CARING FOR ADULTS WHO SURVIVED CHILDHOOD CANCER

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DISCLOSURES

- Consulting fees: Amgen, Roche, Bayer,
- Speaker's bureau/honoraria: Amgen, Novo Nordisk

OBJECTIVES

At the end of this presentation, the participant will be able to :

- Recognize the long-term risks and complications associated with childhood cancer and its treatment
- Identify available sources for evidence-based information to guide follow-up for adult survivors of childhood cancer
- Investigate and screen for possible complications related to the prior cancer and its treatments
- Manage ongoing chronic healthcare needs of this unique population

KEY POINTS

- 75% of childhood cancer survivors experience at least one adverse event and 40% at least one severe, life-threatening or disabling event - Survivors of childhood cancers need a life long systematic follow-up
- 85% of survivor of childhood cancer depend on their primary care physician for follow-up
- If your patient is a survivor of childhood cancer, you should have access to a clear Summary of Cancer Treatment provided by the pediatric cancer centre that treated them.
- Appropriate survivor care requires patient and physician knowledge about the long-term risks of cancer therapy
- Children's Oncology Group (COG) Centres accept referrals to assist with tracing back treatment summaries and preparing individualized follow-up plans.
- COG offers detailed guidelines on identifying, assessing and managing late effects of childhood cancer treatment.

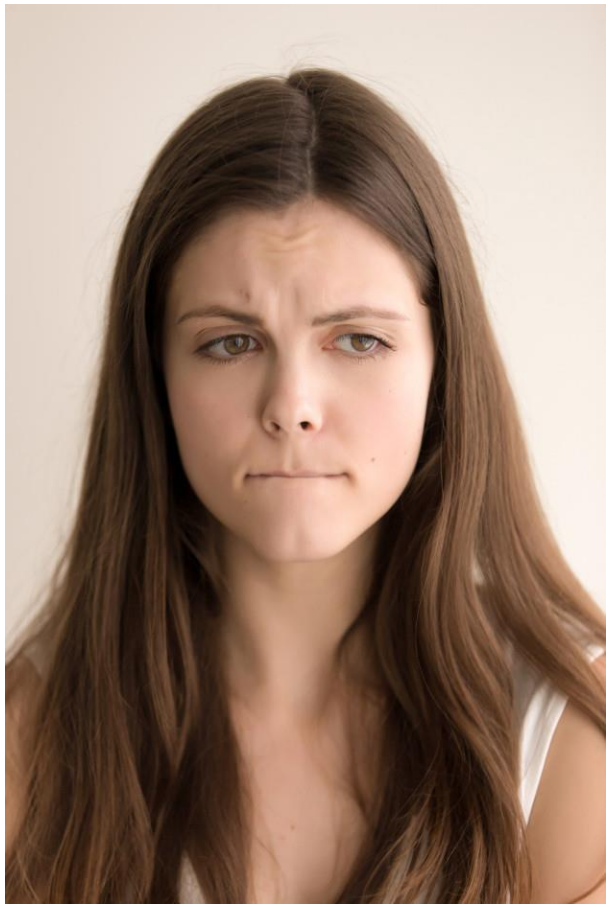
CASE 1

18 yr old girl previously treated for Aplastic Anemia with Allogenic Stem Cell Transplant

4.5 years post BMT from her brother. Fully engrafted with 96% donor chimerism.

Complications from treatment:

- Chronic GVHD
  - residual oral GVHD (previous extensive skin and gut).
  - Vaginal dryness and atrophy
- Mental health issues with depression and anxiety, self harm
- Chronic neuropathic pain - on Gabapentin
- Eating disorder?
- Heavy Marijuana use
- Left eye vitreous hemorrhage with vitrectomy (now developing cataract) developed while thrombocytopenic
- Abnormal PAP smears - will need gyne follow up



CASE 2

19 year old young woman who was treated with allogeneic BMT (MUCB) ~ 18 years ago for Infant ALL.

Treated with high dose chemo & TBI.

She has numerous complications including

- Tachycardia (unknown etiology) and diastolic dysfunction
- Cataracts
- Precocious puberty
- Type 2 diabetes
- Short stature
- Primary ovarian failure
- Mild renal impairment
- Migraines
- Hypertriglyceridemia
- Anxiety, emotional immaturity

TRANSITIONING TO ADULT CARE

CHILDHOOD CANCERS

- Affects 15 per 100,000 children

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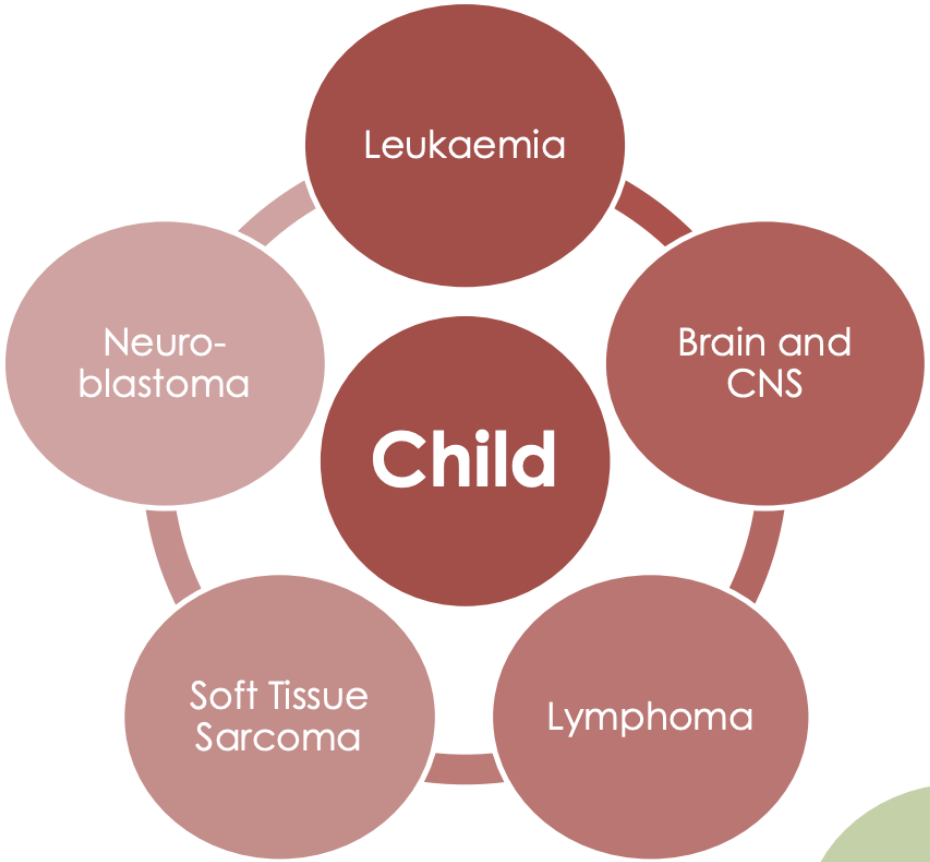
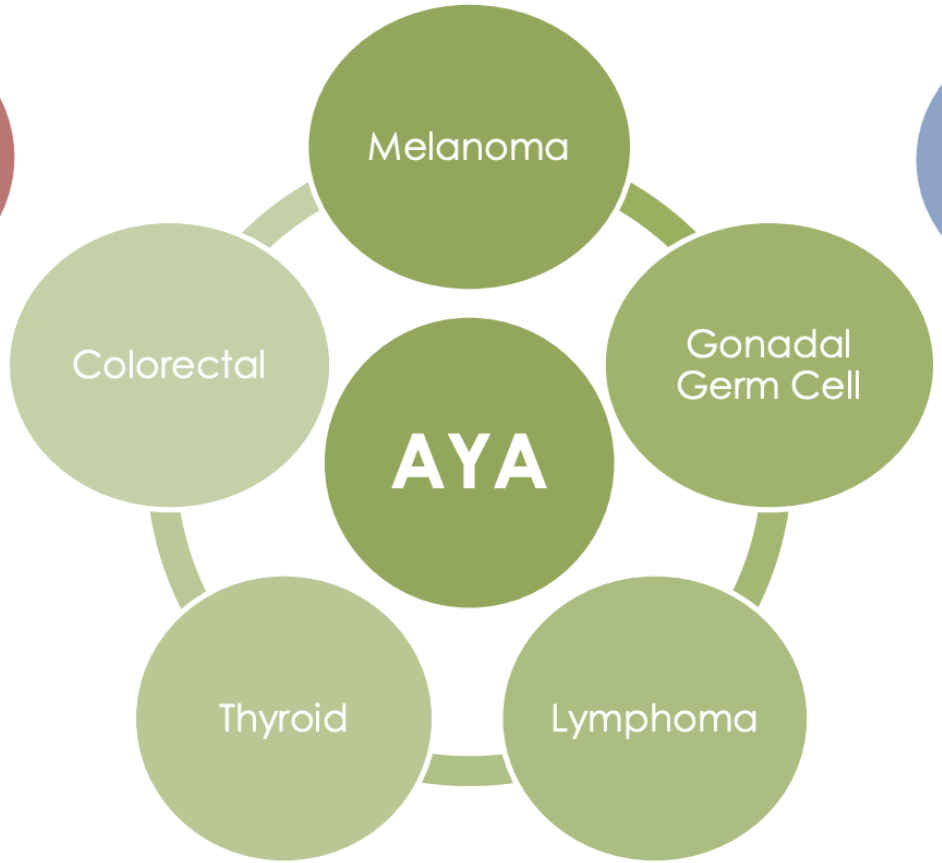
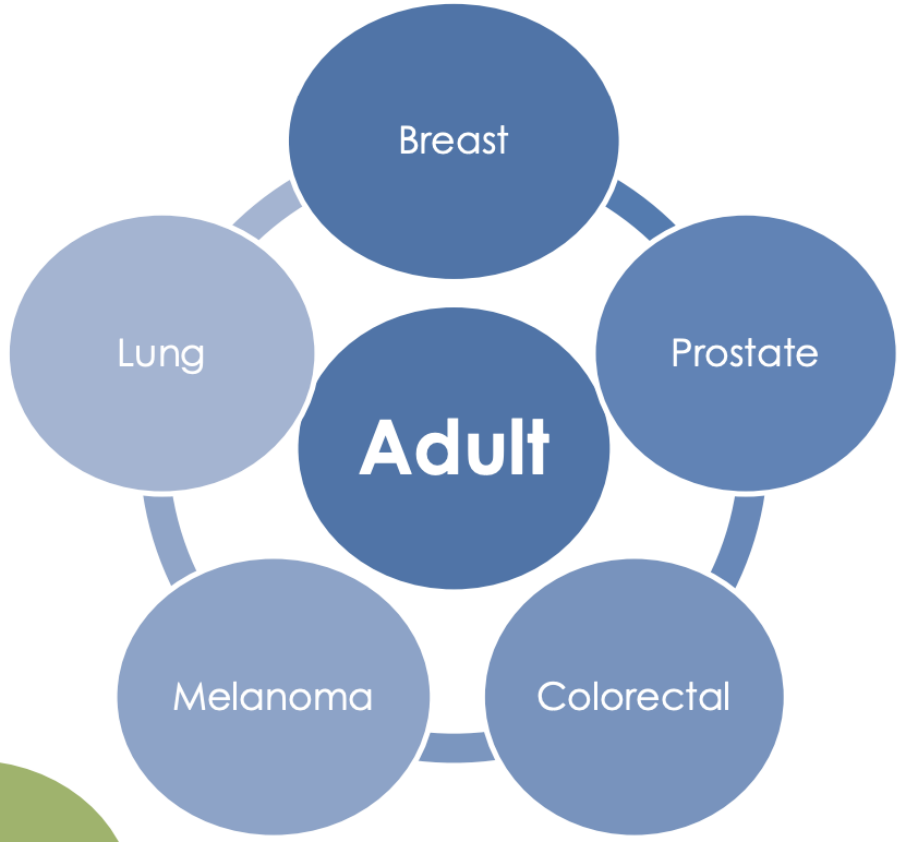
- The most common type of cancer in children is ALL (1/3)
- The most common solid tumors are brain tumors (e.g., glioma and medulloblastoma).



