

Developing Scalable Diet and Exercise Interventions for Cancer Prevention and Control



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American Cancer Society Clinical Research Professor

Learning Objectives

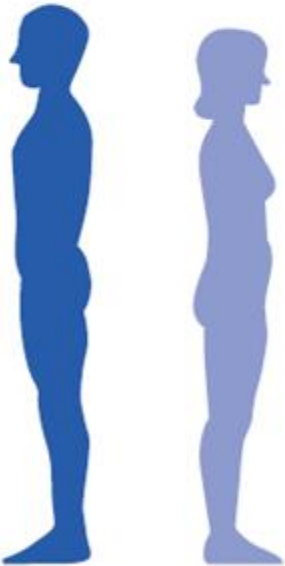
At the end of this activity learners will be able to...

- recognize current diet and exercise recommendations for cancer prevention and control
- identify key activities for designing lifestyle interventions that actively engage and overcome common barriers to populations at risk
- to describe at least two highly scalable interventions that effectively engaged cancer survivors and others to eat a better diet, exercise more and achieve a healthier body weight.

Estimated number of new cancer cases in the US in 2024

Estimated New Cases

Male		
Prostate	299,010	29%
Lung & bronchus	116,310	11%
Colon & rectum	81,540	8%
Urinary bladder	63,070	6%
Melanoma of the skin	59,170	6%
Kidney & renal pelvis	52,380	5%
Non-Hodgkin lymphoma	44,590	4%
Oral cavity & pharynx	41,510	4%
Leukemia	36,450	4%
Pancreas	34,530	3%
All sites	1,029,080	



Female		
Breast	310,720	32%
Lung & bronchus	118,270	12%
Colon & rectum	71,270	7%
Uterine corpus	67,880	7%
Melanoma of the skin	41,470	4%
Non-Hodgkin lymphoma	36,030	4%
Pancreas	31,910	3%
Thyroid	31,520	3%
Kidney & renal pelvis	29,230	3%
Leukemia	26,320	3%
All sites	972,060	

Excludes basal cell and squamous cell skin cancers and in situ carcinoma except urinary bladder.
Source: American Cancer Society, 2024.
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Trends in five-year relative survival (%), US, 1975–2019

Site	1975-77	1995-97	2013-2019
All sites	49	63	69
Breast (female)	75	87	91
Colon & rectum	50	61	64
Leukemia	34	48	67
Liver & intrahepatic bile duct	3	7	22
Lung & bronchus	12	15	25
Melanoma of the skin	82	91	94
Non-Hodgkin lymphoma	47	56	74
Ovary	36	43	51
Pancreas	3	4	13
Prostate	68	97	97
Uterine cervix	69	73	67
Uterine corpus	87	84	81

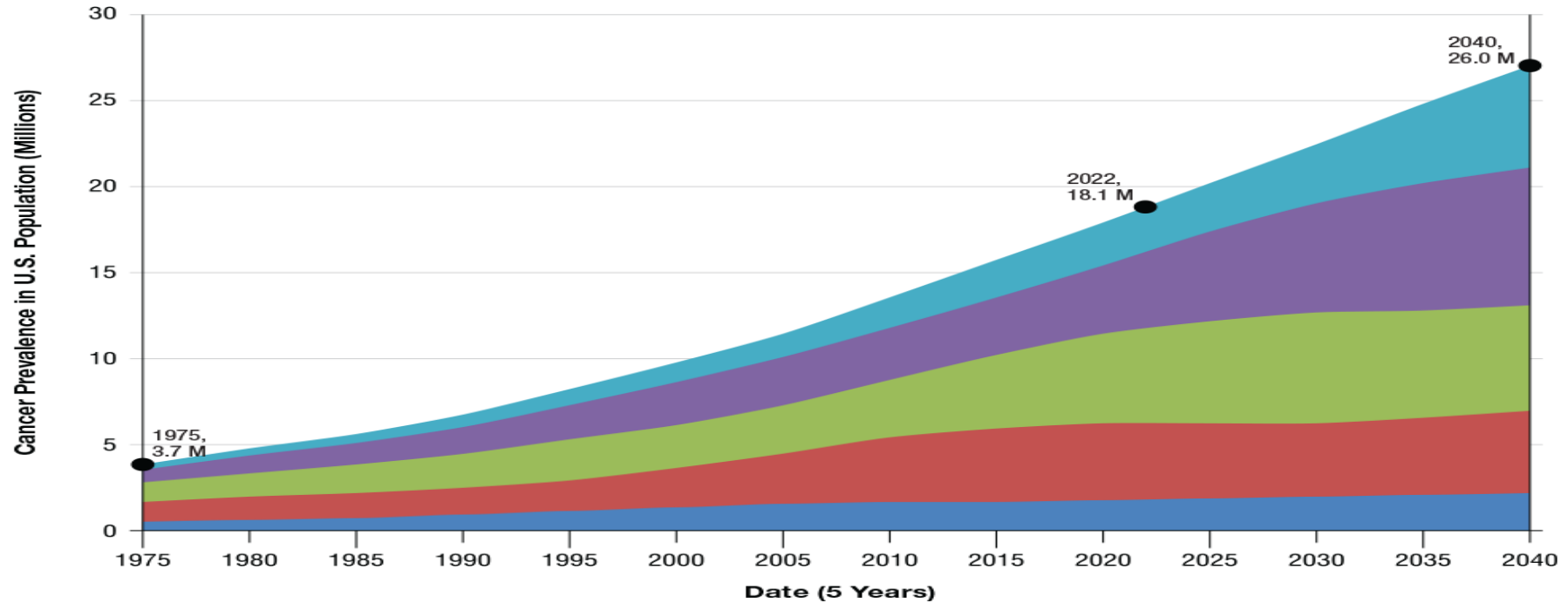
Survival is age adjusted for normal life expectancy and are based on cases diagnosed in the Surveillance, Epidemiology, and End Results (SEER) 9 areas for 1975-1977 and 1995-1997 and in the SEER 22 areas for 2013-2019; all cases were followed through 2019.

Source: Surveillance, Epidemiology, and End Results program, National Cancer Institute, 2023.

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Net Result: The Number of Cancer Survivors are Increasing

Cancer Prevalence and Projections in U.S. Population from 1975–2040



KEY

Age

■ < 50 ■ 50–64 ■ 65–74 ■ 75–84 ■ 85+

REFERENCES

Bluethmann SM, Mariotto AB, Rowland JH. Anticipating the “Silver Tsunami”: Prevalence Trajectories and Comorbidity Burden among Older Cancer Survivors in the United States. *Cancer Epidemiol Biomarkers Prev.* 2016 Jul;25(7):1029-36.

Miller KD, Nogueira L, Devasia T, Mariotto AB, Yabroff KR, Jemal A, Kramer J and Siegel RL. *Cancer Treatment and Survivorship Statistics.* CA A Cancer J Clin. 2022.

Cancer Survivorship: The Bad News



Guidelines for Diet & Physical Activity for Cancer Prevention & Control

	WCRF- AICR (2018)	American Cancer Society (2020/2022)
Weight	Be a healthy weight (avoid weight gain in adulthood)	Achieve & maintain a healthy weight throughout life
Physical Activity (PA)	Be physically active	Be physically active (150-300 min w ⁻¹ moderate PA or 75-150 min w ⁻¹ vigorous PA). Limit sedentary behavior.
Dietary Pattern	<p>Eat a diet rich in whole grains, vegetables, fruits and beans (prudent diet)</p> <p>Limit</p> <ul style="list-style-type: none"> • Fast foods” and other processed foods high in fat, starches or sugars • Red & processed meats (12-18 oz/week) • Sugary drinks 	<p>Follow a healthy eating pattern at all ages</p> <ul style="list-style-type: none"> • High nutrient foods in amts to achieve a healthy wt; • A variety of dark green, orange or red vegetables, legumes (beans and peas), and others; • Fruits, especially whole fruits in a variety of colors; and • Whole grains. <p>Limit or avoid</p> <ul style="list-style-type: none"> • Red and processed meats; • Sugar-sweetened beverages; or • Highly processed foods & refined grains
Alcohol	Limit alcohol. If drink limit to 1-2 drinks/day	Best not to drink alcohol

What are the Lifestyle Practices of Cancer Survivors?

