



ARTICLE TITLE: Practical Clinical Interventions for Diet, Physical Activity, and Weight Control in Cancer Survivors

CME CNE

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1. Summarize evidence regarding the benefits of good nutrition and physical activity in improving disease-specific survival, overall survival, and quality of life among cancer survivors.
2. Describe clinical interventions for positively influencing nutrition and physical activity behaviors among cancer survivors.
3. List nutrition and physical activity resources and programs that are available to cancer survivors in the health care system and the community.

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Practical Clinical Interventions for Diet, Physical Activity, and Weight Control in Cancer Survivors

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The importance of expanding cancer treatment to include the promotion of overall long-term health is emphasized in the Institute of Medicine report on delivering quality oncology care. Weight management, physical activity, and a healthy diet are key components of tertiary prevention but may be areas in which the oncologist and/or the oncology care team may be less familiar. This article reviews current diet and physical activity guidelines, the evidence supporting those recommendations, and provides an overview of practical interventions that have resulted in favorable improvements in lifestyle behavior change in cancer survivors. It also describes current lifestyle practices among cancer survivors and the role of the oncologist in helping cancer patients and survivors embark upon changes in lifestyle behaviors, and it calls for the development of partnerships between oncology providers, primary care providers, and experts in nutrition, exercise science, and behavior change to help positively orient cancer patients toward longer and healthier lives. *CA Cancer J Clin* 2015;000:000-000. © 2015 American Cancer Society.

Keywords: diet, physical activity, exercise, weight control, cancer survivors, neoplasms, exercise, oncology, primary care.



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Introduction

Five years before the Institute of Medicine (IOM) report, *Lost in Transition: From Cancer Patient to Cancer Survivor*,¹ the American Cancer Society (ACS), aware of the growing number of cancer survivors and the problems that they face, issued its first set of nutrition and physical activity guidelines targeted toward this population. Published in 2001, the *Guide for Informed Choices* reflected the nascent state of the science in the area of cancer survivorship² and was heavily based on dietary practices during the time of treatment. Subsequently revised in 2003,³ in 2006,⁴ and most recently in 2012,⁵ the *Guidelines for Nutrition and Physical Activity for Cancer Survivors* have evolved considerably. Although the guidelines still address nutrition and physical activity concerns during treatment, given the ever-increasing overall 5-year survival rates, which now approach 70%, more emphasis is placed on recommendations to enhance overall health in this unique clinical population long term.⁶ In addition, the recent IOM report, *Implementing Survivorship Care Planning*, specifically calls for lifestyle recommendations to be included as a standard part of the cancer survivorship care plan to optimize health and well being after cancer treatment.⁷

The oncologist and the oncology care team now stand at a unique interface—delivering acute care aimed at a life-threatening disease while at the same time readying the patient for a long and healthy life free of comorbidity. Good nutrition and a physically active lifestyle are central to both pursuits, and it is becoming increasingly apparent that these factors need to be routinely integrated into the delivery of optimal cancer care. But what is the evidence basis for such guidance and the evidence that supports intervention? What is the role of the oncologist and of other clinicians? And what resources can they rely

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on to deliver such care? This article is not designed as a comprehensive scientific review but more as a practical guide for health care providers who care for cancer patients and survivors and who seek a basic understanding of the diet and exercise literature in relation to survivorship outcomes and approaches to support patients as they strive to achieve optimal quality and quantity of life postdiagnosis.

What Are the Current Guidelines?

The 2012 ACS *Guidelines on Nutrition and Physical Activity for Cancer Survivors* are summarized in Table 1.⁵ The data supporting these recommendations derive from a body of literature based on a modest number of amply powered randomized controlled trials (RCTs) that have tested various lifestyle interventions in relation to cancer-related recurrence and mortality; considerably more small trials; and observational studies that have assessed impact on quality of life, fatigue, cardiometabolic measures, and other general health outcomes. These recommendations are grouped into 3 broad categories: weight management, physical activity, and diet quality. Data continue to accumulate, and a brief update in each of these areas is provided in the paragraphs that follow.

Weight Management

ACS guideline recommendation

Achieve and maintain a healthy weight.⁵

- If overweight or obese, limit consumption of high-calorie (energy dense) foods and beverages and increase physical activity to promote weight loss.

Rationale

Observational evidence. Obesity is an acknowledged risk factor for several cancers, ie, those of the breast (postmenopausal), colon, endometrium, gastric cardia, kidney, and pancreas,⁸ and data likewise look strong for cancers of the ovary and gallbladder^{9,10}; therefore, a high proportion of individuals diagnosed with cancer are overweight or obese. Moreover, evidence is mounting regarding the role of obesity in contributing to recurrence and cancer-related mortality.¹¹ The data linking obesity to poor outcomes are strongest in breast cancer, in which numerous observational studies have evaluated the relation between body weight status at the time of cancer diagnosis (and, in some cases, before diagnosis) and/or postdiagnosis and the risk of cancer recurrence and/or mortality. A recent meta-analysis of 82 studies that included 213,075 women with breast cancer demonstrated that, for each 5-kg/m² increment in body mass index (BMI), there was a 14% to 29% increased risk of disease-specific mortality and an 8% to 17% increased risk of total mortality.¹² Results of a similar magnitude

TABLE 1. American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Survivors

Achieve and maintain a healthy weight
• If overweight or obese, limit consumption of high-calorie foods and beverages and increase physical activity to promote weight loss
Engage in regular physical activity
• Avoid inactivity and return to normal daily activities as soon as possible after diagnosis
• Aim to exercise at least 150 min/wk
• Include strength training exercises at least 2 d/wk
Achieve a dietary pattern that is high in vegetables, fruits, and whole grains
• Follow the American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention; ie, limit consumption of processed meat and red meat; eat at least 2.5 cups of vegetables and fruits daily; choose whole grains instead of refined grain products; and, if you drink alcoholic beverages, limit consumption to no more than 1 drink daily for women or 2 drinks daily for men

were observed in a meta-analysis in prostate cancer; that analysis of 18,203 patients demonstrated that each 5-kg/m² increase in BMI was associated with a 21% increased risk of biochemical recurrence (relative risk [RR], 1.21, 95% confidence interval [CI], 1.11-1.31; $P < .01$) and a 20% higher risk of prostate cancer-specific mortality (RR, 1.20; 95% CI, 0.99-1.46; $P = .06$).¹³ For colorectal cancer, a recent meta-analysis of 51,303 patients across 29 studies demonstrated a summary hazard ratio (HR) of 1.10 (95% CI, 1.06-1.15) for overall survival among obese individuals versus normal-weight individuals.¹⁴ It should be noted that, for both breast cancer and colorectal cancer, the associations between body weight status and mortality are not linear but instead are “J-shaped,” with data for breast cancer suggesting that the greatest risk is among women who are underweight or obese (compared with those who are normal weight or overweight; ie, in the BMI range of 18.5-29.9 kg/m²); and, for colorectal cancer, the lowest risk patients appear to be those who are overweight, with higher risk observed among underweight and normal-weight patients (ie, those with a BMI <25 kg/m²), as well as those who are obese (ie, those with a BMI ≥30 kg/m²).^{12,14} Although meta-analyses have not been reported for other cancers, systematic reviews suggest that obesity is directly associated with recurrence and overall survival, although the data are less consistent.^{15,16}

Obesity also can contribute to morbidity from cancer treatment and is a risk factor for poor wound healing, postoperative infections, and lymphedema as well as for the development of comorbid illness (eg, cardiovascular disease, cerebrovascular disease, and diabetes) and functional decline.^{11,17} In addition, obesity places individuals at greater risk for developing second primary malignancies.¹⁸ Given the excellent cancer-specific prognoses experienced by survivors of breast, prostate, and some other cancers, especially when diagnosed at an early stage, the relation

between obesity and comorbid illness ultimately may have as great or even greater impact on overall survival in the years after cancer diagnosis as the potential link between obesity and cancer recurrence. Furthermore, the presence of some weight-dependent comorbidities, such as diabetes, may exacerbate additional breast cancer events, as reported in the analysis by Patterson and colleagues in a cohort of 2542 patients with early stage breast cancer in which those who were diabetic had more than double the number of recurrences (HR, 2.1; 95% CI, 1.3-3.4) and mortality (HR, 2.5; 95% CI, 1.4-4.4).¹⁹

Interventional studies. With a few exceptions,^{20,21} almost all interventions targeting weight loss among cancer survivors have been conducted in breast cancer survivors who have completed active treatment. Like most of the lifestyle intervention studies focused on cancer survivors, weight loss studies have generally been small, single-institution studies with fewer than 100 individuals. Studies have had heterogeneous designs with significant variation in the timing of the intervention along the cancer continuum; in the structure of the intervention (supervised or home-based); and in intervention duration, type, and intensity. Study endpoints have generally focused on feasibility, quality of life, and other patient-reported outcomes. However, there are 2 ongoing studies (the Diet and Androgens-5 [DIANA-5] study and the First European Lifestyle Study on Breast Cancer [the German SUCCESS C study]) with moderately large sample sizes ($n = 1400-1600$) that will attempt to explore the effect of purposeful weight loss on breast cancer outcomes.^{22,23}