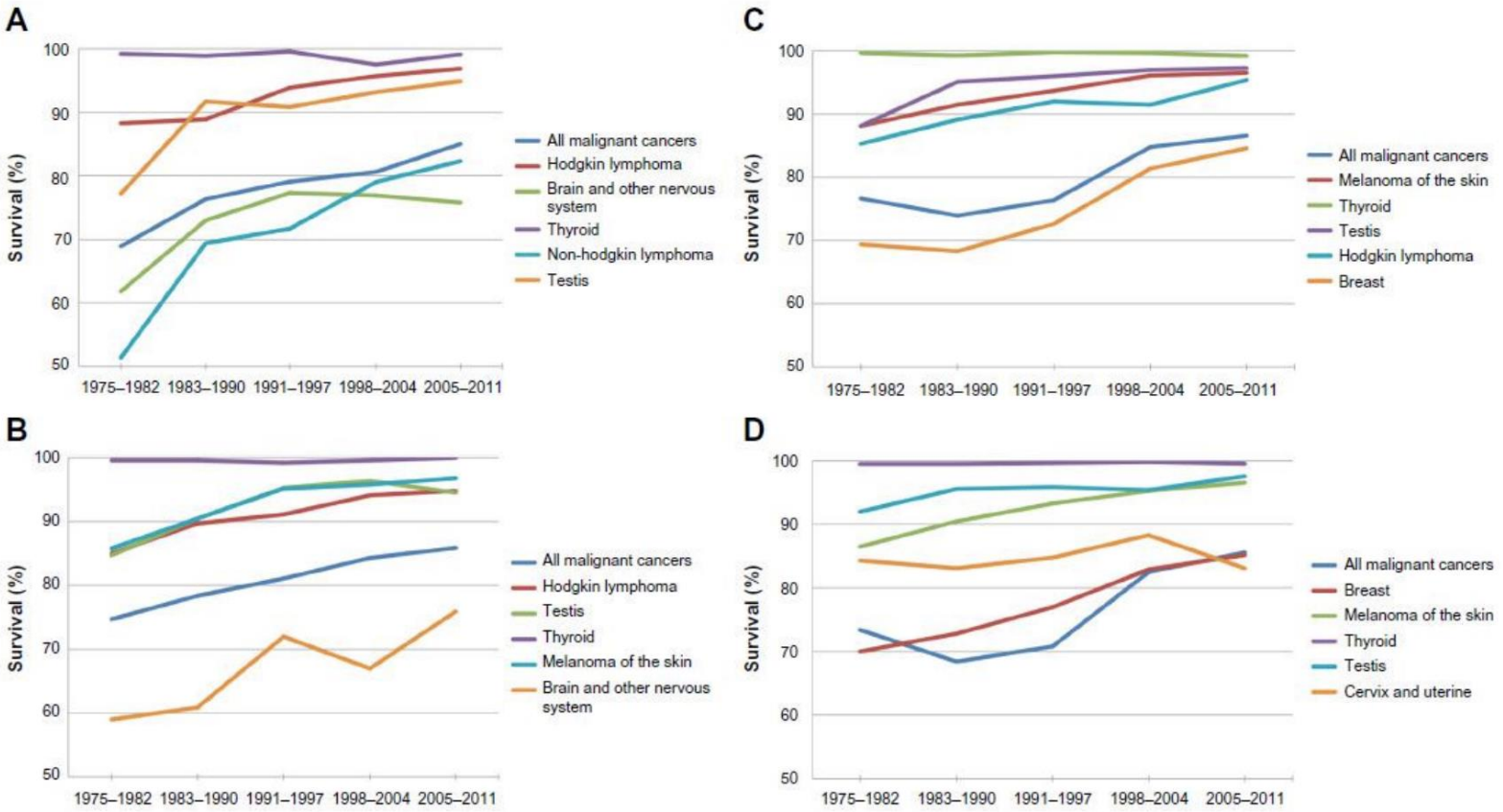




https://canteenconnect.org/

CHILDHOOD CANCERS

- "Late effects" of cancer treatment are defined as therapy-related complications or adverse effects that persist or arise after completion of treatment for a pediatric malignancy.
  - Organ dysfunction
  - Impaired growth and development
  - Neurocognitive problems
  - Secondary cancers



A. 15-19 y.o.
B. 20-24 y.o.
C. 25-29 y.o.
D. 30-34 y.o.

Friend et al. COAYA. 2017

CHILDHOOD CANCERS

- A retrospective study 1362 five-year childhood cancer survivors found that :
  - after a follow-up of 17 years, 75% of childhood cancer survivors had experienced at least one adverse event
  - 40% at least one severe, life-threatening or disabling event.

JAMA, 01 Jun 2007, 297(24):2705-2715

CHILDHOOD CANCERS

- Multiple large cohort stutides found :
  - Higher premature death rates
  - Increased risks of a range of physical and psychosocial problems

CHILDHOOD CANCERS

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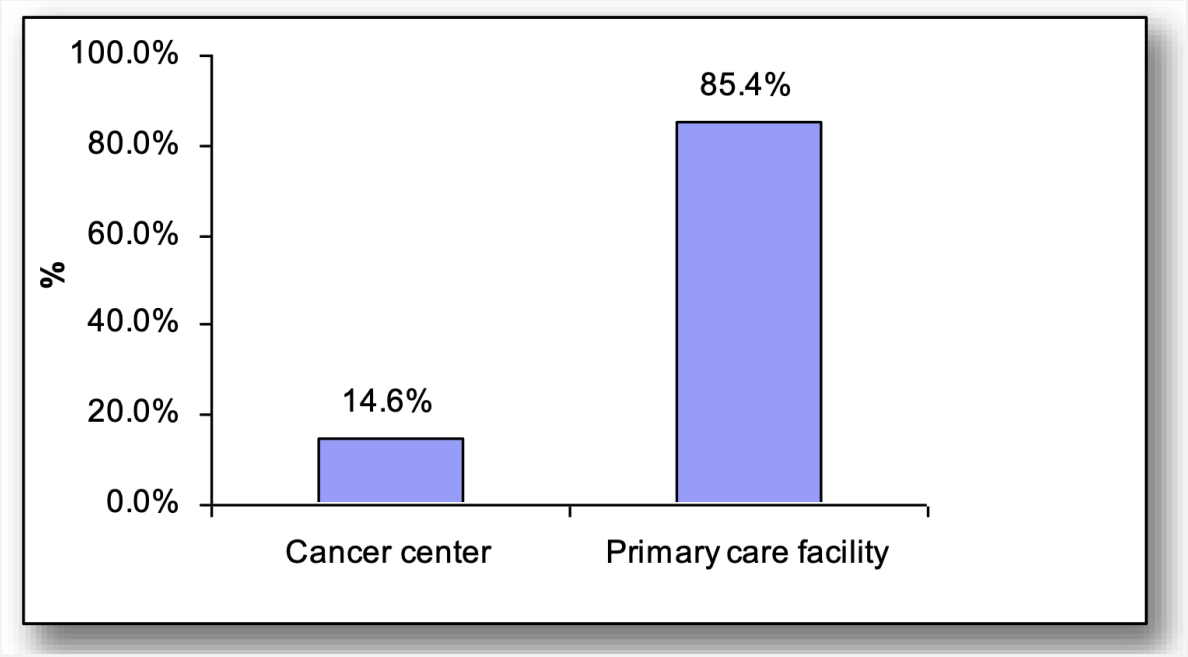
  - Increased risks of a range of physical and psychosocial problems

Survivors of childhood cancers need a life long systematic follow-up

YES BUT… BY WHO?

