Transition from Pediatric to Adult Care: Adult Survivors of Childhood Cancer

Brandon Hayes-Lattin, MD FACP
February 6, 2017
Disclosures

• No conflicts
Objectives

• Understand the epidemiology of cancer survivorship in the US, including adolescents and young adults (AYA)
• Learn the spectrum of potential long-term and late effects of AYA cancer and cancer therapy
• Obtain professional and patient-directed resources for AYA cancer survivors
FIGURE 1  Percent of pediatric oncologists continuing to care for childhood cancer survivors by age of survivor
Epidemiology
Improving Cancer Survival Rates

![Graph showing childhood cancer survival](graph.png)
Incidence & Prevalence: Invasive Cancer, 2014

- **New Diagnoses**
  - 1,650,000 new diagnoses
  - AYA: 70,000 (4.2%)

- **Survivors**
  - 14,483,830 survivors
  - AYA: 633,910 (4.4%)
  - Children: 60,620 (<1%)

Prevalence (Survivors): Invasive Cancer

- 14,500,000 survivors
  - 66% 5-year survival rate
  - 15% of survivors were diagnosed >20 years ago

- Aged 15-39: 633,910 (4.4%)
  - 15-19: 49,000 (<1%)
  - 20-29: 185,000 (1%)
  - 30-39: 400,000 (3%)
    - 2/3 of 15-39 are aged 30-39

Year Since Diagnosis

Cancer Prevalence by Age Group

Figure 15.4: The Interface Between Pediatric and Adult Oncology

http://seer.cancer.gov/publications/aya/
Implications

• Demand for oncologists is expected to exceed supply by 25-30% by 2020
• The social work labor force is older than most professions, with nearly 30% of licensed social workers over age 55
• By 2020, the shortage of registered nurses will be greater than 1 million
Range of Issues/Range of Providers (Sex, Drugs, Rock & Roll)
<table>
<thead>
<tr>
<th>Mental health</th>
<th>Health education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological adjustment to cancer survivorship</td>
<td>Diagnostic and treatment history</td>
</tr>
<tr>
<td>Cognitive functioning</td>
<td>Cancer-related health risks</td>
</tr>
<tr>
<td>Psychopathology</td>
<td>Self-management of medical issues</td>
</tr>
<tr>
<td>Emotional well-being</td>
<td>Impact of health behaviors on cancer-related risks</td>
</tr>
<tr>
<td>Goal attainment</td>
<td>Health screening/surveillance recommendations</td>
</tr>
<tr>
<td>Health-related hindrance</td>
<td>Navigation of the adult health care environment</td>
</tr>
<tr>
<td></td>
<td>Health care access</td>
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<td></td>
<td>Insurance access</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sexual/reproductive health</th>
<th>Physical health and function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fertility preservation</td>
<td>Growth and development</td>
</tr>
<tr>
<td>Sexuality</td>
<td>Promotion of healthy lifestyle</td>
</tr>
<tr>
<td>Contraception</td>
<td>Symptom management</td>
</tr>
<tr>
<td>Sexually transmitted infections/diseases</td>
<td>Cancer-related chronic health problems</td>
</tr>
<tr>
<td>Impact of cancer on fertility/reproductive outcomes</td>
<td></td>
</tr>
<tr>
<td>Sexual dysfunction</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Health behaviors</th>
<th>Social competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol consumption</td>
<td>Partnerships/marriage</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>Interpersonal relations</td>
</tr>
<tr>
<td>Illicit drug Use</td>
<td>Reintegration into normative social systems</td>
</tr>
<tr>
<td>Physical activity</td>
<td>Educational progress/need for resources</td>
</tr>
<tr>
<td>Dietary habits</td>
<td>Vocational planning</td>
</tr>
<tr>
<td>Sun protection</td>
<td>Employment</td>
</tr>
<tr>
<td>Risky sexual behavior</td>
<td></td>
</tr>
<tr>
<td>Adherence to treatment</td>
<td></td>
</tr>
<tr>
<td>Adherence to health screening/surveillance</td>
<td></td>
</tr>
</tbody>
</table>
Age-Specific Fertility Rates

Fertility

• ASCO Clinical Practice Guideline
  • “As part of education and informed consent before cancer therapy”

• Potential influence on Cancer Therapy/Survival Rate
  • 29% of females with breast cancer: infertility influenced treatment decisions

