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Original Research

Health Behaviors in Cervical Cancer Survivors and Associations with Quality of Life

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ABSTRACT

Purpose: Improvement in health behaviors following cancer diagnosis may contribute to better prognosis and well-being. This study examines the prevalence of health behaviors in cervical cancer survivors who have completed treatment, and associations between health behaviors and quality of life (QOL).

Methods: We recruited 204 women who had completed treatment for cervical cancer to participate in a randomized counseling intervention. Participants provided information on health behaviors (smoking, physical activity, and alcohol consumption); QOL (Functional Assessment of Cancer Therapy-Cervical questionnaire); and depression (Patient-Reported Outcomes Measurement Information System), anxiety (Patient-Reported Outcomes Measurement Information System), and distress (Brief Symptom Inventory) at baseline (9–30 months after diagnosis) and subsequent to the intervention. Data were analyzed using multivariate general linear models.

Findings: Participants ranged in age from 20 to 72 years at diagnosis (mean = 43 years), 41% were Hispanic, and 52% were non-Hispanic white. Three-fourths were stage 1 at diagnosis and 51% were treated with radiation with or without chemotherapy. At baseline, 15% of patients were current smokers, 4% reported alcohol consumption of >10 drinks per week, and 63% reported exercising <3 hours per week. Overall, 67.4% of cervical cancer survivors did not meet recommended national guidelines for at least 1 of these health behaviors. QOL scores were significantly higher for patients with greater physical activity (128 vs 118; $P = 0.002$) and increased with the number of recommended guidelines met (P for trend = 0.030). Associations between patient-reported outcomes and smoking and alcohol consumption did not reach statistical significance. Participants who met guidelines for all health behaviors also had less depression ($P = 0.008$), anxiety ($P = 0.051$), and distress ($P = 0.142$). Participants who improved their aggregate health behaviors during the 4-month follow-up experienced a greater improvement in QOL than those who did not improve their health behaviors (10.8 vs 4.5; $P = 0.026$).

Implications: Results indicate that two-thirds of cervical cancer survivors are not meeting national guidelines for smoking, physical activity, and alcohol consumption following completion of definitive treatment. These adverse health behaviors were associated with impaired QOL and higher levels of depression and distress. Positive changes in health behaviors are associated with significant improvement in QOL. (*Clin Ther.* 2016;∎:∎∎∎–∎∎∎) © 2016 Elsevier HS Journals, Inc. All rights reserved.

Key words: cancer, health behaviors, oncology, physical activity, quality of life, survivorship.

INTRODUCTION

Despite a decrease in cervical cancer incidence during the past 2 decades, cervical cancer represents a significant number of gynecologic cancers in the United States accounting for approximately 12,900 cases in 2015.[1] Because of improved screening and diagnostic methods, nearly half of all cervical cancer cases are diagnosed at stage 1 and more than three-fourths of cases are diagnosed at stage 2 or earlier.[2] The overall 5-year survival rate for stage 1 disease is 91%, whereas among all cases, 68% are expected to survive 5 years.[1] Because of the potential for long-term survival, lifestyle factors that may influence prognosis and quality of life (QOL) are important for cervical cancer survivors.

Smoking, lack of physical activity, and alcohol consumption are health behaviors that have all been identified as potential risk factors for cancer. Smoking, a causal factor for cervical cancer,[3] is more common in women with cervical cancer than in women with other cancers[4] and women without cancer.[5] Physical inactivity is prevalent in cervical and gynecologic cancer survivors, with 60% to 70% identified as not meeting national recommendations,[4,6,7] and has been associated with significantly higher risk for cervical cancer.[8] Cancer survivors also report higher alcohol consumption compared with those with no cancer history.[9,10] Furthermore, women with a history of alcohol abuse are at increased risk for cervical cancer.[11]