Despite these limitations, studies to date have demonstrated the feasibility, safety, and benefits of weight loss interventions in cancer populations (Table 2 presents a summary of studies that have used RCT designs and have study samples of greater than 100 participants).^{21,24-29} A recent systematic review by Reeves and colleagues evaluated 14 weight loss trials among breast cancer survivors and observed no adverse events.⁵⁹ In addition, the vast majority of reported weight loss trials in cancer patients have reported success in achieving weight loss of at least 5% of initial body weight within a reasonable (<12-month) time frame—an amount well over the 3% threshold associated with a clinically meaningful reduction in cardiovascular risk factors⁶⁰ and within the 5% to 10% range in which greater clinical benefits are observed.⁶¹ Studies also have reported improvements in quality of life and other patient-reported outcomes, especially with weight loss interventions that have included diet plus a physical activity component. Finally, studies have demonstrated that weight loss interventions in cancer patients induce improvements in biomarkers linked to cancer risk and outcomes, including insulin, leptin, and lipids.^{25,62,63} Less consistent evidence exists for the impact of weight loss on other biomarkers, including insulin-like

growth factors and binding proteins, other adipokines, inflammatory markers, and sex hormones.⁵⁹

There is little information regarding the optimal intervention content to induce weight loss in cancer patients and cancer survivors. Studies have looked at a variety of dietary patterns and interventions, either focusing on diet alone or including a physical activity component along with dietary change. Although the vast number of studies in healthy populations indicate that, whereas caloric restriction is key to promoting weight loss, exercise and behavioral counseling to promote and support behavior change also are required to maintain weight loss long term⁶¹; however, data are limited in cancer populations. Studies by Goodwin et al^{27,64} and others support the role that exercise plays in predicting weight loss at 1-year follow up in cancer populations,^{9,65} and increased physical activity is recommended as an essential part of weight management in cancer survivors as it is for the general population. The need for exercise, however, may be particularly important for individuals with cancer, because there is sparse but concerning evidence that weight loss independent of exercise (especially resistance training) may promote sarcopenia or the loss of lean mass in an already compromised patient population.⁶⁶⁻⁶⁸

With regard to the optimal dietary pattern to achieve weight loss in cancer populations, there is scant evidence, with only 2 studies conducted to date; however, in both, the results were similar. Thomson et al^{26,34} and Sedlacek et al²⁵ compared low-fat versus low-carbohydrate weight loss regimens in breast cancer survivors, and both research teams observed that both diets resulted in favorable and comparable changes in weight and serum insulin, glycated hemoglobin, and lipid levels. The only difference was observed in serum triglycerides, for which both studies observed more significant reductions with the low-carbohydrate regimens. These findings support the updated 2013 guidelines of the American College of Cardiology, the American Heart Association, and The Obesity Society for managing overweight and obesity in adults, which endorse no specific dietary pattern and continue to recommend a 3-pronged approach to weight management that relies on diet (energy restriction independent of macronutrient distribution), regular exercise, and behavior modification.⁶¹

Durability of weight loss also is a notable concern. Indeed, the ultimate goal is to promote weight control long term, but recidivism (ie, weight gain after weight loss) is a significant problem.⁶¹ However, if transitory weight loss is identified as beneficial (as is the case with adjuvant chemotherapy), then it remains unknown how long weight loss would need to be maintained to impact cancer outcomes; likewise, it also is unclear whether the timing of weight loss relative to the time of cancer diagnosis influences outcomes. Most weight loss studies to date have enrolled cancer survivors after the completion of adjuvant therapy, and most have

TABLE 2. Larger Randomized Controlled Trials of Weight Loss, Dietary Change, and/or Exercise Among Cancer Survivors

STUDY: REFERENCE	COUNTRY; CANCER TYPE; SAMPLE SIZE; TREATMENT STATUS	CONTENT, DURATION, AND CONTROL	DELIVERY CHANNEL	OUTCOMES
Weight loss RCTs				
CHOICE: Sedlacek 2011, ²⁴ Thompson 2012 ²⁵	United States; breast cancer; n = 142; post-menopausal; BMI 25.0-34.9 kg/m ²	Calorie-restricted, high-carbohydrate, low-fat diet vs low-carbohydrate, high-fat diet delivered biweekly over 7 mo vs nonintervention control	In-person (individual and group) counseling by dietitians	Both intervention arms lost weight; weight loss range was 3.5-18.9 kg in the low-fat arm and 2.1-17.2 kg in the low-carbohydrate arm; no differences in biomarkers were observed between arms, but weight loss was associated with decreases in cholesterol, triglycerides, and LDL cholesterol
de Waard 1993 ²⁶	Netherlands and Poland; breast cancer; n = 102; postsurgery and XRT	Individual counseling on a balanced diet of 1000-1500 kcal/d with variable contact from 1-3 y; control group unspecified	Individual, in-person counseling by dietitians	Mean weight loss was 6 kg in the intervention arm; 73% retention rate
LISA: Goodwin 2014 ²⁷	Canada; breast cancer; n = 338	Healthy diet with 500-1000 kcal deficit per d plus 150-200 min physical activity (PA)/wk; control group received standardized materials on a healthful diet	Mailed print and telephone counseling by health coaches	Mean weight loss was significantly ($P < .001$) greater in the intervention arm vs the comparison arm (4.3 vs 0.6 kg or 5.3% vs 0.7% at 6 mo; 3.1 vs 0.3 kg or 3.6% vs 0.4% at 24 mo)
RENEW: Morey 2009, ²¹ Snyder 2009, ²⁸ Demark-Wahnefried 2012 ²⁹	North America and United Kingdom; breast cancer, prostate cancer, and CRC; n = 641 (at least 5 y post-dx; age ≥ 65 y); BMI 25.0-39.9 kg/m ²	Personally tailored workbook and quarterly newsletters plus 15 telephone counseling sessions and 8 automated telephone prompts over 12 mo to promote a slow rate of weight loss (approximately 0.50 lb/wk), 5-30-min sessions of aerobic exercise/wk plus 2-3 sessions of resistance training/wk, and improved diet quality; wait-list control	Mailed print and telephone counseling by dietitians and exercise physiologists	Physical function declined significantly less rapidly in the intervention group (-2.15 ; 95% CI, -0.36 , -3.93) vs controls (-4.84 ; 95% CI, -3.04 , -6.63 ; $P = .03$); PA, diet quality, and overall quality of life (QoL) improved significantly with the intervention (all $P < .01$); weight loss was 2.06 kg for the intervention group vs 0.92 kg for controls ($P < .001$); improvements in weight status, diet quality, and PA sustained at 2-y follow-up; effects were replicated in the wait-list control arm; retention rate was 87.1% at 1-y follow-up and 76.1% at 2-y follow-up
Selected exercise RCTs ^a				
ACTION: Vallance 2008, ^{30,31} 2008 ³²	Canada; breast cancer; n = 377; off primary treatment	Targeted print material, pedometer, step calendar	Mail-delivered	Improved self-reported PA, QoL, and fatigue at 3 mo; pedometer more effective than print material alone
CARE: Courneya 2013, ³³ 2014 ^{34,35}	Canada; breast cancer; n = 301; on chemotherapy	Supervised, on-site, standard aerobic exercise vs higher dose aerobic vs higher dose aerobic plus resistance (no nonexercise control); mean duration, 16.4 wk	Exercise physiologists	Of all training sessions, 88% of aerobic and 66% of resistance sessions were completed; no difference in groups with regard to improving SF-36 physical functioning or psychosocial distress; higher aerobic superior to standard aerobic in improving SF-36 physical composite score and PSQI sleep quality; higher aerobic superior to higher aerobic plus resistance in improving SF-36 bodily pain and cardiorespiratory fitness; higher aerobic plus resistance better able to improve muscle strength and was superior to standard aerobic in improving endocrine symptoms

