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Physical activity correlates and barriers in head and neck cancer patients

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Abstract
Purpose Our study purpose was to determine physical activity correlates and barriers among head and neck cancer patients.
Materials and methods Fifty-nine (response rate=91%) head and neck cancer patients from an academic oncology clinic enrolled in a cross-sectional study utilizing chart review and self-administered questionnaire.
Results The majority were men (83%) and white (92%) with mean age of 58±12.8 years and mean months since diagnosis of 18.6±51.9. The strongest bivariate correlates of physical activity included enjoyment (r=0.41; p=0.002), symptom index (r=−0.36; p=0.006), alcohol use (r=0.36; p=0.007), task self-efficacy (r=0.33; p=0.013), perceived barriers (r=−0.27; p=0.047), and comorbidity score (r=−0.27; p=0.042). Stepwise regression demonstrated independent associations with physical activity for enjoyment (β=0.38; p=0.002) and symptom index (β=−0.33; p=0.006; R^2=0.28). The most prevalent barriers significantly associated with physical activity included dry mouth or throat (r=−0.32; p=0.016), fatigue (r=−0.27; p=0.043), drainage in mouth or throat (r=−0.41; p=0.002), difficulty eating (r=−0.32; p=0.015), shortness of breath (r=−0.30; p=0.024), and muscle weakness (r=−0.29; p=0.033).
Conclusions Our results showed that the strongest independent correlates of physical activity were social cognitive (i.e., enjoyment) and treatment-related (i.e., symptom index). Treatment-related activity barriers were frequent and significantly associated with reduced activity. Efforts to enhance exercise adherence in head and neck cancer patients should focus on optimizing enjoyment and managing treatment-related barriers.

Keywords Cancer · Oncology · Physical activity · Predictors · Treatment side effects

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Introduction

More than 40,000 Americans are diagnosed with cancer of the oral cavity, pharynx, or larynx annually [1]. Unfortunately, head and neck cancer patients suffer significant and often persistent reductions in quality of life after diagnosis and treatment [19, 22]. Evidence-based reviews of randomized controlled trials demonstrate consistent support for the effectiveness of physical activity interventions for improving quality of life in patients with cancer types other than head and neck [24, 37], but related studies in head and neck cancer patients have noted inconsistent results [26, 32]. Additional prospective, intervention studies are needed to clarify these preliminary findings.

It is possible that exercise adherence in such intervention studies will pose a larger challenge among head and neck cancer patients when compared with patients with other cancer types because of the more frequent decline in physical activity reported by head and neck cancer patients after diagnosis [32]. Furthermore, if a quality of life benefit from regular physical activity is confirmed among head and neck cancer patients, a better understanding of activity correlates and barriers will assist in designing health promotion programs to enhance physical activity compliance among head and neck cancer patients. Designing physical activity interventions to facilitate adherence must consider activity correlates and barriers within a theoretical framework of behavior change [8]. Additionally, barriers to exercise often differ based on cancer site [5, 10, 11, 14]. Although not previously reported among head and neck cancer patients, activity barriers are expected to be unique due to the disease and treatment effects on speech, food ingestion, and breathing often experienced by this patient population.

Self-efficacy (or confidence) is the central construct in the social cognitive theory [2], and although barrier (or coping) self-efficacy is the most frequently studied aspect of efficacy, task self-efficacy may be a stronger predictor of physical activity in cancer and chronic disease populations [6, 34, 35]. Factors such as perception of barriers, physical activity enjoyment, prediagnosis physical activity, social support, and activity role models may also play a role [3, 5, 10, 11, 15, 35]. Because symptoms (physical and/or psychological) as a measure of physiologic state may influence behavior through self-efficacy [2, 25], this is an important correlate to consider in cancer patients. Unfortunately, only two studies have evaluated the potential influence of symptoms on physical activity and/or activity-related social cognitive constructs. Specifically, higher fatigue was associated with lower adherence to a strength-training intervention for prostate cancer patients [18], and symptom distress was associated with self-efficacy for learning and overcoming barriers to strength training among 40 prostate cancer patients [28]. A theoretical framework for integrating disease-related symptoms into a social cognitive theory approach to physical activity in head and neck cancer patients is provided in Fig. 1.

Our primary study aim was to determine correlates of physical activity among head and neck cancer patients. Specifically, we assessed the associations between physical activity behavior and social cognitive theory constructs (i.e., self-efficacy, physical activity enjoyment, and perceived barriers). We also assessed associations with social support, prediagnosis physical activity, role models, symptoms, depression, and medical comorbidities because of their potential role as self-efficacy correlates (i.e., sources of self-efficacy). We hypothesized that each of the social cognitive theory constructs and sources of self-efficacy would be significantly associated with physical activity. Our secondary study aim was to determine the most frequent and important physical activity barriers reported by head and neck cancer patients. We hypothesized these barriers would be general (e.g., lack of time) and related to the head and neck cancer experience (e.g., difficulty eating).