• Failure of Fertility Preservation
  • Overwhelmed by or focused on cancer diagnosis
  • Unaware of potential for fertility loss
  • Concerned about treatment delay (increasing morbidity/mortality)

Obstetric and Perinatal Outcomes

**Mothers**
- Threatened abortion (RR 2.09)
- Gestational diabetes (2.65)
- Pre-eclampsia (1.32)
- Post-partum hemorrhage (2.83)
- Cesarean delivery (2.62)
- Maternal postpartum hospitalization >5 days (3.01)
- No excess risk of threatened preterm delivery, antepartum hemorrhage, premature rupture of membranes, failure of labor to progress or retained placenta

**Offspring**
- Premature birth (<37 weeks: RR 1.68)
- Low birth weight (<2500 g: 1.51)
- Fetal growth restriction (3.27)
- Neonatal distress indicated by low Apgar score (<7) at 1 minute (2.83), need for resuscitation (1.66) or special care nursery admission (1.44)
- No excess risk of congenital abnormalities or perinatal deaths (intrauterine or <7 days of birth)

Alcohol & Cigarettes

Substance Abuse and Mental Health Services Administration, Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-48, HHS Publication No. (SMA) 14-4863
Smoking

• National Health Information Survey
  • 1,019 AYA diagnosed 15-39, >5 years
• 33% Current Smoker
  • 22% of controls (p<0.001)
  • 92% Smoker prior to cancer diagnosis

• 37% No smoking-related discussions with any healthcare professional

Music

Genre Popularity By Age Range

http://blog.reddogmusic.co.uk/2013/03/07/how-musical-genre-popularity-varies-with-age-range/
# Erik Erikson’s Psychosocial Stages

<table>
<thead>
<tr>
<th>CRISIS</th>
<th>VIRTUE</th>
<th>RELATIONAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trust vs Mistrust</td>
<td>Hope</td>
<td>Mother</td>
</tr>
<tr>
<td>Infancy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Autonomy vs Shame</td>
<td>Will</td>
<td>Parents</td>
</tr>
<tr>
<td>Childhood</td>
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<td>Childhood</td>
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<tr>
<td>3. Initiative vs Guilt</td>
<td>Purpose</td>
<td>Family</td>
</tr>
<tr>
<td>School Age</td>
<td></td>
<td>Play Age</td>
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<tr>
<td>4. Industry vs Inferiority</td>
<td>Competency</td>
<td>Neighbors</td>
</tr>
<tr>
<td>School Age</td>
<td></td>
<td></td>
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<tr>
<td>5. Ego identity vs Role confusion</td>
<td>Fidelity</td>
<td>Peers</td>
</tr>
<tr>
<td>Adolescence</td>
<td></td>
<td>Adolescence</td>
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<tr>
<td>6. Intimacy vs Isolation</td>
<td>Love</td>
<td>Friends</td>
</tr>
<tr>
<td>Young Adult</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Generativity vs Stagnation</td>
<td>Care</td>
<td>Workmates</td>
</tr>
<tr>
<td>Adulthood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Ego integrity vs Despair</td>
<td>Wisdom</td>
<td>Mankind</td>
</tr>
<tr>
<td>Maturity</td>
<td></td>
<td>Maturity</td>
</tr>
<tr>
<td>9. Above, in reverse?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15 to 39

Adolescent & Young Adult

But which is which?
Treatment Setting

- NCI AYA HOPE Study
- 51-64 year old male
- US trained, non-pediatric specialty
- Group practice
- Large metropolitan area
Receipt of Care, 2008

Nathan et al. JCO 2008.
Transitions: Pediatric Oncologist Survey

• Age
  • 96% care for patients >21
  • 42% >25
  • 16% >30

• Transition Education Reported 66%
  • 8% use standardized transition assessments

• Barriers to Transition
  • 91% perceived attachment
  • 86% lack adult providers with expertise
  • 81% patient cognitive delay
  • 80% unstable social situation

Medical Late Effects
Childhood Cancer Survivor Study

• Started in 1994
• 20,346 childhood cancer survivors
  • Diagnosed 1970-1986
• Current Long-Term Follow-Up Study
  • 15,000 childhood cancer survivors
  • 4,000 siblings (comparison group)
• >200 publications

https://ccss.stjude.org
Childhood Cancer Survivor Study

- Baseline Questionnaires
  - BMI
  - Chronic Conditions
  - Hormonal Systems
  - Brief Symptom Inventory (Psychologic)
  - Tobacco/Health Status/Physical Performance Activity Limitation
- Education
- Insurance
Childhood Cancer Survivor Study