WHERE DO ADULT SURVIVORS OF CHILDHOOD AND AYA CANCER GETTING THEIR CARE?



Nathan et al. J Clin Oncol 2008

TRANSITIONING TO ADULT CARE

- Providing appropriate long-term follow-up is a major challenge
  - Most adult survivors of childhood cancer receive their follow-up care from a family physician
  - Often there has been no formal transition from the cancer centre
  - Patients generally are unaware of their long-term risks, have an inadequate understanding of their previous therapy, and arrive without a summary of their cancer treatment.

TRANSITIONING TO ADULT CARE

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  - Most adult survivors of childhood cancer receive their follow-up care

There is help available!

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CHILDREN'S ONCOLOGY GROUP (COG)

- There are 16 Children's Oncology Group clinics/centres in Canada.
- They aim to protect health and promote quality of life for survivors of childhood cancer by providing services such as:
  - Assistance with researching patient histories and providing a summary of treatment.
  - Smooth transition to adult care
  - Offer detailed long-term follow-up guidelines
  - Collection of data on late effects to improve care of future generations of children with cancer.

CHILDREN'S ONCOLOGY GROUP

The world's childhood cancer experts

Summary of Cancer Treatment (Abbreviated)

Demographics		
Name	Sex ☐ M ☐ F	Date of Birth

Cancer Diagnosis		
Diagnosis	Date of Diagnosis	Date Therapy Completed

Chemotherapy ☐ Yes ☐ No *If yes, provide information below*

Drug Name	Additional Information†

†**Anthracyclines**: Include cumulative dose in mg/m^2 (see section 33 of Guidelines for isotoxic dose conversion);
Carboplatin: Indicate if dose was myeloablative
Methotrexate and Cytarabine: Indicate route of administration (i.e., IV, IM, SQ, PO, IT, IO);
IV Methotrexate and Cytarabine: Indicate if "high dose" (any single dose ≥ 1000 mg/m^2) or "standard dose" (all single doses < 1000 mg/m^2)
Note: Cumulative doses, if known, should be recorded for all agents, particularly for alkylators and bleomycin.

Radiation ☐ Yes ☐ No *If yes, provide information below*

Site/Field	Total Dose* (including boost) (Gy)**

*For head/brain, neck, chest, abdomen, spine (whole, cervical, thoracic) radiation and TBI, include total doses (including boost dose, if given)
**To convert cGy or rads to Gy, divide dose by 100 (example: 2400 cGy = 2400 rads = 24 Gy)

Hematopoietic Cell Transplant ☐ Yes ☐ No *If yes, provide information below*

Transplant Type	Autologous ☐ Yes ☐ No	Allogeneic ☐ Yes ☐ No
Chronic Graft-Versus-Host Disease (cGVHD)	Ever diagnosed? ☐ Yes ☐ No	Currently active? ☐ Yes ☐ No

Surgery ☐ Yes ☐ No *If yes, provide information below*

Procedure	Site (if applicable)	Laterality (if applicable)

Other Therapeutic Modalities ☐ Yes ☐ No *If yes, provide information below*

Did the patient receive radioiodine therapy (I-131 thyroid ablation)? ☐ Yes ☐ No

Did the patient receive systemic MIBG (in therapeutic doses)? ☐ Yes ☐ No

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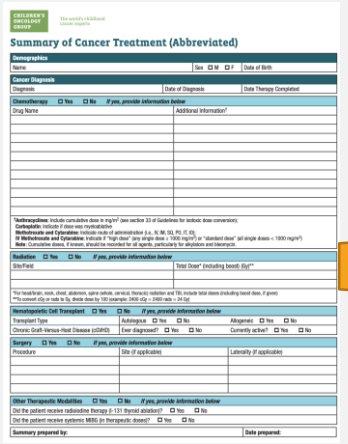

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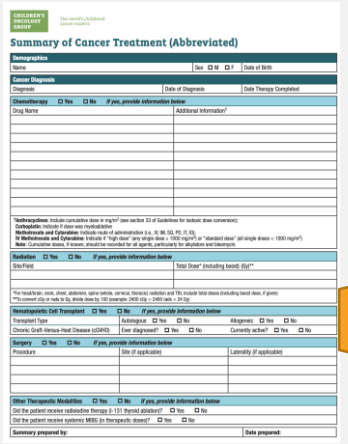

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Busulfan: Indicate if dose was myeloablative (> 4 mg/kg/day PO or > 130 mg/m²) or "standard dose" (all single doses < 1000 mg/m²)
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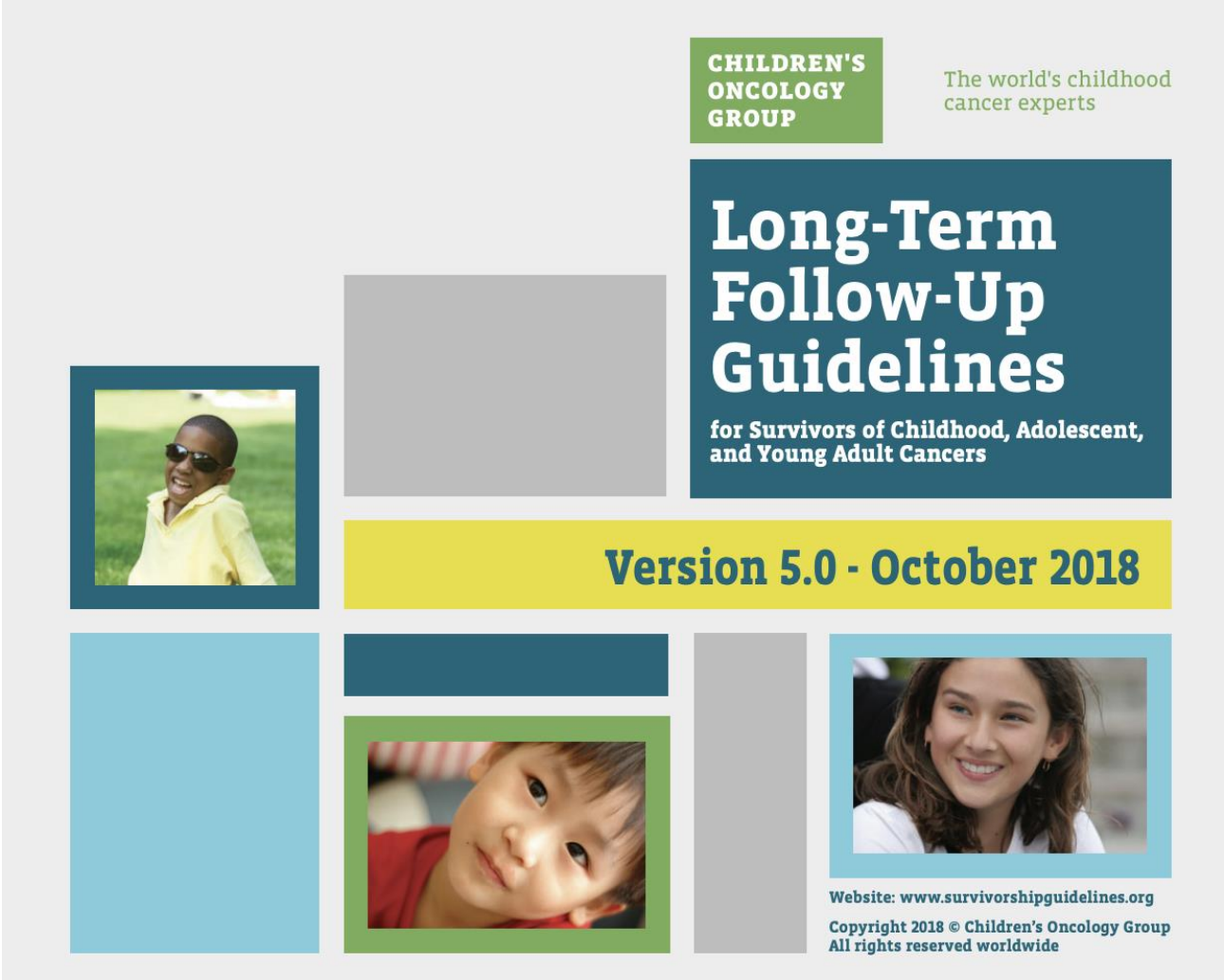
LONG TERM FOLLOW-UP GUIDELINES



http://www.survivorshipguidelines.org/

LONG TERM FOLLOW-UP GUIDELINES

CHILDREN'S ONCOLOGY GROUP

The world's childhood cancer experts

http://www.survivorshipguidelines.org/

BC Children's Hospital™

http://www.bcchildrens.ca/health-professionals/clinical-resources/oncology#LTFU--Guidelines

LONG TERM FOLLOW-UP GUIDELINES

BC Children's Hospital

Ewing Sarcoma

Ewing Early FU Clinic
Ewing Late Effects Clinic

Germ Cell Tumour

Germinoma, localized, focal RT, Early FU clinic
Germinoma, localized, focal RT, Late FU clinic

Hodgkin Lymphoma

Hodgkin Lymphoma Early FU Clinic
Hodgkin Lymphoma Late Effects Clinic

Liver Tumours

Liver Tumours Early FU Clinic
Liver Tumours Late Effects Clinic

LONG TERM FOLLOW-UP GUIDELINES

Allogeneic Blood & Marrow Transplant

BMT Myeloablative with TBI, Dx GVHD Early FU Clinic
BMT Myeloablative with TBI, Dx GVHD Late FU Clinic
BMT Myeloablative with TBI, no GVHD Early FU Clinic
BMT Myeloablative with TBI, no GVHD Late FU Clinic
BMT Myeloablative, no TBI, Dx GVHD Early FU Clinic
BMT Myeloablative, no TBI, Dx GVHD Late FU Clinic
BMT Myeloablative, no TBI, no GVHD Early FU Clinic
BMT Myeloablative, no TBI, no GVHD Late FU Clinicf
BMT Non-myeloablative, no TBI, no GVHD Early FU Clinic.pdf
BMT Non-Myeloablative, no TBI, no GVHD Late FU Clinic

