Risk-Based Health Care of Pediatric Cancer Survivors

Kevin C. Oeffinger, MD

Supported by R01 CA 100474
R21 CA 106972
U24 CA 55727
Outline

- Long-term health risks
- Model for risk-based health care
- Current status of survivorship-focused health care
- Future directions
5-YR Survival Rates, Ages 0-19

Pediatric Cancer Survivors

- All sites > 78% 5-yr survival
- 270,000 childhood cancer survivors in the United States
- 1:640 young adults in the US is a pediatric cancer survivor
Long-Term Health Risks

- Premature mortality
- Morbidity
- Diminished health status
Sex-Specific Mortality Rates of Childhood Cancer Survivors vs. U.S. Population

5-YR Survival Rates for Hodgkin Lymphoma, Ages 0-19

All-Cause Mortality, Hodgkin Lymphoma Diagnosis: 1970-1986

All-Cause Mortality, Hodgkin Lymphoma Diagnosis: 1970-1986

All-Cause Mortality, Hodgkin Lymphoma Diagnosis: 1970-1986

Late recurrence

SMN, Cardiac, Pulmonary

30%

Years since cancer diagnosis

Percent

Morbidity

- 10,397 survivors, diagnosed 1970-1986
- 3,034 siblings

Grading of conditions: CTCAE v3.0

Common Terminology Criteria for Adverse Events

- Grade 1  Mild
- Grade 2  Moderate
- Grade 3  Severe
- Grade 4  Life-threatening or disabling
- Grade 5  Death

### Demographics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Survivors (N=10,397)</th>
<th>Siblings (N=3,034)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender: female</td>
<td>46%</td>
<td>53%</td>
</tr>
<tr>
<td>Race</td>
<td></td>
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<tr>
<td>Non-Hispanic white</td>
<td>84%</td>
<td>92%</td>
</tr>
<tr>
<td>Minorities</td>
<td>16%</td>
<td>8%</td>
</tr>
<tr>
<td>Age at interview</td>
<td>27</td>
<td>29</td>
</tr>
<tr>
<td>Mean (range), years</td>
<td>(18 - 48)</td>
<td>(18 - 56)</td>
</tr>
<tr>
<td>Interval from cancer dx</td>
<td>18</td>
<td>NA</td>
</tr>
<tr>
<td>Mean (range), years</td>
<td>(6 - 31)</td>
<td></td>
</tr>
</tbody>
</table>
Percent with a chronic health condition:

Grade 1: 20.1%
Grade 2: 11.5%
Percent with a chronic health condition:

Grade 1
- Siblings: 20.1%
- Survivors: 18.6%

Grade 2
- Siblings: 11.5%
- Survivors: 15.7%

Similar percentage with mild or moderate conditions.
Percent with a chronic health condition:

Grade 3: 4.2%
Grade 4: 1%
Percent with a chronic health condition:

- Grade 3: 4.2%
- Grade 4: 6.3%

Survivors: 20.5%

Significant difference in severe or life-threatening conditions.
Relative risk with 95% CI of chronic health conditions in survivors compared with siblings
Adjusted for age, sex, and race

Survivors  N= 10,397
Siblings  N= 3,034

- Any Grade: 3.3
- Grade 3 or 4: 8.2
- > 2 Conditions: 4.9
Relative risk of chronic health conditions in survivors compared with siblings
Adjusted for age, sex, and race

<table>
<thead>
<tr>
<th>Primary Cancer</th>
<th>Any Grade</th>
<th>Grade 3 or 4</th>
<th>&gt; 2 Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bone tumor</td>
<td>10.3</td>
<td>38.9</td>
<td>10.7</td>
</tr>
<tr>
<td>CNS tumor</td>
<td>7.1</td>
<td>12.6</td>
<td>12.4</td>
</tr>
<tr>
<td>Hodgkin’s</td>
<td>4.6</td>
<td>10.2</td>
<td>8.7</td>
</tr>
<tr>
<td>Sarcoma</td>
<td>3.5</td>
<td>8.9</td>
<td>5.2</td>
</tr>
<tr>
<td>NHL</td>
<td>3.2</td>
<td>6.8</td>
<td>4.3</td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>2.0</td>
<td>4.7</td>
<td>2.5</td>
</tr>
<tr>
<td>Leukemia</td>
<td>2.2</td>
<td>4.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Wilms’ tumor</td>
<td>1.9</td>
<td>4.1</td>
<td>2.5</td>
</tr>
</tbody>
</table>