Pooled Estimates (95% CI) for Meta-analysis of up to 51 studies

61% (59-63%) Overweight or Obese

69% (60-89%) Low fiber diet

66% (59-73%) Eat <5 servings/day of F&Vs

58% (45-72%) High fat diet

53% (26-80%) Eat >18 oz of meat/week

57% (54-61%) Underactive

17% (14-19%) Exceed moderate alcohol intake



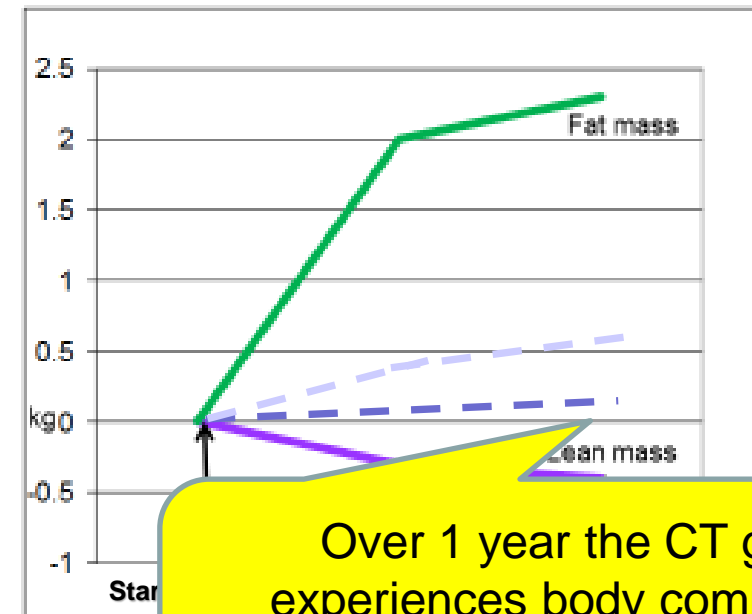
77% have high BMI's or practice multiple “bad” behaviors

Impact of Chemotherapy on Body Composition

- Observational Study
- 53 premenopausal breast cancer patients
 - 36 received chemotherapy (CT)
 - 17 received localized treatment (LT)
- Follow-up over 1-year post diagnosis
- DXA, Resting Energy Expenditure, 2-day dietary recalls, physical activity
- No difference in quadratic trend in REE or kcal intake
- Significant decrease in CT physical activity ($p=0.01$)

	CT (kg)	LT (kg)	P
Weight	+2.1	+1.0	0.02
Fat	+2.3	+0.1	0.002
Lean	-0.4	+0.8	0.02

Solid Lines: Chemo Dashed Lines: Localized Tx



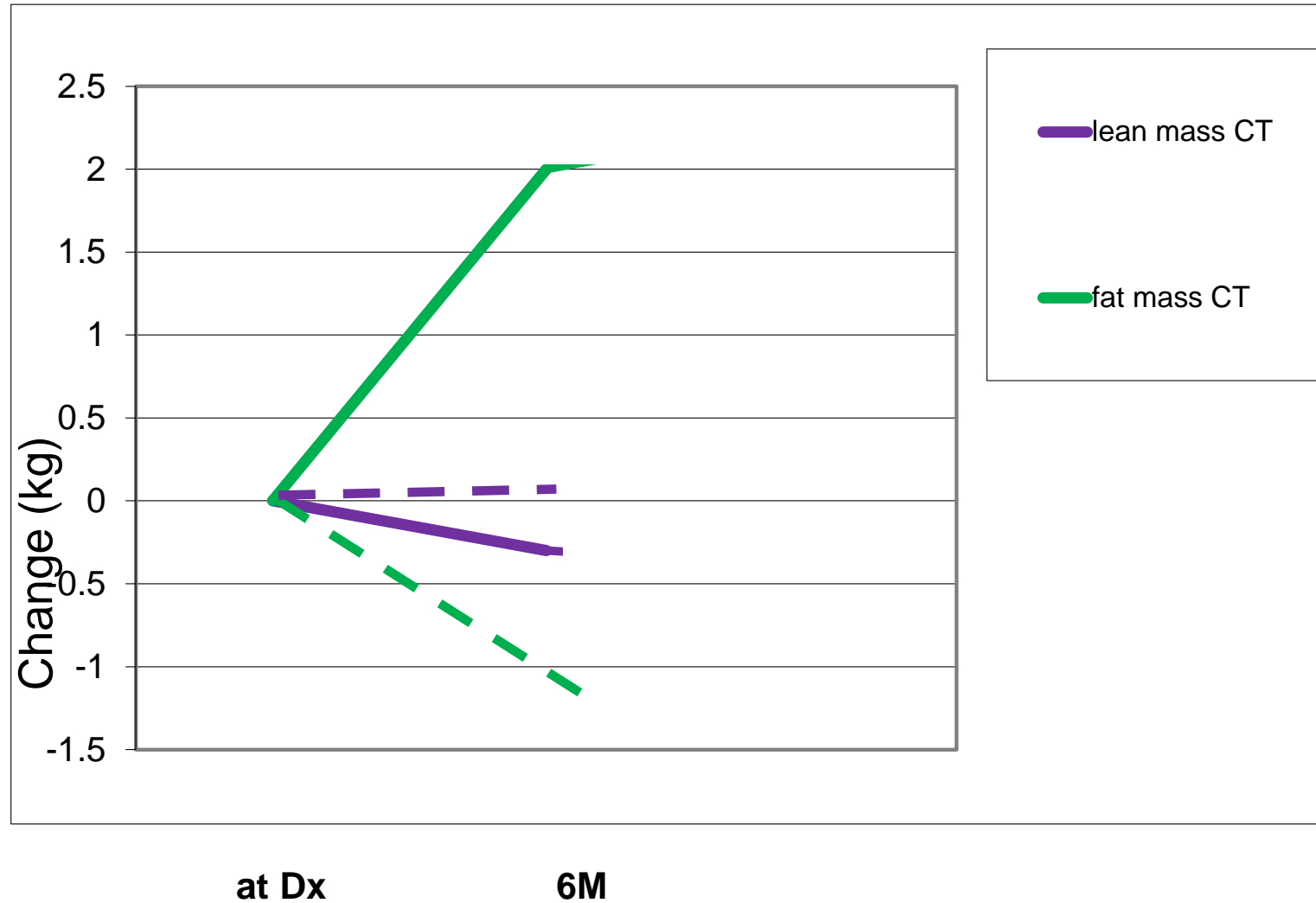
Over 1 year the CT group experiences body composition changes equivalent to 10 years of normal aging

Pilot Study (N=10)

To explore whether an exercise (strength training + aerobic activity) + diet ($\leq 20\%$ fat, plant-based, calcium-rich diet) is feasible & shows promise



Body Composition Changes Post-diagnosis in Premenopausal Breast Cancer Patients on Adjuvant Chemotherapy: Pilot Study Results



Home Based Diet and Exercise Interventions



Survivor TRaining for ENhancing Total Health (STRENGTH) R21 CA92468
90 Premenopausal Breast Cancer Pts on Chemotherapy
Feasibility/% Body Fat

Clin Breast Cancer 8:70-9, 2008.



FRESH START R01 CA81191
543 Breast & Prostate Cancer Survivors within 9M of dx
Achievement of Diet & Exercise Goals

JCO 25:2709-19, 2007.