Acute Lymphoblastic Leukemia & Lymphoblastic Lymphoma

ALL with CNS RT Early FU Clinic
ALL with CNS RT Late Effects Clinic
Standard and High Risk ALL and LLy Early FU Clinic
Standard and High Risk ALL and LLy Late Effects Clinic
Very High Risk, Infant and Ph pos ALL Early FU Clinic
Very High Risk, Infant and Ph pos ALL Late Effects Clinic

LONG TERM FOLLOW-UP GUIDELINES

BC Children's Hospital

CNS Tumours

Ependymoma, localized, focal RT, Early FU clinic
Ependymoma, localized, focal RT, Late FU clinic
Ependymoma, Metastatic, Chemo and CSI RT, Early FU clinic
Ependymoma, Metastatic, Chemo and CSI RT, Late FU clinic
Germinoma, localized, focal RT, Early FU clinic
Germinoma, localized, focal RT, Late FU clinic
Low Grade Glioma (GTR), Surgery only Early and Late FU clinic
Low Grade Glioma (STR) or HGG, chemo, focal RT, Early FU clinic
Low Grade Glioma (STR) or HGG, chemo, focal RT, Late FU clinic
CNS Tumour, Other, Chemo only Early FU clinic
CNS Tumour, Other, Chemo only Late Effects Clinic
Medulloblastoma,PNET, High Risk or Recurrent, Chemo and CSI RT, Early FU Clinic
Medulloblastoma,PNET, High risk or Recurrent, Chemo and CSI RT, Late Effects Clinic
Non-Germinomatous Germ Cell Tumour or Metastatic Germinoma, Chemo and CSI RT, Early FU Clinic
Non-Germinomatous Germ Cell Tumour or Metastatic Germinoma, Chemo and CSI RT, Late FU Clinic
Non-malignant Teratoma or Craniopharyngioma, Surgery only Early and Late FU clinic
Other CNS Tumors with Chemotherapy and Radiation Early FU Clinic
Other CNS Tumors with Chemotherapy and Radiation Late FU Clinic

ATTACH PATIENT ID

Hodgkin Lymphoma*
Pediatric Surveillance & Follow-up Guidelines

	Months from end of therapy	Date	Location	H&P	CBC & ESR	CXR +/- Abdo US	Biochem	Urine tests	ECHO#	TSH & T4	PFTs	LH, FSH, Test or Est	Other
Early Follow-up Clinic	0				End of treatment evaluations (per protocol)								Summary for LTFU clinic
	3			+	+	+	+	+					
	6			+	+	+							Attenuated vaccine re-immunizations
	9			+	+	+							
	12			+	+	+	+	+	+	+	+		Live vaccine re-immunizations
	15			+	+								
	18			+	+	+							
	21			+	+								
	24			+	+	+				+			
LTFU Clinic	30			+	+	+							
	36			+	+	+			+				
	42			+	+	+							
	48			+	+	+				+			
	60			+	+	+							Refer to Late Effects clinic
	Notes					US if abdo involvmt at Dx.	Lytes, LDH, Ca, Mg, PO4, Cr, urea, LFTs.	U/A, urine Prot:Cr & Alb:Cr ratio	#**Insert added frequency** based on cardiac guidelines (see over). ECG if clinical concerns	If chest RT only	Repeat Q2y if RT to lung or abN	Baseline age 12 y if CED ≥4 or clinical concerns. Rpt Q1y	

*Includes all stages, and patients treated with RT
^CED: Cyclophosphamide Equivalence Dose (see over)

Further Surveillance

Semen Analysis	From age 18y in males
Anti-Mullerian Hormone	From age 16y in females if CED ≥ 6 g/m² or pelvic RT; or earlier if clinical concerns
Breast MRI and Mammogram	From later of age 25y or 8y after exposure if chest RT
Colonoscopy	From later of age 30y or 5y after exposure to abdominal RT

Cardiac Surveillance Guidelines (BC)

Anthracycline Dose*	Radiation Dose**	Recommended Frequency of Echo
None	< 15 Gy or none	No Screening
	15 - < 35 Gy	Every 5 years
	35 Gy	Every 2 years
< 250 mg/m^2	< 15 Gy or none	Every 5 years
	15 Gy	Every 2 years
250 mg/m^2	Any or none	Every 2 years

*Based on total doses of doxorubicin or the equivalent doses of other anthracyclines
**Based on radiation dose with potential impact to heart (radiation to chest, abdomen, spine [thoracic, whole], total body [TBI])
COG LTFU Guidelines version 5.0 (Oct 2018)

Anthracycline Equivalent Dose

Agent	Correction factor
Doxorubicin	1.0
Daunorubicin	0.5
Epirubicin	0.67
Mitoxantrone	4.0
Idarubicin	5.0

Chow J Clin Oncol 2015;33(5);394-402

Risk of Prolonged Oligospermia or Azoospermia

Agent	Possible Risk	High Risk
Cyclophosphamide	> 4g/m^2	> 7.5 g/m^2
Busulphan		> 600 mg/m^2
Melphalan		> 140 mg/m^2
Ifosfamide	> 42 g/m^2	> 60 g/m^2
Procarbazine	> 3 g/m^2	> 4 g/m^2
Chlorambucil		> 1.4 g/m^2
BCNU	> 300 mg/m^2	> 1 g/m^2
CCNU		> 500 mg/m^2
Cisplatin	> 300 mg/m^2	> 600 mg/m^2
Testicular RT dose	> 200 cGy	> 1200 cGy

*Lower doses are still possible risk

1. Green J Clin Oncol 2010;28:332-9
2. Meistrich Pediatr Blood Cancer 2009;53:261-6
3. Wyns Human Reprod Update 2010;16(3):312-328

Risk of Premature Ovarian Insufficiency or Infertility

Agent	Possible Risk	High Risk	Ref
CED	> 4 g/m^2	> 8 g/m^2	1
Procarbazine	> 2 g/m^2	> 4 g/m^2	2
Cisplatin	> 300 mg/m^2		3
Dactinomycin	>12.2 mg/m2		4
Ovarian RT dose*	> 100 cGy	> 1000 cGy	5

*Age dependent (see nomogram[5])
^Bevacizumab can cause ovarian failure; possibly acute and transient only[6]

1. Green Pediatr Blood Cancer 2014;61(1):53-67
2. Van der Kaaji J Clin Oncol 2012;30(3):291-299
3. Solheim Gyne Oncol 2015;136(2):224-229
4.Van Den Berg Hum Reprod 2018; 33(8):1474-1488
5. Wallace Int J Radiat Oncol;62(3):738-744
6. Imai Molec Clin Oncol 2017;6:807-810

Cyclophosphamide Equivalent Dose (CED)

Agent	Correction factor
Cyclophosphamide	1.0
Ifosfamide	0.244
Procarbazine	0.857
Chlorambucil	14.286
BCNU	15
CCNU	16
Melphalan	40
Thiotepa	50
Nitrogen Mustard	100
Busulphan	8.823

Green Pediatr Blood Ca 2014;61:53-67

Oncology

BC Children's Hospital works collaboratively with the BC Cancer and the Children's Oncology Group to provide recommendations for investigation, treatment and follow-up for children with cancer.

Resources | Community Partners | LTFU Guidelines

Referrals

You need a referral from a doctor to use this clinic:

Refer to Oncology

Refer to Hematology

Contact Us

Oncology/Hematology/BMT
Room B315, 4480 Oak Street
Vancouver, BC, V6H 3V4

Diagnostic Check list created by

Diagnostic Check List

Name_____ Diagnosis_____ Date off Treatment _____		Date ____ yrs post Rx	Date ____ yrs post Rx	Date ____ yrs post Rx	Date ____ yrs post Rx
At risk and Reason					
Eyes/Vision	**N Y**				
Teeth	**N Y**				
Hearing	**N Y**				
Thyroid	**N Y**				
Heart	**N Y**				
Lungs	**N Y**				
GI/Nutrition	**N Y**				
Liver/Pancreas	**N Y**				
Kidney/Bladder	**N Y**				
Reproductive Menses Tanner	**N Y**				
Breasts	**N Y**				
Bones/Joints	**N Y**				
Skin	**N Y**				
CNS	**N Y**				
Growth	**N Y**				
Immune Defence Infections	**N Y**				
School	**N Y**				
Psychology	**N Y**				
2nd Cancer	**N Y**				
New Family History					
Lansky/ Karnofsky					

Diagnostic Check list created by

http://www.bcchildrens.ca/health-professionals/clinical-resources/oncology#LTFU--Guidelines

Diagnostic Check List

Name_____ Diagnosis_____ Date off Treatment _____		Date ____ yrs post Rx	Date ____ yrs post Rx	Date ____ yrs post Rx	Date ____ yrs post Rx
At risk and Reason					
Eyes/Vision	N Y				
Teeth	N Y				
Hearing	N Y				
Thyroid	N Y				
Heart	N Y				
Lungs	N Y				
GI/Nutrition	N Y				
Liver/Pancreas	N Y				
Kidney/Bladder	N Y				
Reproductive Menses Tanner	N Y				
Breasts	N Y				
Bones/Joints	N Y				
Skin	N Y				
CNS	N Y				
Growth	N Y				
Immune Defence Infections	N Y				
School	N Y				
Psychology	N Y				
2nd Cancer	N Y				
New Family History					
Lansky/ Karnofsky					

