Diet, Physical Activity and Weight

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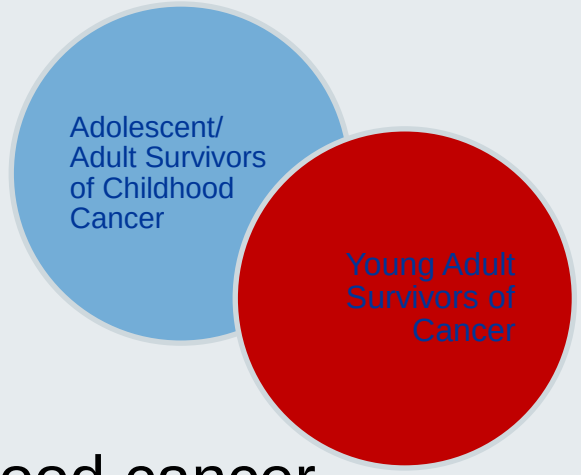
July 16th – Addressing the needs of adolescent and young adults with cancer

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

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

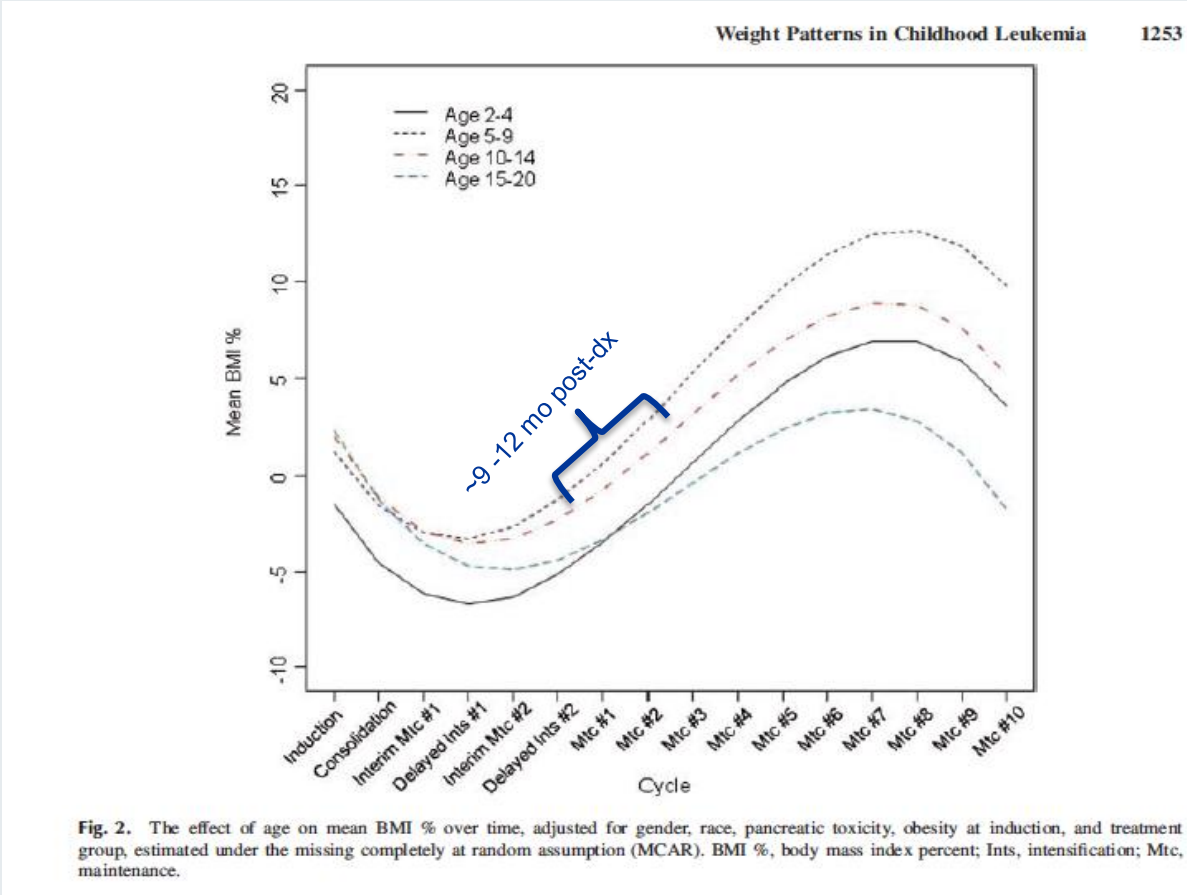


Fig. 2. The effect of age on mean BMI % over time, adjusted for gender, race, pancreatic toxicity, obesity at induction, and treatment group, estimated under the missing completely at random assumption (MCAR). BMI %, body mass index percent; Ints, intensification; Mtc, maintenance.