Reach-out to ENhance Wellness in Older Survivors (RENEW) R01 CA106919
641 Longterm Breast, Prostate,& Colon Cancer Survivors
Physical Function

JAMA 301: 1883-91, 2009.



DAMES: Daughters And MothErS Against Breast Cancer R21 CA122143
136 Overweight Breast Cancer Survivors & Daughters
Feasibility Team vs. Independent Approach/Weight Status

Cancer 2014; 120:2522-34, 2014.

How do we achieve Success?

- Great Multidisciplinary Research Teams
- Solid Grounding in Behavioral Theory



Social Cognitive Theory

- Self-Efficacy
 - Incremental goal setting
 - Reinforcement
 - Identifying/Overcoming Barriers
 - Modelling
- Social Support

Overview of behavior change techniques (*Michie's Behavioural Change Technique Taxonomy*) and the frequency used in 30 weight loss trials among cancer survivors *Hoedjes et al. J Cancer Surv 2017*

8

Goal setting (behavior), Action planning, Social support, Instruction on how to perform the behavior

7

Self-monitoring, Behavioral cues

6

Goal setting (outcome)

5

Demonstration of the behavior, Feedback on behavior, Credible source

4

Behavioral practice/rehearsal, Graded tasks, Problem solving

3

Review behavior goal(s), Non-specific reward

2

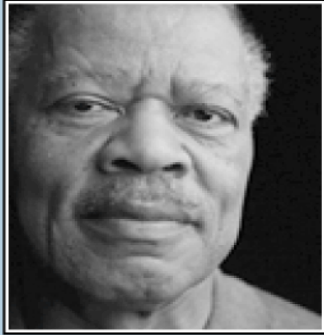
Biofeedback, Self-monitoring of outcome(s) of behavior, Reduce negative emotions ,
Discrepancy between current behavior and goal

1

Review outcome goal(s), Prompts/cues, Social reward, Information about health consequences,
Monitoring of emotional consequence, Avoidance/reducing exposure to the behavior,
Framing/reframing, Self-talk, Framing/reframing, Monitoring of behavior by others without
feedback, Monitoring of outcome(s) of behavior without feedback

Tailor on Age, Race, Gender & Cancer Coping Style

Helpless Hopeless



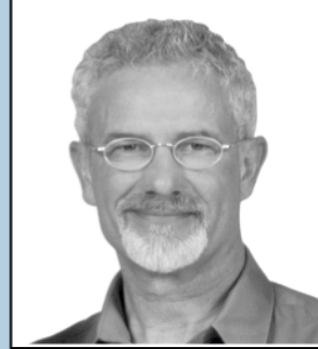
Richard Goode • diagnosed with prostate cancer at age 64, father of five, grandfather of eight.

When I was diagnosed with prostate cancer 3 years ago, I felt like I'd been hit by a truck. Hearing the word "cancer" made me tune out everything else. I was at a loss about what to do. One day, one of my children said to me, "Look at you! Why aren't you trying

I was at a loss about what to do.

to fight this thing?" I finally realized that I owed something more to those who care about me and to

Fighting Spirit



Jeff Preston • diagnosed with prostate cancer at age 49, father of three.

When I was diagnosed with prostate cancer 3 years ago, I made up my mind that I was going to beat this ~~disease~~. People were counting on me to get better, and I wasn't going to let them down. I saw the cancer as my own personal

My health and my family are

battle and knew there were things that I **COULD** DO to fight it. Three years

Anxious Preoccupier



Marian Ward • diagnosed with breast cancer at age 62, mother of four, grandmother of seven.

When I was diagnosed with breast cancer 3 years ago, I was shocked and scared. I found it hard to concentrate at work and spend time with my friends and family—I was always thinking about my cancer. I felt other people who had cancer dealt with it better than me.

I found it hard to concentrate at work

What seemed to help them was taking control over the parts of their lives they could control—

Interventions Provided Content on Diet Modification and Exercise, also personalized computer tailoring on key behavioral constructs

Incremental Goal Setting/Self-monitoring/feedback

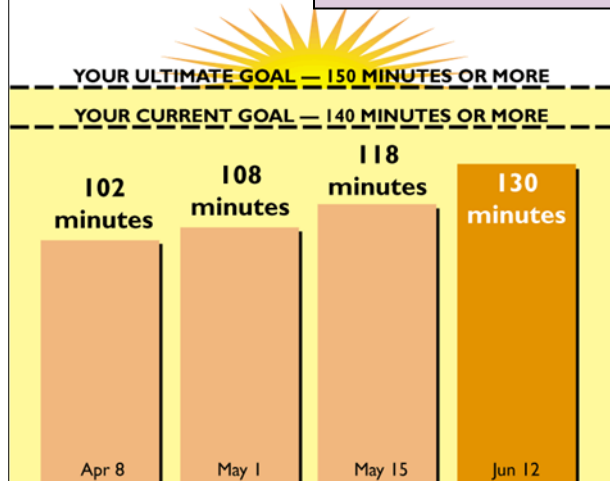
Where does Jane Doe stand?

Look at the graph below to see your progress!

- The first three bars on the left show your previous level of exercise. If you see any big “?”s, it’s because we didn’t get your update cards.
- The bar on the far right shows the number of minutes of exercise you reported on your last update card.
- Your ultimate goal is to exercise AT LEAST 150 minutes each week—see the top dashed line.
- During the next month, try to get just 10 minutes more of exercise each day. The bottom dashed line shows this goal. You CAN do it!

You’re heading in the right direction, Jane Doe! Keep with it.

Average number of minutes per week...



Identifying & Overcoming Barriers

Ask Ms. Greene



Dear Jane Doe,

When you spoke to us over the phone, you said that eating more vegetables and fruits was hard for you because it's hard to get vegetables and fruits when you eat out. Here is what our Health Educator, Sonya Green, says.

Eating out doesn't mean you can't eat healthy.

- ✔ Visit the salad bar or order a vegetable salad with your meal (remember to order the dressing on the side).
- ✔ Choose restaurants with salad bars, and choose wisely by piling lots of plain vegetables and fruit on your plate. Limit the amount of bacon bits, cheese and other items.
- ✔ Instead of a potato or french fries, order vegetable side dishes. Many restaurants make substitutions for their customers. But, it's up to you to ask!
- ✔ Add lettuce, tomatoes and onions to your hamburgers and sandwiches.
- ✔ Instead of soda, drink 100% fruit juice.

See pages 12-13 of your workbook for other tips on getting more vegetables and fruits when eating out.

Social Support



Marian Ward • diagnosed with breast cancer at age 62, mother of four, grandmother of seven.

When I was diagnosed with breast cancer 3 years ago, I was shocked and scared. I found it hard to concentrate at work and spend time with my friends and family—I was always thinking about my cancer. I felt other people who had cancer dealt with it better than me.

