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Motivational readiness for physical activity and quality of life in long-term lung cancer survivors

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Summary

Little is known about the relationship between motivational readiness for physical activity and quality of life (QOL) in long-term lung cancer survivors. Long-term survivors are considered those who are living 5 years or more following a cancer diagnosis. This project examined the relationship between a self-report measure of motivational readiness for physical activity and QOL in a sample of 272 long-term lung cancer survivors. Participants (54% male, average age 70 years old) completed the mailed survey an average of 6 years after being diagnosed with lung cancer. Survey measures included the stage of change for physical activity and a set of single item QOL and symptom scales. Thirty-seven percent of respondents reported they currently engaged in regular physical activity (a total of 30 min or more per day, at least 5 days per week). Kruskal–Wallis tests revealed that those who reported engaging in regular physical activity reported a better overall QOL, better QOL on all five domains of QOL functioning (mental, physical, social, emotional, and spiritual), and fewer symptoms compared to those with a sedentary lifestyle. Physical activity level may have important QOL and symptom management benefits for long-term lung cancer survivors.

Keywords

Exercise; Quality of life; Survivor; Physical activity; Symptom control; Motivational readiness; Stage of change

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Conflict of interest
None.

1. Introduction

Lung cancer is a major health problem in this country. The American Cancer Society estimates that there will be 213,380 new cases in 2007, and lung cancer is the leading cause of cancer death in this country for both men and women (ACS). However, little is known about the quality of life (QOL) status of long-term lung cancer survivors who are beyond 5 years post-diagnosis [1]. QOL can be defined as a multidimensional construct that incorporates the physical, mental, emotional, social, and spiritual functioning of the individual [2]. Previous research has demonstrated that health behaviors can greatly impact the QOL of cancer survivors. For example, persistent cigarette smoking after lung cancer diagnosis, exposure to second hand smoke, alcohol use, and being overweight all reduce the QOL [3] of lung cancer survivors. Previous research has also shown that depression is associated with poor QOL [4], and that respiratory symptom burden contributes to diminished QOL in lung cancer survivors [5]. While several studies have shown a relationship between symptoms, QOL and physical fitness in lung cancer patients [6,7] how physical activity level impacts the QOL of long-term lung cancer survivors is not well understood. The further examination of factors associated with QOL in this population is important since lung cancer survivors report lower QOL relative to other cancer survivors [1,8,9].

The physical and mental health benefits of physical activity in the general population have been well documented [10,11]. A growing literature also demonstrates numerous physical and mental benefits of physical activity for the cancer survivor. For instance, physically active breast cancer survivors report less confusion, more vigor, greater social support, and higher QOL compared to sedentary breast cancer survivors [12,13]. A more recent study also reported breast cancer survivors who had improved cardio-respiratory fitness from regular exercise also reported higher QOL [14]. Participation in a cycling program [15] or in a walking program can reduce levels of anxiety and fatigue in cancer patients [16–18]. Participation in a structured exercise program has been shown to improve the QOL of women with breast cancer [19,20] and men with prostate cancer [21]. Motivational readiness, or stage of change, for physical activity level has been shown to be predictive of exercise change in cardiac rehabilitation patients [22], in college students [23], and has been utilized in breast cancer survivors [24]. To date, we were unable to find any published studies of physical activity level in long-term lung cancer survivors. Therefore, how motivational readiness for physical activity impacts the QOL of long-term lung cancer survivors is not well understood.

To examine the relationship between motivational readiness for physical activity and QOL in long-term lung cancer survivors, the stage of change for physical activity level questionnaire was utilized [25]. According to the Trans-theoretical Model of Behavior Change [26] an individual's motivational readiness for behavior change will vary across time, and will be impacted by his or her experiences, self-efficacy or confidence level, and personal perceived gains and losses of engaging in the behavior.