Materials and methods

A detailed description of study methodology has been previously reported [32]. The following provides a summary with relevant additional detail as needed.

Study design and sampling methodology

Study approval was obtained through the local Institutional Review Board, and informed consent was obtained from all study participants. A cross-sectional study design with convenience sampling in an academic Head and Neck Cancer outpatient clinic was carried out. Participant-inclusion criteria included history of head and neck cancer (i.e., oral cavity, pharynx, larynx, nasal cavity, or salivary gland), ≥21 years of age, and English speaking. Patients with dementia, organic brain syndrome, or characteristic (i.e., medical, psychological, or social) that would interfere with ability to accurately

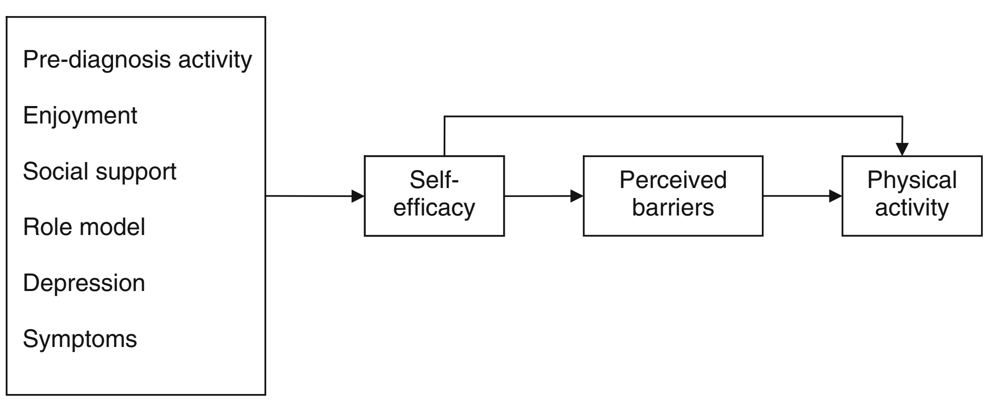

Fig. 1 Theoretical framework integrating social cognitive theory constructs and disease-related symptoms associated with physical-activity behavior in head and neck cancer patients

complete the survey were excluded (i.e., four patients were either too sick or had a psychiatric condition).

Potential eligibility by preliminary chart review was assessed by trained research staff. Unless advised by the patient's oncologist not to approach the patient (n=2), potentially eligible patients were invited to participate. A self-administered survey was completed by the participant during the clinic visit with missing and/or ambiguous responses clarified by telephone follow-up. Research nurse or physician investigator completed a chart review for selected medical variables after survey completion.

Measures

Demographic and medical variables

Demographic and medical variables were measured by survey and chart review. Age, gender, race, education level, annual household income, cigarette use, alcohol use, and medical comorbidities were self-report with body mass index (BMI; weight in kg/height in m^2), time since diagnosis (in months), and cancer type, site, stage, and treatment obtained by chart review. The medical comorbidities included those with the potential to influence physical activity (i.e., lung disease, heart disease, peripheral vascular disease, renal dialysis, and arthritis) and were summed for a comorbidity score (i.e., a score of 1 was assigned for each disease present for a range of 0 to 5).

Physical activity

Self-reported physical activity was assessed by a modified Godin Leisure-Time Exercise Questionnaire [23]. Participants reported the average weekly duration and frequency of light, moderate, and vigorous activity over the past month and also over a typical month during the year before their cancer diagnosis. Reported duration was multiplied by frequency to determine the minutes per week spent in each of the three activity levels (i.e., light, moderate, or vigorous). Total exercise minutes from all intensities (i.e., light+moderate+vigorous) were calculated for prediagnosis and current levels. Prior analyses demonstrated that total minutes is the optimal exercise outcome in our dataset due to the low prevalence of active individuals [32].

Social cognitive theory constructs

Confidence (i.e., self-efficacy) was rated on a Likert type scale from 0 to 100% (0%=not at all confident to 100%= extremely confident) with the mean score for each self-efficacy scale used for the analysis. *Barrier* (*or coping*) *self-efficacy* (i.e., an individual's confidence in their ability to overcome physical activity barriers) was measured utilizing a 14-item scale adapted from a 9-item scale tested for reliability in another cancer population [33]. For example, participants were asked "How confident are you that you can exercise when you are tired?" The original nine-item scale was adapted by adding five additional items that addressed barriers expected to be specific to the head and neck cancer experience (i.e., trouble breathing, trouble eating, shoulder weakness, muscle weakness, and pain). Half of the items (i.e., seven) asked about confidence in ability to overcome specific physical symptoms with the remaining seven focusing on nonphysical symptoms such as lack of time, interest, etc. The coefficient alpha for the 14-item barrier self-efficacy scale in our study population was 0.96. *Task self-efficacy* (i.e., an individual's confidence in their ability to perform physical activity) was measured utilizing a four-item scale developed for chronic disease patients and tested in another cancer population [33]. For example, participants were asked "Rate your confidence in your ability to walk 20 min without stopping." Coefficient alpha for the four-item task self-efficacy scale in our population was 0.95.