I found it hard to concentrate at work and spend

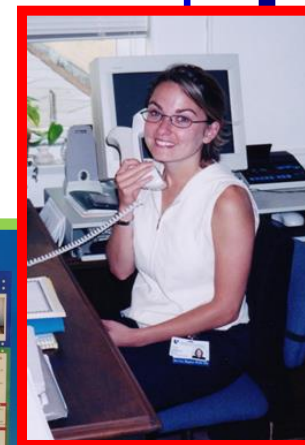
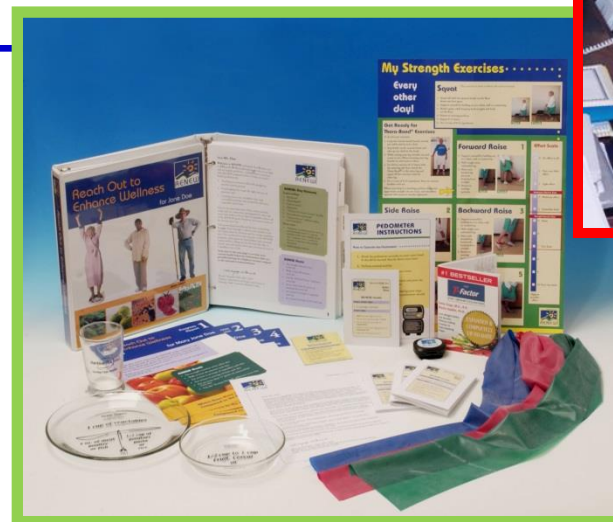
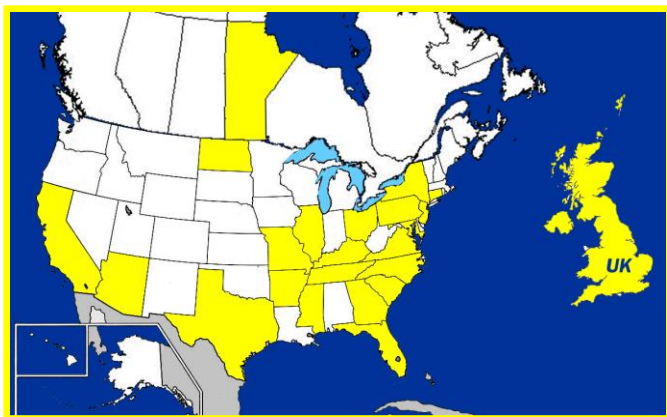
What seemed to help them was taking control over the parts of their lives they could control—





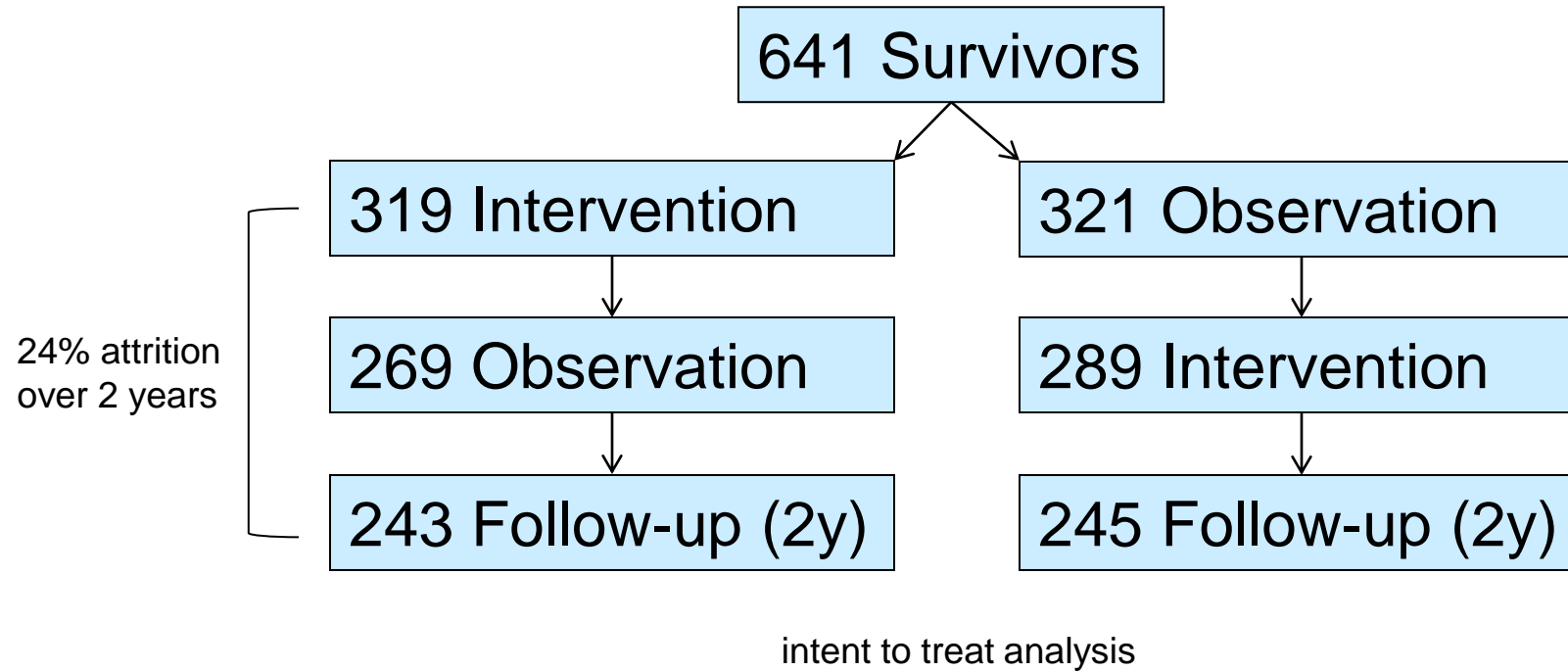
Reach Out to ENhance E Wellness in Older Survivors (R01 CA106919)

- Test the impact of a diet-exercise mailed material/telephone counseling program on weight loss & physical functioning in 640 prostate, colorectal & breast cancer survivors
- 65+ years of age & overweight
- 5+ years out from diagnosis





Study Schema



RENEW Study Sample Characteristics (n=641)

Age	73.1 (5.1) (range 65-87)
% Male	45%
% Caucasian	89%
Education	33% \leq HS 30% Some College 37% \geq College Grad
Type of Cancer	45% Breast 41% Prostate 14% Colorectal
Years since Dx	8.6 (2.7) (range 5-26)
# of Comorbidities	2 (1.2)
Current Smoker	6%
Physical Function (SF 36)	75.7 (18.9) (range 10-100)