TABLE 2. Continued

STUDY: REFERENCE	COUNTRY; CANCER TYPE; SAMPLE SIZE; TREATMENT STATUS	CONTENT, DURATION, AND CONTROL	DELIVERY CHANNEL	OUTCOMES
Duijts 2012 ³⁶	Netherlands; breast cancer; n = 422; post-treatment menopausal symptoms; age <50 y	Cognitive behavioral therapy (6 weekly 90-min group sessions) vs exercise (home-based, tailored, monthly counseling; goal, 2.5-3.0 h/wk for 12 wk) vs both; control, wait-list	Clinical psychologists, clinical social workers, and physiotherapists	Criteria for intervention compliance were met by 42% of cognitive behavioral therapy group, 36% of exercise group, and 30% of the group that received both; exercise ± cognitive behavioral therapy demonstrated beneficial effects on perceived frequency of overall endocrine symptoms, physical functioning (SF-36), and urinary symptoms, whereas only cognitive behavioral therapy demonstrated beneficial effects on hot flashes, night sweats, and SF-36 bodily pain
Jacobsen 2014 ³⁷	United States; mixed cancer types; n = 711; hematopoietic cell transplantation recipients	Self-directed exercise program vs self-administered stress-management program vs both vs neither; 20-min introduction session, 2 follow-up contacts at 30 d and 60 d; DVD, written information, logs, and pedometer (exercise groups only); controls received usual psychosocial care and general transplantation DVD	Trained site personnel (details regarding required expertise not reported)	Increase in self-reported use of stress-management techniques; no increase in PA or differences with regard QoL (SF-36), overall survival, days of hospitalization, or patient-reported outcomes (eg, treatment-related distress, sleep quality, pain, and nausea)
Midgaard 2013 ³⁸	United States; mixed cancer types (61% breast cancer); n = 214; off treatment	Weekly, on-site, supervised resistance and high-intensity interval aerobic training combined with additional home-based exercise (goal, ≥3 h/wk) for 12 mo; 4 individual and 6 group behavioral counseling sessions; controls received 3 health evaluation sessions discussing fitness test and exercise benefits	Exercise physiologists, psychologist	Improved percentage of participants self-reporting ≥3 h/wk of exercise postintervention (70% of exercise group vs 43% of control group); beneficial intervention effects on cardiorespiratory fitness, muscle strength, depression (HADS), and mental health (SF-36)
Mutrie 2007 ³⁹	Scotland; breast cancer; n = 203; on treatment (chemotherapy and/or radiation)	Supervised, on-site exercise and discussion group sessions (twice weekly) and home-based exercise (once weekly) for 12 wk, moderate intensity aerobic and resistance training; usual care was written materials on safe exercise guidelines, assistance with personalized exercise plan after final assessment	Exercise specialists	Attendance rates not reported; significant improvements in the number of self-reported weekly min of moderate intensity PA; improvements in meters walked in 12 min, shoulder mobility, FACT-Breast additional concerns subscale, and positive mood; no improvement in general QoL (FACT-General) or other FACT subscales
ONCORE: Jones 2004, ⁴⁰ 2005 ⁴¹	Canada; breast cancer; n = 450; newly diagnosed	Physician recommendation (standardized message regarding recommendations and benefits) ± referral for free fitness consultation	Oncologists	Improved self-reported PA 5 wk later; less improvement in referral group
Saarto 2012 ⁴²	Finland; breast cancer; n = 573; within 4 mo of treatment	Supervised, on-site group sessions once weekly and unsupervised home-based session twice weekly; aerobic jumping and circuit resistance exercise for 12 mo; control group instructed to maintain normal PA behavior	Physiotherapists	Median group session attendance, 58% (premenopausal) and 63% (postmenopausal); average home compliance was 3 h/wk (logs); improved "figure-8" running test; prevented loss of bone mineral density at the femoral neck but not at the lumbar spine in premenopausal participants; no effect on bone mineral density loss in postmenopausal participants
START: Courneya 2007, ⁴³ Dolan 2020, ⁴⁴ Courneya 2014 ⁴⁵	Canada; breast cancer; n = 242; on chemotherapy	Supervised, on-site exercise 3 times/wk; aerobic vs resistance vs usual care (median duration, 17 wk), usual care, asked not to exercise, given 1-mo free exercise program after final assessment	Exercise physiologists	Adherence rate was 70%; aerobics improved self-esteem, aerobic fitness, and percentage body fat; resistance improved self-esteem, muscle strength, lean body mass, and chemotherapy completion rates; favorable but not statistically significant improvements in fatigue, QoL, depression, and anxiety in both exercise groups; no effect on hemoglobin decline, but both exercise groups better able to maintain aerobic capacity; exploratory analyses demonstrated an 8-y disease-free survival rate of 82.7% for the exercise groups vs 75.6% for controls (HR, 0.68; 95% CI, 0.37-1.24; P = .21; log-rank test)

TABLE 2. Continued

STUDY: REFERENCE	COUNTRY: CANCER TYPE: SAMPLE SIZE: TREATMENT STATUS	CONTENT, DURATION, AND CONTROL	DELIVERY CHANNEL	OUTCOMES
Strive to Survive: Belanger 2014 ⁴⁶	Canada; adolescents and young adults; n = 212; 90% off treatment	Targeted print material	Mai-delivered	No improvements in PA overall but significant increase in PA among survivors reporting <300 min/wk at baseline
Winters-Stone 2014 ⁴⁷	United States; breast cancer; n = 295; off treatment; at risk or with lymphedema	Local YMCA, twice weekly weight training for 12 mo (supervised for first 3 mo); controls maintained usual PA behavior; all participants received 1-h lymphedema education lecture	Certified exercise trainer specifically trained to implement study protocol	Adherence rate was 72% (82% during the first half and 58% during the second half); improved muscle strength without exacerbating or causing lymphedema; no intervention effect on bone density
Diet-modification RCTs				
WHEL (2002-2014): Pierce 2007 ⁴⁸	United States; breast cancer; n = 3088; within 5 y of dx	Telephone counseling with monthly cooking classes and newsletters over 2 y on a plant-based diet, including 3 fruits/d and 5 vegetables/d, 16 oz vegetable juice, 15%-20% energy as fat, and >30 g fiber; control group received 2 counseling sessions on NCI cancer-prevention guidelines	Trained telephone counselors	No difference in breast cancer recurrence; increased carotenoid concentrations associated with reduced recurrence within the control group and lower oxidative stress, suggesting that long-term diet may have more impact than dietary change after dx; high FV intake plus higher PA associated with lower overall mortality independent of body weight
WINS: Chelbowski 2006 ⁴⁹	United States; breast cancer; postmenopausal within 1 y of surgery	In-person individual and group counseling (8 biweekly sessions over 4 mo, then every 3 mo through 5 y) on a low-fat diet with 15% of kcal coming from fat; control group received counseling every 6 mo on a healthy diet	Dietitians	The risk of relapse was reduced in the low-fat arm at interim analysis (HR, 0.76; 95% CI, 0.60-0.98); the effect was more pronounced in ER-negative women (ie, HR, 0.58; 95% CI, 0.37-0.91); mean 6.1-lb difference in weight loss over time between groups
WINS: Parry 2011 ⁵⁰	United Kingdom; breast cancer; n = 107; postmenopausal at least 1-y from surgery	Quarterly in-person counseling over a 1-y period to reduce total fat intake by half of baseline levels; controls received healthy diet advice	Dietitians	A 50% reduction in fat intake was achieved by 3 mo and was maintained at 24 mo
Multiple component diet and exercise RCTs (not aimed at weight loss)				
Bloom 2008 ⁵¹	United States; breast cancer; n = 404; stage 0-IV, at least 5 y post-dx, age <50 y	Three 6-h workshops over 3 mo; sessions included supervised 30-min resistance exercise and yoga sessions, group walks, exercise prescription, progress reports, healthy diet handouts (on low-fat cooking, eating more FVs); wait-list control group	Multidisciplinary team (oncologists, pharmacists, nutritionist, exercise physiologist)	No differences in diet-related outcomes, but 57% of participants reported increases in PA vs 47% of controls (P = .036); 96% retention rate
CanChange (2009-2014): Hawkes 2012 ²²	Australia; CRC; n = 410; within 12 mo of dx	Eleven telephone coaching sessions delivered over 6 mo focusing on PA, weight management, diet quality, alcohol, and smoking; usual care control group	Health coaches with baccalaureate or higher degrees in nursing, psychology, or health promotion and at least 5 y of field experience	At 12 mo, significant intervention effects were observed for moderate PA (28.5 min; P = .003), BMI (-0.9 kg/m ² ; P < .001), energy from total fat (-7%; P < .006), and energy from saturated fat (-2.8%; P = .016); no significant differences for health-related QoL; cancer-related fatigue; fruit, fiber, or alcohol intake; or smoking; retention rate, 78%

TABLE 2. Continued

STUDY: REFERENCE	COUNTRY; CANCER TYPE; SAMPLE SIZE; TREATMENT STATUS	CONTENT, DURATION, AND CONTROL	DELIVERY CHANNEL	OUTCOMES
FRESH START: Demark-Wahnefried 2007, ⁵³ Christy 2011, ⁵⁴ Ottenbacher 2012 ⁵⁵	North America; breast and prostate cancers; locoregionally staged cancers; n = 543; within 9 mo of dx	Individually tailored cancer coping style, demographics, current behaviors, and stage of readiness self-efficacy workbook and 6 newsletters over 10 mo promoting exercise; 150 min/wk, ≥5 servings of FV/d, and total (<30%) and saturated (<10%) fat restriction; controls received standardized brochures in public to improve diet and exercise	Mailed print	Both arms significantly improved dietary behaviors and PA (all $P < .05$), but the tailored intervention produced significantly greater improvements as well as improved weight status (all $P < .02$); self-reports were corroborated by accelerometry, measured weights, and sera carotenoid measures in a subset; improvements in PA and FV consumption were sustained at 2-y follow-up: the retention rate was 96% at 1-y follow-up and 90% at 2-y follow-up ^b
NC STRIDES: Campbell 2009 ⁵⁶	United States; CRC; n = 266; approximately 2.5 y post-dx	Four tailored newsletters and 4-20-min motivational interviewing calls over 9 mo; control group: received standardized materials, no calls	Trained telephone counselors	No significant changes in weight, PA, or FV consumption among CRC survivors
Project LEAD (2003-2006): Demark-Wahnefried 2003, ⁵⁷ 2008 ⁵⁸	United States; breast cancer, prostate cancer, and CRC; n = 182; within 18 mo post-dx; age ≥65 y	Personally tailored workbook and biweekly telephone counseling over 6 mo to promote exercise and improve diet quality; control arm received general health counseling and materials	Mailed print plus telephone counseling by dietitians and exercise physiologists	Intervention produced significant improvements in diet quality (P < .003) and trends toward improved PA and function at 6-mo follow-up; effects diminished at 12 mo; retention rate was 92.3% at 6 mo and 87.2% at 12 mo

Abbreviations: ±, with or without; ACTION, Activity Promotion Trial; AICR, American Institute for Cancer Research; BMI, body mass index; CARE, Combined Aerobic and Resistance Exercise Trial; CI, confidence interval; CRC, colorectal cancer; dx, diagnosis; ER, estrogen receptor; FACT, Functional Assessment of Cancer Treatment; FACT-Breast, Functional Assessment of Cancer Treatment-Breast Cancer; HADS, Hospital Anxiety and Depression Scale; HR, hazard ratio; LDL, low-density lipoprotein; LISA, Lifestyle Intervention Study in Adjuvant Treatment of Early Breast Cancer; NCI, National Cancer Institute; ONCORE, Oncologist Recommendation to Exercise Trial; Project LEAD, Center for National Breast Cancer Coalition (NBCC) Advocacy Training; PSQI, Pittsburgh Sleep Quality Index; RCTs, randomized controlled trials; RENEW, Reach Out to Enhance Wellness Trial; SF-36, Medical Outcomes Study 36-item Short Form questionnaire; START1, Supervised Trial of Aerobic Versus Resistance Training; WHEL Study, Women's Healthy Eating and Living Study; WINS, Women's Intervention Nutrition Study; XRT, external-beam radiotherapy; YMCA, Young Men's Christian Association. ^aExercise trials were selected based on enrolling ≥200 participants with intervention ≥12 weeks (health outcomes trials) or follow-up ≥12 weeks (translational behavior change trials). ^bControl brochures that may improve diet and exercise behaviors can be ordered from the AICR.