Perceived physical activity barriers was assessed with a 33-item scale from another cancer population [35] that was modified to include barriers related to the respiratory system, eating, and muscle weakness expected in head and neck cancer patients. Participants rated on a 5-point Likert scale (1=never to 5=very often) how often 33 different barriers interfered with exercise. The items were summed for a perceived barriers score. Coefficient alpha for our study sample was 0.95.

Physical activity enjoyment was measured with a single item (5-point Likert scale) asking the participant to rate their agreement with the following statement "I enjoy engaging in regular physical activity". A single-item approach has been successfully used in cancer patients [10] with the specific item used developed for a prior study [35].

Other potential activity correlates

Four items measuring *social support* asked for the frequency with which friends or family encouraged or offered to exercise with the participant with Likert scale responses of 1 (none) to 5 (very often) summed for a social support score. This measure has demonstrated significant associations with physical activity [36].

Role model exposure was measured by summing three yes/no questions (1=yes and 0=no for a range of 0 to 3). Participants were asked if they had known a head and neck cancer patient who "exercised during or after treatment" or "benefited from exercise during or after treatment". Participants were also asked if their exercise behavior had been "influenced by another head and neck cancer patient that exercised during or after treatment". The questions were adapted from that used in a prior study [35].

The Center for Epidemiologic Studies Depression Scale (CES-D) scale was used to measure *depression* [30]. Participants rated the frequency of 20 depression-related symptoms on a scale of 0 (rarely; less than 1 day a week) to 3 (most; 5 to 7 days a week). Responses were summed for a depression score (i.e., higher score represents greater depressive symptomatology). Coefficient alpha for our study population was 0.82 [32]. Although the descriptive statistics and unadjusted correlations with physical activity, comorbidity score, and alcohol use for this scale have been previously reported [32], this is the first reporting of associations with the social cognitive theory related variables.

The *symptom index* was assessed with the Functional Assessment of Cancer Therapy/National Comprehensive Cancer Network (FACT/NCCN) head and neck symptom index [7]. This ten-item scale asked participants to rate on a 4-point Likert scale the frequency of ten different cancer-related symptoms (e.g., pain, difficulty swallowing, trouble breathing, etc.). Frequency was rated from 0 (not at all) to 4 (very much). Coefficient alpha for our study population was 0.84. The FACT Head and Neck Symptom Index (FACT-H&N) as a measure of quality of life was used in a prior publication [32], but the results of the symptom index FACT subscale (10 of the 39 FACT-H&N items) have not been previously reported. The FACT/NCCN head and neck symptom index subscale was chosen because it was specifically designed to provide a summary score for symptoms relevant to the head and neck cancer experience. Although it shares items with the FACT-H&N instrument, it does not duplicate the seven quality-of-life domains reported previously [32].

Data management and analysis

Before proceeding with the primary study aim, scatter plots suggested potential outliers for minutes of light, moderate, and/or vigorous activity. Using the definition of greater than three standard deviations from the mean [27], three participants were found to be outliers (one for minutes of vigorous, one for minutes of moderate, and one for minutes of light activity). Because outliers may unduly influence population estimates, analyses for the primary study aim were performed without inclusion of the three outliers [27]. Because of the reduced variability in the activity variables, the total minutes of mild, moderate, and vigorous activity was used for the analyses. Potential correlate and covariate associations with total weekly activity minutes were analyzed with Pearson correlations. Variables with significant zero order associations with activity were retained for a stepwise linear regression analysis to determine independent physical activity correlates.