• Treatment Data (abstraction)
  • Alkylating Agents
  • Anthracyclines & Antibiotics
  • Antimetabolites
  • Steroids/Plant Alkyloids/Epipodophyllotoxins
  • Other Chemotherapy
  • Radiotherapy
  • Surgery

• Mortality

https://ccss.stjude.org
Sample Domains

- Mortality
- Cancer Recurrence
- Secondary Cancers
- Chronic Health Conditions
- Psychological Impact
- Genetics and Fertility
- Finances
Second Malignancy Risk

Cardiovascular Disease Risk Profiles
The Kaiser Permanente AYA Cancer Survivors Study

- 5,673 AYA survivors
  - Diagnosed 15-39, 1998-2009, survival >2 years
  - 57,617 matched controls
- Coronary artery disease, CHF, stroke through 2012
- 2x adjusted risk from controls
  - 2.4x breast cancer
  - 4.2x leukemia
- Traditional risks matter in AYAs
  - 3.2x diabetes
  - 3.7x hypertension
  - 1.8x dyslipidemia

Mortality

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Armstrong et al. JCO 2009
Causes of Death

Fig 2. Cumulative cause-specific mortality.

Armstrong et al. JCO 2009
Second Malignancy

Fig 1. Cumulative incidence of second malignant neoplasms (SMNs) and nonmelanoma skin cancer (NMSC) in childhood cancer survivors. At the 30-year follow-up, the cumulative incidence of SMNs and NMSC continues to increase with time since 5 years after diagnosis of primary childhood cancer.

Meadows et al. JCO 2009.
Second Malignancy

• Multivariate Analysis differed by second cancer type, but included
  • Radiotherapy
  • Age at Diagnosis
  • Sex
  • Family History
  • Primary Cancer Diagnosis

• 60% of Breast cancers occurred in Hodgkin Lymphoma survivors

Meadows et al. JCO 2009.
2\textsuperscript{nd} (and 3\textsuperscript{rd}) Malignancy After Hodgkin Lymphoma

4.7 fold higher than general population

Survivors and siblings had mean ages of 26.6 years (range, 18.0 to 48.0) and 29.2 years (range, 18.0 to 56.0), respectively.

Table 2. Cancer Survivors and Siblings with a Chronic Health Condition, According to the Severity Score.*

<table>
<thead>
<tr>
<th>Health Condition</th>
<th>Survivors (N=10,397)</th>
<th>Siblings (N=3034)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No condition</td>
<td>3887 (37.4)</td>
<td>1917 (63.2)</td>
</tr>
<tr>
<td>Grade 1 (mild)</td>
<td>1931 (18.6)</td>
<td>610 (20.1)</td>
</tr>
<tr>
<td>Grade 2 (moderate)</td>
<td>1635 (15.7)</td>
<td>349 (11.5)</td>
</tr>
<tr>
<td>Grade 3 (severe)</td>
<td>2128 (20.5)</td>
<td>128 (4.2)</td>
</tr>
<tr>
<td>Grade 4 (life-threatening or disabling)</td>
<td>653 (6.3)</td>
<td>30 (1.0)</td>
</tr>
<tr>
<td>Grade 5 (fatal)</td>
<td>163 (1.6)</td>
<td>NA†</td>
</tr>
<tr>
<td>Any condition‡</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grades 1–4</td>
<td>6482 (62.3)</td>
<td>1117 (36.8)</td>
</tr>
<tr>
<td>Grade 3 or 4</td>
<td>2858 (27.5)</td>
<td>158 (5.2)</td>
</tr>
<tr>
<td>Multiple health conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥2</td>
<td>3905 (37.6)</td>
<td>397 (13.1)</td>
</tr>
<tr>
<td>≥3</td>
<td>2470 (23.8)</td>
<td>163 (5.4)</td>
</tr>
</tbody>
</table>