used short-term interventions. Two notable exceptions are the Reach Out to Enhance Wellness in Older Cancer Survivors (RENEW) and LISA (women with breast cancer receiving letrozole) RCTs, both of which randomized large groups of cancer survivors to distance-based weight loss interventions and provided long-term data demonstrating the durability of weight changes. The RENEW trial enrolled 641 older, overweight or obese, long-term survivors of breast, prostate, or colorectal cancer randomized either to a 1-year weight loss intervention that was designed to increase dietary quality and physical activity or to a wait-list control group. Intervention participants significantly increased physical activity and diet quality and lost a modest amount of weight (approximately 2 kg) compared with controls. Two-year follow-up data demonstrated that participants maintained this weight loss a year after the completion of the intervention.²⁹ Intervention participants also experienced significant improvements in physical functioning compared with controls. The LISA study enrolled 338 overweight/obese, postmenopausal breast cancer survivors with hormone receptor-positive breast cancer and randomized them to a 2-year, telephone-based weight loss intervention that focused on a low-fat, calorically restricted diet and increased physical activity.²⁷ Participants who were randomized to the weight loss intervention lost significantly more weight than controls at the end of the 6-month intensive phase of the intervention (4.3 kg vs 0.6 kg; $P < .001$), and the differences in weight loss were maintained at 24 months (3.1 kg vs 0.3 kg; $P < .001$).

More data are needed to establish the most efficacious and cost-effective means of achieving weight loss in cancer survivors in terms of optimal timing (beginning during active treatment or at specific time points or milestones during the survivorship trajectory), delivery channel or method (in-person vs home-based [telephone counseling, mailed tailored print, or web-based methods]), individual vs group), and schedule of follow up, as well as to evaluate the impact of weight loss on cancer-specific outcomes.

Physical Activity

ACS guideline recommendation

Engage in regular physical activity.⁵

- Avoid inactivity and return to normal daily activities as soon as possible following diagnosis;
- Aim to exercise at least 150 minutes per week; and
- Include strength-training exercises at least 2 days per week.

Rationale

Observational evidence. Physical inactivity is an acknowledged risk factor for both breast and colon cancer,⁶⁹ and numerous observational studies also suggest an inverse association between physical activity after a cancer diagnosis and mortality,⁷⁰ again with the most compelling

evidence observed for these 2 cancers. In 2014, Schmid and Leitzmann identified 16 breast cancer studies and 7 colorectal cancer studies involving almost 50,000 cancer survivors with over 8000 deaths and almost 5000 deaths from cancer.⁷¹ Those results indicated that, after diagnosis, the most active breast cancer survivors had lower rates of death from breast cancer (RR, 0.72; 95% CI, 0.60-0.85) and from all other causes (RR, 0.52; 95% CI, 0.42-0.64). Similarly, the most active colorectal cancer survivors after diagnosis had lower rates of death from colorectal cancer (RR, 0.61; 95% CI, 0.40-0.92) and from all other causes (RR, 0.58; 95% CI, 0.48-0.70). Moreover, breast cancer and colorectal cancer survivors who reported an increase in physical activity after diagnosis had a lower risk of death (RR, 0.61; 95% CI, 0.46-0.80) than those who did not report increased physical activity.

Evidence of the benefits of physical activity for survivors of other cancers is less clear, although increased physical activity brings many benefits in addition to survival. The combination of physical activity from aerobic exercise and as resistance training is associated with lower risk and/or better control of prevalent comorbidities, such as cardiovascular disease, osteoporosis, and diabetes.^{5,72} In addition, there is evidence that physical activity may interact with other lifestyle factors, such as the consumption of fruits and vegetables or a healthy diet, in exerting its impact on survival. In a study by George and colleagues,⁷³ there appeared to be a significant, synergistic, protective effect exerted by higher levels of physical activity and a healthy diet on both breast cancer-specific survival and overall survival in a cohort of 670 early stage breast cancer survivors. Likewise, a similar association was observed in the Women's Healthy Eating and Lifestyle trial, in which physically active women who ate more servings of fruits and vegetables also had fewer breast cancer events.⁷⁴ However, an analysis by Kim et al⁷⁵ of 2729 breast cancer survivors in the Nurse's Health Study indicated that a healthy diet may be of most benefit among women who are sedentary.

Interventional studies. The number of studies on exercise interventions in cancer survivors has increased dramatically over the past decade, resulting in a proliferation of systematic reviews and meta-analyses. Overall, exercise interventions have resulted in multiple positive effects in several cancer survivor groups, with most research in breast cancer survivors.⁷⁶⁻⁸³ Specifically, small-to-moderate benefits have been noted in the following areas: cardiorespiratory fitness,⁸⁴ muscular strength,⁸⁵ physical functioning,⁸⁶ fatigue,⁸⁷ depression,⁸⁸ self-esteem,⁸³ and quality of life.⁸⁹ Limited evidence is available for other important outcomes, such as bone health, muscle mass, peripheral neuropathy, pain, sexual functioning, menopausal symptoms, cognitive function, and sleep problems.^{34,37,47,70,90-93} In addition, studies of physical

activity in cancer patients and survivors have demonstrated beneficial changes in various biomarkers, including insulin, insulin-related pathways, inflammation, and immunity,^{70,94-97} which theoretically represent reasonable surrogate endpoints for cancer growth and recurrence.

Evidence for the benefits of exercise is most convincing for survivors of breast cancer and prostate cancer,^{79,98} whereas other cancer survivor groups remain understudied (for larger studies conducted to date, see Table 2).^{30-44,46,47,90-92,99-105} Moreover, although benefits appear to accrue during active treatment,¹⁰⁶ therapeutic effects may be greater (or adherence improved) after primary treatment, assuming that interventions are tailored to the type of cancer and treatment and to the barriers to adherence that vary along the course of survivorship.^{84,86,93} Gaps exist in studying exercise in the pre-surgical setting¹⁰⁷ as well as in patients with end-stage disease.¹⁰⁸ Most exercise trials, especially earlier studies, focused primarily on aerobic exercise, whereas more recent studies have combined aerobic exercise with strength training. In a systematic review and meta-analysis of 82 intervention trials in patients with a variety of cancer types (83% limited to or inclusive of breast cancer patients and survivors), Speck and colleagues observed a large effect of physical activity interventions on upper and lower body strength and moderate effects on fatigue when administered after the completion of cancer-directed treatments.⁸³

To date, there are no data from adequately powered randomized trials testing the impact of increased physical activity after cancer diagnosis on the rates of cancer recurrence or mortality, although a recent follow-up study of the 242 breast cancer survivors enrolled on the Supervised Trial of Aerobic versus Resistance Training (START) trial reported interesting, but nonsignificant, differences in event rates of 15.6% versus 22% after a median follow-up of 89 months in the intervention group versus the control group, respectively.⁴⁵ One ongoing study being conducted through the National Cancer Institute of Canada Clinical Trials Group will evaluate the impact of a 3-year structured exercise intervention on rates of disease recurrence in roughly 1000 individuals with stage II and III colon cancer.^{109,110} Additional work is needed to determine whether increased physical activity or resistance exercise will improve cancer outcomes; however, given the benefits of physical activity in alleviating cancer and treatment-related symptoms as well as prevalent forms of comorbidity, such as cardiovascular disease in cancer patients and survivors, regular physical activity should be routinely prescribed in cancer populations.⁵

As with weight loss, additional data are needed to determine the most effective interventions for increasing physical activity among cancer survivors. In a recent Cochrane review of interventions promoting habitual exercise in sedentary cancer survivors,⁷⁶ it was noted that few randomized trials have attempted to confirm increases in physical activity

with objective measures (eg, accelerometry), and none have reported that $\geq 75\%$ of intervention participants met the physical activity recommendations of 150 weekly minutes postintervention. Common components of the more effective interventions included clearly stated physical activity goals, generalization of supervised exercise into unsupervised settings, and regular prompting to self-monitor and practice.⁷⁶ It is of clinical relevance that a simple recommendation by an oncologist can motivate survivors to increase their physical activity,⁴⁰ as can the provision of print materials,^{30,32,53} particularly if combined with the distribution of a pedometer.^{30,32}

Diet Quality

ACS guideline recommendation

Achieve a dietary pattern that is high in vegetables, fruits, and whole grains.⁵

- Follow the American Cancer Society *Guidelines on Nutrition and Physical Activity for Cancer Prevention*⁶⁹; ie, limit consumption of processed meat and red meat; eat at least 2.5 cups of vegetables and fruits each day; choose whole grains instead of refined grain products; and, if you drink alcoholic beverages, limit consumption to no more than one drink per day for women or 2 drinks per day for men.