LATE EFFECTS

End organ damages

- Cardiovascular
- Respiratory
- Renal
- Nervous system
- Vision
- Hearing

Growth and development

- Endocrine/metabolic
- Musculoskeletal
- Neurocognitive
- Mental Health

Fertility and reproduction

Cancer

- Recurrence
- Subsequent cancers

CANCER RISK

- Survivors of childhood cancer are at a lifelong increased risk of subsequent primary cancer
- **Radiotherapy**
  - Subsequent primary cancer usually within or just at the edge of the area originally irradiated.
  - Typically, > five years after treatment
    - increase in incidence with length of follow-up.
- **Chemotherapy**
  - Particularly alkylating agents (e.g., cyclophosphamide) and epipodophyllotoxins (e.g., etoposide)

Contents

Section #	Page	Sex	Therapeutic Agent	Potential Late Effect
41	51		Plant Alkaloids	**Vasospastic attacks (Raynaud's phenomenon)**
42	52		Epipodophyllotoxins	**Acute myeloid leukemia**
			Radiation	
43	54		All Fields	**Secondary benign or malignant neoplasm occurring in or near radiation field**
44	56		All Fields	**Dermatologic toxicity**
45	57		Brain/Cranium	**Brain tumor (benign or malignant)**
46	58		Brain/Cranium	**Neurocognitive deficits**
47	59		Brain/Cranium	**Clinical leukoencephalopathy**
48	60		Brain/Cranium	**Cerebrovascular complications**
49	61		Brain/Cranium	**Craniofacial abnormalities**
50	62		Brain/Cranium	**Chronic sinusitis**
51	63		Neuroendocrine Axis	**Overweight; Obesity**
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53	67	Male	Neuroendocrine Axis	**Precocious puberty**
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55	69		Neuroendocrine Axis	**Hyperprolactinemia**
56	70		Neuroendocrine Axis	**Central hypothyroidism**
57	71	Male	Neuroendocrine Axis	**Gonadotropin deficiency**
58	73	Female	Neuroendocrine Axis	**Gonadotropin deficiency**
59	75		Neuroendocrine Axis	**Central adrenal insufficiency**
60	76		Eye	**Cataracts**
61	77		Eye	**Ocular toxicity**
62	78		Ear	**Ototoxicity**
63	80		Oral Cavity	**Xerostomia; Salivary gland dysfunction**
64	81		Oral Cavity	**Dental abnormalities; Temporomandibular joint dysfunction**
65	82		Oral Cavity	**Osteoradionecrosis of the jaw**
66	83		Neck/Thyroid	**Thyroid nodules**
67	84		Neck/Thyroid	**Thyroid cancer**

Section #	Page	Sex	Therapeutic Agent	Potential Late Effect
68	85		Neck/Thyroid	**Hypothyroidism**
69	87		Neck/Thyroid	**Hyperthyroidism**
70	88		Neck/Thyroid	**Carotid artery disease**
71	89		Neck/Thyroid	**Subclavian artery disease**
72	90	Female	Breast	**Breast cancer**
73	91	Female	Breast	**Breast tissue hypoplasia**
74	92		Lungs	**Pulmonary toxicity**
75	93		Lungs	**Lung cancer**
76	94		Heart	**Cardiac toxicity**
77	96		Spleen	**Functional asplenia**
78	98		GI/Hepatic System	**Esophageal stricture**
79	99		GI/Hepatic System	**Impaired glucose metabolism/diabetes mellitus**
80	100		GI/Hepatic System	**Dyslipidemia**
81	101		GI/Hepatic System	**Hepatic toxicity**
82	102		GI/Hepatic System	**Cholelithiasis**
83	103		GI/Hepatic System	**Bowel obstruction**
84	104		GI/Hepatic System	**Chronic enterocolitis; Fistula; Strictures**
85	105		GI/Hepatic System	**Colorectal cancer**
86	107		Urinary Tract	**Renal toxicity**
87	108		Urinary Tract	**Urinary tract toxicity**
88	109		Urinary Tract	**Bladder malignancy**
89	110	Male	Male Reproductive System	**Testicular hormonal dysfunction**
90	111	Male	Male Reproductive System	**Impaired spermatogenesis**
91	113	Female	Female Reproductive System	**Ovarian hormone deficiencies**
92	114	Female	Female Reproductive System	**Reduced ovarian follicular pool**
93	116	Female	Female Reproductive System	**Uterine vascular insufficiency**
94	117	Female	Female Reproductive System	**Vaginal fibrosis/stenosis**

INFO FOR PATIENTS AND FAMILIES

- Patient education materials, known as "Health Links" accompany the COG guidelines

http://www.survivorshipguidelines.org/

INFO FOR PATIENTS AND FAMILIES

Health Link
Healthy living after treatment of childhood, adolescent, and young adult cancer

CHILDREN'S ONCOLOGY GROUP
The world's childhood cancer experts

Cataracts after Cancer Treatment

Childhood cancer treatment sometimes requires the use of medications or radiation that can increase the risk of developing cataracts. Because vision can have a significant impact on daily living, it is important for survivors who received these treatments to have their eyes checked regularly.

What is a cataract?

A cataract is clouding of the normally clear lens of the eye. Cataracts often develop slowly, but as the clouding increases, vision can be affected.

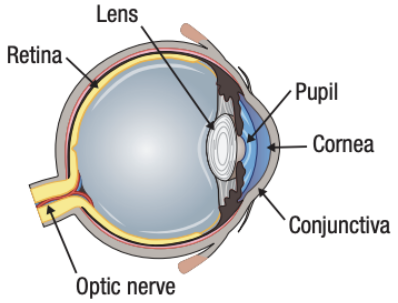
How does a cataract affect vision?

The eyes are remarkable organs, allowing light to be converted into impulses that are transmitted to the brain, where images are perceived. Light enters the eye through a clear layer of tissue known as the **cornea**. The cornea bends and focuses the light, and sends it through the opening of the eye known as the **pupil**. The pupil controls how much light enters the eye. Behind the pupil is the **lens** of the eye, which focuses the light onto the **retina**, the membrane along the back wall of the eye. The nerve cells in the retina change the light into electrical impulses and send them through the **optic nerve** to the brain, where the image is perceived. When the l**ens becomes cloudy due to a cataract**, the image delivered to the retina becomes blurry.

What are the symptoms of a cataract?

Common symptoms of cataracts include:

- Painless blurring of vision
- Sensitivity to light and glare
- Double vision in one eye
- Poor night vision
- Fading or yellowing of colors
- The need for frequent changes in prescriptions for glasses or contact lenses



What cancer therapies increase the risk of developing cataracts?

Certain medications, including:

- **Busulfan**
- **Corticosteroids**, such as prednisone and dexamethasone

Radiation therapy to the following areas:

- Eye and surrounding tissue (orbits)
- Head or brain
- Total body irradiation (TBI)

INFO FOR PATIENTS AND FAMILIES

Gastrointestinal System:
Gastrointestinal Health (English)(Spanish) (Chinese-TC) (Chinese-SC)
Hepatitis (English)(Spanish) (Chinese-TC) (Chinese-SC)
Liver Health (English)(Spanish) (Chinese-TC) (Chinese-SC)

Immune System:
Splenic Precautions (English)(Spanish)(French) (Chinese-TC) (Chinese-SC)

Musculoskeletal System:
Amputation (English)(Spanish) (Chinese-TC) (Chinese-SC)
Bone Health (English)(Spanish) (Chinese-TC) (Chinese-SC)
Limb Sparing Procedures (English)(Spanish) (Chinese-TC) (Chinese-SC)
Osteonecrosis (English)(Spanish) (Chinese-TC) (Chinese-SC)
Scoliosis and Kyphosis (English)(Spanish) (Chinese-TC) (Chinese-SC)

Neurological System:
Chronic Pain (English)(Spanish) (Chinese-TC) (Chinese-SC)
Peripheral Neuropathy (English)(Spanish) (Chinese-TC) (Chinese-SC)
Raynaud's Phenomenon (English)(Spanish) (Chinese-TC) (Chinese-SC)

Pulmonary System:
Bleomycin Alert (English)(Spanish) (Chinese-TC) (Chinese-SC)
Pulmonary Health (English)(Spanish) (Chinese-TC) (Chinese-SC)

Reproductive System:
Female Health Issues (English) (Spanish) (Chinese-TC) (Chinese-SC)
Male Health Issues (English)(Spanish) (Chinese-TC) (Chinese-SC)

Sensory:
Cataracts (English)(Spanish)(French) (Chinese-TC) (Chinese-SC)
Eye Health (English)(Spanish)(French) (Chinese-TC) (Chinese-SC)
Hearing Loss (English)(Spanish) (Chinese-TC) (Chinese-SC)

Subsequent Neoplasms:
Breast Cancer (English)(Spanish)(French) (Chinese-TC) (Chinese-SC)
Colorectal Cancer (English)(Spanish) (Chinese-TC) (Chinese-SC)
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INFO FOR PATIENTS AND FAMILIES

- Treatment with other chemotherapy drugs that can also damage the lungs (see related Health Link: "Pulmonary Health")
- Exposure to high oxygen levels (such as during general anesthesia or SCUBA diving)
- Smoking
- Inhaling drugs, such as smoking marijuana

What monitoring is recommended for people who have received bleomycin for treatment of childhood cancer?

- A yearly medical check-up is recommended.
- Pulmonary function tests may show lung problems that are not apparent during a check-up. For this reason, it is helpful to have these tests done at least once (at least 2 years after completing cancer treatment) to find out if there are any problems. Your healthcare provider can decide if further testing is needed based on these results.
- In some cases, your healthcare provider may recommend repeating the pulmonary function tests if you are scheduled for surgery that requires general anesthesia to check for changes in the lungs that could increase the risk of breathing problems during or after anesthesia.

Are there any special precautions I should take?