Results

Participants

The study population, physical activity, and CES-D score have been previously described [32]. In summary, 59 of the 65 eligible patients (response rate=91%) completed the survey. Most participants were men (83%), white (92%), nonsmokers (75%), and nondrinkers (66%). Mean participant age was 58±12.8 with 12±2.6 years of education. The most frequent cancer sites were oropharynx (37%), larynx (25%), or oral cavity (24%). With regard to disease stage, 20% were stage I, 7% stage II, 19% stage III, and 54% stage IV. Ten (17%) had recurrent disease. The majority (86%) were off treatment at time of the survey, with those on treatment receiving chemotherapy only (2%), radiation only (5%), or both (7%). For those who had completed treatment, the mean months since treatment completion was 23±62 (range <1 to 360) with 33% receiving surgery alone, 33% receiving surgery plus radiation, 3% receiving radiation alone, and 31% receiving both radiation and chemotherapy [with (18%) or without (13%) surgery]. The mean BMI was 25.9±6.5, number of comorbidities was 1.0±1.2, and months since diagnosis was 18.6±50.9 (range <1 to 360). On average, participants were inactive (i.e., mean total weekly minutes of 110.2±164.8) with a decrease from 383.7 min prediagnosis. Mean CES-D score (i.e., depression) was 18.7±9.9.

Table 1 provides the descriptive statistics for potential correlates within a social cognitive theory framework. Self-efficacy for overcoming barriers (i.e., mean of 28.7; slightly confident) was less than confidence to engage in exercise (i.e., mean of 39.2; moderately confident). Perceived barriers and enjoyment approached the midrange of 99 and 3, respectively, while social support was low (i.e., 5.8 out of a possible 20) and role models infrequent [i.e., only 2 (3%)]. The symptom index was 15.3 out of a possible maximum of 40.

Table 1 Descriptive statistics for social cognitive theory variables (n=59)

Variable	Mean±SD or n (%)
Barrier self-efficacy (range 0–100)	28.7±22.5
Task self-efficacy (range 0–100)	39.2±35.6
Perceived physical activity barriers (range 33–165)	87.8±29.7
Physical activity enjoyment	3.0±1.5
Social support (range 0–20)	5.8±4.8
Role model	
Yes	2 (3%)
No	57 (97%)
Depression (CES-D)	18.7±9.9[a]
Symptom index (range 0–40)	15.3±9.1

[a] Mean and standard deviation for depression previously reported [32]

Physical activity correlates

Zero order Pearson correlations are provided in Table 2. The physical activity associations previously reported as they relate to quality of life and important covariates are indicated in the table [32]. The strongest correlates of physical activity included enjoyment (r=0.41; p=0.002), symptom index (r=−0.36; p=0.006), alcohol use (r=0.36; p=0.007), task self-efficacy (r=0.33; p=0.013), perceived barriers (r=−0.27; p=0.047), and comorbidity score (r=−0.27; p=0.042). Stepwise regression demonstrated that two variables had independent associations with physical activity: enjoyment (β=0.38; p=0.002) and symptom index (β=−0.33; p=0.006; R^2=0.28).

Specific barriers and symptoms

The prevalence of each activity barrier and its unadjusted Pearson correlation with total weekly activity minutes is provided in Table 3. Among the most prevalent barriers, those significantly associated with physical activity were primarily related to head and neck cancer treatments [e.g., dry mouth or throat (r=−0.32; p=0.016), fatigue (r=−0.27; p=0.043), drainage in mouth or throat (r=−0.41; p=0.002), difficulty eating (r=−0.32; p=0.015), shortness of breath (r=−0.30; p=0.024), muscle weakness (r=−0.29; p=0.033), difficulty swallowing (r=−0.28; p=0.039), and decreased food intake (r=−0.28; p=0.039)]. Although several nonphysical barriers were among the most prevalent (i.e., ≥39% reported lack of interest, exercise not a priority, lack of enjoyment, exercise not in routine, procrastination, and lack of self-discipline), none were significantly associated with activity. Fear of injury, although infrequent (i.e., reported by 18%) was the only nonphysical barrier significantly associated with activity (r=−0.27; p=0.042).

Because of the significant association between symptom index and activity-related variables, prevalence and association with activity for each individual item are provided in Table 4. The strongest and most frequent correlates included fatigue (r=−0.33; p=0.012), pain in mouth, throat, or neck (r=−0.33; p=0.012), and discontent with current quality of life (r=−0.28; p=0.038). Difficulty communicating was significantly associated with activity (r=−0.28; p=0.036) but less frequent (i.e., reported by 9% only).

Discussion

In this study designed to explore physical activity barriers and social cognitive theory correlates of exercise among head and neck cancer patients, statistically significant unadjusted associations were found for enjoyment, symptom index, alcohol use, task self-efficacy, perceived barriers, and presence of comorbidities. The strongest independent correlates included both social cognitive (i.e., enjoyment) and treatment-related side effects (i.e., symptom index). Degree of symptoms was strongly associated with the constructs of self-efficacy and perceived barriers, possibly influencing the lack of independent association between activity and these usually important constructs. With

Table 2 Zero order correlations among physical activity, social cognitive theory constructs, and selected[a] demographic and medical variables in head and neck cancer patients (n=56)