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

Variable (mean, IQR)	Females			Males		
	Survivors (*n* = 83)	Controls (*n* = 33)	*P*	Survivors (*n* = 87)	Controls (*n* = 38)	*P*
Age, y	20.3 (14.2–26.2)	15.5 (12.2–17.9)	0.004	18.5 (12.4–23.4)	16.6 (10.8–19.9)	0.13
Height, cm	155.0 (147.7–163.1)	161.3 (158.1–169–3)	0.03	163.2 (152.7–173–9)	167.0 (160.5–178.2)	0.11
Weight, kg	57.9 (44.8–67.6)	63.4 (53.0–73.4)	0.14	64.9 (51.1–76.3)	66.2 (60.1–80.1)	0.68
BMI, kg/m^2	23.6 (19.0–26.4)	24.3 (22.0–27.6)	0.49	23.5 (20.6–24.9)	22.6 (19.9–26.3)	0.38
Body fat, %	36.3 (28.3–43.0)	34.5 (28.8–41.7)	0.43	25.8 (17.9–33.2)	20.7 (13.8–28.2)	0.007
Trunk fat, %	35.0 (25.9–43.4)	33.5 (26.9–41.6)	0.55	26.7 (19.3–34.8)	21.3 (13.3–29.2)	0.008

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

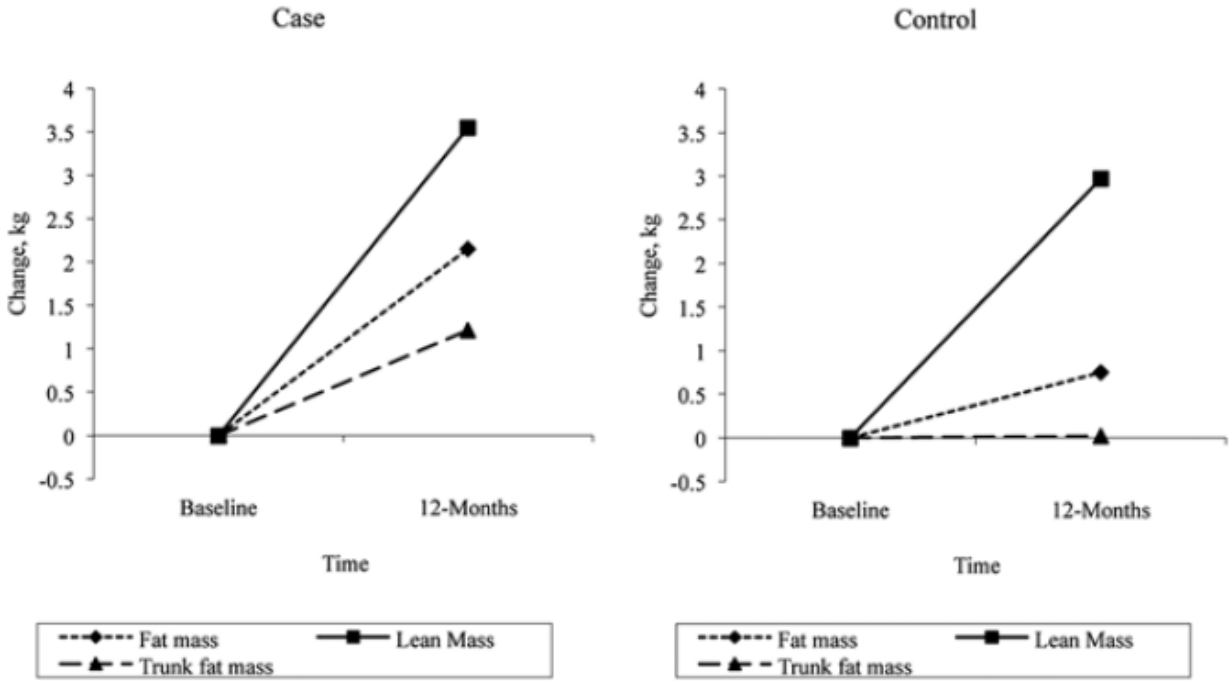
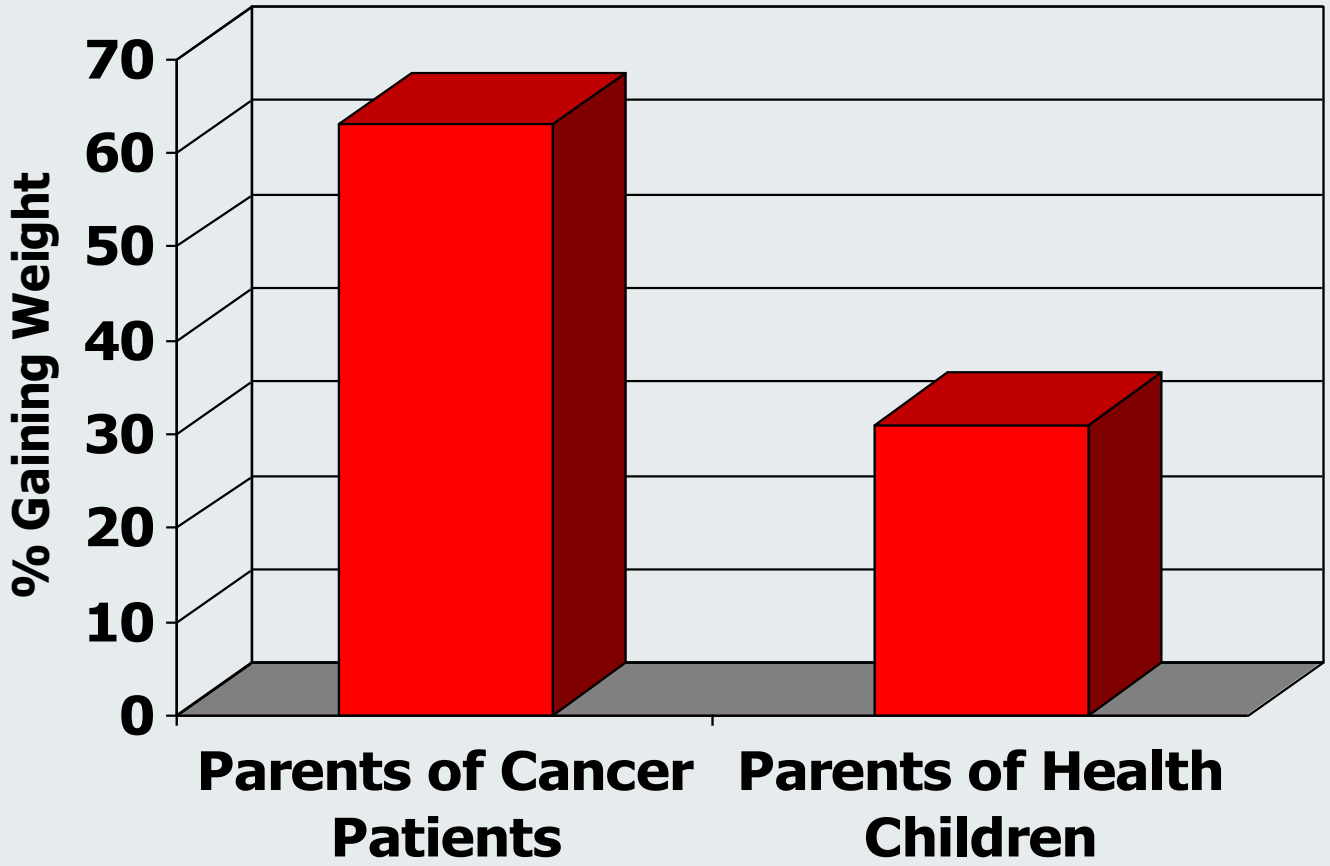


FIGURE 2. Change in fat mass and lean body mass from baseline to 12 months by group.