If you received therapy with bleomycin, you should:

- Avoid SCUBA diving, unless you have had a complete check-up and have been advised by a pulmonologist (lung specialist) that diving is safe. During SCUBA diving, increased underwater pressures and high oxygen levels can damage the lungs.
- Tell your surgeon, anesthesiologist, and other healthcare providers about your medical history before any scheduled procedures that may require oxygen.
- Avoid breathing high concentrations of oxygen whenever possible, especially for long periods of time (such as over several hours). If you require oxygen, monitoring of your oxygen levels can usually be done so that you can receive the lowest oxygen concentration that is necessary.
- Get the pneumococcal (pneumonia) vaccine.
- Get yearly influenza (flu) vaccines.
- Don't smoke or use inhaled drugs such as marijuana. If you currently smoke, talk to your healthcare provider about a program to help you quit.

Written by Margery Schaffer, RN, MSN, CPNP, Cincinnati Children's Hospital Medical Center, Cincinnati, OH.

Reviewed by Emmett H. Broxson, Jr., MD; Edward Walz, MD; Karen Stormer, RN, CNS, CPON®; Melissa M. Hudson, MD; Debra L. Friedman, MD; Neyssa Marina, MD; and Smita Bhatia, MD, MPH.

Additional health information for childhood cancer survivors is available at *www.survivorshipguidelines.org*

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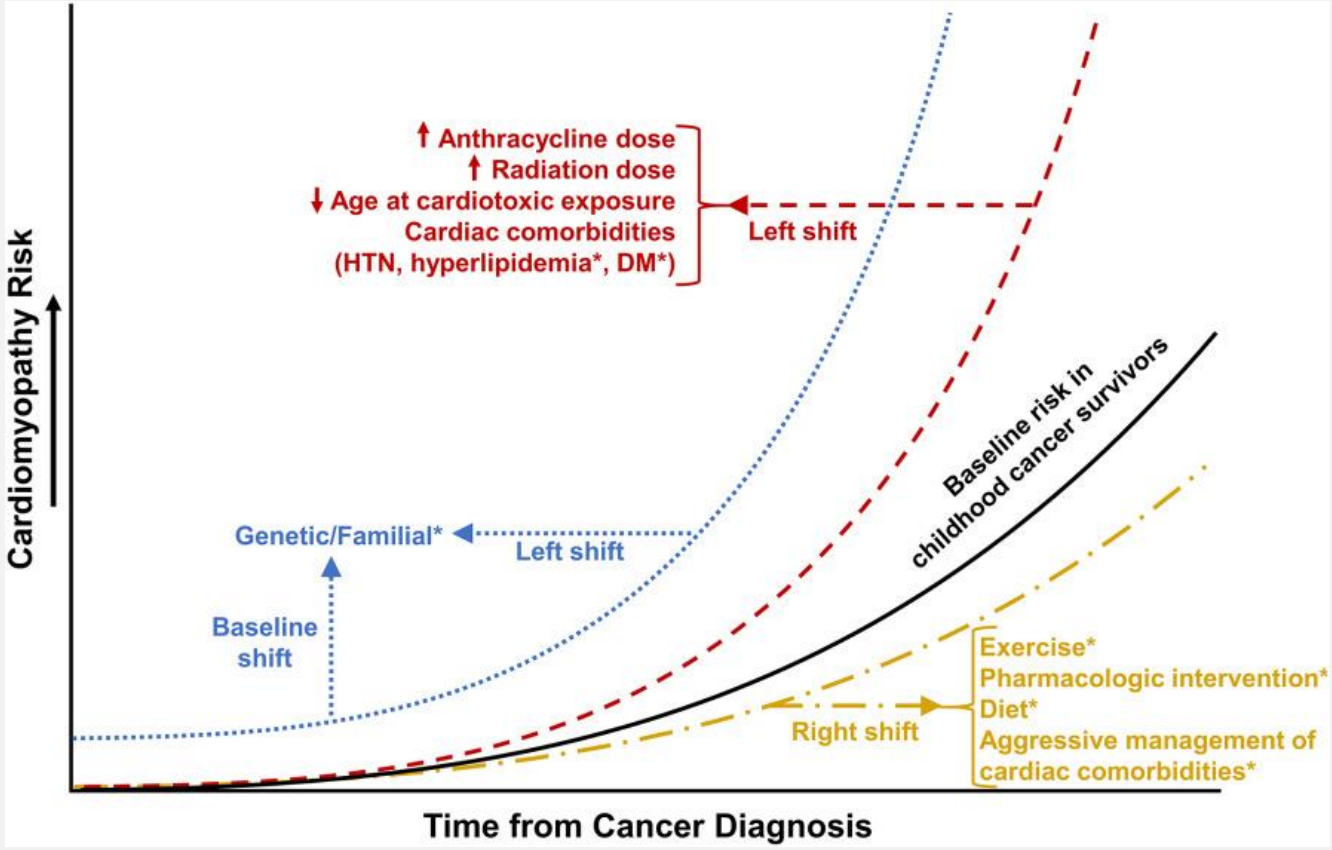
ENDOCRINE EFFECT

- Obesity/Metabolic syndrome
- DM
- Primary hypothyroidism
- Hypothalamic/pituitary dysfunction
- Decrease bone density
- Secondary thyroid cancer

IMPAIRED GROWTH

- Multifactorial : underlying disease, complications of treatment (e.g., infection, vomiting), effects of the treatment itself
  - Cranial radiotherapy can cause growth hormone deficiency and impaired growth, which then may be compounded by other pituitary hormone deficiencies
  - Localized tumour treatments may affect growth and function of individual organs (e.g., spinal irradiation affects spinal growth and skeletal disproportion)
  - Chemotherapy alone may also have significant effects on growth

CARDIOVASCULAR EFFECTS



Cardiomyopathy in childhood cancer survivors: lessons from the past and challenges for the future. Curr Oncol Rep. 2016;18:22

CARDIOVASCULAR EFFECTS

Be on the lookout for :

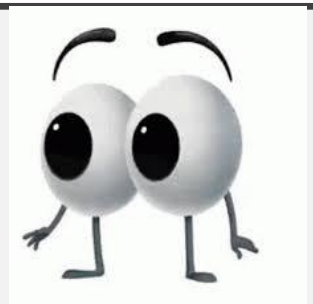
- Pericarditis
- Cardiomyopathy
- CAD and CVD (if irradiation of cerebrovascular structures)
- valve disease
- conduction defects

- Those who received either anthracyclines or radiation to a field that included the heart should have regular assessment (e.g., echocardiography)

CARDIOVASCULAR EFFECTS

- Risk factors of late-onset cardiotoxicity
  - Higher cumulative doses of anthracyclines
  - Younger age (< 5 years) at time of treatment
  - Female gender
  - Combination therapy with other agents
  - Mediastinal radiation

RENAL EFFECTS



Be on the lookout for :

- Glomerular toxicity
- Tubular toxicity (renal tubular acidosis, Fanconi syndrome, hypophosphatemic rickets)

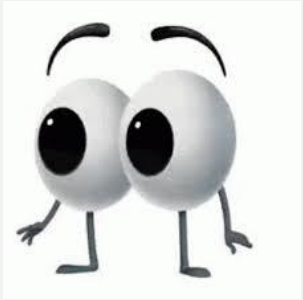
Worst offenders :

Cisplatin, carboplatin, ifosfamide, radiation impacting the kidney, surgical resection of kidney

MUSCULOSKELETAL EFFECTS

Be on the lookout for

- Low lean-muscle mass/weakness
- decreased exercise capacity
- frailty or accelerated aging



Worst offenders :

- corticosteroids; doxorubicin; radiation therapy impacting brain, abdomen, or pelvis; lower extremity amputation

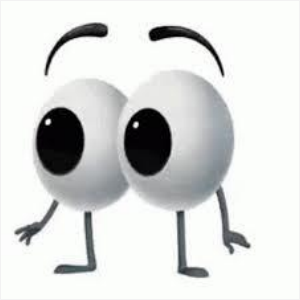
Radiation therapy impacting chest wall or thoracic spine can cause Scoliosis

HEPATIC EFFECTS

Be on the lookout for :

Hepatic dysfunction

Steatosis/cirrhosis



Worst offenders :