	1	2	3	4	5	6	7	8	9	10	11	12
1. Total weekly activity minutes		0.19	0.33*	−0.27*	.24	0.41**	0.07	0.14	0.06[b]	−0.36**	−0.27*[b]	0.36**[b]
2. Barrier self-efficacy			0.65**	−0.54**	.07	0.38**	0.38**	0.01	−0.23	−0.37**	−0.24	0.23
3. Task self-efficacy				−0.46**	−0.11	0.35**	0.24	−0.07	−0.32*	−0.55**	−0.49**	0.37**
4. Perceived activity barriers					−0.07	−0.32*	−0.21	0.21	0.34*	0.66**	0.10	−0.20
5. Social support						0.24	0.05	0.07	0.17	0.24	0.21	0.06
6. Physical activity enjoyment							0.13	0.04	−0.09	−0.08	−0.14	0.21
7. Role model								0.14	−0.06	−0.19	−0.09	0.07
8. Prediagnosis activity									0.06	0.14	−0.17	−0.15
9. Depression										0.52**	0.16[b]	−0.07[b]
10. Symptom index											0.26	−0.32*
11. Comorbidity score												−0.28*
12. Any alcohol use												

*p<0.05
**p<0.01
[a] Only demographic and medical variables with statistically significant associations (i.e., p<0.05) with physical activity included
[b] Correlation previously reported [32]

Table 3 Exercise barriers among head and neck cancer patients: prevalence and associations with total exercise minutes (n=56)

Barriers (higher score=barrier interferes with exercise more often)	Respondents reporting barrier often or very often interfered with exercise (%)	Weekly exercise minutes (correlation coefficient[a])
Dry mouth or throat	27 (48%)	−0.32*
Lack of interest	25 (45%)	−0.21
Fatigue	25 (45%)	−0.27*
Exercise not a priority	24 (43%)	−0.20
Lack of enjoyment	23 (41%)	−0.03
Exercise not in routine	22 (39%)	−0.10
Procrastination	22 (39%)	−0.05
Drainage in mouth or throat	22 (39%)	−0.41**
Lack of self-discipline	22 (39%)	−0.03
Difficulty eating	21 (38%)	−0.32*
Pain	21 (38%)	−0.17
Lack of equipment	20 (36%)	−0.08
Weather	20 (36%)	0.03
Inconvenient exercise schedule	20 (36%)	−0.12
Shortness of breath	20 (36%)	−0.30*
Exercise is boring	19 (34%)	−0.01
Muscle weakness	19 (34%)	−0.29*
Difficulty swallowing	18 (32%)	−0.28*
Decreased food intake	17 (30%)	−0.28*
Difficulty breathing	17 (30%)	−0.32*
Lack of time	17 (30%)	−0.02
Lack of facilities and/or space	16 (28%)	−0.05
Shoulder weakness and/or pain	15 (27%)	−0.32*
Cough	15 (27%)	−0.31*
Difficulty communicating	14 (25%)	−0.27*
Lack of company	13 (23%)	−0.26
Cost	12 (21%)	0.05
Family responsibilities	12 (21%)	0.25
Fear of making condition worse	11 (20%)	−0.19
Lack of knowledgeable exercise staff	10 (18%)	0.06
Fear of injury	10 (18%)	−0.27*
Lack of skills	7 (13%)	−0.15
Nausea	7 (13%)	−0.16

*Statistically significant p value <0.05
**Statistically significant p value < 0.01.
[a] Pearson correlation coefficient

Table 4 Symptom index items for head and neck cancer patients: prevalence and associations with total exercise minutes (n=56)

Symptom (higher score=symptom occurs more often)	Respondents reporting symptom occurs “quite a bit” or “very much” (%)	Weekly exercise minutes (correlation coefficient[a])
Difficulty swallowing	26 (46%)	−0.23
Lack of energy	25 (45%)	−0.33*
Not content with current quality of life	21 (38%)	−0.28*
Inability to eat solid food	19 (34%)	−0.25
Pain (general)	15 (27%)	−0.20
Worried that condition will get worse	13 (25%)	−0.14
Pain in mouth, throat, neck	12 (21%)	−0.33*
Trouble breathing	10 (18%)	−0.22
Nausea	7 (13%)	−0.08
Difficulty communicating	5 (9%)	−0.28*

*Statistically significant p value <0.05
[a] Pearson correlation coefficient

regard to specific barriers, head and neck cancer patients frequently report disease-related activity barriers and symptoms that are significantly associated with reduced activity.