All estimates are significant at $p < 0.001$
Relative risk with 95% CI of Grade 3 or 4 conditions in survivors compared with siblings
Adjusted for age, sex, and race

- Anthracycline + Alkylating agent: 10.9
- Chest RT + Abd/pelvic RT: 10.9
- Chest RT + Anthracycline: 13.0
- Chest RT + Bleomycin: 13.6

Relative Risk
Cumulative incidence curves of chronic health conditions in survivors, by GRADE 1-5 and GRADE 3-5
Cumulative incidence curves of chronic health conditions in survivors, by GRADE 1-5 and GRADE 3-5
Morbidity of Survivors

• By 30 years post cancer:
  • 73% survivors with at least one condition
  • 42% with a grade 3-5 condition
  • 32% with multiple conditions
• Survivors – 8.2 times more likely to have a severe or life-threatening health condition than siblings
Health Status of Survivors

- 9535 young adult survivors
- Moderate-extreme adverse outcomes
  - General health 10.6%
  - Mental health 17.2%
  - Functional impairment 11.8%
  - Limitations in activity 13.5%
  - Pain post cancer 10.2%
  - Anxiety/fears post cancer 13.2%
  - Any adverse HS domain 43.2%

Hudson MM et al. JAMA 290:1583, 2003
Foundations of Risk-Based Care

- High-risk population
- Wide array of potential late effects
- Risk often does not plateau with aging
- Clinically silent period for many late effects - 20-30 yrs
Foundations of Risk-Based Care

- High-risk population
- Wide array of potential late effects
- Risk often does not plateau with aging
- Clinically silent period for many late effects – 20-30 yrs
  - Potentially modifiable by secondary or tertiary prevention and early diagnosis/intervention
Paradigm Shift

Shift from a focus solely on cure to

maximize the cure

and

minimize the cost

(late occurring health problems associated with the cancer therapy)
Premorbid Conditions

Aging and Co-morbid Conditions

Genetic
• BRCA, ATM, p53 polymorphisms

Cancer-Related Morbidity

Health Behaviors
• Tobacco
• Diet
• Alcohol
• Exercise

Host Factors
• Gender
• Race/ Ethnicity
• Socioeconomic

Tumor Factors
• Response
• Histology
• Biology
• Site

Treatment
• Radiation
• Chemotherapy
• Surgery

Treatment Events

Hudson and Oeffinger 2004
Basis for Risk Estimate

Determine risk for potential late effects, based on:

• Cancer – type, site, etc.
• Therapeutic exposures
• Treatment events
• Genetic predispositions
• Co-morbid conditions
• Lifestyle behaviors and practices
Plan for Risk-Based Care

• Monitor for recurrence of cancer
• Surveillance for second cancers and late effects
  • Early diagnosis and intervention
• Prevention
  • Tobacco use, physical activity, calcium intake
• Counseling and education

Oeffinger KC. Institute of Medicine, 2003
Oeffinger KC, Hudson MM. CA Cancer J Clin 54:208-236, 2004
Long-Term Mortality

Event Free Survival

Years since cancer diagnosis
Grade 1-4 Chronic Health Conditions

Cumulative Incidence

Years since cancer diagnosis
Grade 3-4 Chronic Health Conditions

Cumulative Incidence

Years since cancer diagnosis
Phases of Follow Up Care

Cumulative Incidence

Years since cancer diagnosis
YRS 0-2 Post Therapy

- Characteristics
  - High risk of relapse
  - Resolving toxicity of therapy
  - Early late effects of cancer/therapy

- Focus
  - Close monitoring for cancer relapse
  - Evaluation for persistent toxicity

Cumulative Incidence

Years since cancer diagnosis
YRS 2-10 Post Therapy

- Characteristics
  - Relapse/recurrence
  - Endocrinopathies
  - Neurocog sequelae

- Focus
  - Monitoring relapse
  - Screening
  - Counseling/school

Cumulative Incidence

Years since cancer diagnosis
YRS > 10 Post Therapy

- Characteristics
  - Increasing incidence of SMN and late effects
  - Fertility issues
  - Independence/work

- Focus
  - Surveillance
  - Manage late effects
  - Counseling

Years since cancer diagnosis
Long-Term Follow-up Programs

- LTFU programs created for care of cancer survivors in 1980-1990’s
- Based at a children’s hospital or a cancer center
- Variation between programs: resources, size, research
Long-Term Follow-up Programs