Rationale

Observational evidence. To date, there have been several studies in a variety of populations throughout the world that have evaluated adherence to dietary guidelines in relation to primary cancer risk for several cancers as well as cancer-related mortality and overall mortality. A 2012 meta-analysis evaluating 11 prospective cohort studies of dietary guideline adherence and cancer-specific mortality indicated that, on average, cancer mortality was 22% lower in adults who reported greater adherence to dietary guidelines.¹¹¹ Moreover, a recent computational analysis of Canadian data suggested that 8% of all cancer-related deaths and 14% of total mortality could be averted with adherence to national dietary guidelines.⁴⁶

Guidelines-based diets are also termed “prudent diets” and are plant-based diets that are high in fruits and vegetables and unrefined grains while at the same time being low in red and processed meats, refined grains, and sugars. These diets are contrasted to “Western” diets, which have the opposite pattern and are heavy in meats, sweets, other processed foods, and dietary fat. Prudent diets have been identified as protective for a number chronic illnesses; for example, the Dietary Approaches to Stop Hypertension (DASH) diet is a specific, guidelines-based dietary pattern proven to reduce blood pressure.¹¹²

To date, there have been 4 studies examining overall and disease-free survival among cancer survivors who report the consumption of guidelines-based diets versus Western diets. Three studies were conducted in large (n = 1901-2619) and

diverse cohorts of breast cancer survivors who received a variety of treatments for various stages of disease,¹¹³⁻¹¹⁵ and one study was conducted in a circumscribed sample of 1009 patients with stage III colon cancer who were enrolled in a specific RCT (Cancer and Leukemia Group B trial 89803).¹¹⁶ In all breast cancer cohorts, guidelines-based diets were associated with significantly reduced risk for overall and/or noncancer-related mortality, with reductions that ranged from 15% to 43%; whereas the Western diet was associated with significantly increased risk for these outcomes.¹¹³⁻¹¹⁵ Although one of those studies demonstrated a significant protective effect for recurrence (a 29% decrease) and deaths from breast cancer (a 26% decrease) with guidelines-based diets,¹¹⁵ the other 2 studies did not.^{113,114} In contrast, among colon cancer patients, the prudent diet was not identified as protective for either overall or cancer-specific survival; however, the Western diet was associated with higher cancer-specific and overall mortality rates that were 2 or 3 times higher than the rates among patients who did not consume Western diets.¹¹⁶ Therefore, these studies suggest that Western diets increase the risk for overall mortality and deaths from other causes for a broad spectrum of cancer survivors and may increase cancer-specific mortality in cancers for which key components of the Western diet (eg, red and processed meats) are also strongly associated with primary risk, such as colon cancer.¹¹⁷

Other studies have used measures of diet quality to characterize the diet, with higher scores reflecting more guidelines-based dietary patterns and lower scores reflecting Western diets. To date, 4 prospective observational studies have assessed diet quality after a breast cancer diagnosis in relation to overall and breast cancer-specific mortality. In 3 of 4 studies, higher diet quality had a significant protective association with overall mortality, with risk reductions ranging from 26% to 60%,^{74,118,119} but only one study reported a significant protective association between higher diet quality and reduced breast cancer-specific mortality (with a risk reduction of 88%).⁷²

Interventional studies. Two large-scale, randomized trials have tested the impact of changing dietary patterns after a breast cancer diagnosis on the risk of cancer recurrence and mortality. The Women's Intervention Nutrition Study (WINS) randomized 2437 women with early stage breast cancer who were within 1 year of surgery but had completed primary cancer therapy to receive counseling and support either on a nutritionally adequate diet or on a nutritionally adequate diet that provided at most 15% of energy from dietary fat (ie, a low-fat diet).⁴⁹ Participants who were randomized to the low-fat intervention decreased their fat intake from greater than 30% to roughly 20% and lost an average of 2.7 kg over the 5-year study period. Breast cancer recurrence was reduced by 24% (HR, 0.76;

95% CI, 0.60-0.98) compared with controls, an effect that was even more pronounced in estrogen receptor-negative patients in secondary subset analyses. The WINS intervention was implemented in the United Kingdom on a much smaller scale and was successful in reducing dietary fat, but data on other endpoints were not collected.⁵⁰ The second large dietary intervention study, the Women's Healthy Eating and Living (WHEL) study, had a similar design but randomized 3088 women who were within 4 years of a diagnosis with early stage breast cancer to a 4-year intervention that promoted 5 servings of fruits and vegetables per day through mailed print educational materials versus an intervention that promoted 10 servings of fruits and vegetables per day (30 g/day of fiber) combined with a low-fat diet (15%-20% of energy from fat) through mailed print materials, group classes, and telephone counseling.⁴⁸ The intervention was successful in promoting dietary change, but without weight loss. In this sample of survivors with high-quality diets at the time of enrollment, there was no impact of the intervention on rates of cancer recurrence after a mean follow-up of 7.3 years. It has been hypothesized that the differences in outcomes in the WINS and WHEL trials were caused by several factors: the lack of weight loss among WHEL study participants; the timing of intervention (ie, within 4 years of diagnosis vs within a year of surgery); ceiling effects due to the high-quality diet and reported consumption of 7.4 servings per day of fruits and vegetables of WHEL participants at baseline; and/or changes in breast cancer therapy, including the widespread use of selective estrogen receptor modulators over the long course of these 2 trials.

Multiple smaller efforts have been conducted in prostate cancer populations.¹²⁵ Investigators have successfully implemented diets that lowered fat or increased phytoestrogens, lycopene, or other plant-based nutrients. One such trial was a phase 2 study testing the comparative effects of a low-fat diet (20% of total kcal) and/or flaxseed supplementation (30 g/day) in 161 men who were scheduled for prostatectomy in which the primary endpoint was the tumor proliferation rate (Ki-67). Although men in the low-fat arms experienced significant reductions in several serum markers associated with inflammation and angiogenesis,¹²⁶ only men in the flaxseed-supplementation arms manifested significantly lower tumor proliferation.¹²⁷ Other interventions have generally been performed in men electing active surveillance for low-grade disease; in those trials, no intervention slowed the rates of prostate cancer progression, as measured by prostate-specific antigen. Several ongoing studies are now testing the impact of dietary change on cancer outcomes in prostate cancer. For example, the National Cancer Institute cooperative groups are currently enrolling 464 patients with clinically localized prostate cancer undergoing active surveillance to a telephone-based

dietary intervention designed to increase vegetable intake with the primary outcome of clinical progression defined by prostate-specific antigen or prostate biopsy.¹²⁸ Additional work is needed to determine whether specific changes in diet will affect cancer outcomes.

Healthy Lifestyle

Recommendation: Concomitant or Sequential Weight Reduction, Improvements in Dietary Quality, and Increased Physical Activity

Rationale: Observational evidence

As briefly mentioned above, there is evidence for synergy between weight control, physical activity, and diet quality and the adherence to a healthy lifestyle that results from their aggregate practice. For example, several studies have used composite scores derived from guidelines set by the ACS^{5,69} or the World Cancer Research Fund/American Institute for Cancer Research¹¹⁷ to determine associations between healthy lifestyles and the primary risk for cancer, with significant reductions in RR ranging from 16% to 60% for individuals with greater adherence to lifestyle guidelines.¹²⁴⁻¹²⁹ Similarly, associations between healthy lifestyles have been explored in relation to cancer-specific and/or all-cause mortality.^{127,130-132} In a study of 111,996 cancer-free participants in the Cancer Prevention Study II, McCullough and colleagues observed that men and women who adhered to more of the ACS guidelines (scores of 7-8) versus those who adhered to fewer guidelines (scores of 0-2) had significantly lower rates of cancer-related mortality (range, 24%-30%), all-cause mortality (42%), and cardiovascular mortality (range, 48%-58%).¹³³ To date, only one research team has investigated associations between broad adherence to healthy lifestyle practices and various outcomes in cancer survivors. Among 2193 postmenopausal breast cancer survivors, Inoue-Choi et al¹³⁴ observed a 33% lower mortality rate in women who were most adherent versus least adherent to the American Institute for Cancer Research/World Cancer Research Fund guidelines and significantly positive associations with quality of life.¹³⁵

Interventional studies

Because of the importance placed on both diet and exercise in managing obesity, diabetes, and cardiovascular disease,^{60,136-138} several interventions have included both elements in studies that have targeted cancer survivors. While the importance of using a multicomponent approach of diet, exercise, and behavior modification is emphasized above, the pursuit of a healthful diet and a physically active lifestyle are still beneficial even in individuals of a healthy weight or in those who are overweight or obese if weight loss does not occur. Several studies have promoted changes in both behaviors either simultaneously,¹³⁴⁻¹³⁶ or in

sequence^{102,137-139} (see Table 2). Of the 5 larger studies conducted in this arena,^{51-53,58} all but one⁵⁶ produced significant improvements in either diet and/or physical activity among survivors. Improvements also were observed in other important outcomes, such as physical functioning⁵⁸ and reduction of obesity.⁵³ Moreover, one of those studies resulted in durable changes in lifestyle behaviors in a large group of cancer survivors. The FRESH START trial, which randomized 543 breast and colon cancer survivors either to a 10-month lifestyle intervention or to a control group, demonstrated durable changes in behavior, with increases in fruit and vegetable consumption⁵⁴ and physical activity⁵⁵ noted 1 year after the intervention was complete. The ongoing Gynecologic Oncology Group (GOG)/National Surgical Adjuvant Breast and Bowel Project/Radiation Therapy Oncology Group/GOG (GOG-NRG)-0225 study will build on work in this area. GOG-NRG-0225 is a phase 3 randomized trial that will test the impact of a 2-year, telephone-based intervention, which was designed to increase physical activity, increase consumption of vegetables, and lower consumption of fat, on progression-free survival in 1070 women with stage II, III, and IV ovarian cancer who have no evidence of persistent disease after first-line treatment with or without consolidation chemotherapy. The study is currently open to enrollment and will provide important information regarding the impact of lifestyle modification on cancer outcomes in women with ovarian cancer.

