disease	545 (99.5)	2 (0.4)	1 (0.2)	0 (0.0)
Non-Hodgkin's Lymphoma	62 (30.4)	5 (2.5)	90 (44.1)	47 (23.0)
Kidney	156 (99.4)	0 (0.0)	1 (0.6)	0 (0.0)
Neuroblastoma	114 (97.4)	2 (1.7)	1 (0.9)	0 (0.0)
Soft Tissue Sarcoma	165 (87.8)	11 (5.9)	2 (1.1)	10 (5.3)
Bone Cancer	111 (91.0)	11 (9.0)	0 (0.0)	0 (0.0)
Year of diagnosis				
70-75	458 (49.0)	176 (18.8)	24 (2.6)	277 (29.6)
76-80	408 (40.2)	135 (13.3)	46 (4.5)	425 (41.9)
81-86	338 (46.9)	102 (14.2)	56 (7.8)	224 (31.1)

TABLE 5
Reasons for Special Education Services
by Cranial Radiation Dose

Dose Level	Had Special Education		Number who responded Yes or No to Specific Reason[1]							
			Missed School		Low Tests		Learning/ Concentrating		Emotional/ Behavioral	
	Y	N	Y	N	Y	N	Y	N	Y	N
no brain XRT	256 (22.0)	909 (78.0)	51 (41.8)	71 (58.2)	45 (37.8)	74 (62.2)	68 (55.7)	54 (44.3)	16 (6.3)	76 (29.7)
1000-2499 cGy	291 (35.8)	521 (64.2)	56 (25.6)	163 (74.4)	120 (55.3)	97 (44.7)	184 (84.0)	35 (16.0)	18 (6.2)	137 (47.1)
2500-3499 cGy	18 (39.1)	28 (60.9)	3 (23.1)	10 (76.9)	9 (64.3)	5 (35.7)	11 (78.6)	3 (21.4)	0 (0.0)	10 (55.6)
3500-4499 cGy	17 (54.8)	14 (45.2)	3 (18.8)	13 (81.2)	9 (56.2)	7 (43.8)	15 (93.7)	1 (6.3)	1 (5.9)	8 (47.1)
4500-5499 cGy	115 (57.8)	84 (42.2)	23 (23.0)	77 (77.0)	50 (50.0)	50 (50.0)	89 (89.9)	10 (10.1)	7 (6.1)	71 (61.7)
≥ 5500 cGy	38 (59.4)	26 (40.6)	8 (24.2)	25 (75.8)	17 (56.7)	13 (43.3)	26 (81.2)	6 (18.8)	4 (10.5)	23 (60.5)
χ^2	163.84 p<.01		14.19 p=.014		11.4 p=.044		50.99 p<.01		6.61 p=.761	

[1] Results based on 2,346 participants who have complete radiation data, 735 of which indicated they were in special education Participants who answered "don't know" or who did not indicate specific reasons are not represented in this table

TABLE 6
Enrollment into Special Education
by Chemotherapeutic Agent

Drug	Relative Risk	95% Confidence Limits	p-value
Actinomycin-D	1.27	0.99 , 1.64	0.589
Bleomycin	1.01	0.70 , 1.47	0.953
Cis-Platinum	1.03	0.73 , 1.45	0.881
Cyclophosphamide (Cytoxan)	1.56*	1.31 , 1.45	<.01
IT Cytosine Arabinoside (IT Ara-C)	0.70*	0.53 , 0.93	0.014
Cytosine Arabinoside (Ara-C) other routes	0.66*	0.51 , 0.85	<.01
Daunorubicin (Daunomycin)	1.35*	1.01 , 1.81	0.041
Dexamethasone	0.81	0.63 , 1.05	0.112
Doxorubicon (Adriamycin)	1.28*	1.07 , 1.52	<.01
L-Asparaginase	1.14	0.87 , 1.50	0.335
6-Mercaptopurine (6 MP)	0.97	0.73 , 1.30	0.848
IT Methotrexate (IT MTX)	0.91	0.68 , 1.23	0.548
Methotrexate (MTX)	0.99	0.76 , 1.31	0.994
Nitrogen Mustard	1.62*	1.10 , 2.37	0.015
Prednisone	0.89	0.69 , 1.14	0.354
Procarbazine	0.94	0.66 , 1.33	0.708
6-Thioguanine (6 TG)	1.12	0.79 , 1.59	0.517
Vinblastine (Velban)	1.32	0.88 , 1.99	0.179
Vincristine	0.99	0.79 , 1.25	0.967