Thioguanine, methotrexate, mercaptopurine, busulfan

history of treatment related veno-occlusive disease

BONE HEALTH

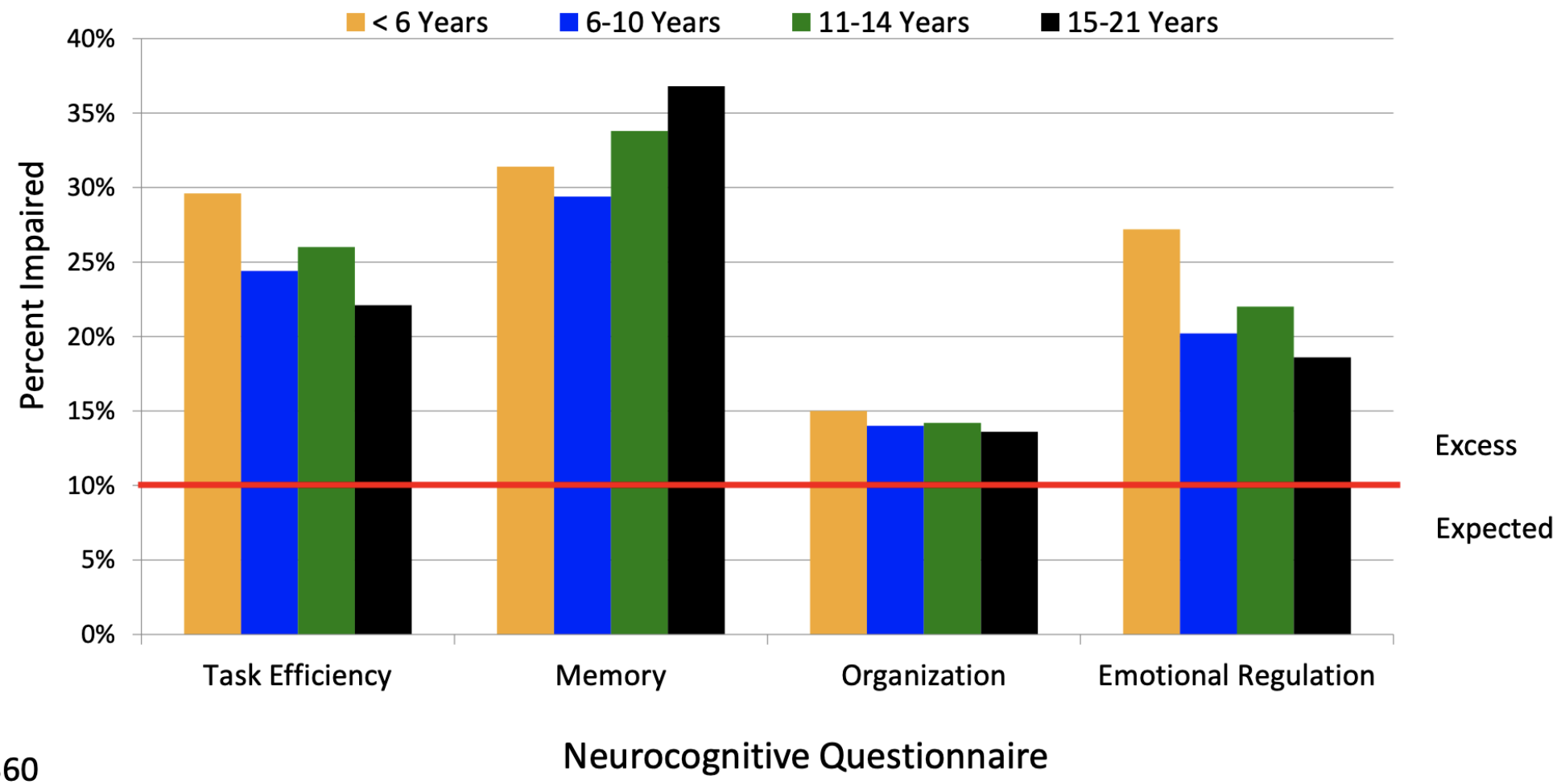
- Risk of low bone mineral density increases with:
  - high cumulative dose of steroids
  - high cumulative doses of methotrexate
  - cranial irradiation or bone marrow transplantation
- A baseline evaluation of BMD should be done at around two years after completion of treatment in patients with these risk factors and in those whose treatment puts them at risk of endocrine dysfunction

NEUROCOGNITIVE EFFECTS

Cranial radiation may cause the brain to age faster and increase the risk of early-onset dementia

- Regular evaluation of educational and psychosocial function later in life very important for **all childhood cancer survivor**.
  - Refer for neuropsychological assessment if problem suspected
  - Methylphenidate (MPH) can improve neurocognitive and learning outcomes in selected patients

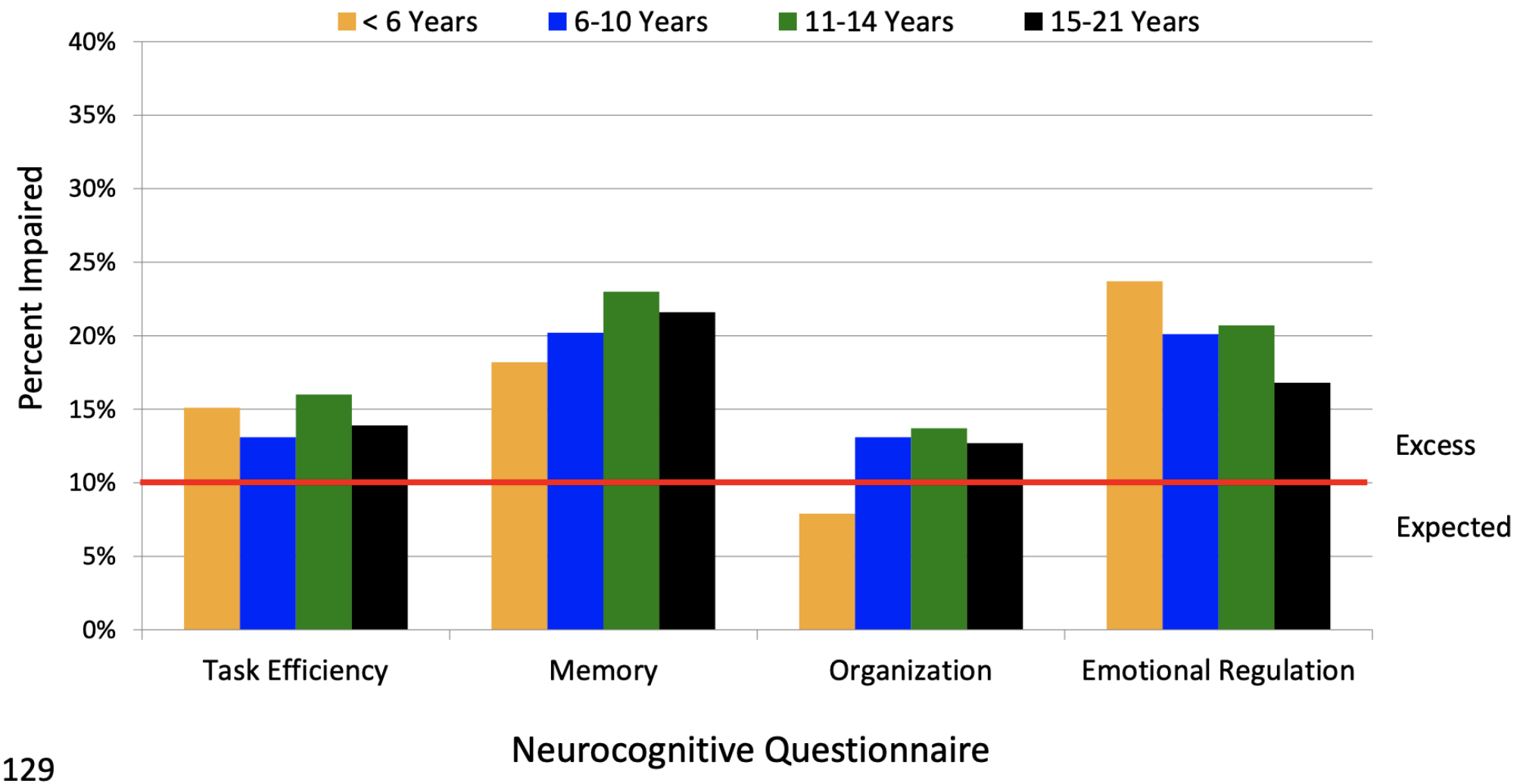
CNS Tumor and Leukemia Survivors by Age at Diagnosis



N=3360

(Prasad et al, *J Clin Oncol*, 2015)

Lymphoma and Sarcoma Survivors by Age at Diagnosis



N=2129

(Prasad et al, *J Clin Oncol*, 2015)

OPHTHALMOLOGICAL AND AUDITORY EFFECTS

- Ophthalmological
  - Cataracts - Busulfan, radiation impacting the eye
- Auditory
  - Sensorineural hearing loss, tinnitus, vertigo - Cisplatin, carboplatin, radiation impacting the ear
  - Tympanosclerosis, otosclerosis, eustachian tube dysfunction, conductive hearing loss - Radiation impacting the ear

NERVOUS SYSTEM EFFECTS

Be on the lookout for :	**Worst offenders :**
• Peripheral sensory or motor, neuropathy	Cisplatin, Vinca alkaloids
• Leukoencephalopathy	HD or IT Methotrexate/cytarabine
• spasticity, ataxia, dysarthria, dysphagia	Brain RoTx
• hemiparesis, seizures	

FERTILITY/GONADAL ISSUES

- Female survivors are potentially at risk of developing menopause before age 40 and having premature reduced ovarian reserve.
- Women treated with an alkylating agent plus radiation to the abdomen and pelvis have a cumulative incidence of premature menopause approaching 30%.

- Males are at risk of oligospermia or azoospermia.

FERTILITY/GONADAL ISSUES

Impact of Cancer and Treatment on Female Fertility

- Damage to uterus (fibrosis, vascular insufficiency)
  - Impaired mplantation
  - Pre-term loss
- Hormonal dysfunction (neuroendocrine)
- Germ Cell Loss
  - Surgery
  - Radiation
  - Chemotherapy

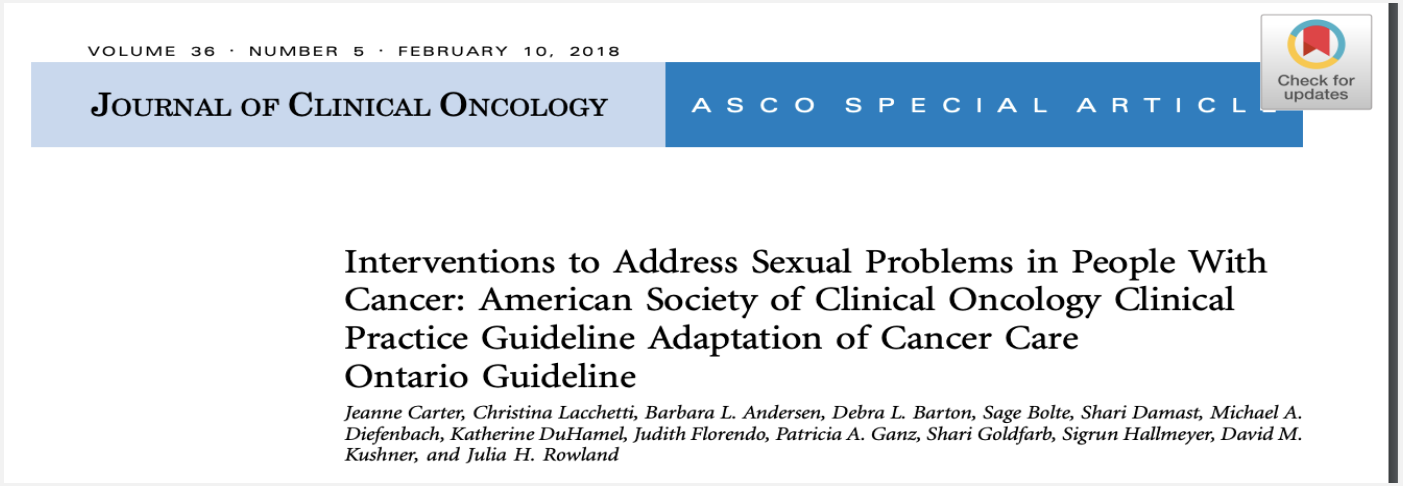
FERTILITY

- High-dose radiation to the pelvis/ uterus (> 500 Gy), compared to survivors who did not receive radiotherapy, were at significantly higher risk of having infants who were
  - preterm (50.0% vs. 19.6%), low birth weight (36.2 vs. 7.6%), and small for gestational age (18.2 vs. 7.8%).
- Exposition to chemotherapy, radiation therapy or both :
  - Not at increased risk of having children with congenital or chromosomal abnormalities

Cardonick EH. Overview of fertility and pregnancy in cancer survivors.