Studies of physical activity correlates in other cancer populations have used various frameworks (i.e., social cognitive theory, theory of planned behavior, Five Factor Model of personality, attribution theory, and self-determination theory) to demonstrate significant activity associations with social support/role models (similar to subjective norm), self-efficacy (similar to perceived behavioral control), prediagnosis physical activity, perceived barriers, negative outcome expectations and/or values (similar to attitudes) [9–13, 15–17, 29, 31, 35, 38, 39]. These studies have focused on patients with cancers other than head and neck (e.g., breast, prostate, colorectal, and bone marrow transplant recipients). Although specific symptoms such as nausea and fatigue have often been evaluated as potential barriers, only one prior study has evaluated the association between symptoms (i.e., specifically fatigue) and activity [18] and no prior study has used a symptom index to evaluate more fully the potential influence of symptoms on activity behavior. Head and neck cancer treatment can result in disabling, long-term side effects that may be greater than that of other cancers due to its impact on nutrition and social interaction [21]. In addition, more than half of our study participants had stage IV disease, which may require more aggressive treatment with a higher likelihood of long-term sequela, depending on whether surgery-sparing, chemoradiation protocols are used [38]. The large association between symptoms and physical activity in a cancer population with significant physical symptoms suggests that disease sequela and treatment side effects should receive adequate attention to facilitate the effectiveness of intervening on the more traditional social cognitive constructs. This is consistent with a prior study that demonstrated weaker activity associations with theory of planned behavior constructs among bone marrow transplant recipients with significant thrombocytopenia when compared with those without thrombocytopenia [17].

Our data also suggest that enjoyment of physical activity is unrelated to symptoms but may be associated with a patient's perception of self-efficacy and barriers. Although the cross-sectional nature of our study prevents inferences related to causality, several possibilities may exist. When significant physical symptoms are present, the positive benefit of enjoying activity may help overcome the negative influence of symptoms on self-efficacy and perceived barriers. In addition, self-efficacy and barrier perceptions may influence the degree of enjoyment experienced.

Although the fact that barrier self-efficacy was a weaker correlate than task self-efficacy is consistent with other studies in chronic disease and cancer populations, the relatively weak associations with both components of self-efficacy is not [6, 34, 35]. Our findings may have differed for several reasons. First, barrier self-efficacy was low in our population with very few individuals (i.e., 6 to 26%) reporting ≥50% confidence in ability to overcome any of the barriers. This coupled with the very low activity level overall suggests the inability to fully evaluate associations due to lack of individuals with both high efficacy and high activity behavior. Furthermore, our task self-efficacy measure asked about ability to perform moderate and/or vigorous activity, yet very few of the individuals reported any activity other than light activity. Finally, self-efficacy for overcoming barriers (some of which are symptom related) may not be helpful in predicting physical activity beyond knowing the degree of symptoms because efficacy perceptions are quite low. Perhaps targeting efficacy through patient education in symptom management related to maintaining an active lifestyle would enhance the association between self-efficacy and activity in this population.

In addition to self-efficacy, the lack of association with perceived barriers was unexpected [9, 10, 12, 35]. Although the perceived barriers scale consisted of both physical and cognitive barriers, the potential overlap between the symptom index and perceived barriers may have contributed to the lack of independent association between physical activity and perceived barriers. Another unexpected finding was the lack of association between current and prediagnosis physical activity [10, 35]. It is possible that the experience, functional level, and efficacy that one gains from prediagnosis activity becomes less important as an activity correlate when the individual's physical status changes dramatically as often occurs in head and neck cancer patients. Future studies should examine possible interactions between prediagnosis activity levels and degree of symptoms that reflect these dramatic physical changes. Another possible explanation may lie in the fact that we used total activity minutes rather than moderate plus strenuous only. Although this was done to allow adequate variability for analysis, prediagnosis activity may be a weaker correlate of lighter-intensity activity.

The most frequent barriers and symptoms with significant associations with activity were the direct result of head and neck cancer treatments (e.g., dry mouth or throat, fatigue, drainage in mouth or throat, difficulty eating, shortness of breath, pain, difficulty communicating, and discontent with quality of life) and will require attention if activity levels are to be increased. These issues require rigorous palliative management from a multidisciplinary head and neck cancer team. Nutritional status, which frequently deteriorates during treatment, should be closely watched, and timely placement of a feeding tube is often necessary. Pain and mucositis are best dealt with through topical therapy, treatment of underlying infections such as thrush and oral herpetic lesions, and use of transdermal opiates for analgesic relief. Fatigue, if related to anemia, may be treated with transfusions and possibly erythropoietin. Thick upper aerodigestive secretions frequently persist after treatment is finished and require symptomatic treatment with agents such as guafenisin [4].

Fear of injury was the only other barrier with a significant association with physical activity, and concerns about the negative outcome of exercise has been noted in other cancer populations [35]. Future interventions should include adequate patient education and supervision to minimize exercise-related injury. Although musculoskeletal and cardiac issues are generally of greatest concern with regard to injury prevention, head and neck cancer patients may also require attention to nutritional, respiratory, and shoulder dysfunction issues.