These same health behaviors have been more recently examined for their contribution to recurrence and poor prognosis in cancer survivors. In prospective analyses, smokers with cervical cancer had more recurrences than nonsmokers, with significantly shorter relapse-free (28.5 vs 46.8 months) and overall survival (38.7 vs 50.1 months).[12] Compared with nonsmokers, women with cervical cancer who smoked had a greater likelihood of death from any cause (hazard ratio [HR] = 1.35; 95% CI, 1.17–1.56) and death from cervical cancer (HR = 1.21; 95% CI, 1.01–1.46).[13] Heavy alcohol use, reported by 10% of advanced cervical cancer patients in another study, was associated with a significant decrease in disease-free (HR = 10.57; 95% CI, 2.07–53.93) and overall (HR = 10.80; 95% CI, 2.57–45.40) survival after adjusting for covariates.[14] A number of studies have reported lower cancer and overall mortality with increased physical activity in cancer survivors, albeit mostly in patients with cancers other than of the cervix.[15–18]

Better QOL is a strong predictor of improved prognosis and overall survival in cancer clinical trials,[19,20] thus a growing body of literature has examined associations between health behaviors and QOL in cross-sectional data on cancer survivors. Whereas treatment and disease side effects contribute to compromised QOL in patients with cancer, evidence suggests that lifestyle factors may also play a role. Adherence to physical activity guidelines was associated with higher QOL in gynecologic cancer survivors,[4] older female cancer survivors,[21] and in a representative cross-section of cancer survivors.[22–24] A positive association with QOL has also been observed with a combination of lifestyle behaviors, including physical activity, diet, and lower alcohol and/or tobacco consumption in survivors of ovarian,[25] endometrial,[26] breast,[27] colorectal,[28] and other cancers.[4,6] The ability of interventions to improve QOL through health behavior changes is uncertain. Improved QOL following an exercise intervention has been reported in breast cancer survivors[29]; however, a meta-analysis of 8 studies of ovarian and endometrial cancer survivors noted only nonsignificant improvements in QOL following physical activity interventions.[30]

Although previous research has examined the prevalence of health behaviors and associations with quality of life in survivors of other cancers, few studies have focused specifically on the importance of lifestyle factors for cervical cancer survivors. The purpose of this study is to describe the prevalence of health behaviors (ie, physical activity, smoking, and alcohol consumption) among cervical cancer survivors participating in a randomized clinical trial of psychosocial telephone counseling and examine potential health behavior associations with QOL. We will also examine associations between longitudinal change in health behaviors and change in QOL, depression, anxiety, and psychological distress over follow-up.

METHODS

Research Design and Study Sample

Following approval by the Institutional Review Boards of the University of California, Irvine, and California Cancer Registry (CCR), cervical cancer survivors diagnosed between 2008 and 2012 were identified through the CCR and recruited to participate in a randomized psychosocial telephone counseling trial. Eligible patients were diagnosed with stage I to IVa cervical cancer, had completed definitive

treatment at least 2 months before contact, were free of disease, and able to speak and read English or Spanish. All patients provided informed consent consistent with federal, state, and local requirements and were subsequently randomized to psychosocial telephone counseling (PTC) or usual care (UC). The intervention, based on the transactional model of stress and coping, included a QOL/psychosocial interview; 3 sessions focused on managing stress and emotions, health and wellness, and relationship/sexuality concerns; a summary/integration session; and a final booster session to review progress. Further detail is provided elsewhere.[31]

Data Collected

Questionnaires were completed via mail or telephone at baseline and approximately 4 and 9 months later. Data collected included sociodemographic characteristics, patient-reported outcome measures, and health behaviors.[31,32] Age, ethnicity, marital status, education, and income data were collected on the baseline questionnaire. Comorbidities before cancer diagnosis were self-reported by patients using a 29-item checklist. Disease stage was derived from the CCR database. Treatment data were self-reported by patients at baseline and validated by comparison to the CCR data. At baseline and follow-up, patients were asked about amount and duration of smoking, quantity of alcohol consumed, weekly hours of physical activity, and changes in diet following cancer diagnosis. Health behaviors were subsequently classified as meeting recommended guidelines or not based on published recommendations by the American Cancer Society.[7,33] Recommendations include no smoking, consumption of ≤7 alcohol-containing drinks per week for women, and at least 150 minutes of moderate-intensity physical activity per week.