- LTFU programs created for care of cancer survivors in 1980-1990’s
- Based at a children’s hospital or a cancer center
- Variation between programs: resources, size, research
- 1997 - 50% centers in US and Canada with a LTFU program

LTFU Program

• Team approach (MD/NP/SW)
• Multi-disciplinary network of consultants
• Annual evaluation
  • History and physical
  • Screening based on exposures
  • Targeted education on risk and lifestyle behaviors
  • Medical summary of treatment

## SUMMARY OF CANCER TREATMENT

**Date Prepared:** 08/22/2005

<table>
<thead>
<tr>
<th>Name: John Doe</th>
<th>Date of Birth:</th>
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<th>Treatment Center:</th>
<th>Memorial Sloan Kettering Cancer Center</th>
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<table>
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<tr>
<th>Cancer Diagnosis:</th>
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<th>Date of Diagnosis:</th>
<th>Age at Diagnosis:</th>
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<td>06/18/1978</td>
<td>14 years</td>
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<table>
<thead>
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<th>Date of Completion of Therapy:</th>
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### Cancer Treatment

#### Surgery

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<th>Date</th>
<th>Procedure</th>
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<td>03/20/1978</td>
<td>Biopsy of left thigh mass</td>
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<tr>
<td>04/06/1978</td>
<td>EnBloc Resection left anterior medial thigh</td>
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<tr>
<td>06/10/1985</td>
<td>Excision of left distal thigh mass</td>
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#### Radiation Therapy

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<th>Date Stop</th>
<th>Field</th>
<th>Dose (cGy)</th>
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#### Chemotherapy

<table>
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<th>Drug Name</th>
<th>Dose (units or mg/m²)</th>
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<tr>
<td>Actinomycin-D</td>
<td>Yes – 6.96 mg/m²</td>
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<tr>
<td>BCNU (Carmustine)</td>
<td>Yes – 177.78 mg/m²</td>
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<tr>
<td>Bleomycin</td>
<td>Yes – 80 mg/m²</td>
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<tr>
<td>Cyclophosphamide (Cytoxan)</td>
<td>Yes – 19644.44 mg/m²</td>
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<tr>
<td>Doxorubicin (Adriamycin)</td>
<td>Yes – 345 mg/m²</td>
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<tr>
<td>Methotrexate</td>
<td>Yes – 77.04 mg/m²</td>
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<td>Vincristine</td>
<td>Yes</td>
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### Late Effects Risks

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<tr>
<th>Late Effects Risks</th>
<th>Screening Recommendations**</th>
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<tbody>
<tr>
<td>Cardiomyopathy</td>
<td>Echo every year</td>
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<tr>
<td>Pulmonary fibrosis</td>
<td>PFTs with DLCO baseline</td>
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<tr>
<td>Hypogonadism</td>
<td>Testosterone, FSH, LH as indicated</td>
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<td>Hemorrhagic cystitis</td>
<td>Urinalysis yearly</td>
</tr>
<tr>
<td>Bladder cancer</td>
<td>Urinalysis yearly</td>
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</tbody>
</table>

**Screening recommendations from the CureSearch Children’s Oncology Group Long-Term Follow-Up Guidelines at [http://www.survivorshipguidelines.org](http://www.survivorshipguidelines.org).**
Standardized Screening

- Late Effects Screening Guidelines from the Children’s Oncology Group
- www.survivorshipguidelines.org
- Melissa Hudson/Wendy Landier
- Multi-disciplinary
Standardized Screening

- Late Effects Screening Guidelines from the Children’s Oncology Group
- www.survivorshipguidelines.org
- Melissa Hudson/Wendy Landier
- Multi-disciplinary
- Strength of the association of treatment exposure to late effect
- Principles of screening/surveillance in a high-risk population
Long-Term Follow-Up Guidelines
for Survivors of Childhood, Adolescent,
and Young Adult Cancers