Lifestyle Behaviors Among Cancer Survivors

Despite evidence demonstrating the benefit of healthy lifestyle practices, obesity, inactivity, and the ingestion of poor-quality diets are common in cancer survivors, as evidenced by a number of large cross-sectional surveys.¹³⁹⁻¹⁴¹ The largest of these, the ACS Study of Cancer Survivors-II, assessed diet and physical activity patterns in 9105 survivors of breast, prostate, colorectal, uterine, bladder, and melanoma skin cancers who were identified through tumor registries.¹³⁹ The study demonstrated that, although variable percentages of survivors of each type of cancer adhered to specified guidelines, adherence was practiced by a minority of survivors ranging from rates of only 14.8% to 19.1% of survivors consuming at least 5 daily servings of fruits and vegetables and only 29.6% to 47.3% of survivors engaging in at least 150 minutes of moderate-intensity physical activity or 60 minutes of strenuous physical activity per week. These findings were corroborated in the other 2 studies that evaluated lifestyle factors in cancer survivors in the context of large national surveys of health behaviors. Using the National Health Interview Survey, Bellizzi and colleagues¹⁴¹ reported that only 29.6% of individuals with a cancer diagnosis reported engagement in at least 150

minutes of moderate-intensity physical activity or 60 minutes of strenuous physical activity each week, with 37% reporting that they were overweight and 21.9% reporting that they were obese. In Canada, using data obtained from the Canadian Community Health Survey, Courneya et al¹⁴⁰ observed that less than half (47%) of cancer survivors were either “active” or “moderately active” (defined as walking for at least 60 or 30 minutes per day, respectively). The rates of overweight and obesity in that study were 34.4% and 18.4% in cancer survivors, respectively. In both the National Health Interview Study and the Canadian study, weight and physical activity patterns were not significantly different in cancer and noncancer populations.

In addition to these cross-sectional surveys, data regarding lifestyle factors in cancer survivors also have been collected as part of a number of prospective cohort studies. Despite the fact that these studies relied on self-reported lifestyle measures from study populations that were sufficiently motivated to complete multiple physical activity, diet, and weight assessments over time, the prospective studies confirmed relatively low levels of physical activity, poor adherence with dietary guidelines, and a high prevalence of overweight and obesity in cancer survivors.¹⁴²⁻¹⁴⁶ For example, within the cohort of nurses who developed either breast or colon cancer in the Nurse’s Health Study, engagement in at least 150 minutes of moderate-intensity physical activity or 60 minutes of strenuous physical activity was pursued by only 39% of breast cancer survivors¹⁴³ and 42% of colon cancer survivors.¹⁴²

Because most prospective cohort studies collect information regarding lifestyle factors at several time points over the cancer trajectory, these studies not only provide information regarding physical activity, dietary patterns, and weight patterns in cancer survivors but, more importantly, offer insight into possible changes in these lifestyle behaviors that occur after cancer diagnosis. For example, in the Health, Eating, Activity, and Lifestyle study, a cohort study of 1183 women with early stage breast cancer, it was observed that women decreased their total physical activity by approximately 2 hours per week (11% of total activity) after diagnosis.¹⁴⁴ Recreational activity decreased more significantly than household chores or occupational activity, with a 50% reduction in time spent in recreational activity among women who received chemotherapy and radiation. Follow-up evaluations in that study demonstrated that these reductions were long-lasting, and half of study participants did not return to baseline levels of physical activity even 3 years after diagnosis. The Health, Eating, Activity, and Lifestyle study also evaluated changes in body weight after breast cancer diagnosis and indicated that 68% of study participants gained weight in the 3 years after diagnosis, with an average weight gain of 1.7 kg.¹⁴⁵ Weight gain was greater in

women with higher stage disease (average weight gain, 3.1 kg) and in women who were premenopausal at diagnosis (average weight gain, 2.8 kg). The Nurses’ Health Study investigators also confirmed significant weight gain in their breast cancer cohort, with 45% of women reporting weight gain. Weight gain of more than 2 kg/m² was observed in 12.5% of the cohort, with an average weight gain of 7.7 kg. in this group.¹⁴⁷ Finally, even in the international sample that comprised the 12,915 women examined in the Breast Cancer Pooling Project, weight gain was far more common than weight loss (ie, 34.7% vs 14.7% of participants) and occurred far more frequently among women who were of normal weight at diagnosis compared with those who were overweight or obese at diagnosis.¹⁵⁰ Given evidence that normal-weight patients who are weight-stable postdiagnosis are at lowest risk for recurrence and all-cause mortality,^{147,148} there is a need for clinicians to reinforce the importance of weight control among patients regardless of their current weight status.

Thus, data demonstrate that a significant proportion of cancer survivors do not meet current lifestyle guidelines as outlined by the ACS panel. Inactivity, poor diet quality, and obesity are common in cancer survivors. These suboptimal lifestyle behaviors and factors are often present at the time of cancer diagnosis and may become more pronounced as a result of cancer diagnosis and treatment.

Implementing Healthful Lifestyle Change in Cancer Survivors

The role of the oncologist

Although data indicate that the lifestyle practices of cancer survivors are suboptimal, data also show that a cancer diagnosis may in fact serve as a “teachable moment,” ie, a point in time when individuals are motivated to make changes in factors that they feel are linked to the development of their cancer or pose a risk to its progression.¹⁴⁹ For example, in the previously mentioned ACS Study of Cancer Survivors-II, 40% of survivors reported an attempt to eat healthier, 35% reported trying to lose weight, and 29% reported exercising more since their cancer diagnosis.¹⁵⁰ However, despite good intentions, self-efficacy may be low, knowledge may be lacking, or survivors may be challenged to find the resources, support, or reinforcement needed to achieve and sustain healthy lifestyles.

In a recent study of 175 patients with nonsmall cell lung cancer who, on average, were 3.6 years postsurgery, Philip and colleagues observed that the clear majority desired advice regarding physical activity, with 80% identifying a preference for a face-to-face recommendation by a physician, and 92% stating that they preferred this interaction under the auspices of a cancer center.¹⁵¹ Although the generalizability of these findings may be limited, there is little

debate that one of the most powerful influences over patients' behavior is the recommendation of the physician. Although most data that support this observation emanate from studies done in tobacco cessation and screening,¹⁵²⁻¹⁶¹ Jones et al observed that the oncologist's recommendation also was a critical factor in determining whether or not cancer survivors exercised.⁴⁰ Despite this strong evidence, a national survey of oncologists reported that, although 62% agreed that exercise was beneficial and safe for their patients, only 42% *ever* recommended it to their patients, and only 26% reported that they recommended exercise to any of their patients within the past month.¹⁶² Usual barriers, such as time constraints, were reported, but a perceived lack of expertise also was viewed as a major barrier.¹⁶² In response, there have been some resources, ie, tool kits, that have been developed by organizations like the American Society of Clinical Oncology in an effort to build the self-efficacy of oncologists in delivering health-promotion guidance in areas like weight control (available at: asco.org/practice-research/obesity-and-cancer, accessed October 23, 2014).¹¹ Furthermore, the oncologist and oncology care team can provide advice on lifestyle change recommendations and appropriate referrals as part of comprehensive survivorship care planning with cancer survivors.^{7,163}

Although diet, exercise, and weight management are complex behaviors, and simple approaches and one-time "touches" are unlikely to promote large and long-lasting changes in behavior or in body weight status,¹⁶⁴ data indicate that simple interventions and messaging can result in benefit. For example, the trial conducted by Jones et al⁴⁰ in 450 patients with newly diagnosed breast cancer demonstrated that an intervention as simple as an oncologist's recommendation to exercise resulted in a significant improvement of 3.4 metabolic equivalent hours per week (95% CI, 0.7-6.1 metabolic equivalent hours per week; $P = .011$) or roughly an hour of brisk walking. These data provide support for the hypothesis that improvements in behavior are possible with minimal interventions, potentially if timed within the year after diagnosis. Because it has been demonstrated that 5As approaches (Ask, Advise, Assess, Assist, and Arrange) are effective and are well accepted by physicians for smoking cessation,¹⁶⁵ they have been proposed for a broader spectrum of behaviors.¹⁶⁶ Table 3 offers some strategies that are common elements of successful interventions (eg, incremental goal setting, situational and environmental control, and self-monitoring)^{31,167-170} and organizes these concepts into a 5As framework. Although implementation of all steps is recommended, Asking, Advising, and Arranging appear to be key, especially for the oncologist, whose value added comes primarily from catalyzing and reinforcing the behavior change and not from personally overseeing and supporting the process.

Integration of weight management between oncology and primary care providers

The incorporation of weight management into oncology care will require a partnership between oncology professionals, who often provide the bulk of medical care to cancer patients in the months to years after cancer diagnosis, and nononcology health providers with experience in treatment of obesity as well as specific expertise in nutrition, physical activity, and behavior change. As with many issues that arise in the survivorship period, partnerships between oncology and primary care providers are essential to effective weight management in cancer survivor populations. Although primary care physicians typically provide weight management counseling and referrals as a routine part of general practice, many patients do not seek regular medical care from a primary care physician in the years after cancer diagnosis. Thus, attention to weight management may provide an opportunity to facilitate the transition to effective comanagement of survivorship issues, including diet, physical activity, and other health behaviors.

Receipt of specialized care to improve diet and exercise behaviors

Although primary care physicians are an essential part of weight management for cancer survivors as well as the general population, long-lasting behavior change often requires a level of ongoing support that can be difficult to provide through a physician office. Unfortunately, reimbursement for longitudinal weight management services specifically for cancer survivors is sparse at this time. However, in some settings, consultation or ongoing support may be available for specialized care to support dietary and physical activity changes in cancer populations, particularly for those with comorbid conditions such as diabetes or cardiovascular disease. Of note, because obesity is now considered a "disease," Medicare coverage is available for weight loss counseling that is provided by a primary care physician or other qualified practitioner for patients whose BMIs are 30 kg/m² and above (available at: medicare.gov/coverage/obesity-screening-and-counseling.html, accessed October 23, 2014).

