Diet, Physical Activity and Weight

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July 16th – Addressing the needs of adolescent and young adults with cancer
Preface

• The literature in this area covers:

  – Adolescent/adult survivors of childhood cancer (CCS) – primarily diagnosed during childhood
    • More studies

  – Young Adult Cancer Survivors – primarily diagnosed during adolescence or young adulthood
    • Fewer studies
Why diet, physical activity and weight management?

Good nutrition and regular exercise offer many benefits to cancer survivors including *

- Promoting healing of tissues and organs damaged by cancer and treatment
- Building strength and endurance
- Reducing the risk of adult cancers and other chronic diseases co-occurring during survivorship
- Decreasing stress

Children’s Oncology Group Recommendation*
Weight

- Risk for obesity is well documented among those with Leukemia (ALL)

- CCSS Cohort
  - obesity prevalence among survivors is greater than the prevalence in the population
    - OR females=1.5; OR males =1.2
  - CRT dose, sex, age at treatment differences were noted
    - Obesity prevalence is higher in survivors compared to siblings among those:
      - treated with high dose radiation (> 20 Gy)
      - Females diagnosed/treated at young age

- BRFSS data
  - Investigators compared 4054 AYA survivors (ages 15-29) and 345,592 respondents with no history of cancer
    - Prevalence of obesity was higher (31% vs 27%) among survivors

- What does weight gain look like through the course of treatment?

Oeffinger, et al. 2003, Ped Blood Cancer; Meacham et al., 2005, Cancer; Tai et al., 2012 Cancer
Weight in children with high risk ALL enrolled from 1996-2002

- 23% of patients (n=1638) were obese at end of treatment compared to 14% at the beginning

- Obesity was highest among:
  - those diagnosed at ages 5-9
  - non-white
  - and who had a higher initial BMI
  - radiation tx not a factor

- Greatest increase in weight occurred between ~9-12 months post-diagnosis

Withycombe et al., 2009, Ped Blood Cancer
Adiposity in AYA survivors of pediatric cancer

Male survivors show similar BMI values as siblings, but higher trunk and body fat (58% leukemia/lymphoma)

Table 2. Adiposity characteristics of 170 pediatric cancer survivors and 71 sibling controls

<table>
<thead>
<tr>
<th>Variable (mean, IQR)</th>
<th>Females</th>
<th></th>
<th></th>
<th></th>
<th>Males</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Survivors (n = 83)</td>
<td>Controls (n = 33)</td>
<td>P</td>
<td>Survivors (n = 87)</td>
<td>Controls (n = 38)</td>
<td>P</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Age, y</td>
<td>20.3 (14.2–26.2)</td>
<td>15.5 (12.2–17.9)</td>
<td>0.004</td>
<td>18.5 (12.4–23.4)</td>
<td>16.6 (10.8–19.9)</td>
<td>0.13</td>
<td></td>
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</tr>
<tr>
<td>Height, cm</td>
<td>155.0 (147.7–163.1)</td>
<td>161.3 (158.1–169–3)</td>
<td>0.03</td>
<td>163.2 (152.7–173–9)</td>
<td>167.0 (160.5–178.2)</td>
<td>0.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight, kg</td>
<td>57.9 (44.8–67.6)</td>
<td>63.4 (53.0–73.4)</td>
<td>0.14</td>
<td>64.9 (51.1–76.3)</td>
<td>66.2 (60.1–80.1)</td>
<td>0.68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>23.6 (19.0–26.4)</td>
<td>24.3 (22.0–27.6)</td>
<td>0.49</td>
<td>23.5 (20.6–24.9)</td>
<td>22.6 (19.9–26.3)</td>
<td>0.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body fat, %</td>
<td>36.3 (28.3–43.0)</td>
<td>34.5 (28.8–41.7)</td>
<td>0.43</td>
<td>25.8 (17.9–33.2)</td>
<td>20.7 (13.8–28.2)</td>
<td>0.007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trunk fat, %</td>
<td>35.0 (25.9–43.4)</td>
<td>33.5 (26.9–41.6)</td>
<td>0.55</td>
<td>26.7 (19.3–34.8)</td>
<td>21.3 (13.3–29.2)</td>
<td>0.008</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Mixed models (SAS Proc Mixed) were used to estimate means by sex while adjusting for age and sibling pairs. Abbreviation: IQR, interquartile range.

- Any CRT and TV viewing hours predicted higher adiposity

Miller et al., 2010, Cancer Epi Biomarkers and Prevention
Body composition changes during the first year of treatment

Controls (n=15) matched to Cases (n=15) based on age, sex, and race

FIGURE 2. Change in fat mass and lean body mass from baseline to 12 months by group.

Fuemmeler et al., 2012 J Pediatr Hematol Oncol
A greater percentage of parents of cancer patients gain weight in the first 3 months of their child’s treatment compared to parents observed over a similar time period.

Smith, Baum, & Wing 2005
Diet

• Little evidence to suggest that the quality and quantity of food intake of AYA survivors is different from healthy peers

  – However, there may be some specific times when they differ
    • During childhood cancer treatment a higher caloric-dense diet may be promoted to prevent weight loss

    • Glucocorticoid therapy during maintenance therapy for ALL has been shown to increase intake (Reilly 2001)