Oeffinger et al. NEJM 2006.
Table 3. Relative Risk of Selected Severe (Grade 3) or Life-Threatening or Disabling (Grade 4) Health Conditions among Cancer Survivors, as Compared with Siblings.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Survivors (N=10,397)</th>
<th>Siblings (N=3034)</th>
<th>Relative Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major joint replacement*</td>
<td>1.61</td>
<td>0.03</td>
<td>54.0 (7.6–386.3)</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>1.24</td>
<td>0.10</td>
<td>15.1 (4.8–47.9)</td>
</tr>
<tr>
<td>Second malignant neoplasm†</td>
<td>2.38</td>
<td>0.33</td>
<td>14.8 (7.2–30.4)</td>
</tr>
<tr>
<td>Cognitive dysfunction, severe</td>
<td>0.65</td>
<td>0.10</td>
<td>10.5 (2.6–43.0)</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>1.11</td>
<td>0.20</td>
<td>10.4 (4.1–25.9)</td>
</tr>
<tr>
<td>Cerebrovascular accident</td>
<td>1.56</td>
<td>0.20</td>
<td>9.3 (4.1–21.2)</td>
</tr>
<tr>
<td>Renal failure or dialysis</td>
<td>0.52</td>
<td>0.07</td>
<td>8.9 (2.2–36.6)</td>
</tr>
<tr>
<td>Hearing loss not corrected by aid</td>
<td>1.96</td>
<td>0.36</td>
<td>6.3 (3.3–11.8)</td>
</tr>
<tr>
<td>Legally blind or loss of an eye</td>
<td>2.92</td>
<td>0.69</td>
<td>5.8 (3.5–9.5)</td>
</tr>
<tr>
<td>Ovarian failure‡</td>
<td>2.79</td>
<td>0.99</td>
<td>3.5 (2.7–5.2)</td>
</tr>
</tbody>
</table>

* For survivors, major joint replacement was not included if it was part of cancer therapy.
† For both groups, this category excludes basal-cell and squamous-cell carcinoma (grade 2). For siblings, this category includes a first cancer.
‡ Values are for women only.
Heart Failure

Armstrong et al. JCO 2013.
Cardiac Risk Factors, Modifiable

- 2 or more cardiac risk factors reported in 10.3% of survivors
- Risk of cardiac event increased with presence of cardiac risk factors
- Hypertension
  - Coronary Artery Disease (RR 6.1)
  - Heart Failure (RR 19.4)
  - Valvular Disease (RR 13.6)
  - Arrhythmia (RR 6.0)

Armstrong et al. JCO 2013.
Care & Resources
## Awareness of Late Effects

<table>
<thead>
<tr>
<th></th>
<th>Oncologist</th>
<th>PCP</th>
<th>(P)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiac Toxicity:</strong></td>
<td>95%</td>
<td>55%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>doxorubicin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Secondary Malignancies:</strong></td>
<td>62%</td>
<td>17%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>cyclophosphamide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Premature menopause:</strong></td>
<td>71%</td>
<td>15%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>cyclophosphamide</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Peripheral neuropathy:</strong></td>
<td>97%</td>
<td>22%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>paclitaxel or oxaliplatin</td>
<td></td>
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</tr>
</tbody>
</table>

adapted from Nekhlyudov at al, JOP, 2013.
Cancer Screening Rates

Cancer Surveillance Rates

Treatment Summary & Survivorship Care Plan

- American Society of Clinical Oncology
- National Comprehensive Cancer Network
- Commission on Cancer
- Institute of Medicine
Survivorship Care Plan Use: Survey 1130 Oncologists, 1020 PCPs

Blanch-Hartigan et al. JCO 2014
Resources: NCCN AYA Guidelines

- Comprehensive assessment
  - Age-appropriate info
  - Fertility
  - Psychosocial
  - Genetic/Familial Risk
- Age-Appropriate care
- Treatment-related issues
  - Dosing
  - Toxicity
- Fertility/Endocrine considerations

- Psychosocial/Behavioral considerations
  - Individual
  - Relationships
  - Socioeconomic
- Survivorship
- Disease-specific issues
  - ALL, sarcoma, colon, melanoma
- Palliative care and end-of-life considerations

Coccia et al. NCCN 2016
NCCN Guidelines Version 1.2017
Adolescent and Young Adult Oncology