Measures

Overall QOL was assessed by the 27-item Functional Assessment of Cancer Therapy-Cervical (FACT-Cx), a multidimensional, combined generic and disease-specific QOL questionnaire that includes the FACT-General questionnaire (version 4) consisting of 4 subscales (physical, social, emotional, and functional well-being) plus a cervical cancer-specific additional concerns subscale.[34] Subdomains are summed to create the FACT-Cx score (Cronbach's α = 0.92). High scores indicate better QOL. Emotional distress was assessed by the

Patient-Reported Outcomes Measurement Information System (www.PROMIS.org) short form consisting of 8 items on depression and 7 items on anxiety. Items are rated on a 5-point Likert scale and summarized in separate summary scores for depression and anxiety. Standardized T scores are normed to the general population with mean = 50 and SD = 10, with higher scores indicating more distress. The Brief Symptom Inventory is an 18-item measure of psychological distress, including an overall total score and subscales to measure anxiety, depression, and somatization.[35,36] Standardized scores are normed to the general population with mean = 50 and SD = 10. Higher scores indicate greater psychological distress.

Statistical Methods

Participants were classified according to whether they did or did not meet American Cancer Society guidelines for smoking, alcohol consumption, and exercise at baseline, individually and in aggregate. Associations between health behaviors (independent variables) and baseline QOL, depression, anxiety, and distress (dependent variables) were analyzed using general linear models. Covariates included in the model were age, ethnicity, treatment, stage, comorbidities, and time from diagnosis to study. The assigned study arm at randomization was not included in the analysis of baseline data. Participants were subsequently classified by change in health behaviors at the 4-month follow-up. Associations between change in health behaviors and change in patient-reported outcomes after adjusting for covariates were analyzed using general linear models. Effect size was calculated as the difference between subgroup means divided by the pooled SD. Effect sizes of magnitude 0.33 to 0.5 are considered clinically important differences.[37] Because the number of participants reporting change in health behaviors was small and thus power was limited, the PTC and UC arms were combined to examine associations between change in health behavior and patient-reported outcomes.

RESULTS

A total of 204 women completed the baseline evaluation as part of the randomized clinical trial. Demographic and clinical characteristics of the study participants are depicted in Table I. The age of participants at diagnosis ranged from 20 to 72 years, with

a mean of 43.1 years (SD = 9.6). The majority of participants were non-Hispanic white (52%), whereas 41% of participants were Hispanic. Overall, 40% had

Table I. baseline characteristics of study partici-pants (N = 204).

Characteristic	Mean	SD
Age at baseline evaluation, y	44.7	9.6
Age at cancer diagnosis, y	43.2	9.6
	n	%
Race/ethnicity		
White/non-Hispanic	105	51.7
African American	5	2.5
Hispanic	81	39.9
Asian/Pacific Islander	11	5.4
Native American	1	0.5
Stage		
I	146	71.9
II–IVa	54	26.6
Education		
Less than high school	43	21.1
High school graduate	39	19.2
Some college	56	27.6
College graduate	29	14.3
Graduate school	34	16.7
Marital status		
Single	31	15.3
Married/living with partner	129	63.5
Separated	9	4.4
Divorced	28	13.8
Widowed	5	2.5
Income		
<$15,000	51	25.1
$15,000–$24,999	17	8.3
$25,000–$34,999	15	7.4
$35,000–$44.999	15	7.4
$45,000–$54,999	10	4.9
≥$55,000	66	32.5
Treatment		
Surgery only	100	49.0
Radiation only	15	43.6
Chemotherapy with or without radiation	89	7.4
History of multiple comorbidities before cancer diagnosis	64	31.5

a high school education or less. Nearly three-fourths of women were diagnosed with stage I (73%) cervical cancer. Treatment included surgery only for 49% of patients, radiation alone for 7%, and both chemo-therapy and radiation for 44%.

Self-reported health behavior practices at base-line (9–30 months postdiagnosis) are summarized in Table II. Fifteen percent of participants were current smokers, whereas 4% self-reported high alcohol con-sumption. National recommendations for physical activity were not met by 62.8% of participants. When the health behavior practices were aggregated, the majority of women (67.4%) reported having at least 1 health behavior practice below the recommended standard, whereas 14% reported 2 or more deficient health behaviors.