Results

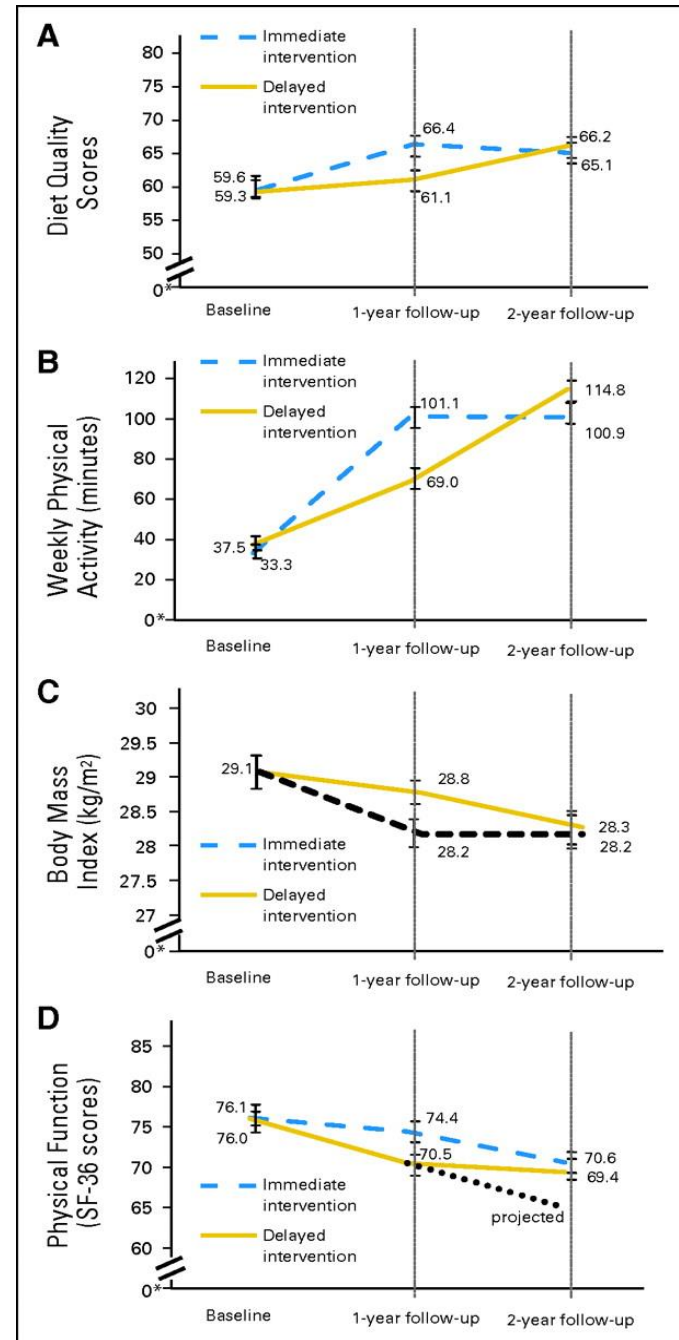
	Δ Intervention Arm Mean (SE)	Δ Wait List Control Arm Mean (SE)	P- value
SF-36 Physical Function	-2.55 (1.07)	-5.39 (1.01)	.034
Basic Lower Extremity – LLF	+0.41 (0.71)	-2.11 (0.67)	.005
Adv. Lower Extremity – LLF	+0.44 (0.60)	-2.55 (0.61)	.015
Strength Exercise (min/w)	+22.2 (2.8)	+0.5 (3.0)	<.0001
Strength Exercise (session/w)	+1.4 (2.6)	+0.2 (2.5)	<.0001
Endurance Exercise (min/w)	+43.1 (5.7)	+26.1 (6.3)	<.0001
Endur. Exercise (session/w)	+1.6 (3.9)	+0.5 (4.1)	.005
F&V Intake (servings/d)	+1.48 (0.16)	+0.15 (0.12)	<.0001
Saturated Fat Intake (g/d)	-3.64 (0.61)	-1.19 (0.55)	.002
Healthy Eating Index	+7.1 (0.9)	+1.4 (0.8)	<.0001
Weight (kg)	-2.45 (0.22)	-1.03 (0.2)	<.0001
BMI	-0.82 (0.07)	-0.035 (0.08)	.0002
Quality-of-Life (Total SF-36)	+0.91 (0.86)	-2.17 (0.90)	.025

(A) dietary quality

(B) physical activity

(C) BMI

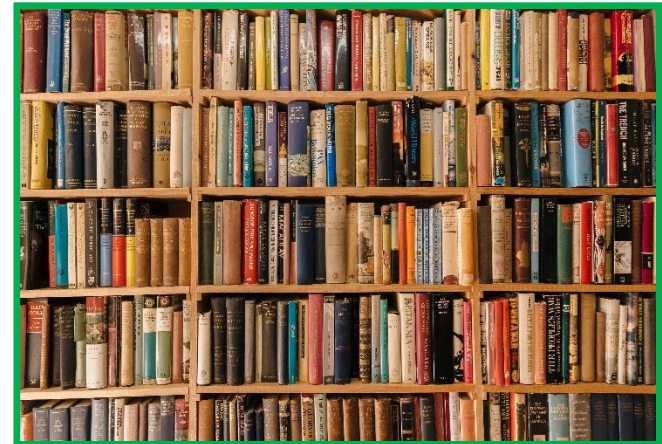
(D) physical functioning



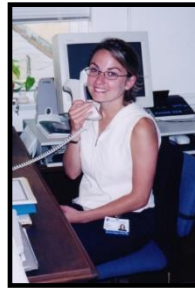
Baseline to 2-year changes in the immediate- vs. delayed intervention arms

Despite the Success of our Tailored Print Interventions...

The per patient costs of \$500 are a barrier to dissemination and keep these interventions “on the shelf”



Adapting RENEW so that it is scalable: Availability Online!



<https://survivorshine.org/>

RENEW (n=641) Breast,
Prostate & Colorectal CA
Survivors
(R01 CA81191)

Survivorshine
(ACS CRP-14-111-
01CPPB)

AMPLIFY (n=603)
Survivors of 9 Obesity-
related CAs focusing on
older, minority and rural
(P01 CA22997)

Williams V et al. *JMIR Form Res*. 2022 Feb 21;6(2):e30974. PMID: PMC8902653.

Williams VA et al. *J Cancer Educ*. 2021 Jun 1;10.1007/s13187-021-02026-x. PMID: PMC8633161.

Pekmezi et al. *BMC Cancer*. 2022 Apr 29;22(1):471. doi: 10.1186/s12885-022-09519-y. PMID: PMC9051494.



AiM Plan and act on LiFestYles: AMPLIFY Survivor Health

(Adapting MultiPLe behavior Interventions that eFfectively Improve (AMPLIFI) Cancer Survivor Health)

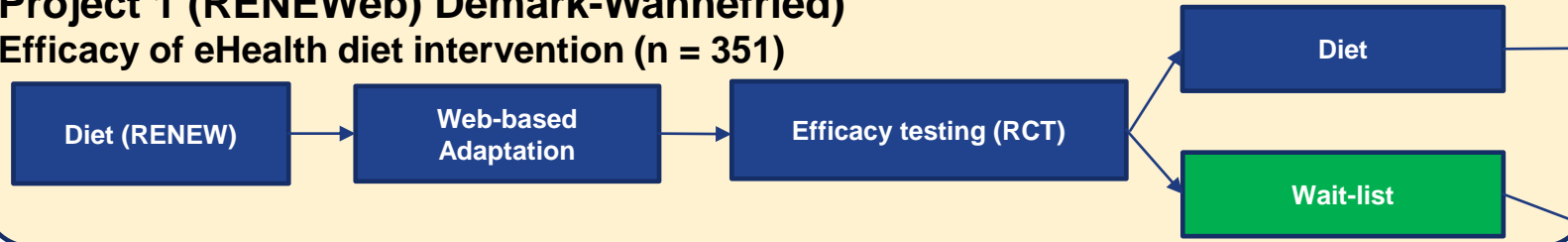
P01 CA229997, R01 CA246695, R01 CA242737, ACS (134169-CRP-19-175-06-COUN)