SURVIVORSHIP

- Develop a "Cancer Treatment Summary and Survivorship Care Plan" [See NCCN Guidelines for Survivorship]
- Provide a periodic evaluation focusing on history, physical examination, and screening based on treatment exposures and risk for treatment-related late effects
- Vaccinations
  - HPV vaccine is recommended for males 9-22 years and females from 9–27 years of age except in high risk groups
  - Annual influenza vaccine
- Counsel regarding lifestyle practices and methods to reduce risk (e.g., avoiding smoking, increasing level of physical activity)
- Advocate for appropriate health care coverage
- For patients who received chemotherapy and/or radiation therapy (RT), recommend a dental exam and cleaning every 6 months

SELECTED EXPOSURES

- Cranial or craniospinal radiation
- Chest radiation
- Abdominal or pelvic radiation
- Alkylating agents
- Anthracyclines
- Bleomycin
- Cisplatin/carboplatin
- Epipodophyllotoxins

SCREENING RECOMMENDATIONS

- Neuroendocrine axis screening
- Neuropsychological evaluation
- Females: see breast cancer screening
- Thyroid screening
- Cardiovascular risk assessment and screening
- Screening for cardiomyopathy
- Screening for valvular heart disease
- Pulmonary screening
- Colorectal cancer screening
- Assessment of gonadal function
- Screening for kidney or bladder disease
- Screening for kidney or bladder disease
- Assessment of gonadal function
- Screening for treatment-related AML (t-AML) or myelodysplasia
- Pulmonary screening (for selected agents)
- Screening for cardiomyopathy
- Screening for t-AML or myelodysplasia
- Screening for t-AML or myelodysplasia
- Cardiovascular risk assessment
- Screening for kidney and/or bladder disease
- Audiological evaluation
- Screening for t-AML or myelodysplasia

AYAO cancer survivor

Note: All recommendations are category 2A unless otherwise indicated.
Clinical Trials: NCCN believes that the best management of any patient with cancer is in a clinical trial. Participation in clinical trials is especially encouraged.
NCCN Guidelines Version 1.2013 Table of Contents
Survivorship

NCCN Survivorship Panel Members
NCCN Survivorship Sub-Committee Members
General Principles of the Survivorship Guidelines (SURV-1)
Definition of Survivorship &
Assessment By Health Care Provider at Regular Intervals (SURV-2)
Survivorship Baseline Assessment (SURV-A)
Anxiety and Depression (SANXDE-1)
Cognitive Function (SCF-1)
Exercise (SE-1)
Fatigue (SFAT-1)
Immunizations and Infections (SIMIN-1)
Pain (SPAIN-1)
Sexual Function
• Female (SSFF-1)
• Male (SSFM-1)
Sleep Disorders (SSD-1)

Clinical Trials: NCCN believes that the best management for any cancer patient is in a clinical trial. Participation in clinical trials is especially encouraged. To find clinical trials online at NCCN Member Institutions, click here: nccn.org/clinical_trials/physician.html.

NCCN Categories of Evidence and Consensus: All recommendations are category 2A unless otherwise specified. See NCCN Categories of Evidence and Consensus.
Long-Term Follow-Up Guidelines
for Survivors of Childhood, Adolescent, and Young Adult Cancers

Version 3.0 – October 2008

CureSearch
Children’s Oncology Group

www.survivorshipguidelines.org

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# Exposures

## CHEMOTHERAPY

<table>
<thead>
<tr>
<th>Sec #</th>
<th>Therapeutic Agent(s)</th>
<th>Potential Late Effects</th>
<th>Risk Factors</th>
<th>Highest Risk Factors</th>
<th>Periodic Evaluation</th>
<th>Health Counseling Further Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>29</td>
<td>ANTI-TUMOR ANTIBIOTICS Bleomycin</td>
<td>Pulmonary toxicity, interstitial pneumonitis, pulmonary fibrosis, acute respiratory distress syndrome (very rare)</td>
<td>Heat Factors: Younger age at treatment, treatment factors, bronchial administration, combined with: Busulfan, Carmustine (BCNU), Lomustine (CCNU)</td>
<td>Treatment factors: Bleomycin dose ≥ 400 U/m² (injury observed in doses 60-100 U/m² in children) Combined with: - Chest radiation - TBI</td>
<td>History: Cough, SDB, DOE, Wheezing, Yearly</td>
<td>Health Links: Pulmonary Health, Bleomycin Alert, Resources: Extensive information regarding smoking cessation is available for patients on the NCI's website: <a href="http://www.smokefree.gov">www.smokefree.gov</a>. Counseling: Notify healthcare providers of history of bleomycin therapy and risk of worsening fibrosis with high oxygen exposure such as during general anesthesia. Administration of high concentrations of oxygen may result in chronic progressive pulmonary fibrosis. Counsel regarding tobacco avoidance/smoking cessation. Due to the potential pulmonary toxicity of this therapy, patients who desire to SCUBA dive should be advised to obtain medical clearance from a pulmonologist. Considerations for Further Testing and Intervention: In patients with abnormal PFTs and/or CXR, consider repeat evaluation prior to general anesthesia. Pulmonary consultation in patients with symptomatic or progressive pulmonary dysfunction. Influenza and pneumococcal vaccines.</td>
</tr>
</tbody>
</table>