FERTILITY

- Fertility preservation (banking eggs or sperm) is now available for post pubertal children with cancer.
- Freezing ovarian or testicular tissue is considered experimental and is not available in Canada,



VOLUME 36 · NUMBER 5 · FEBRUARY 10, 2018

JOURNAL OF CLINICAL ONCOLOGY

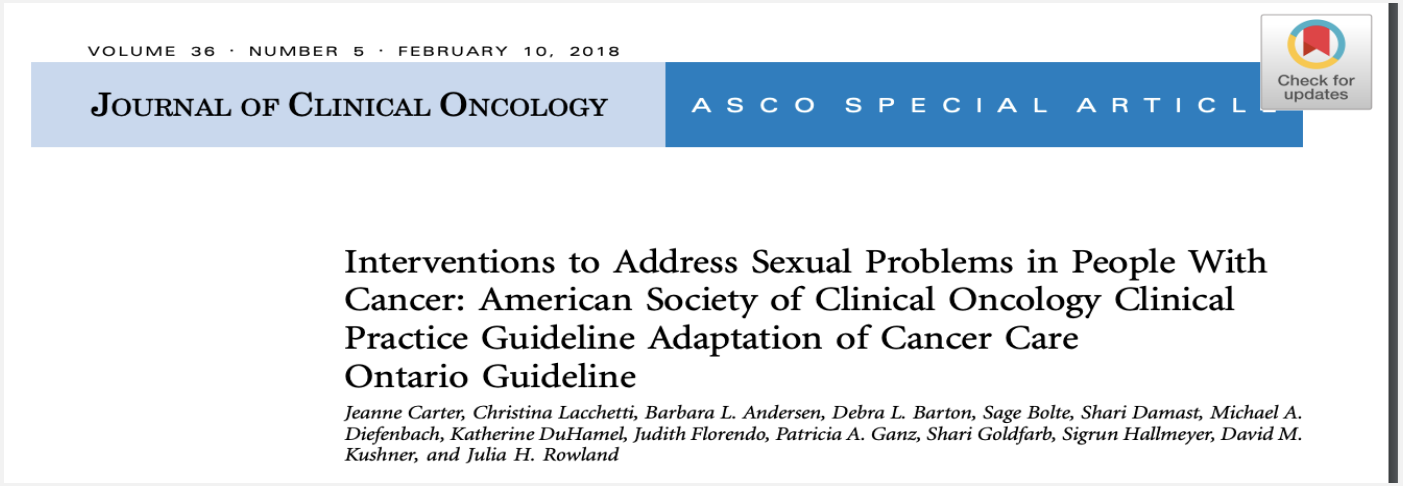
ASCO SPECIAL ARTICLE

Check for updates

Interventions to Address Sexual Problems in People With Cancer: American Society of Clinical Oncology Clinical Practice Guideline Adaptation of Cancer Care Ontario Guideline

Jeanne Carter, Christina Lacchetti, Barbara L. Andersen, Debra L. Barton, Sage Bolte, Shari Damast, Michael A. Diefenbach, Katherine DuHamel, Judith Florendo, Patricia A. Ganz, Shari Goldfarb, Sigrun Hallmeyer, David M. Kushner, and Julia H. Rowland

- Discuss sexual health and dysfunction resulting from cancer or its treatment.
- Psychosocial and/or psychosexual counseling should be offered to all patients with cancer,
  - improve sexual response, body image, intimacy and relationship issues, and overall sexual functioning and satisfaction.
- Medical and treatable contributing factors should be identified and addressed first.



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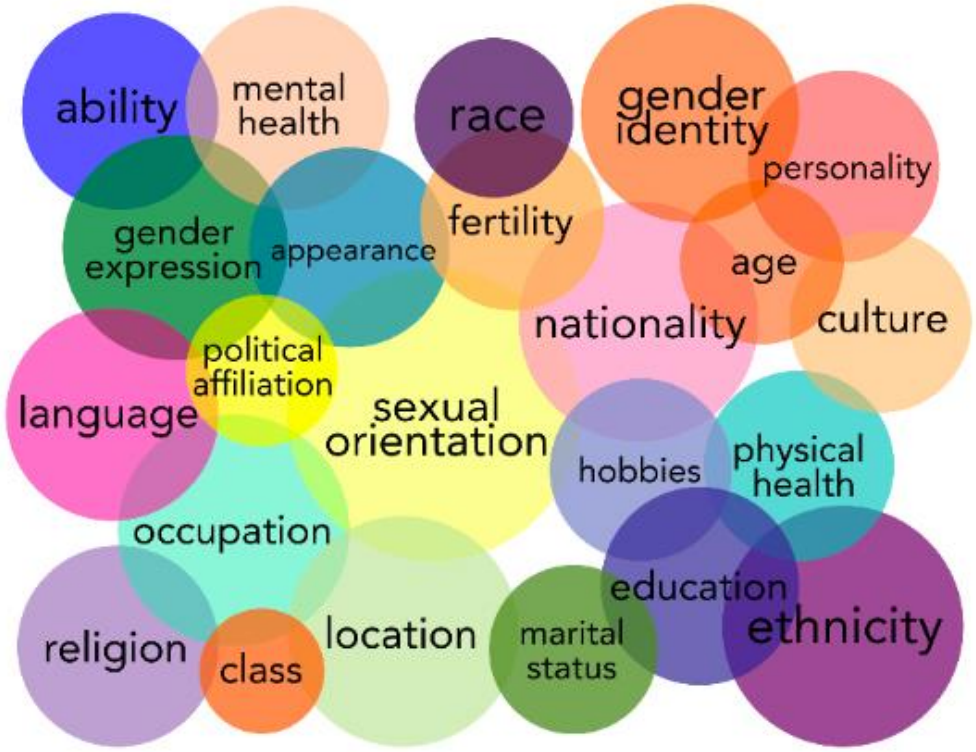
- In women with symptoms of vaginal and/or vulvar atrophy, lubricants in addition to vaginal moisturizers may be tried as a first option. Low-dose vaginal estrogen, lidocaine, and dehydroepiandrosterone may also be considered in some cases.
- In men, medication such as phosphodiesterase type 5 inhibitors may be beneficial, and surgery remains an option for those with symptoms or treatment complications refractory to medical management.



YOUR WORDS MATTER :

ADAPT THEM TO YOUR PATIENTS' REALITY

TALKING ABOUT SEX

Ressources :

- teens.aboutkidshealth.ca/cancer
- teenhealthsource.com
- www.macmillan.org.uk/Cancerinformation/teensandyoungadults/Relationshipssexandfertility/Cancerandsexuality/Ca ncera ndsexuality.aspx
- www.sexandu.ca

PSYCHOSOCIAL

Mental Health
- Depression/mood disorders
- Cancer-related anxiety
- Post-traumatic stress

Physical/Body image
- Weight loss/gain
- Loss of organs/tissues

Chronic Symptoms
- Fatigue/ low energy
- Disrupted sleep
- Poor memory/concentration
- Chronic pain

Self-care
- Independent living

Education/Vocation
- Academic underachievement
- Vocational limitations
- Under/unemployment
- Loss of job/benefits

Insurance discrimination
- Access to health care

Financial/economic
- Debt (medical/other)

Social Interaction
- Family/peer relationships
- Social withdrawal/isolation
- Intimacy/marriage/family
- Cancer-related stigma

Scholarships/educational funds available:

All:	Terry Fox (humanitarian award)	http://terryfoxawards.ca/applicant-information/
Oncology Patients:	Childhood cancer Canada Undergraduate & graduate scholarships	http://www.childhoodcancer.ca/get-help/survivor-scholarship/
	Emmy Duff	http://www.emmyduffscholarship.org/
Brain Tumour Patients:	Brain Tumour Foundation of Canada	http://www.braintumour.ca/4472/education-awards
Women only, age 18-40 years at diagnosis with any cancer	Pink Pearl Foundation	http://www.pinkpearlfoundation.org/scholarship-application/

Anyone: ScholarshipsCanada.com

KEY POINTS

- 75% of childhood cancer survivors experience at least one adverse event and 40% at least one severe, life-threatening or disabling event - Survivors of childhood cancers need a life long systematic follow-up
- 85% of survivor of childhood cancer depend on their primary care physician for follow-up
- If your patient is a survivor of childhood cancer, you should have access to a clear Summary of Cancer Treatment provided by the pediatric cancer centre that treated them.
- Appropriate survivor care requires patient and physician knowledge about the long-term risks of cancer therapy
- Children's Oncology Group (COG) Centres accept referrals to assist with tracing back treatment summaries and preparing individualized follow-up plans.
- COG offers detailed guidelines on identifying, assessing and managing late effects of childhood cancer treatment.