NCT04000880

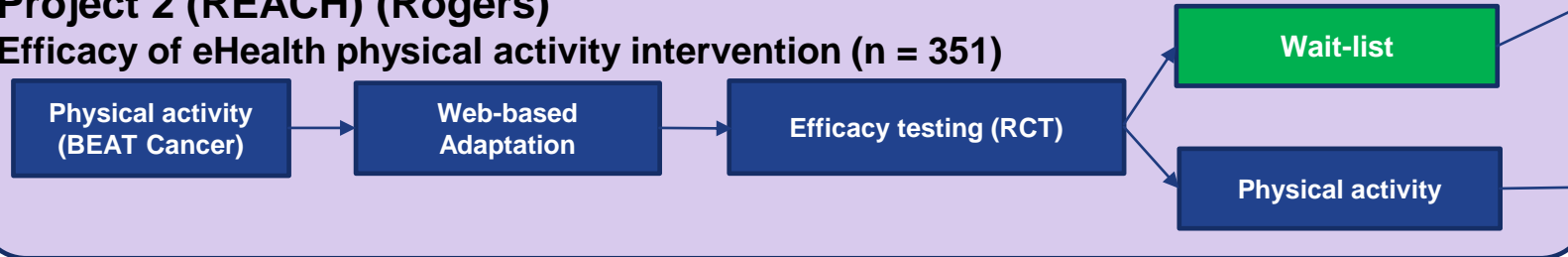


AMPLIFI STUDY DESIGN: INTEGRATION

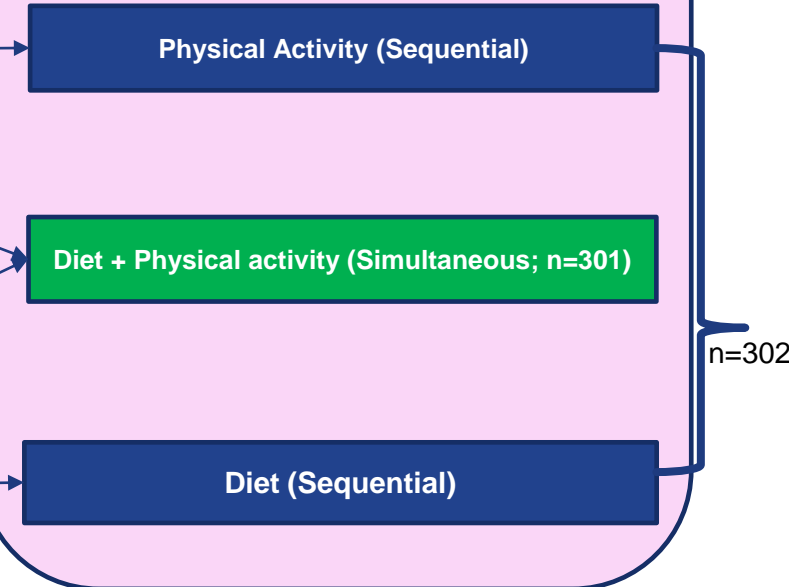
Project 1 (RENEWeb) Demark-Wahnefried) Efficacy of eHealth diet intervention (n = 351)



Project 2 (REACH) (Rogers) Efficacy of eHealth physical activity intervention (n = 351)



Project 3 (Fontaine/Pekmezi) Sequential or Simultaneous eHealth interventions (n = 603)



All projects are supported by 4 Cores: Administrative
Adaptation, Dissemination, and Implementation
Recruitment and Retention
Assessment and Analysis



MAIN OUTCOMES

- Change over time in weight, physical activity, and diet quality

Comparison	Primary Hypotheses	Outcomes	Assessment mode
Project 1 DIET intervention vs. wait list at 6 months	Higher proportion of participants with ≥ 3% weight loss	Weight Diet Quality	In person/Zoom visit
Project 2 EXERCISE intervention vs. wait list at 6 months	Higher proportion of participants with ≥150 weekly minutes of ≥moderate intensity physical activity	Physical activity (Accelerometry)	Accelerometer for 7 days during wake and sleep time
Project 3 SIMULTANEOUS vs. SEQUENCED at 12/18 months	Higher proportion of participants with ≥ 3% weight loss, improved Diet Quality, ≥150 weekly minutes of ≥moderate intensity PA	Weight, Physical Activity, Diet Quality	Two dietary recalls via phone, week and weekend days

VIRTUAL ASSESSMENTS

- Surveys: diet recalls, PA, QoL, health care utilization
- Physical Activity/Sleep (Accelerometry/Actigraphy)
- Muscle mass (D3 creatine)
- Dry blood Spot (DBS)
 - Insulin, Glucose, Cholesterol, TG, Leptin, Adiponectin, IL6, CRP
- Blood Pressure/Heart Rate
- Protocol adaptations to conduct clinical assessments virtually (extensive training/certification)
 - Weight/Waist circumference
 - Physical performance and Balance Testing



D3 creatine



DBS



Automated Portable B/P
AMPLIFY
SURVIVOR HEALTH

WHAT IS AMPLIFY?

A web-based diet and exercise trial for cancer survivors who are committed to taking the next year to lose weight, eat healthier, and move towards better health. By logging in only 15-20 minutes each week and by interacting with the program, cancer survivors can begin their journey to better health through a lifestyle plan that is safe, evidenced based, and personalized just for them.

<https://amplifymyhealth.org/welcome>

ELIGIBILITY CRITERIA

- Age: 50+ years
- Survivors completing primary treatment for the following cancers (with no recurrence or other second cancers):
 - Localized through regional Breast, Colorectum, Endometrium, Prostate, Thyroid
 - Localized Kidney, Ovary
 - Multiple Myeloma and Non-Hodgkin Lymphoma
- Overweight/Obese (BMI: 25–50 kg/m²)
- Moderate-to Strenuous Physical Activity <150 minutes/week
- Not enrolled in a diet or exercise program
- English writing/speaking + completed 8th grade

REACH: AMPLIFY CONDUCTED IN 31-OF-50 US STATES*



* Enrolled participants in 87% of states with the greatest prevalence of cancer survivors

CHARACTERISTICS OF THE AMPLIFY STUDY SAMPLE (603)

Characteristics	% of sample	National data on cancer survivors*
Female Gender	75.3%	53.9%
Age mean (sd) range	63.1 (7.4) 50-82	66.7 (9.0)
Minority	26.0%	23.0%
Rural Residence	35.7%	21.0%
Cancer Type		
• Breast	56.6%	22.5%
• Prostate	18.9%	19.5%
• Endometrial	7.6%	1.7%
• Colorectal	6.8%	8.0%
• Thyroid	3.2%	4.6%
• Renal	3.0%	3.4%
• Ovarian	1.7%	1.7%
• Multiple Myeloma	1.2%	<1.0%
• Non-Hodgkin Lymphoma	1.0%	4.7%

* Cancer Treatment and Survivorship Facts and Figures 2022-2024, ACS, 2022; Gregory K et al. J Cancer Surv. 2023; Hsieh R et al. Cancer 2019

What AMPLIFY participants are saying about the program?

Mrs. H

I'm a breast cancer survivor. The biggest thing I got out of AMPLIFY was being able to go online and answer the questions and put my weight in every day. I have never weighed myself daily, and that has really been a big help. AMPLIFY is a wonderful program. I've been very successful with it.

Ms. H has been in the program for about 6 months, and she lost 36 pounds (21% of her body weight), and dropped her waist size by 5.5 inches .

Mr. C

"I'm a 68 year old prostate cancer survivor. Before I started AMPLIFY, I was completely washed-out. I could barely walk a hundred feet without having to stop and catch my breath. I have enjoyed the program. I am eating and sleeping better, and have lost weight."