• Still – diet quality and quantity is suboptimal
## Diet among CCS/AYA

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Mean Age (years)</th>
<th>Percent consuming ≤30% dietary fat</th>
<th>Percent consuming 5+ servings of FV intake/day</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demark-Wahnefried et al., 2005*</td>
<td>209</td>
<td>20.3</td>
<td>16%</td>
<td>21%</td>
<td>32% meeting guidelines for calcium intake</td>
</tr>
<tr>
<td>Badr et al., 2011*</td>
<td>170</td>
<td>17.8</td>
<td>36%</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>Robien et al., 2008*</td>
<td>72</td>
<td>29.9</td>
<td>49%</td>
<td></td>
<td>86% exceeded recommended sugar intake</td>
</tr>
<tr>
<td>Rabin et al., 2010**</td>
<td>60</td>
<td>32.7</td>
<td>54%</td>
<td>37% Fruit 25% Vegetable</td>
<td></td>
</tr>
<tr>
<td>Tai et al., 2013**</td>
<td>4054</td>
<td>40</td>
<td>21.3%</td>
<td></td>
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</tr>
</tbody>
</table>

*diagnosed during childhood; **diagnosed during adolescence or young adulthood
Physical Activity

- Some evidence to suggest AYA survivors have lower levels of PA and greater sedentary activity than healthy peers

- Impairments in physical functioning following treatment are believed to play a role

- Atypical development of lean muscle mass during sensitive periods may have longer term consequences
## Physical Activity among CCS/AYA

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Mean age (years)</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florin et al., 2007*</td>
<td>2648 (CCSS)</td>
<td>28.7</td>
<td>ALL survivors were less likely to meet guidelines and be inactive compared to a population-based cohort (BRFSS)</td>
</tr>
<tr>
<td>Ness et al. 2009*</td>
<td>9301 (CCSS)</td>
<td>18-50+</td>
<td>52% vs. 46.9 siblings not meeting guidelines 22.7% vs 14% sibling inactive</td>
</tr>
<tr>
<td>Castellino et al 2005*</td>
<td>8767 (CCSS)</td>
<td>26.5</td>
<td>51% - 72% (depending on race/gender) not meeting guidelines of &gt;20 min of MVPA on 5 or more days per week</td>
</tr>
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<td>Demark-Wahnefried et al., 2005*</td>
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<tr>
<td>Rabin et al., 2010**</td>
<td>60</td>
<td>32.7</td>
<td>10% reporting meeting recommendations</td>
</tr>
<tr>
<td>Belanger et al., 2011**</td>
<td>588</td>
<td>38.2</td>
<td>78% not meeting guideline of 150-300 min of MVPA per week; 23% completely sedentary</td>
</tr>
<tr>
<td>Tai et al., 2013**</td>
<td>4054</td>
<td>40</td>
<td>30.5% with no leisure-time PA</td>
</tr>
</tbody>
</table>

*diagnosed during childhood; **diagnosed during adolescence or young adulthood
Limitations of Current Literature

- Few studies use standardized measures of diet or objective measures of physical activity
  - Performance of self-report instruments have not been evaluated among this population

- Self-reported BMI may underestimate the true effect
  - Fewer studies measure height/weight directly and/or assess body composition

- Little is known about the correlates of diet, physical activity and weight management in this population
  - Fear of injury, fatigue, pain, self-efficacy, stress, depression and social support may be important factors to consider
High Demand – Low Supply

Percent very/extremely interested

<table>
<thead>
<tr>
<th>Activity</th>
<th>2010</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise Program/Get in Shape</td>
<td><strong>59</strong></td>
<td>42</td>
</tr>
<tr>
<td>Healthy Eating Program</td>
<td><strong>53</strong></td>
<td>48</td>
</tr>
<tr>
<td>Weight Loss</td>
<td>37</td>
<td>40</td>
</tr>
</tbody>
</table>

*Rabin et al 2010 **

*Demark-Wahnefried et al 2005 *

*diagnosed as children; **diagnosed as adolescents or young adults
Challenges

• AYA survivors are geographically dispersed

• One size does not fit all – developmental tailoring should be considered

• Attrition is high, especially for programs that require patients attend in-person meetings

• Distance-based delivery channels are preferred*

*Demark-Wahnefried et al. 2005
Novel Approaches

- Internet based PA intervention for YACS (Rabin et al., 2011)
  - Pilot study: YACS received 12-week internet-based program based on stages of change model (n=8) or directed to cancer-related websites (n=10)

- Participants in the intervention showed trends toward greater changes in PA relative to those in the control

- Acceptability was high - 71% satisfied with intervention
Novel Approaches

- Facebook-based PA intervention for YACS (Valle et al. 2013)
  - YACS received 12 week FITNET intervention (n=45) or self-help comparison (n=41)
    - FITNET – Moderated Facebook page where participants also had access to a website for tracking/viewing progress + a pedometer
    - Self-Help – access to basic Facebook page with no access to websites for tracking/viewing progress + pedometer

- Both groups increased MVPA, but not groupxtime interaction observed

- Acceptability was high in both groups
  - >50% said they would recommend it to a friend
Novel Approaches

- Mila Celestial Bloom (Fuemmeler et al., in progress)
  - Intervention to promote healthy diet and physical activity among adolescent cancer survivors
  - Delivered using a platform that includes smartphone app and decision support web interface for a health coach
  - Participants advance through a series of expeditions by logging their diet, syncing their pedometer and accepting health challenges
  - Feasibility trial underway
Mila Blooms – Select Screen Shots

Map

Fuel

Climb

Camp
Summary

- CCS/AYA survivors appear to be at greater risk for overweight/obesity compared to healthy peers
  - High risk groups: ALL survivors; those treated at younger age; non-whites

- Similar to the general population, survivors have poor diet quality

- Lower participation in physical activity among survivors compared to health peers

- High demand – low supply of interventions to improve lifestyle behaviors
What is needed

• Improved measurement approaches for both epidemiologic and intervention studies

• Better understanding of cancer-specific psychological and social factors that may be related to unhealthy lifestyles

• Interventions that can reach geographically dispersed population (internet, smartphone, etc)

• Interventions sensitive to developmental stage (adolescences vs. adulthood)
References