Baseline scores for overall quality of life, depression, anxiety, and psychological distress were compared be-tween subgroups defined by meeting or not meeting recommendations for health behaviors after adjusting for the covariates age, ethnicity, treatment, stage, comor-bidities, and time from diagnosis to study (Table III). There were no significant differences in patient-reported outcomes by smoking status or alcohol use; however, power to detect differences was limited by the small number of smokers (n = 28) and high alcohol consumers (n = 8). Compared with women who exercised fewer than 3 hours total per week, women who met national guidelines for physical activity had significantly higher quality of life scores (128.0 vs 117.9; P = 0.002) along with significantly lower depression (50.8 vs 55.0; P = 0.003) and anxiety scores (51.7 vs 55.5; P = 0.020). Further, women who met recommended lifestyle stand-ards (ie, not smoking and limited alcohol and exercise) reported significantly higher QOL (P = 0.013) and lower depression (P = 0.008) than those reporting ≥1 un-healthy behavior. Lower anxiety and distress were also observed in those who met recommended standards; however, differences did not reach statistical significance. For QOL, there was a significant decreasing trend with increasing numbers of health risk behaviors (P = 0.030). Examination of pairwise differences showed that QOL decreased significantly with the first unhealthy behavior; however, the decline in QOL with additional health risk behaviors was not significant. Trends in depression, anxiety, and distress with increasing numbers of health risk behaviors did not reach statistical significance.

At the 4-month follow-up time point, 31 of 159 returning patients (19.5%) reported improving their

Table II. Baseline health behaviors of study participants (N = 204).

Health behavior	n	%
Smoking status		
Nonsmoker	171	85.5
Current smoker	29	14.5
Alcoholic drinks per week		
None	94	46.3
3 or less	79	38.9
4–10	19	9.4
11–17	8	3.9
Hours of physical activity per week		
None	64	31.5
<1	21	10.3
1–2	40	19.7
3–4	35	17.2
5–7	30	14.8
8–12	4	2.0
12+	5	2.5
Multiple health behavior risks		
0 Behavior risks	63	32.6
1 Behavior risk	104	53.9
≥2 Behavior risks	26	13.5

health risk behaviors to meet at least 1 additional guideline for health behaviors, 116 (73%) reported no change, and 12 (7.5%) met fewer guidelines (decreasing positive health behaviors). Longitudinal changes in patient reported outcomes from baseline to the 4-month follow-up visit were compared by change in health behavior (Figure) after adjusting for age, ethnicity, treatment, stage, comorbidities, and time from diagnosis to study. Mean FACT-Cx scores improved for all patients over time; however, the amount of improvement differed significantly between those who improved their health behaviors (+10.8) and those who did not (+4.5; $P = 0.026$). Changes in depression, anxiety, and distress showed similar patterns, with greater improvement among those who improved their health behaviors compared with those who did not improve; however, trends did not reach statistical significance. Although the intervention was not designed to change health behaviors, 25% of PTC patients (n = 20) improved health behaviors compared with 13% of control patients (n = 10). Patients

in both study arms who improved health behaviors had higher QOL than those who made no changes or adopted worse behaviors. Differences between arms were not statistically significant ($P = 0.89$); however, the number of patients improving their health behaviors was small and power to detect differences between PTC and UC was limited.

DISCUSSION

The high prevalence of health risk behaviors not meeting the recommended standard in our sample of cervical cancer survivors who had completed treatment was comparable to rates observed in other studies of cancer survivors. Current smoking was reported by 15% of our sample compared with 21% observed by Beesley et al[4] in cervical cancer survivors, and 10% in healthy women participating in the 2009 California Health Interview Survey.[38] Approximately 63% of our sample did not meet recommended guidelines for physical activity, similar to the 61% to 70% reported in other studies of cancer survivors[4,6] and to the 68% reported for healthy California women in the 2005 California Health Interview Survey.[39] Alcohol consumption is difficult to compare due to the categorical response, but we determined that 9% of cervical cancer survivors consumed 4 to 10 alcohol-containing drinks per week, whereas 4% reported consuming >10 alcohol-containing drinks per week. In other studies, the percentage of women consuming more than the recommended limit for alcohol ranged from 5% to 12%.[10,26,40] Overall, two-thirds of cervical cancer survivors did not meet guidelines for at least 1 health behavior, and 13% did not meet guidelines for 2 or more.