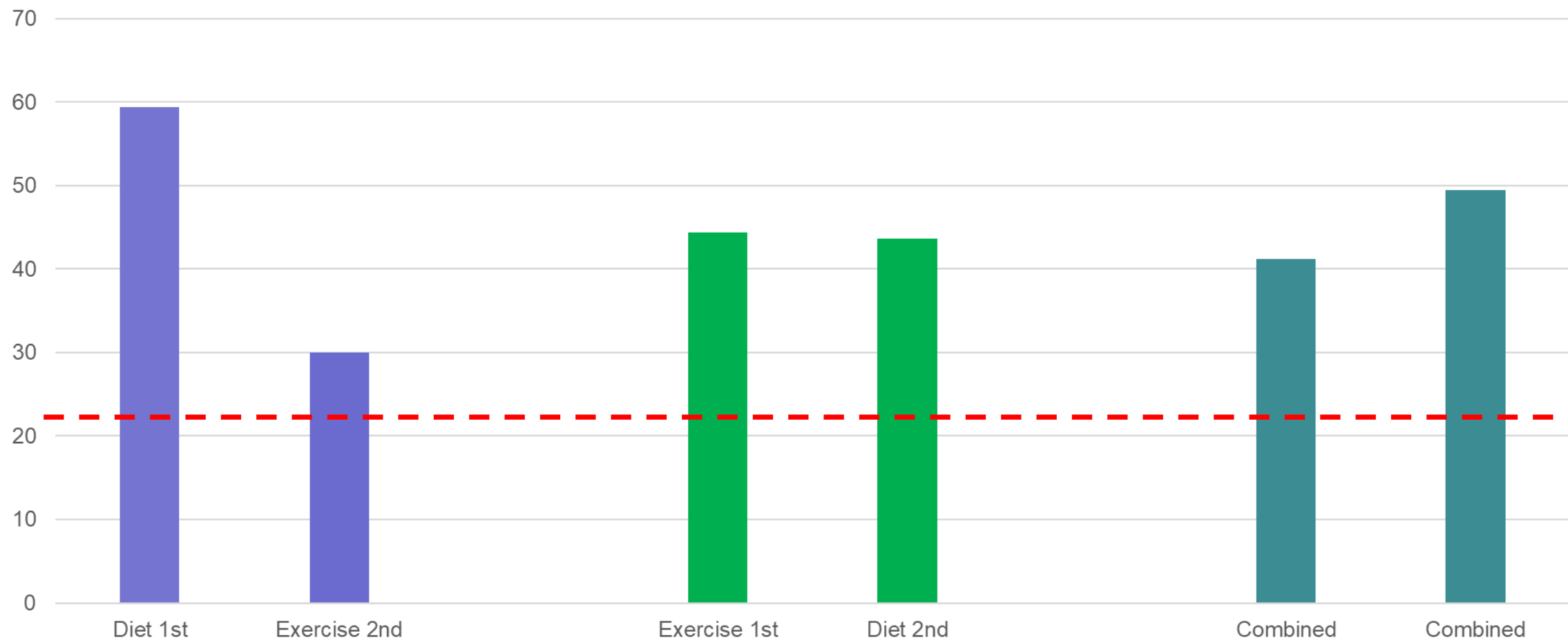
Over the course of the past 12 months, Mr. C lost 16 pounds (10% of his body weight) and improved his endurance by walking 27% more steps during a 2-minute testing period.

Ms. W

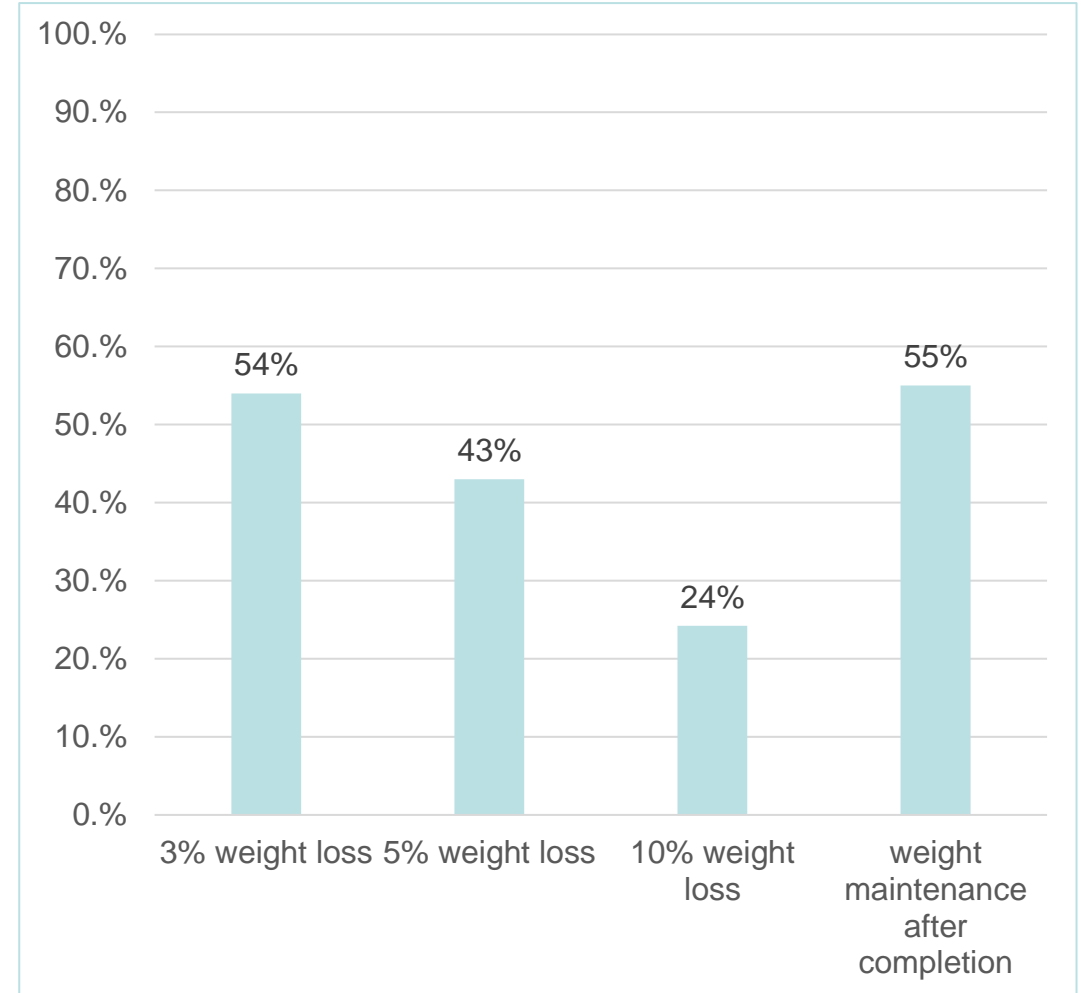
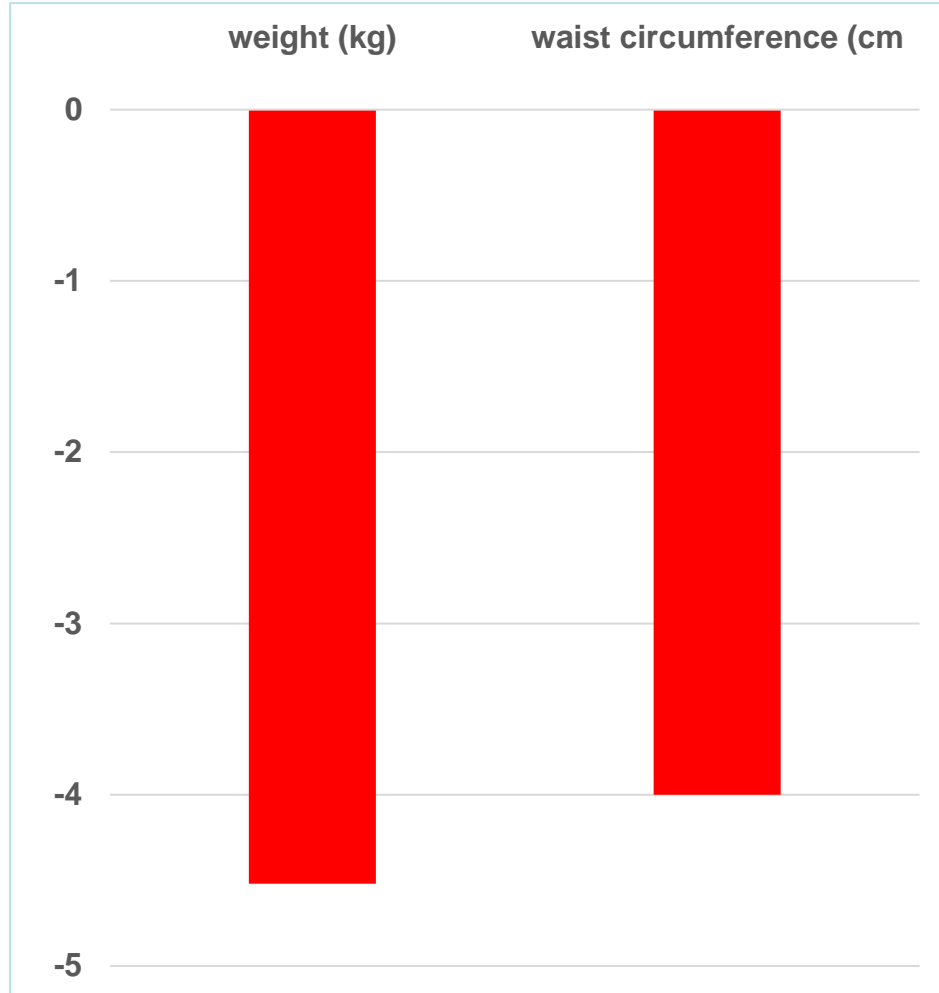
"I'm a breast cancer survivor. I would describe AMPLIFY as being very helpful to live a healthier and better life and be successful in your survivorship. Others should join AMPLIFY because they'll feel better about themselves. Their fight is not over. ... Life needs to get better and better, and I believe the AMPLIFY study can help that."