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

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

*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

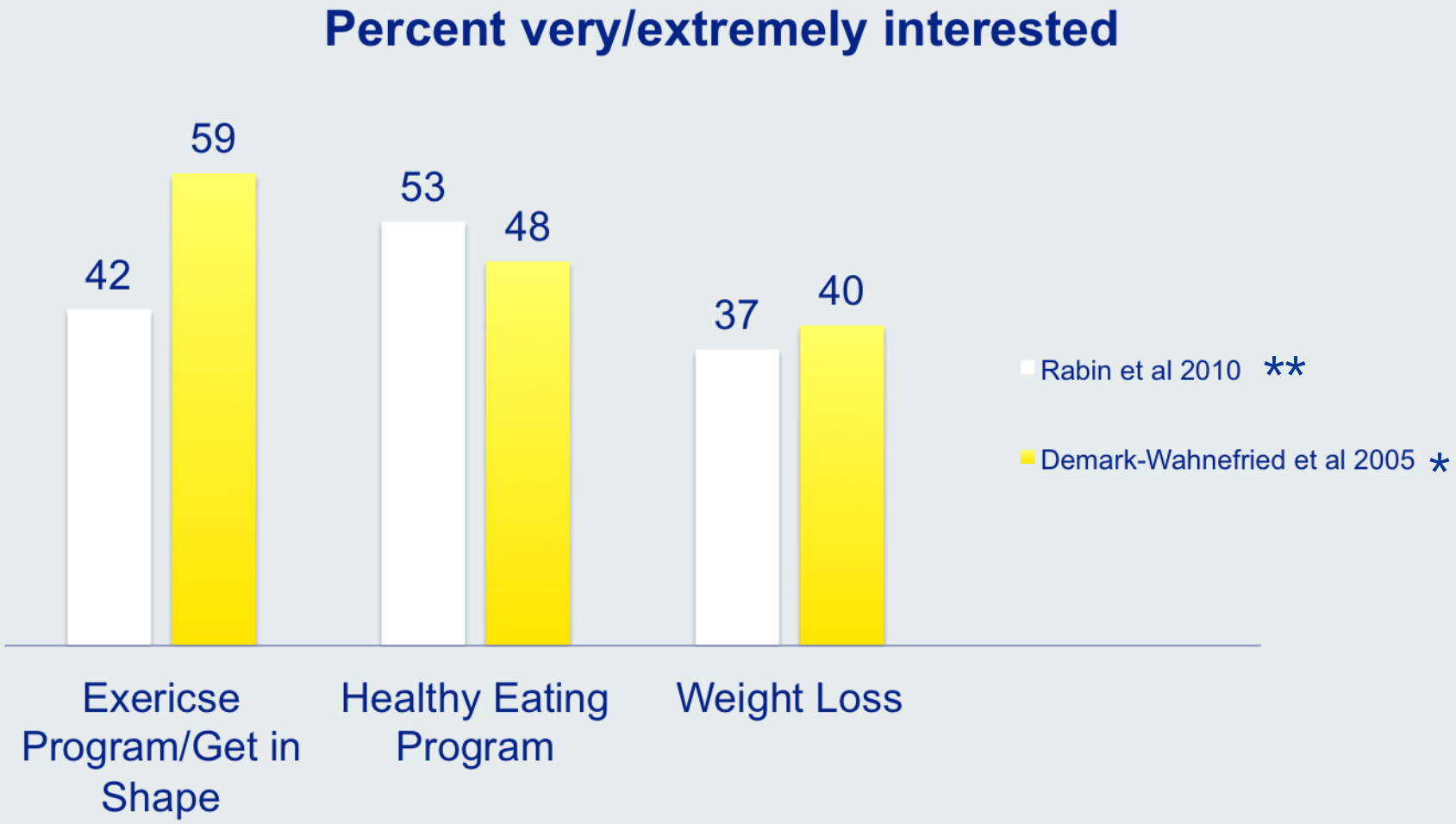
Study	N	Mean age (years)	Findings
Florin et al., 2007*	2648 (CCSS)	28.7	ALL survivors were less likely to meet guidelines and be inactive compared to a population-based cohort (BRFSS)
Ness et al. 2009*	9301 (CCSS)	18-50+	52% vs. 46.9 siblings not meeting guidelines 22.7% vs 14% sibling inactive
Castellino et al 2005*	8767 (CCSS)	26.5	51% - 72% (depending on race/gender) not meeting guidelines of >20 min of MVPA on 5 or more days per week
Demark-Wahnefried et al., 2005*	209	20.3	52% not meeting guidelines
Badr et al., 2011*	170	17.8	65% not meeting guidelines
Rabin et al., 2010**	60	32.7	10% reporting meeting recommendations
Belanger et al., 2011**	588	38.2	78% not meeting guideline of 150-300 min of MVPA per week; 23% completely sedentary
Tai et al., 2013**	4054	40	30.5% with no leisure-time PA

*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 know 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



*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)

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