TABLE 7
Reasons for Special Education Services
by Type of Treatment

Treatment Type	Had Special Education		Number who responded Yes or No to Specific Reason[1]							
			Missed School		Low Tests		Learning/ Concentrating		Emotional/ Behavioral	
	Y	N	Y	N	Y	N	Y	N	Y	N
neither	230 (21.9)	819 (78.1)	42 (40.0)	63 (60.0)	39 (38.6)	62 (61.4)	58 (54.7)	48 (45.3)	13 (12.6)	90 (87.4)
cranial XRT	197 (53.2)	173 (46.8)	36 (22.6)	123 (77.4)	79 (51.3)	75 (48.7)	138 (88.5)	18 (11.5)	12 (7.8)	141 (92.2)
IT Methotrexate	26 (23.0)	87 (77.0)	9 (52.9)	8 (47.1)	6 (33.3)	12 (66.7)	10 (62.5)	6 (37.5)	3 (16.7)	15 (83.3)
both	282 (35.8)	506 (64.2)	57 (25.7)	165 (74.3)	126 (56.5)	97 (43.5)	187 (83.5)	37 (16.5)	18 (8.3)	200 (91.7)
χ^2	141.99		15.30		11.08		50.05		3.16	
	p<.01		p=<.01		p=.011		p<.01		p=.368	

[1] Results based on 2,346 participants who have complete radiation data, 735 of which indicated they were in special education
Participants who answered "don't know" or who did not indicate specific reasons are not represented in this table

TABLE 8
Factors Associated with Enrollment into Special Education
Multiple Logistic Regression Analysis

Variable	Relative Risk	95% Confidence Limits	p-value
Leukemia	1.19	0.67, 1.18	0.018
CNS	1.60*	1.18, 2.17	<.01
Cranial Radiation	2.50*	2.11, 3.26	<.01
IT Methotrexate	0.77*	0.59, 0.99	0.040
Brain Surgery	1.43*	1.07, 1.93	0.016
Age at Diagnosis	0.94*	0.93, 0.96	<.01
Year of Diagnosis	1.01	0.99, 1.03	0.246
Female	0.90	0.77, 1.05	0.176

TABLE 9
Multiple Logistic Regression
for Variables Associated with Special Education
Best Fitting Model

Variable	Relative Risk	95% Confidence Limits	p-value
CNS	1.87	1.43, 2.43	<.01
CRT < 2499 cGy	1.24	0.44, 3.47	0.689
CRT ≥ 2500 cGy	1.81	0.67, 4.93	0.244
IT MTX < 108 mg	0.99	0.76, 1.29	0.951
IT MTX ≥ 108 mg	0.65	0.50, 0.85	<.01
Age at diagnosis			
0-5	1.48	1.03, 2.15	0.037
CRT < 2499 cGy	1.75	0.59, 5.14	0.31
CRT ≥ 2500 cGy	1.77	0.54, 5.76	0.347
6-10	1.27	0.86, 1.87	0.231
CRT < 2499 cGy	1.21	0.39, 3.78	0.739
CRT ≥ 2500 cGy	2.27	0.73, 7.07	0.156
11-15	1.16	0.81, 1.66	0.423
CRT < 2499 cGy	0.59	0.17, 2.04	0.405
CRT ≥ 2500 cGy	0.88	0.28, 2.79	0.829
Gender			
Female	0.59	0.35, 0.87	0.011
CRT < 2499	2.62	0.55, 12.45	0.225
CRT ≥ 2500 cGy	0.44	0.09, 2.22	0.318
Age at Diagnosis			
0-5	1.41	0.78, 2.54	0.251
CRT < 2499	0.83	0.16, 4.28	0.819
CRT ≥ 2500	7.09	1.01, 49.86	0.049
6-10	1.42	0.76, 2.65	0.268
CRT < 2499	0.55	0.10, 3.06	0.491
CRT ≥ 2500	2.75	0.43, 17.37	0.283
11-15	1.3	0.73, 2.32	0.37
CRT < 2499	1.16	0.19, 7.02	0.874
CRT ≥ 2500	2.87	0.45, 18.51	0.267