Over 12 months, Ms. W lost 26 pounds (14% of her body weight) and reduced her waist size from 37 inches to 33 inches (4 inches).

Engagement: 2-3x of other comparable studies

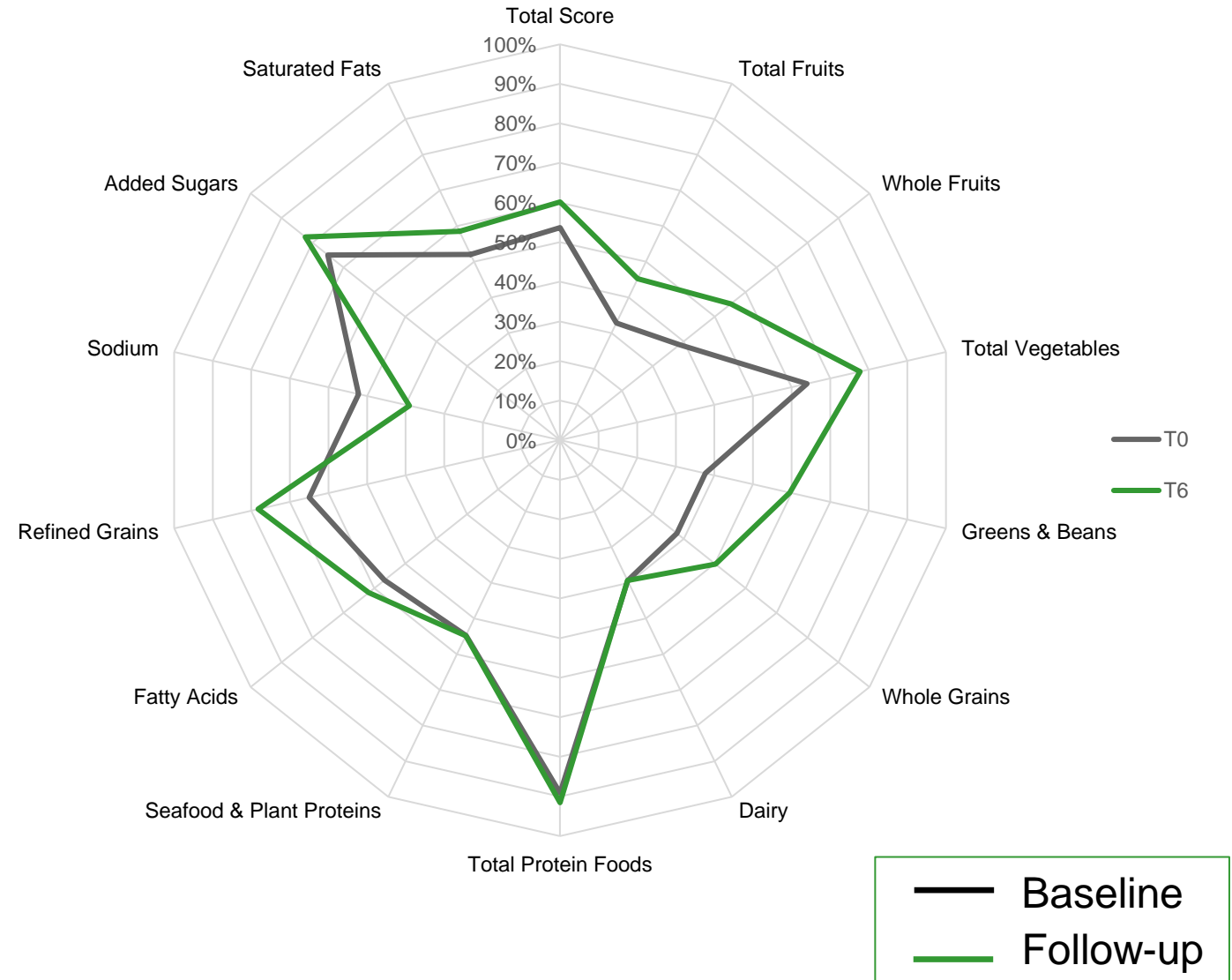


Preliminary data: 0-12 m Δ in adiposity (all groups combined)



PRELIMINARY DATA: CHANGES IN BEHAVIORAL OUTCOMES

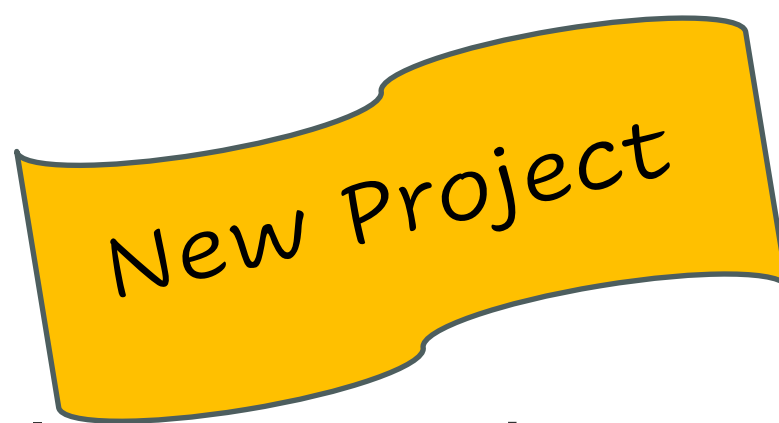
- +19.5 minutes/week of MVPA over 12 months
- +13.2 points Healthy Eating Index over 6 months



Conclusions

- **Cancer survivors - a growing, high-risk population who could benefit from education and support to improve their diets and nutritional status.**
- **RDNs play a critical role in addressing these needs – at apex of triage ladder to provide specialized (more complex) care.**
- **Many survivors could benefit from minimal touch interventions, especially interventions that are grounded in behavioral theory, refined by soliciting the input of the target population and key stakeholders, and which enlist the support of creative individuals that are scalable and that have long-lasting effects.**
- **There have been significant strides – but much more work is needed to optimize interventions to improve uptake and outcomes**





Internet-Based Lifestyle Intervention to Eradicate Obese Frailty in Prostate Cancer Survivors (iLIVE)

Co-PIs: Wendy Demark-Wahnefried (UAB) and Kerri Winters-Stone, PhD, FACSM (OHSU)

UAB Co-Investigators: Laura Rogers, MD, Maria Pisu, PhD, Sunil Sudarshan, MD, Lisa Zubkoff, PhD

OHSU Co-Investigators: Julie Graff, MD, Arthur Hung, MD, Nathan Dieckmann, PhD

NCT06011499

Funding: NCI 1R01CA275055-01A1

7/1/2023-6/30/2028



KNIGHT
CANCER
Institute





Adapts AMPLIFY to address specific needs of men treated with ADT for Prostate Cancer and pairs it with online strength training classes to reduce obese frailty

Send an email to:
iLIVE4health@ohsu.edu

Call us at: 833-880-6800



Acknowledgements

RENEW

Elizabeth Clipp, PhD
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Richard Sloane, MPH
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