Nutrition counseling. The American College of Surgeons Commission on Cancer standards and the Association of Community Cancer Centers guidelines both recognize nutrition services as an important element of comprehensive care and call for nutrition screening and assessment, care plans, and early nutrition intervention by a nutrition professional.^{171,172} Both the Association of Community Cancer Centers and the American College of Surgeons Commission on Cancer recognize that the nutrition professional best able to deliver oncologic nutritional care is the registered dietitian (RD) or registered dietitian nutritionist (RDN) and recommend that registered dietitians/registered dietitian nutritionists working within the oncology setting

TABLE 3. Sample Strategies to Promote Healthy Lifestyles^a

STEP ^b	WEIGHT CONTROL	DIET QUALITY	PHYSICAL ACTIVITY
Ask	Have you tried to lose weight recently? (Ask only if overweight or obese)	a) How many servings of vegetables and fruit do you eat each day?	On average, how many minutes per week do you do aerobic (or cardio) exercise? How many times a week do you do strengthening exercises? How many hours per day do you spend sitting or watching TV?
		b) How many servings of red and processed meats do you eat each week?	
		c) Do you eat white or whole-grain breads and cereals?	
		d) What dietary supplements do you use?	
Advise	This chart (show BMI chart) is used to graph people's height and weight to determine whether people are overweight or obese. You can see here that you are <overweight/obese>. That is of concern to me, since I am providing you with cancer treatment that is aimed at prolonging your life. But, if you are <overweight/obese>, you may be at greater risk for complications that occur later on (lymphedema, heart disease, diabetes, etc). Therefore, it is important that you lose weight.	Positively reinforce patients if their answers are a) 5 or more servings; b) 2 or more servings; c) whole grain; and d) dietary supplement use is minimal or used to treat a deficiency condition, such as osteoporosis or anemia (not an excessive dose, ie, within 100% of daily values); if the answers differ, advise that they should be consuming a plant-based diet in which they eat at least 5 servings of vegetables and fruit per day and no more than 2 servings of red or processed meat per week and that they should eat whole-grain products instead of refined products; moreover, they are to rely on their diets, rather than supplements, to provide needed nutrients	Positively reinforce patients if they do aerobic exercise at least 150 minutes a week or strength training exercises at least twice a week; if not, advise that they should strive to do so; refer to a trained exercise professional for help in initiating strength training if they have lymphedema, colostomy, or other relevant condition; encourage patients to reduce sitting time
Assess	Losing weight can be hard, but it is important and I am sure that you could do it if you tried—are you ready to lose weight?	Eating a healthy diet is important—are you willing to make a few changes?	Regular exercise is important—are you willing to start?
	If yes → "Great, let me give you this brochure (see resource list), which will help get you on your way"; use tips from Assist and Arrange (below)	If yes → "Great, let me give you this brochure (see resource list), which will help get you on your way"; use tips from Assist and Arrange (below)	If yes → "Great, let me give you this brochure (see resource list), which will help get you on your way"; use tips from Assist and Arrange (below)
	If no → "OK, but the next time we meet, I will ask again; in the meantime, I want you to read this brochure and just try to do (choose one strategy from Assist items 2 through 5 below)."	If no → "OK, but the next time we meet, I will ask again; in the meantime, I want you to read this brochure and just try to do (choose one strategy from Assist items 2 through 5 below)."	If no → "OK, but the next time we meet, I will ask again; in the meantime, I want you to read this brochure and just try to do (choose one strategy from Assist items 2 through 5 below)."
Assist	1) Set a start date: "Although it would be good to start right away, it is more important to get a good solid start than a fast start; think about any special events in the next week or 2, and give yourself time to buy foods that make it easier to diet... lots of raw vegetables and other low calorie foods; look at the calendar—when can you start?"	1) Over the next week, and at every time you eat, ask the question, "Am I making food choices that are healthy?"	1) Set a start date: "It's important to get more physical activity, and walking works for most people. What sort of exercise works best for you—when can you start?" (if interested in strength training, consider referral to trained exercise professional for assistance in proper form and correct choice of exercises)
	2) Incremental change: The journey to weight loss goes one step at a time, and even small changes in your diet can make a big difference on the scale over time, eg, substituting diet soft drinks or water for regular soft drinks, the use of milk and sweetener in coffee or tea instead of cream (creamer) and sugar	2) Incremental change: Small changes over time can make a big difference in diet quality, eg, substituting whole-grain bread, like whole wheat, rye, or pumpernickel, for white bread; eating brown rice or whole-grain pasta instead of white rice or pasta; or snacking on baby carrots, celery sticks, radishes, or cherry tomatoes instead of other things	2) Incremental change: Start slowly and then build up, eg, start with 10 minutes of <walking or other exercise> every day, then add 5 minutes a day the following week, and so on.
	3) Environmental control examples: Refraining from bringing tempting foods into the home or workplace, storing all food in the pantry or refrigerator (rid the home or office of candy dishes), and limiting eating out to at most once a week	3) Environmental control examples: Making a point to read the label and purchasing fresh and dried fruit for dessert instead of cookies and cakes	3) Environmental control examples: Taking the stairs instead of the elevator; Parking in more distant spaces and walking in; and walking or bicycling to places that are less than a mile away.

TABLE 3. *Continued*

STEP ^b	WEIGHT CONTROL	DIET QUALITY	PHYSICAL ACTIVITY
	4) Situational control examples: Plating food at the stove (no serving dishes at the table); and putting down your fork or spoon between bites and savoring the flavors	4) Situational control examples: Ordering vegetables or salads instead of potatoes when dining-out; bringing healthy foods to potlucks and parties instead of chips and baked goods; and making a point to always include a vegetable, fruit, nuts, or whole grains when eating a meal or snack	4) Situational control examples: Making a point to stand up during TV commercials and move around; and having an exercise buddy (social support) who will accompany you on walks
	5) Self-monitoring: a) Weigh once a day—record it on a calendar; b) BEFORE eating anything, record it on paper or use a web-based program (see resource list)	5) Self-monitoring: Track the number of servings of fruits and vegetables you eat on a daily basis; record it on a calendar	5) Self-monitoring: a) Track the number of minutes you exercise each day and record it on a calendar; b) wear a pedometer and track the number of steps you take each day, record it on a calendar, and gradually work toward a goal of 10,000 steps per day
Arrange	Refer to primary care provider		
	Refer to registered dietitian		
	Refer to certified exercise professional, eg, physiatrist, physical therapist, exercise physiologist		

Abbreviation: BMI, body mass index. ^aAdapted from: *Five Major Steps to Intervention (The "5 A's")*. Rockville, MD: Agency for Healthcare Research and Quality; 2012. (Available at: <http://www.ahrq.gov/professionals/clinicians-providers/guidelines-recommendations/tobacco/5steps.html>). ^bSteps set in **bold text** (Ask, Advise, and Arrange) are key points of action for the oncologist.

obtain intensive training and certification in oncology nutrition as Certified Specialists in Oncology Nutrition (CSOs).¹⁷⁵ A directory of CSOs by state can be found online (available at: ams.eatright.org/eweb/DynamicPage.aspx?Site=CDRNEW&WebKey=8EADAFE4-F1E1-4309-B21C-66D3CC2AA112, accessed October 23, 2014). Oncologists therefore are encouraged to refer their patients who require guidance on weight management and nutritional issues to CSOs, although reimbursement for this outpatient care (compared with inpatient care, which is covered) varies from state to state and payer to payer and also depends on the age and weight status of the patient, extant comorbidities, and whether the deliverer of such care practices within a Medicare-approved (or other third-party payer) setting.^{174,175}

Exercise training. Given the benefits of exercise observed in cancer survivors at any stage of disease management and throughout their lifespan, regular physical activity should be encouraged for all cancer survivors. An expert roundtable convened by the American College of Sports Medicine in 2008 evaluated 85 exercise intervention trials in cancer populations and concluded that, although it is always advisable for a patient to check with their physician before initiating an exercise program, moderate-intensity aerobic exercise could be initiated by most cancer survivors (who do not have other serious comorbidities) without stress testing or other extensive evaluation.