Although our study was not population-based, which limits its generalizability, it is the first study to explore physical activity correlates in head and neck cancer patients. Our response rate of 91% minimizes the potential selection bias resulting from exclusion of patients by the oncologist or for a medical/psychological/social reason, and it is reassuring that the observed postdiagnosis prevalence of smoking and alcohol are consistent with that reported in other head and neck cancer samples [20]. Although we report current treatment but not the associations with prior anticancer treatment, this information is not expected to provide additional clinical significance above and beyond the symptoms resulting from the treatments. In addition, the number of patients on treatment (n=8) was too small to allow stratification of our analyses by treatment status. Such stratification is not expected to influence the associations reported; however, the prevalence of barriers might be greater in those on treatment, and future studies assessing barriers in head and neck cancer patients should consider treatment status and type. Our sample size allowed the performance of preliminary regression analyses but was not adequate for path analysis or hierarchical regression to more fully assess the theoretical framework (i.e., Fig. 1) that guided our choice of variables. Lastly, the large number of associations tested may have increased the likelihood of type I error; however, this is acceptable given the exploratory nature of the study and the desire to identify all possible associations warranting further study.

Our results suggest several implications for future research and practice. Future assessment of the usefulness of the social cognitive theory in head and neck cancer populations should consider the physiologic state (e.g., symptoms), an often overlooked component of the social cognitive theory which may influence behavior through self-efficacy [2, 25]. Furthermore, studies are needed to determine the degree with which significant physical symptoms may alter the relative importance of traditional social cognitive variables in cancer patients. Efforts to enhance exercise adherence in head and neck cancer patients should focus on optimizing enjoyment while managing symptoms and providing education in overcoming symptom-related barriers. The strong association between symptoms and depression also suggest that more aggressive treatment for depression may be of benefit. Finally, counseling should consider the potential relationships among self-efficacy, symptoms, and enjoyment. Future research regarding physical activity correlates in head and neck cancer patients is warranted. These studies could be strengthened by longitudinal designs that enroll larger, population-based samples with greater variability in disease stage, physical activity, and self-efficacy variables allowing additional multivariate analyses. Understanding exercise adherence and dealing effectively with the unique challenges experienced by head and neck cancer patients has the potential for providing important benefits in this population which suffers long-term and significant reductions in quality of life.

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Potential conflict of interest. None

References

1. ACS (2007) Cancer facts and figures 2007. American Cancer Society, Atlanta, GA
2. Bandura A (1986) Social foundations of thought and action: a social cognitive theory. Prentice-Hall, Upper Saddle River, NJ
3. Bandura A (2004) Health promotion by social cognitive means. Health Educ Behav 31:143–164
4. Berger AM, Portenoy RK, Weissman DE (2002) Principles and practice of palliative care and supportive oncology. Lippincott, Williams & Wilkins, Philadelphia, PA
5. Blanchard CM, Courneya KS, Rodgers WM et al (2002) Determinants of exercise intention and behavior in survivors of breast and prostate cancer: an application of the theory of planned behavior. Cancer Nurs 25:88–95
6. Blanchard CM, Rodgers WM, Courneya KS et al (2002) Self-efficacy and mood in cardiac rehabilitation: should gender be considered? Behav Med 27:149–160
7. Cella D, Paul D, Yount S et al (2003) What are the most important symptom targets when treating advanced cancer? A survey of providers in the National Comprehensive Cancer Network (NCCN). Cancer Invest 21:526–535
8. Courneya KS (2004) Sport psychology: theory, applications and issues. Wiley & Sons Australia, Queensland, Australia
9. Courneya KS, Friedenreich CM (1997) Determinants of exercise during colorectal cancer treatment: an application of the theory of planned behavior. Oncol Nurs Forum 24:1715–1723
10. Courneya KS, Friedenreich CM (1999) Utility of the theory of planned behavior for understanding exercise during breast cancer treatment. Psychooncology 8:112–122