2. Patients and methods

Participants in this study were enrolled into the Epidemiology and Genetics of Lung Cancer Research Program at Mayo Clinic Rochester [27]. Since 1 January 1997, all patients at our institution who were diagnosed with lung cancer have been offered participation in a prospective cohort study. All patients provided informed consent and the study has been approved by our Institutional Review Board on an annual basis. Our participation rate has been over 90% of eligible lung cancer patients [27,28]. Specifics on ongoing patient recruitment, baseline data retrieval, and patient follow-up have been previously described

and are again briefly summarized below. Upon enrollment into the MCLCC, all patients complete baseline health-related surveys at 6 and 12 months, and then they were then mailed similar surveys on an annual basis. In addition, trained study personnel reviewed their medical records at enrollment. Information on demographics, previous or concurrent illnesses, tobacco usage and exposure, tumor staging, nutritional habits, and cancer therapy were abstracted and entered into the database. The Revised TNM Staging System of non-small cell lung cancer was utilized [29]. Of note, all cancer treatment decisions were deferred to the individual patient's healthcare providers, and enrollment into the MCLCC did not in any way influence clinical decision-making.

Participants were long-term lung cancer survivors who are living at least 5 years from diagnosis and had reported physical activity level and QOL data. Their most recently completed forms were used in the analysis when more than one questionnaire was completed over time. Summary measures included means and standard deviations. Differences between groups were tested with two-sided Kruskal–Wallis tests with a 0.05 statistical significance level.

3. Measures

3.1. Smoking status

Those who reported smoking less than 100 cigarettes in their lifetime were classified as "never smokers." Those who had not smoked a cigarette in the past 30 days were classified as "former smokers", and those who reported smoking any cigarette in the past 30 days were classified as "current smokers" [30].

3.2. Stage of change for physical activity level

This four-item measure asks subjects about their current level of physical activity and about their intention to become more physically active [25,31,32]. Respondents were then classified according to their readiness for physical activity level: (1) **precontemplation**, no current structured physical activity, and no intention to increase in the next 6 months; (2) **contemplation**, are not currently physically active, but plan to start in the next 6 months; (3) **preparation**, some participation in physical activity, but not meeting recommended level of activity; (4) **action**, those who are physically active; and (5) **maintenance**, those who have been physically active for at least 6 months [12,22,23,25,31,32]. This measure has been utilized in cancer patients [33] and in our previous research we have found that this measure can be successfully completed by study participants when using mailed surveys [22,23,33,34].

3.3. Linear analogue self-assessment (LASA)

LASA items are a series of individual items that ask individuals to rate their level of functioning on a 0–10-point scale [35]. The six QOL LASA items asked participants to circle the number that best reflects their response from 0 (as bad as it can be) to 10 (as good as it can be) on: (1) mental (intellectual) well-being; (2) physical well-being; (3) emotional well-being; (4) level of social activity; (5) spiritual well-being; and (6) overall quality of life. The LASA has been validated for use in cancer patients with Cronbach's alpha ranging from 0.83 to 0.88, and the LASA items are correlated to ECOG performance score, MMSE Score, POMS and FACT-Br [36]. For the symptom control items, participants were asked to rate: (1) frequency of pain; (2) severity of pain; (3) dry coughing; (4) coughing with phlegm; (5) shortness of breath; and (6) level of fatigue. Participants were asked to rate these symptoms from 0 (none) to 10 (as bad as it can be). Normative data for the overall QOL LASA item range from an average of 4.4 for medical students to 8.0 for healthy individuals with a standard deviation of two points on the scale [36,37]. The LASA has been utilized in newly

diagnosed high grade glioma patients [36,38] and patients with advanced stage cancer [39–43] Clinically meaningful differences between groups have been defined as half the standard deviation (1 point on the 0–10 point scale) [44].

4. Results

Two hundred seventy-two patients had survived at least 5 years from diagnosis and had completed motivational readiness for physical activity, QOL, and symptom questionnaires. Patients were an average of 64 years old at the time of their lung cancer diagnosis. See Table 1 for demographic data including race, gender, marital status and diagnosis. The QOL and symptom questionnaires were completed an average of 5 years from diagnosis. Patients were mostly married, white males. The majority of participants had early stage (75%) NSCLC (96%) and were former smokers (77%). Thirty-seven percent (n = 100) of the patients were classified as in the maintenance stage for physical activity level, 17% (n = 47) were in the preparation stage, 22% (n = 60) were in the contemplation stage, and 25% (n = 65) were in the precontemplation stage.