Version 2.0 – March 2006

CureSearch
Children’s Oncology Group

www.survivorshipguidelines.org

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**Chemotherapy**

<table>
<thead>
<tr>
<th>Sec #</th>
<th>Therapeutic Agent(s)</th>
<th>Potential Late Effects</th>
<th>Risk Factors</th>
<th>High Risk Factors</th>
<th>Periodic Evaluation</th>
<th>Health Counseling Further Considerations</th>
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<tbody>
<tr>
<td>7</td>
<td>ALKYLATED AGENTS</td>
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<td></td>
<td>Busulfan</td>
<td>Gonal dysfunction (testicular)</td>
<td>Treatment Factors</td>
<td>Host Factors</td>
<td>Male gender</td>
<td>Male Health Issues</td>
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<td></td>
<td>Carmustine (BCNU)</td>
<td>Hypogonadism infertility</td>
<td>Higher cumulative doses of alkylators or combinations of alkylators</td>
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<td>Male gender</td>
<td>Male Health Issues</td>
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<tr>
<td></td>
<td>Chlorambucil</td>
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<td>Combined with radiation to:</td>
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<td></td>
<td>Cyclophosphamide</td>
<td></td>
<td>- Abdomen/pelvis</td>
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<td>Male Health Issues</td>
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<tr>
<td></td>
<td>Ifosfamide</td>
<td></td>
<td>- Testes</td>
<td></td>
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<td>Male Health Issues</td>
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<tr>
<td></td>
<td>Lomustine (CCNU)</td>
<td></td>
<td>- Brain, cranium (neuroendocrine axis)</td>
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<td>Male Health Issues</td>
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<tr>
<td></td>
<td>Mechlorethamine</td>
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<td></td>
<td>Melphalan</td>
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<td></td>
<td>Prednisolone</td>
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<td></td>
<td>Thiotepa</td>
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<td>HEAVY METALS</td>
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<td></td>
<td>Carboplatin</td>
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<td>Male Health Issues</td>
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<td>Cisplatin</td>
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<td></td>
<td>NON-CLASSICAL ALKYLATED AGENTS</td>
<td>Dacarbazine (DTIC)</td>
<td>Treatment Factors</td>
<td>Host Factors</td>
<td>Male gender</td>
<td>Male Health Issues</td>
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<tr>
<td></td>
<td></td>
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<td>MOPP &gt; 3 cycles</td>
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<td>Ifosfamide cumulative dose &gt; 7.5 g/m² or as conditioning for HCT</td>
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<td>Male Health Issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Any alkylators combined with:</td>
<td></td>
<td></td>
<td>Male Health Issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Testicular radiation</td>
<td></td>
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<td>Male Health Issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Pelvic radiation</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- TBI</td>
<td></td>
<td></td>
<td>Male Health Issues</td>
</tr>
</tbody>
</table>