Physical activity at baseline was strongly associated with baseline QOL in our study, with higher QOL on the FACT-Cx for those meeting recommended guidelines compared with those who did not (128 vs 118; $P = 0.002$). This difference of 10 points in QOL is equal to an effect size of 0.5 SD and is considered a clinically meaningful difference.[37] Those who exercised at least 3 hours per week also experienced less depression ($P = 0.003$), anxiety ($P = 0.020$), and distress ($P = 0.056$). These results are consistent with other evidence showing a beneficial effect on health-related QOL for moderate exercise.[4,6,22–30] Associations between QOL and both smoking and alcohol consumption at baseline were nonsignificant, a finding consistent with other studies of cancer survivors.[4,6,28]

Table III. Comparison of quality of life, depression, and distress by health behaviors at baseline.[*]

	n	FACT-Cx	Depression	Anxiety	BSI
Smoking status					
Nonsmoker	169	122.0 (2.2)	53.6 (0.9)	54.7 (1.1)	51.6 (1.1)
Current smoker	28	116.8 (4.5)	53.4 (2.0)	50.9 (2.3)	52.3 (2.3)
P		0.266	0.893	0.100	0.765
Alcohol Consumption					
≤10 drinks/wk	189	121.4 (2.1)	53.4 (0.9)	54.0 (1.0)	51.6 (1.0)
>10 drinks/wk	8	121.7 (8.0)	57.0 (3.5)	60.2 (4.0)	56.5 (4.0)
		0.976	0.304	0.130	0.235
Physical activity					
≤2 h/wk	123	117.9 (2.2)	55.0 (1.0)	55.5 (1.1)	53.0 (1.2)
≥3 h/wk	73	128.0 (2.9)	50.8 (1.3)	51.7 (1.5)	49.8 (1.5)
P		0.002	0.003	0.020	0.056
Multiple risk factors					
No risk factors	63	128.2 (3.2)	50.1 (1.4)	51.3 (1.6)	49.4 (1.7)
1 risk factor	101	118.7 (2.4)	55.0 (1.1)	55.7 (1.2)	52.6 (1.3)
≥2 risk factors	26	116.8 (4.8)	54.0 (2.1)	53.0 (2.4)	53.6 (2.5)
P		0.013	0.008	0.051	0.142

BSI = Brief Symptom Inventory; FACT-Cx = Functional Assessment of Cancer Therapy-Cervical questionnaire.
[*]Values are presented as mean (SE). Means are adjusted for age, ethnicity, treatment, comorbidities, stage, and time from diagnosis to study.

Current smokers reported nonsignificantly lower QOL at baseline (117 vs 122; $P = 0.266$) and lower anxiety (51 vs 55; $P = 0.100$), but no differences in depression or distress. Whereas excessive alcohol consumption was not associated with lower QOL, cervical cancer survivors who consumed >10 drinks per week reported higher levels of depression, anxiety, and distress. Differences did not reach statistical significance but effect sizes ranged from 0.4 to 0.8, suggesting these differences may be clinically meaningful.

A significant cumulative effect on QOL was observed with increasing numbers of health risk behaviors. Cervical cancer survivors with no deficient health behaviors reported the highest QOL (FACT-Cx score = 128) with progressively lower QOL reported with 1 (FACT-Cx score = 119) or more (FACT-Cx = 117) deficient health behaviors (P for trend = 0.030). Although trends in depression, anxiety, and distress with increasing number of health behaviors not meeting the recommended standard did not reach statistical significance, results are consistent with observations for survivors of other cancers. Significant decreasing trends in QOL with increasing numbers of deficient health behaviors, including physical inactivity, diet, obesity, and/or smoking have been reported for survivors of ovarian,[25] endometrial,[26] colorectal,[28] and other cancers.[6] In breast cancer survivors, increasing numbers of modifiable health risk factors were associated with decreased time to recurrence and death.[41] Our results are consistent with Blanchard et al[6] and suggest that physical activity may be more important than other lifestyle factors for improving QOL. This has clear implications for cervical cancer survivors, who may be able to enjoy a more robust posttreatment life with a moderate physical activity schedule.