Utilizing the two-sided Kruskal–Wallis test to compare groups, results indicated that higher levels of motivational readiness for physical activity were significantly associated with higher levels of all the QOL endpoints. The differences between ‘preparation’ and ‘maintenance’ were small, patients in the contemplation group were slightly worse than those two groups, and patients in the precontemplation phase were much worse than patients in the other groups. Additional results also indicated levels of motivational readiness for physical activity were significantly associated with lower levels of all symptoms except frequency of dry coughing. See Table 2 for QOL means by motivational readiness for physical activity level and Table 3 for symptom ratings by level of motivational readiness for physical activity.

Table 2 shows mean QOL scores by each stage of change in physical activity level. It shows the increasing mean QOL scores by increasing stages of change in physical activity level. Table 3 shows the trend in decreasing mean symptom scores by increasing stage of physical activity level. We also examined the relationship between performance score and the QOL and symptom scores, and PS was significantly associated with all of the QOL and symptom scores ($p < 0.001$). Since PS is a measure of physical ability, it could have been a confounding factor in these analyses. To adjust for this possible confounding effect, linear regression models were fit for each of the endpoints using maintenance as an indicator variable and adjusting for PS. After adjusting for PS, maintenance level was still significant for overall physical well-being ($p = 0.0009$), level of social activity ($p = 0.0019$), and level of support from family and friends ($p = 0.0014$). It was also close to being significant for spiritual well being ($p = 0.07$) and fatigue ($p = 0.06$).

5. Discussion

The major finding of this study of long-term lung cancer survivors was that those who were in the maintenance stage of change for physical activity, namely those who were physically active on a regular basis, reported having significantly better QOL relative to sedentary survivors. Differences were observed on overall QOL and on all five domains of QOL. Specifically, physically active long-term lung cancer survivors reported having better overall, mental, physical, emotional, social, and spiritual QOL compared to sedentary survivors. Additionally, across the board, as stage of change for physical activity increased, so did QOL. There was no exception to this strong association between motivational readiness for physical activity level and QOL. Previous research has demonstrated that QOL issues are important for the cancer survivor [45,46]. In other cancers survivor populations,

physical activity has been associated with higher QOL. Therefore, our results suggest it is plausible that adopting a physically active lifestyle can enhance the QOL of long-term lung cancer survivors.

Several investigators have begun to explore the feasibility of formal exercise programs for lung cancer survivors. For example, Dr. Jones and colleagues recently found that 46 patients with inoperable non-small lung cancer could safely undergo cardiopulmonary exercise testing, which will be important for screening these patients for contraindications to exercise training [47]. In a non-randomized case study, investigators found that 25 patients who had undergone lung resection for non-small cell lung cancer could participate in a 26-day inpatient pulmonary rehabilitation program [48]. Subjects participated in five daily 3-h supervised sessions, with a goal of achieving 30 min of continuous cycling at 70–80% of maximal work load. Subjects demonstrated improvements in dyspnoea on exertion, pH, and 6MWD. The authors conclude that participation in an early rehabilitative program prevents deterioration and enhances the recovery of surgical patients resected for NSCLC. The results of our study suggest that exercise may also have QOL benefits for the long-term lung cancer survivor. Therefore, future research should examine how to provide a safe, feasible and effective exercise intervention that is tailored to the long-term lung cancer survivor's level of motivational readiness for physical activity.

Physically active long-term lung cancer survivors additionally reported having less difficulty with symptom control. Physically active survivors reported having a lower frequency of pain, less severity of pain, less frequency of coughing with phlegm, less shortness of breath, and less fatigue compared to sedentary survivors. Again, as stage of change for physical activity increased, symptoms reduced. The pattern of consistency was again striking. Although it is possible to consider that those with fewer symptoms have less disability and are therefore able to exercise more, it is also plausible that physical activity can be an important strategy for improving symptom control. We also found that higher performance score was associated with higher QOL and symptom score. Again suggesting a connection between activity level and QOL. Clearly our findings do not demonstrate a causal relationship, but perhaps exercise participation may help reduce the burden of symptoms experienced by long-term lung cancer survivors.