**SECTION 7 REFERENCES**


**SYSTEM = Male reproductive**

**SCORE = Alkylyating Agents: 1**

**Heavy Metals: 2A**

**Non-Classic Alkylyaters: 2A**

**Version 2.0 – March 2006**
RADIATION

<table>
<thead>
<tr>
<th>Sec #</th>
<th>Therapeutic Agent(s)</th>
<th>Potential Late Effects</th>
<th>Risk Factors</th>
<th>High Risk Factors</th>
<th>Periodic Evaluation</th>
<th>Health Counseling Further Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>71</td>
<td>Medial / mediastinal</td>
<td>Cardiac toxicity</td>
<td>Host Factors</td>
<td>Host Factors</td>
<td>HISTORY</td>
<td>Health Links</td>
</tr>
<tr>
<td></td>
<td>Chest (thoracic)</td>
<td>Congestive heart failure</td>
<td>Younger age at irradiation</td>
<td>Female sex</td>
<td>SOB</td>
<td>Heart Health</td>
</tr>
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<td></td>
<td>Axilla</td>
<td>Cardiomyopathy</td>
<td>Family history of dyslipidemia</td>
<td>Black of African descent</td>
<td>DHE</td>
<td>Diet and Physical Activity</td>
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<tr>
<td></td>
<td>Spleen</td>
<td>Pericarditis</td>
<td>Coronary artery disease</td>
<td>Age younger than 5 years at time of treatment</td>
<td>Ortho</td>
<td>Resources</td>
</tr>
<tr>
<td></td>
<td>Whole abdomen</td>
<td>Pericardial fibrosis</td>
<td>Treatment Factors</td>
<td>TBI Combined with radiation therapy</td>
<td>Chest</td>
<td>A downloadable wallet card is available from the AHA website for patients requiring endocarditis prophylaxis: <a href="http://www.americanheart.org/downloadable/healthinfo/0023625600174aef68173.pdf">www.americanheart.org/downloadable/healthinfo/0023625600174aef68173.pdf</a></td>
</tr>
<tr>
<td></td>
<td>All upper abdominal fields</td>
<td>Vascular disease</td>
<td>Radiation dose &gt; 20 Gy to chest TBI</td>
<td>Combined with radiotherapeutic chemotherapy (e.g., dacarbazine, dacarbazine)</td>
<td>Chest pain</td>
<td>Counseling</td>
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<tr>
<td></td>
<td></td>
<td>Myocardial infarction</td>
<td>Lack of abdominal shielding</td>
<td>Combined with other cardiotoxic chemotherapy</td>
<td>Palpitations</td>
<td>Counsel patients with prolonged QTc interval about use of medications that may further prolong the QTc interval (e.g., tricyclic anti-depressants, angiotensin-converting enzyme inhibitors, metronidazole) Counsel regarding maintaining appropriate weight, blood pressure, and heart-healthy diet. Counsel regarding endocarditis prophylaxis if valvular abnormalities present, Counsel regarding appropriate exercise. Aerobic exercise is generally safe and should be encouraged for most patients. Intensive isometric activities (e.g., heavy weight lifting, wrestling) should generally be avoided. Limited high repetition weight lifting (i.e., lifting a lighter weight with ease no more than 10 to 20 times in a row) is much less stressful to the heart and is more likely to be safe. Patients who choose to engage in strenuous or varsity team sports should discuss appropriate guidelines and a plan for ongoing monitoring with a cardiologist.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arrhythmia</td>
<td>- Anthracyclines</td>
<td>Doses &gt; 30 Gy in patients who have received anthracyclines</td>
<td>Abdominal symptoms (nausea, vomiting)</td>
<td>Physical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Atherosclerotic heart disease</td>
<td>- Cyclophosphamide</td>
<td>Doses &gt; 40 Gy in patients who have not received anthracyclines</td>
<td>(yearly)</td>
<td>Cardiac murmur</td>
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<table>
<thead>
<tr>
<th>RECOMMENDED FREQUENCY OF ECHOCARDIOGRAM</th>
</tr>
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<tbody>
<tr>
<td>Age at Treatment</td>
</tr>
<tr>
<td>&lt; 5 years old</td>
</tr>
<tr>
<td>≥ 5 years old</td>
</tr>
<tr>
<td>Any age with serial decrease in function</td>
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<tr>
<td></td>
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*Age at time of first cardiotoxic therapy (anthracycline or chest radiation, whichever was given first) (Based on an equivalent mg of doxorubicin/dactinomycin)
### Hematopoietic Cell Transplant (continued)

<table>
<thead>
<tr>
<th>Sec #</th>
<th>Therapeutic Agent(s)</th>
<th>Potential Late Effects</th>
<th>Risk Factors</th>
<th>High Risk Factors</th>
<th>Periodic Evaluation</th>
<th>Health Counseling Further Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>Hematopoietic Cell Transplant (RCT)</td>
<td>Hepatic toxicity Chronic hepatitis Cirrhosis Iron overload</td>
<td>Treatment Factors History of multiple transfusions Radiation to the liver Antimetabolite therapy</td>
<td>Medical Conditions Chronic hepatitis C with siderosis and steatosis</td>
<td>SCREENING: ALT AST Bilirubin Ferritin (Baseline at entry into long-term follow-up. Repeat as clinically indicated.)</td>
<td>Health Links Liver Health Gastrointestinal Health</td>
</tr>
</tbody>
</table>

### Section 95 References

What is unique about LTFU-type care?

Clinicians’ (MD, NP, SW, Psych)
primary focus is on cancer survivors:
• Clinical care
• Research
• Critical review of the survivor literature
• National networking with other survivor clinicians
Cancer Center Visit in Last 2 YRS

Percent

Years since cancer diagnosis
Cancer Center Visits and Late Effects

Years since cancer diagnosis

Percent

Young adult survivors
Future Directions of Care

- There is not adequate capacity to care for pediatric cancer survivors in the US.
  - Increasing numbers and capacity of LTFU programs
  - Partnerships with the community
  - Hybrid programs
    - Stratified by risk of survivor - low, med, high
    - Frequency and location based on risk
### Summary of treatment for the primary diagnosis

#### Passport for Care

**Protocol**

**Surgeries**

<table>
<thead>
<tr>
<th>Date</th>
<th>Procedure Description</th>
<th>Site</th>
<th>Laterality</th>
<th>Surgeon Institution</th>
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<tr>
<td>05-02-1997</td>
<td>Limb sparing procedure humerus gross total resection</td>
<td></td>
<td>Left</td>
<td>Dan Cutter, NO Nowhere General Hospital</td>
</tr>
</tbody>
</table>

**Chemotherapies**

<table>
<thead>
<tr>
<th>Drug Name</th>
<th>Single Dose</th>
<th>Cumulative Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vincristine</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Daunorubicin</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Doxorubicin</td>
<td>NO</td>
<td>400</td>
</tr>
<tr>
<td>Ifosfamide</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Etoposide (VP16)</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