## ANTI-TUMOR ANTIBIOTICS

### SECTION 29 REFERENCES

- **SYSTEM = Pulmonary**
- **SCORE =**
  - Interstitial pneumonitis: 1
  - Pulmonary fibrosis: 1
  - ARDS: 2B
<table>
<thead>
<tr>
<th>Potential Late Effects</th>
<th>Risk Factors</th>
<th>Highest Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulmonary toxicity</strong></td>
<td><strong>Host Factors</strong></td>
<td><strong>Treatment Factors</strong></td>
</tr>
<tr>
<td>Interstitial pneumonitis</td>
<td>Younger age at treatment</td>
<td>Bleomycin dose ≥ 400 U/m² (injury observed in doses 60-100 U/m² in children)</td>
</tr>
<tr>
<td>Pulmonary fibrosis</td>
<td>Combined with:</td>
<td>Combined with:</td>
</tr>
<tr>
<td>Acute respiratory distress syndrome (very rare)</td>
<td>- Busulfan</td>
<td>- Chest radiation</td>
</tr>
<tr>
<td></td>
<td>- Carmustine (BCNU)</td>
<td>- TBI</td>
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<tr>
<td></td>
<td>- Lomustine (CCNU)</td>
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</table>

**Medical Conditions**
Renal dysfunction
High dose oxygen support such as during general anesthesia

**Health Behaviors**
Smoking
<table>
<thead>
<tr>
<th>Periodic Evaluation</th>
<th>Health Counseling Further Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>HISTORY</td>
<td>Health Links</td>
</tr>
<tr>
<td>Cough</td>
<td>Pulmonary Health</td>
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<td>SOB</td>
<td>Bleomycin Alert</td>
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<td>DOE</td>
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<td>Wheezing</td>
<td></td>
</tr>
<tr>
<td>Yearly</td>
<td></td>
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<tr>
<td>PHYSICAL</td>
<td>Resources</td>
</tr>
<tr>
<td>Pulmonary exam</td>
<td>Extensive information regarding smoking cessation is available for patients on the NCI's website: <a href="http://www.smokefree.gov">www.smokefree.gov</a></td>
</tr>
<tr>
<td>Yearly</td>
<td></td>
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<tr>
<td>SCREENING</td>
<td>Counseling</td>
</tr>
<tr>
<td>Chest x-ray</td>
<td>Notify healthcare providers of history of bleomycin therapy and risk of worsening fibrosis with high oxygen exposure such as during general anesthesia. Administration of high concentrations of oxygen may result in chronic progressive pulmonary fibrosis. Counsel regarding tobacco avoidance/smoking cessation. Due to the potential pulmonary toxicity of this therapy, patients who desire to SCUBA dive should be advised to obtain medical clearance from a pulmonologist.</td>
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<tr>
<td>PFTs (including DLCO and spirometry)</td>
<td>Considerations for Further Testing and Intervention</td>
</tr>
<tr>
<td>Baseline at entry into long-term follow-up. Repeat as clinically indicated in patients with abnormal results or progressive pulmonary dysfunction.</td>
<td>In patients with abnormal PFTs and/or CXR, consider repeat evaluation prior to general anesthesia. Pulmonary consultation in patients with symptomatic or progressive pulmonary dysfunction. Influenza and pneumococcal vaccines.</td>
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</tbody>
</table>
## Cancer Screening