A strength of our study was our ability to examine longitudinal changes in health behaviors during the posttreatment survivorship period. Women with cervical cancer who improved their health behaviors during the 4-month follow-up experienced a 2-fold greater improvement in QOL than did those women who made no changes or who increased their risk-prone behaviors ($P = 0.026$). Although an intervention study focused on physical activity in breast cancer survivors did result in improved QOL,[29]
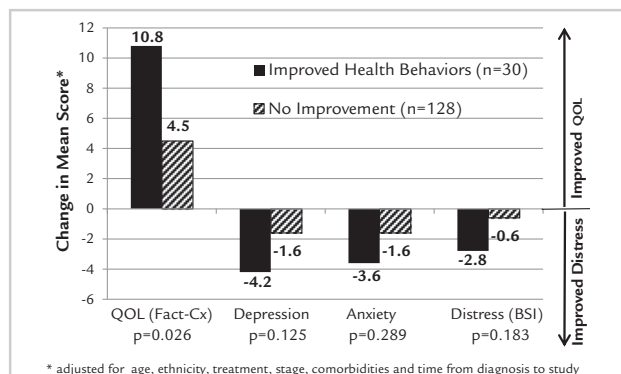
Figure. Change in quality of life, depression and distress by change in health behaviors. This figure illustrates change in QOL and patient-reported outcomes between subjects who improved their health behaviors over the 4 month follow-up (n = 30) and those who did not improve (n = 128). Increasing values for QOL (Fact-Cx) indicate improvement whereas decreasing values for depression, anxiety and distress indicate improvement.

a meta-analysis of intervention studies designed to improve lifestyle factors for ovarian and endometrial cancer survivors did not show significant improvement in QOL.[30] Further confirmation of the longitudinal effect of changes in health behaviors on QOL in female cancer survivors is needed.

Our results are not without limitations. Health behaviors were collected as categorical data and categories did not always correspond to recommended national guidelines, which were published after design, approval, and funding of the clinical study. Numbers of patients reporting high alcohol consumption in particular were small, resulting in limited power to detect associations with QOL. Further, we were unable to examine associations between diet and QOL with our data. Although some questions addressed change in diet after cancer diagnosis and treatment, baseline dietary characteristics were not collected. Thus, we could not determine if diet or dietary changes reflected national guidelines. Data on health behaviors at the 4-month follow-up were available for only a subset of our sample (n = 158). Furthermore, health behaviors changed for only a small number over this 4-month period, improving for 30 and getting worse for 12. Power to test the effect of

changes in health behaviors on change in QOL was limited, and power to test for differences between the PTC and UC arms was even more limited. Although 1 of 6 counseling sessions addressed some issues related to health and wellness, modifying health behaviors was not a primary focus of the intervention. Future studies that are adequately powered to test interventions containing elements designed specifically to change health behaviors in cervical cancer survivors would be of interest.

CONCLUSIONS

Our results show that poor health behaviors that may contribute to cancer recurrence or early death are prevalent in cervical cancer survivors. Large numbers of cervical cancer survivors are not meeting national guidelines for smoking, physical activity, and alcohol consumption. These behaviors are associated with impaired QOL, depression, and distress in cervical cancer survivors. Changes in lifestyle behaviors during cancer survivorship resulted in significant improvement in QOL. Interventions designed to moderate lifestyle and health behaviors during cancer survivorship may play an important role in improving well-being for cancer survivors.

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N. Iyer was involved in literature search and manuscript preparation. S. Hsieh and J. Tucker were involved in literature search and data collection. B. Monk contributed to interpretation of data. K. Osann was involved in literature review, study design, interpretation of data, manuscript preparation and critique. E. Nelson and L. Wenzel were involved in study design and manuscript preparation and critique. All authors participated in manuscript review.

CONFLICTS OF INTEREST

The authors have indicated that they have no conflicts of interest regarding the content of this article.