**Radiation**

<table>
<thead>
<tr>
<th>Site/Field</th>
<th>Laterality</th>
<th>Start Date</th>
<th>Shop Date</th>
<th>Fraction</th>
<th>Dose per Fraction (cGy)</th>
<th>Total Dose (cGy)</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremity: Upper</td>
<td>Left</td>
<td>18</td>
<td>100</td>
<td>5400</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Blood Products**

- Exposure to any blood or serum product, including packed red cells, whole blood, white cells, platelets, fresh frozen plasma, cryoprecipitate, allogeneic marrow or stem cells, immunoglobulin preparations (e.g., IVIG, ISTIC), and clotting factor concentrates.

[YES] [NO]
**Passport for Care**

- **Follow-up guidelines** are based on the cumulative summary and drawn from the guidelines database.

- The display of periodic evaluations is organized by system and includes the PLE and frequency requirements.

---

**Periodic Evaluations**

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>PLE</th>
<th>EVALUATION</th>
<th>BASELINE</th>
<th>FREQUENCY</th>
<th>REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes/Ears/Nose/Mouth/Throat</td>
<td>Ototoxicity: sensorineural hearing loss, tinnitus, vertigo</td>
<td>hearing difficulties (with/without background noise)</td>
<td>YEARLY</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Eyes/Ears/Nose/Mouth/Throat</td>
<td>Ototoxicity: sensorineural hearing loss, tinnitus, vertigo</td>
<td>tinnitus</td>
<td>YEARLY</td>
<td>11</td>
<td></td>
</tr>
<tr>
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<td>Ototoxicity: sensorineural hearing loss, tinnitus, vertigo</td>
<td>vertigo</td>
<td>YEARLY</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Cardiomyopathy: arrhythmia; subclinical left ventricular dysfunction (cystic dysplasia as assessed by echocardiography or radiologic angioangiography)</td>
<td>SOB, D3E, orthopnea, chest pain, palpitations; if under 25 yr: abdominal symptoms (nausea, vomiting)</td>
<td>YEARLY</td>
<td>24-72h</td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>Pulmonary insufficiency</td>
<td>cough, SOB, D3E, wheezing</td>
<td>YEARLY</td>
<td>94</td>
<td></td>
</tr>
<tr>
<td>Geriatric</td>
<td>Hemorrhagic cystitis, bladder fibrosis, dysfunctional voiding, vesicoureteral reflux, hydronephrosis</td>
<td>frequency</td>
<td>YEARLY</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Geriatric</td>
<td>Hemorrhagic cystitis, bladder fibrosis, dysfunctional voiding, vesicoureteral reflux, hydronephrosis</td>
<td>hematuria</td>
<td>YEARLY</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Geriatric</td>
<td>Hypoparathyroidism, infertility</td>
<td>medication use impacting sexual function</td>
<td>YEARLY</td>
<td>6-12m, 1-4y, 1-4y-2y, 1-4y-3y</td>
<td></td>
</tr>
<tr>
<td>Geriatric</td>
<td>Hypoparathyroidism, infertility</td>
<td>pubertal onset, tempo</td>
<td>YEARLY</td>
<td>6-12m, 1-4y, 1-4y-2y, 1-4y-3y</td>
<td></td>
</tr>
<tr>
<td>Geriatric</td>
<td>Hypoparathyroidism, infertility</td>
<td>sexual function (erections, nocturnal emissions, libido)</td>
<td>YEARLY</td>
<td>6-12m, 1-4y, 1-4y-2y, 1-4y-3y</td>
<td></td>
</tr>
</tbody>
</table>
Patient Portals

**e Health Record**

- Medical Summary
- Progress notes
- Medications
- Labs/Tests
- Problem lists
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**Shared Record**
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- Screening recommendations
- Asynchronous email
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Firewall

Patient
Patient Portals

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Patient

Firewall
Patient Portals

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[Diagram showing Patient Portals and firewall between patient and PCP]
Summary

- Cancer survivors face long-term risks
- Many late effects are modifiable
- Goal of risk-based survivor care:
  - Reduce morbidity and mortality
  - Enhance quality of life
Acknowledgments

• Leslie Robison, PhD
• Noreen Aziz, MD, PhD
• Melissa Hudson, MD
• Ann Mertens, PhD
• Charles Sklar, MD

❖ Our patients