11. Courneya KS, Blanchard CM, Laing DM (2001) Exercise adherence in breast cancer survivors training for a dragon boat race competition: a preliminary investigation. Psychooncology 10:444–452
12. Courneya KS, Friedenreich CM, Arthur K et al (1999) Understanding exercise motivation in colorectal cancer patients: a prospective study using the theory of planned behavior. Rehabil Psychol 44:68–84
13. Courneya KS, Friedenreich CM, Quinney HA et al (2004) Predictors of adherence and contamination in a randomized trial of exercise in colorectal cancer survivors. Psychooncology 13:857–866
14. Courneya KS, Friedenreich CM, Quinney HA et al (2005) A longitudinal study of exercise barriers in colorectal cancer survivors participating in a randomized controlled trial. Ann Behav Med 29:147–153
15. Courneya KS, Friedenreich CM, Sela RA et al (2002) Correlates of adherence and contamination in a randomized controlled trial of exercise in cancer survivors: an application of the theory of planned behavior and the five factor model of personality. Ann Behav Med 24:257–268
16. Courneya KS, Friedenreich CM, Sela RA et al (2004) Exercise motivation and adherence in cancer survivors after participation in a randomized controlled trial: an attribution theory perspective. Int J Behav Med 11:8–17
17. Courneya KS, Keats MR, Turner R (2000) Social cognitive determinants of hospital-based exercise in cancer patients following high-dose chemotherapy and bone marrow transplantation. Int J Behav Med 7:189–203
18. Courneya KS, Segal RJ, Reid RD et al (2004) Three independent factors predicted adherence in a randomized controlled trial of resistance exercise training among prostate cancer survivors. J Clin Epidemiol 57:571–579
19. De Boer MF, McCormick LK, Pruyn JF et al (1999) Physical and psychosocial correlates of head and neck cancer: a review of the literature. Otolaryngol Head Neck Surg 120:427–436
20. Duffy SA, Ronis DL, Valenstein M et al (2007) Depressive symptoms, smoking, drinking, and quality of life among head and neck cancer patients. Psychosomatics 48:142–148
21. El-Deiry M, Funk GF, Nalwa S et al (2005) Long-term quality of life for surgical and nonsurgical treatment of head and neck cancer. Arch Otolaryngol Head Neck Surg 131:879–885
22. Fialka-Moser V, Crevenna R, Korpan M et al (2003) Cancer rehabilitation: particularly with aspects on physical impairments. J Rehabil Med 35:153–162
23. Godin G, Shephard RJ (1985) A simple method to assess exercise behavior in the community. Can J Appl Sport Sci 10:141–146
24. Irwin ML, Ainsworth BE (2004) Physical activity interventions following cancer diagnosis: methodologic challenges to delivery and assessment. Cancer Invest 22:30–50
25. McAuley E, Elavsky S, Jerome GJ et al (2005) Physical activity-related well-being in older adults: social cognitive influences. Psychol Aging 20:295–302
26. McNeely ML, Parliament M, Courneya KS et al (2004) A pilot study of a randomized controlled trial to evaluate the effects of progressive resistance exercise training on shoulder dysfunction caused by spinal accessory neurapraxia/neurectomy in head and neck cancer survivors. Head Neck 26:518–530
27. Osborne JW, Overbay A (2004) The power of outliers (and why researchers should always check them). Pract Assess, Res Eval 9: Online
28. Ott C, Fulton MK (2005) Osteoporosis risk and interest in strength training in men receiving androgen ablation therapy for locally advanced prostate cancer. J Am Acad Nurse Pract 17:113–122
29. Pinto BM, Maruyama NC, Clark MM et al (2002) Motivation to modify lifestyle risk behaviors in women treated for breast cancer. Mayo Clin Proc 77:122–129
30. Radloff LS (1977) The CES-D Scale: A self-report depression scale for research in the general population. Appl Psychol Meas 1:385–401
31. Rhodes RE, Courneya KS, Bobick TM (2001) Personality and exercise participation across the breast cancer experience. Psychooncology 10:380–388
32. Rogers LQ, Courneya KS, Robbins KT et al (2006) Physical activity and quality of life in head and neck cancer survivors. Support Care Cancer 14:1012–1019
33. Rogers LQ, Courneya KS, Verhulst S et al (2006) Exercise barrier and task self-efficacy in breast cancer patients during treatment. Support Care Cancer 14:84–90
34. Rogers LQ, McAuley E, Courneya KS et al (2007) Racial differences in physical activity associations among primary care patients. Ethn Dis (in press)
35. Rogers LQ, Shah P, Dunnington G et al (2005) Social cognitive theory and physical activity during breast cancer treatment. Oncol Nurs Forum 32:807–815
36. Sallis JF, Hovell MF, Hofstetter CR et al (1989) A multivariate study of determinants of vigorous exercise in a community sample. Prev Med 18:20–34
37. Schmitz KH, Holtzman J, Courneya KS et al (2005) Controlled physical activity trials in cancer survivors: a systematic review and meta-analysis. Cancer Epidemiol Biomarkers Prev 14:1588–1595
38. Terrell JE, Ronis DL, Fowler KE et al (2004) Clinical predictors of quality of life in patients with head and neck cancer. Arch Otolaryngol Head Neck Surg 130:401–408
39. Wilson PM, Blanchard CM, Nehl E et al (2006) Predicting physical activity and outcome expectations in cancer survivors: an application of Self-Determination Theory. Psychooncology 15:567–578