REFERENCES

1. American Cancer Society. Cancer Facts & Figures 2015. Atlanta: American Cancer Society; 2015.

2. Howlader N, Noone AM, Krapcho M, et al, eds. SEER Cancer Statistics Review, 1975-2010. Bethesda, MD: National Cancer Institute; 2013.

3. The health consequences of smoking: a report of the Surgeon General. [Atlanta, Ga]: Dept. of Health and Human Services, Center for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and health; Washington, D.C., 2004.

4. Beesley VA, Eakin EG, et al. Gynecologic cancer survivors' health behaviors and their associations with quality of life. *Cancer Causes Control.* 2008;19:775–782.

5. Plummer M, Herrero R, et al. Smoking and cervical cancer: pooled analysis of the IARC multi-centric case-control study. *Cancer Causes Control.* 2003;14:805–814.

6. Blanchard CM, Courneya KS, Stein K. Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: results from the American Cancer Society's SCS-II. *J Clin Oncol.* 2008;26:2198–2204.

7. Kushi LH, Byers T, Doyle C, et al. American Cancer Society guidelines on nutrition and physical activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin.* 2006;56:254–281.

8. Lee JK, So KA, Pivathilake CJ, Kim MK. Mild obesity, physical activity, calorie intake, and the risks of cervical intraepithelial neoplasia and cervical cancer. *PLoS One.* 2013;8: e66555.

9. Eakin EG, Youlden DR, Baade PD, et al. Health behaviors of cancer survivors: data from an Australian population-based survey. *Cancer Causes Control.* 2007;18:881–894.

10. Bellizzi KM, Rowland JH, Jeffery DD, McNeel T. Health behaviors of cancer survivors: examining opportunities for cancer control intervention. *J Clin Oncol.* 2005;23: 8884–8893.

11. Thygesen LC, Mikkelsen P, Andersen TV, et al. Cancer incidence among patients with alcohol use disorders – long term follow-up. *Alcohol Alcohol.* 2009;44:387–391.

12. Mileshkin L, Paramanathan A, Kondalsamy-Chennakesavan S, et al. Smokers with cervix cancer have more uterine corpus invasive disease and an increased risk of recurrence after treatment with chemoradiation. *Int J Gynecol Cancer.* 2014;24:1286–1291.

13. Coker AL, DeSimone CP, Eggleston KS, et al. Smoking and survival among Kentucky women diagnosed with invasive cervical cancer: 1995-2005. *Gynecol Oncol.* 2009;112:365–369.

14. Mayadev J, Li CS, Lim J, et al. Alcohol abuse decreases pelvic control and survival in cervical cancer: an opportunity of lifestyle intervention for outcome improvement. *Am J Clin Oncol.* 2015. [Epub ahead of print].

15. Li Y, Gu M, Jing F, et al. Association between physical activity and all cancer mortality: dose-response meta-analysis of cohort studies. *In J Cancer.* 2015. [Epub ahead of print].

16. Ballard-Barbash R, Friedenreich CM, Courneya KS, et al. Physical activity, biomarkers, and disease outcome in cancer survivors: a systematic review. *J Natl Cancer Inst.* 2012;104:815–840.

17. Ligibel J. Lifestyle factors in cancer survivorship. *J Clin Oncol.* 2012;30: 3697–3704.

18. Lahart IM, Metsios GS, Nevill AM, Carmichael AR. Physical activity, risk of death and recurrence in breast cancer survivors: a systematic review and meta-analysis of epidemiologic studies. *Acta Oncol.* 2015;54:635–654.

19. Quinten C, Coens C, Mauer M, et al. Baseline quality of life as a prognostic indicator of survival: a meta-analysis of individual patient data from EORTC clinical trials. *Lancet Oncol.* 2009;10:865–871.

20. Gotay CC, Kawamoto CT, Bottomley A, Efficace F. The prognostic significance of patient-reported outcomes in cancer clinical trials. *J Clin Oncol.* 2008;26:1355–1363.

21. Inoue-Choi M, Lazovich D, Prizment AE, Robien K. Adherence to the World Cancer Research Fund/American Institute for Cancer Research recommendations for cancer prevention is associated with better health-related quality of life among elderly female cancer survivors. *J Clin Oncol.* 2013;31:1758–1766.