### CANCER SCREENING GUIDELINES

<table>
<thead>
<tr>
<th>Sec #</th>
<th>Organ</th>
<th>At Risk Population</th>
<th>Highest Risk Factors</th>
<th>Periodic Evaluation</th>
<th>Health Counseling Further Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>137</td>
<td>Female</td>
<td>Breast</td>
<td>Over age 40 &lt;br&gt; Family history of breast cancer &lt;br&gt; in first degree relative &lt;br&gt; Early onset of menstruation &lt;br&gt; Late onset of menopause (age 55 or older) &lt;br&gt; Older than 30 at birth of first child &lt;br&gt; Never pregnant &lt;br&gt; Obesity &lt;br&gt; Previous breast biopsy with atypical hyperplasia &lt;br&gt; Hormone replacement therapy</td>
<td>Chest radiation with potential impact to the breast (see Section 68), including ≥ 20 Gy to the following fields: &lt;br&gt; - Chest (thorax) &lt;br&gt; - Whole lung &lt;br&gt; - Mediastinal &lt;br&gt; - Axilla &lt;br&gt; - Mini-Mantle &lt;br&gt; - Mantle &lt;br&gt; - Extended Mantle &lt;br&gt; - TLJ &lt;br&gt; - STLI &lt;br&gt; - TBI* &lt;br&gt; BRAC1, BRAC2, ATM mutation</td>
<td><strong>PATIENTS AT STANDARD RISK</strong> (ACS Recommendation) &lt;br&gt; <strong>PHYSICAL</strong> &lt;br&gt; Clinical breast exam &lt;br&gt; Every 3 years between ages 20-39, then yearly beginning at age 40</td>
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</tbody>
</table>

**Info Link:** Important: The risk of breast cancer in patients who received TBI alone is of a lower magnitude compared to those who received ≥ 20 Gy of radiation with potential impact to the breast (e.g., thorax, axilla); therefore, monitoring of patients who received TBI without additional radiation potentially impacting the breast should be determined on an individual basis.

**Physical:**
- Breast self exam
- Monthly, beginning at puberty

**Screening:**
- Mammogram
- Yearly, beginning at puberty until age 25, then every 6 months

**Patients at highest risk**
- **Physical**
  - Breast self exam
  - Monthly, beginning at puberty
  - Clinical breast exam
  - Yearly, beginning at puberty until age 25, then every 6 months

**Screening**
- Mammogram
- Yearly, beginning 8 years after radiation or at age 25, whichever occurs last.

**Breast MRI**
- Yearly, as an adjunct to mammography beginning 8 years after radiation or at age 25, whichever occurs last.

**Info Link:**
The risk of breast cancer in patients who received TBI alone is of a lower magnitude compared to those who received ≥ 20 Gy of radiation with potential impact to the breast (e.g., thorax, axilla); therefore, monitoring of patients who received TBI should be determined on an individual basis.

Mammography is currently limited in its ability to evaluate the premenopausal breast. MRI is now recommended as an adjunct to mammography in women treated with chest radiation for childhood cancer similar to screening of other populations at high risk for breast cancer (e.g., premenopausal known or likely carriers of gene mutation of known penetrance). The upper age limit at which both modalities should be used for breast cancer surveillance has not been established.
High Risk Factors

Chest radiation with potential impact to the breast (see Section 68), including $\geq 20$ Gy to the following fields:
- Chest (thorax)
- Whole lung
- Mediastinal
- Axilla
- Mini-Mantle
- Mantle
- Extended Mantle
- TLI
- STLI
- TBI*
BRACA1, BRACA2, ATM mutation
PATIENTS AT HIGHEST RISK

PHYSICAL
Breast self exam
Monthly, beginning at puberty
Clinical breast exam
Yearly, beginning at puberty until age 25, then every 6 months

SCREENING
Mammogram
Yearly, beginning 8 years after radiation or at age 25, whichever occurs last.

Breast MRI
Yearly, as an adjunct to mammography beginning 8 years after radiation or at age 25, whichever occurs last.
Advocacy and Support

- Critical Mass [http://criticalmass.org](http://criticalmass.org)
- Stupid Cancer [http://stupidcancer.org](http://stupidcancer.org)
Resources

http://cancercontrol.cancer.gov/ocs/
http://www.cdc.gov/cancer/survivorship/
http://www.survivorshipguidelines.org
https://bethematchclinical.org/Post-Transplant-Care/
http://www.asco.org/practice-research/cancer-survivorship
Summary

• There are more and more cancer survivors
  • Primary Care will see these patients
• Following survivors leads to evidence-based guidelines
  • Childhood cancer leads the way
• Don’t forget routine recommended medical care among cancer survivors