However, some cancer survivors are at higher risk of adverse events from exercise, either as a result of cancer treatment (eg, peripheral neuropathy, lymphedema) or comorbidities. In addition, some patients will desire to initiate programs that involve more vigorous exercise or carry a higher risk of injury, such as upper body strength training

programs in breast cancer survivors. In these settings, evaluation is ideally undertaken by a health care provider with specialized knowledge in exercise physiology and advanced knowledge and skills in cancer rehabilitation.^{163,176,177} In 2009, the American College of Sports Medicine developed the Certified Cancer Exercise Trainer program and has certified over 170 professionals in the United States. A wide array of health care professionals may qualify to take the certification program as well as athletic trainers and other certified American College of Sports Medicine fitness providers.¹⁷⁸ The Certified Cancer Exercise Trainer program provides a basic level of cancer-related knowledge to an exercise professional to enable a better understanding of the impact of cancer treatment side effects on an exercise program. More advanced rehabilitative services can be provided by a physiatrist (a physician who specializes in rehabilitation medicine) or by an occupational or physical therapist. The Oncology Section of the American Physical Therapy Association grants certification to licensed physical therapists who demonstrate specialized knowledge and skills in oncology by offering a Certificate of Achievement in Oncology Physical Therapy and also is developing board-specialty certification in Oncology with a heavy focus on exercise physiology, exercise education, and promotion of healthy lifestyles that should be available by 2015.¹⁷⁴

Resources for the oncology care community and the cancer survivor

Currently, there are various resources aimed at providing support for both the nutritional and exercise needs of cancer survivors. In many cases, private agencies or health care institutions offer such services. That being said, programs

TABLE 4. Contacts and Resources for Cancer Survivors and the Oncology Care Community to Promote Weight Management, Physical Activity, and a Healthy Diet^a

DOMAIN	RESOURCE
Weight management	Academy of Nutrition and Dietetics: Board Certified Specialists in Oncology Nutrition ams.eatright.org/eweb/DynamicPage.aspx?Site=CDRNEW&WebKey=8EADAFE4-F1E1-4309-B21C-66D3CC2AA112
	American Cancer Society (library of brochures and web-based information for cancer survivors) cancer.org/treatment/survivorshipduringandaftertreatment/index
	American Institute for Cancer Research (library of brochures and web-based information for cancer survivors) aicr.org/patients-survivors
	American Society of Clinical Oncology Obesity Tool Kit (oncologist and patient guides) asco.org/practice-research/obesity-and-cancer
	LIVESTRONG (web-based diet and exercise information and calorie tracker) livestrong.com
Physical activity	American Cancer Society (library of brochures and web-based information for cancer survivors) cancer.org/treatment/survivorshipduringandaftertreatment/index
	American College of Sports Medicine: Exercise is Medicine Campaign exercisemedicine.org/
	American Institute for Cancer Research (library of brochures and web-based information for cancer survivors) aicr.org/patients-survivors
	LIVESTRONG (web-based exercise information) livestrong.com
	LIVESTRONG at the YMCA (12-wk exercise program) livestrong.org/what-we-do/our-actions/programs-partnerships/livestrong-at-the-ymca
	American College of Sports Medicine (Cancer Exercise Trainer certification) certification.acsm.org/acsm-cancer-exercise-trainer
	Silver Sneakers silversneakers.com
Healthy diet	Academy of Nutrition and Dietetics: Board-Certified Specialists in Oncology Nutrition ams.eatright.org/eweb/DynamicPage.aspx?Site=CDRNEW&WebKey=8EADAFE4-F1E1-4309-B21C-66D3CC2AA112
	American Cancer Society (library of brochures and web-based information for cancer survivors) cancer.org/treatment/survivorshipduringandaftertreatment/index
	American Institute for Cancer Research (library of brochures and web-based information for cancer survivors) aicr.org/patients-survivors

^aPrograms that are for profit or those that are only available regionally are not included.

differ markedly with respect to access and quality throughout the nation. Hence, the description of credentialing covered in the previous sections can be of benefit in guiding both the oncologist and the patient to safe and effective resources or can be used to create a high-quality survivorship program within their respective institutions. A listing of current and nationally available resources is provided in Table 4. These include resources for referral as well as for information in each of the areas of weight management, physical activity, and a healthy diet. Of note, many cancer survivors, especially those who are no longer receiving active treatment or experiencing significant late effects, can benefit from more broadly administered weight loss programs, such as commercial weight loss programs, meal-replacement and/or exercise programs, and facilities, several of which have been evaluated on a small scale for safety and early efficacy in cancer survivor populations.^{179,180}

Unmet Needs and Future Directions

As noted above, although exercise, diet, and weight loss interventions have been shown to be safe for most cancer survivors, efficacious, and feasible to implement in controlled clinical settings, such interventions are not widely disseminated as the standard of care, nor are they adequately reimbursed by insurers.

- ***Need for studies that will ascertain the impact of diet and exercise interventions upon disease outcomes in cancer survivors***

Given the lack of data demonstrating that changes in lifestyle behaviors impact rates of cancer recurrence and mortality (as well as the prevalence of comorbidity and all-cause mortality), programs to help survivors improve diet quality, increase physical activity, and lose weight generally are not reimbursed by third-party payers. Because the provision of

adequate and continued support for dietary and physical activity behavior change can be heavy investments with regard to time and resources, these barriers of reimbursement are not trivial. These issues, in combination with several other unmet needs, represent barriers in being able to integrate health behavior change interventions into standard survivorship care and to secure third-party reimbursement.

• ***Need for research to overcome barriers and leverage resources/facilitators at multiple levels***

It is clear that multilevel approaches incorporating the many facilitators and barriers to behavior change that have been elucidated in previous research at the survivor, family, provider, health care system, and public health levels must be considered in the design of interventions that are feasible for survivors to undertake and for clinic or community facilities to provide. Survivors need interventions that address their particular barriers to making positive exercise, diet, or weight loss changes and that fit into their cultural value systems and busy schedules. As such, tailored approaches are warranted, and these factors should be considered as clinicians approach the 5As of care. Clinicians need empirically validated interventions conducted by appropriately trained staff to which survivors can be referred so that referral for lifestyle modification intervention is as easy for their busy clinics as referral for diagnostic imaging. Several key steps are needed to develop these interventions. Tailoring interventions to individuals' needs and circumstances and recognizing that one size will not fit all may increase uptake, utilization, and overall impact. For example, whereas many survivors can likely undertake unsupervised walking programs or community interventions meant for the general (ie, noncancer) population, there is a small but important subgroup of cancer survivors who likely need medically supervised interventions due to special factors, such as impaired immune functioning, severe dyspnea, bowel dysfunction, neuropathy, severe fatigue, or lymphedema. Research is needed to support the identification of these individuals and to develop risk-stratification algorithms that direct these survivors into appropriate interventions for these subgroups, to develop and test those interventions, and to train staff to deliver them. Future research also should focus on determining how to help survivors who need to make multiple behavior changes (eg, improve diet and exercise plus quit smoking) and how to help survivors maintain meaningful changes in healthy behaviors over time. Although research should determine the optimal types, doses, and timing of interventions needed for different groups of cancer survivors, depending on survivors' individual biology, sociodemographic characteristics, outcome needs, and psychosocial circumstances, clinicians should not feel the need to await

such research before routinely assessing and advising on healthy lifestyle behaviors for their cancer patients.

• ***Need for research in diverse populations of cancer survivors and in diverse settings***

Another unmet need is the narrow reach of current lifestyle intervention trials. Most trials to date have focused on higher socioeconomic status, Caucasian, younger female breast cancer survivors with high functional status. Future trials must include more diverse samples of survivors, focusing especially on those most in need of making positive lifestyle changes. In particular, research is needed to identify how to overcome barriers and promote healthful behavioral changes in low-socioeconomic status or minority communities, among men, and among adults aged 65 years or older with comorbidities, who are the largest group of cancer survivors but often are less interested in or are excluded from health behavior change research. Clinicians should develop an understanding of the barriers to physical activity and healthy eating in their patient population while at the same time offering advice and arranging support for the patient to be successful despite identified barriers. For example, clinicians might promote healthy behaviors by sharing a list of local no or low-cost fitness centers (YMCA), starting a walking club among survivors at the clinic, serving healthy vegetables in the waiting area, partnering with local programs such as "Silver Sneakers" (see Table 4) or local gardening clubs, etc.

• ***Need to develop and test interventions that are scalable, durable, and cost effective***

Lifestyle intervention trials must be designed to foster dissemination and implementation in a variety of settings and to provide payers with data necessary to consider reimbursement for participation. Data on costs, including intervention staff time, clinic time, and patient/family costs, need to be collected as part of testing trial efficacy. Trial designs should attempt to optimize sustainability when the grant money ends by engaging stakeholders (eg, survivors, health care providers, insurers, community partners) in the design from the beginning of the study and conducting trials in the settings where later adoption is likely (eg, community settings). Clinic or other facility-based interventions can build in components to help survivors transition the intervention to the home or community setting to facilitate sustainability and maintenance of behavior changes.

• ***Need to evaluate the impact of long-term lifestyle behavior change and its impact on the health of cancer survivors***

Several short-term studies have been conducted to evaluate adherence to and health impact of healthy lifestyle

behaviors in the survivor population. Most have focused on modification of metabolic health and related indices as surrogates of recurrence risk and/or modifiers of risk factors of comorbid disease (insulin, inflammatory markers, etc). There is a need to evaluate the impact of adherence to healthy diet (and greater physical activity) on the long-term health status of cancer survivors, including the risk of death and/or recurrent or new cancer diagnoses.

Conclusion

With increasing numbers of cancer survivors being diagnosed at earlier stages and with concomitant advances in cancer care, the number of survivors is growing rapidly. This is indeed good news and an indicator that we are making strides in the battle against a fierce adversary. However, it is a short-lived victory if patients die from a recurrence, second malignancy, or prevalent forms of comorbidity. The IOM endorses the importance of weight management, physical activity, and a healthful diet as important components of delivering quality cancer care and as important

components of a plan for survivorship care.^{7,167} The background and tools provided in this article are an incremental step in assisting with tertiary prevention and the needs of cancer survivors, who now comprise 4% of the US population. Moving forward, research is needed to further define the benefits of lifestyle changes in cancer survivors and to evaluate the most efficacious interventions and populations most likely to benefit. However, clinicians should not feel paralyzed by the current research gaps. Rather, systems should be put into place that will support a routine assessment of lifestyle behavior in cancer patients, reassessment at regular intervals, and advisement and arrangement to optimize the likelihood that all cancer patients will engage in efforts to improve their diet, activity, and related cancer-preventive health behaviors. As evidence supporting the role of lifestyle change in cancer populations continues to grow, infrastructure to support these programs and coverage for these services is needed to ensure that cancer patients are able to optimize cancer-specific and overall outcomes in the years after cancer diagnosis. ■

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