22. Tannenbaum SL, McClure LA, Asfar T, et al. Are cancer survivors physically active? A comparison by U.S. states. *J Phys Act Health.* 2015. [Epub ahead of print].

23. Kripp M, Heuser AL, Belle S, et al. Does physical activity improve quality of life in cancer patients undergoing chemotherapy? *Oncol Res Treat.* 2015;38:230–236.

24. Mishra S, Scherer RW, Geigle PM, et al. Exercise interventions on health-related quality of life for cancer survivors. *Cochrane Database Syst Rev.* 2012;8:CD007566.

25. Smits A, Smits E, Lopes A, et al. Body mass index, physical activity and quality of life of ovarian cancer survivors: time to get moving? *Gynecol Oncol.* 2015;139:148–154.

26. Von Gruenigen VE, Waggoner SE, Frasure HE, et al. Lifestyle challenges in endometrial cancer survivorship. *Obstet Gynecol.* 2011;117:93–100.

27. Blanchard CM, Stein KD, Baker F, et al. Association between current lifestyle behaviors and health-related quality of life in breast, colorectal, and prostate cancer survivors. *Psychol Health.* 2004;19:1–13.

28. Schlesinger S, Hampe WJ, von Schonfels W, et al. Lifestyle factors and health-related quality of life

in colorectal cancer. *Cancer Causes Control*. 2014;15:99–110.

29. Casla S, Lopez-Tarruella S, Jerez Y, et al. Supervised physical activity improves VO2max, quality of life, and health in early stage breast cancer patients: a randomized controlled trial. *Breast Cancer Res Treat*. 2015;153:371–382.

30. Smits A, Lopes A, Das N, et al. The effect of lifestyle interventions on the quality of life of gynaecological cancer survivors. A systematic review and meta-analysis. *Gynecol Oncol*. 2015;139:546–552.

31. Wenzel L, Osann K, Hsieh S, et al. Psychosocial telephone counseling for survivors of cervical cancer: results of a randomized biobehavioral trial. *J Clin Oncol*. 2015;33:1171–1179.

32. Osann K, Hsieh S, Neslon EL, et al. Factors associated with poor quality of life among cervical cancer survivors: implications of clinical care and clinical trials. *Gynecol Oncol*. 2014;135:266–272.

33. Doyle C, Kushi L, Byers T, et al. Nutrition and physical activity during and after cancer treatment: An American Cancer Society guide for informed choices. *CA Cancer J Clin*. 2006;56:323–353.

34. Cella DF, Tulsky DS, Gray G, et al. The Functional Assessment of Cancer Therapy scale: Development and validation of the general measure. *J Clin Oncol*. 1993;11:570–579.

35. Zabora J, BrintzenhofeSzoc K, Curbow B, et al. The prevalence of psychosocial distress by cancer site. *Psychooncology*. 2001;10:19–28.

36. Zabora J, BrintzenhofeSzoc K, Jacobsen P, et al. A new psychosocial instrument for use with cancer patients. *Psychosomatics*. 2001;42:241–246.

37. Yost KJ, Eton DT, Garcia SF, Cella D. Minimally important differences were estimated for six Patient-Reported Outcomes Measurement Information System-Cancer scales in advanced-stage cancer patients. *J Clin Epidemiol*. 2011;64:507–516.

38. Max W, Sung HY, Shi Y, Stark B. The cost of smoking in California. *Nicotine Tob Res*. 2015. [Epub ahead of print].

39. Luncheon C, Zack M. Health-related quality of life and the physical activity levels of middle-aged women, California Health Interview Survey, 2005. *Prev Chronic Dis*. 2011;8:A36.

40. Loftipour S, Cisneros V, Ogbu UC, et al. A retrospective analysis of ethnic and gender differences in alcohol consumption among emergency department patients: a cross-sectional study. *BMC Emergency Med*. 2015;15:24.

41. Saquib N, Pierce JP, Saquib J, et al. Poor physical health predicts time to additional breast cancer events and mortality in breast cancer survivors. *Psychooncology*. 2011;20:252–259.

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