In a study of 129 lung cancer patients, pre-diagnosis QOL was the most significant predictor of length of survival, even after adjusting for prognostic factors [45]. Lung cancer survivors do not experience the same length of life and QOL as their age-matched peers or other cancer survivors [1]. There is clearly a need to identify and intervene with subgroups of long-term cancer survivors who are at an elevated risk of diminished QOL. Because lung cancer is one of the most prevalent cancers world-wide, and QOL has been shown to be lowest in lung cancer patients relative to other cancer patients [8], any information related to improving QOL is of great value.

Strengths of this study included a large sample of lung cancer survivors who were more than 5 years past lung cancer diagnosis. This study, however, has several limitations. The sample was primarily Caucasian, and a self-report measure of motivational readiness for physical activity was utilized. Furthermore, since physical activity level was not directly measured, nor was activity level monitored over time, the causal nature of the relationship between QOL and physical activity level is not known. It is possible that survivors with more symptoms were unable to be physically active. However, many studies in other patient populations have found that becoming physically active greatly reduces symptoms and improves QOL. Future longitudinal studies using validated measures of physical activity level are needed. Other variables that may impact physical activity level, such as exercise self-efficacy, should also be included in future research.

The physical and mental health benefits of exercise have been well established in the general population and in numerous patient populations. These findings support the growing literature that demonstrates an association of QOL, symptom management, and physical activity level in long-term cancer survivors [43]. Clearly, further investigation that examines the association of physical activity and QOL in long-term lung cancer survivors is warranted.

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Table 1

Demographics and clinical characteristics of 272 long-term lung cancer survivors

Age at lung cancer diagnosis, mean ± S.D.	64 years ± 9.7 (range 21–89 years)
Age at follow-up, mean ± S.D.	71 years ± 9.9 (range 27–95 years)
Gender (%)	Female 46%
	Male 54%
Racial group (%)	Caucasian 91%
	Hispanic 2%
	Alaska native/native American 7%
Marital status (%)	Single 4%
	Married 74%
	Divorced/widowed 22%
Cigarette smoking status at follow-up (%)	Current 6%
	Former 77%
	Never 17%
Histology (%)	SCLC 4%
	NSCLC 96%
Pack years	51 years ± 31.9 (range 1–168)
Chemotherapy	25%
Radiation therapy	24%
Surgery	89%

SCLC: small cell lung cancer; NSCLC: non-small cell lung cancer.

Table 2

Stage of change for physical activity level and mean values on the five domains of QOL among 272 lung cancer survivors

QOL domain	Stage of change					
	Precontemplation (*N* = 65)	**Contemplation (*N* = 60)**	**Preparation (*N* = 47)**	**Maintenance (*N* = 100)**	**Total (*N* = 272)**	***p*-Value**
Mental well-being	6.8	7.8	8.3	8.4	7.9	<0.0001
Physical well-being	5.3	6.4	7.5	7.9	6.9	<0.0001
Emotional well-being	6.7	7.4	8.2	8.3	7.7	<0.0001
Level of social activity	5.3	6.6	7.9	8.3	7.1	<0.0001
Spiritual well-being	7.0	7.9	8.4	8.7	8.0	<0.0001
Overall QOL	5.9	7.3	8.1	8.1	7.4	<0.0001

All endpoints are on a scale from 0 to 10 with 10 being the best possible score.

Table 3

Stage of change for physical activity level and mean levels of symptom control among 272 lung cancer survivors

QOL domain	Stage of change					
	Precontemplation (*N* = 65)	Contemplation (*N* = 60)	Preparation (*N* = 47)	Maintenance (*N* = 100)	Total (*N* = 272)	*p*-Value
Frequency of pain	4.6	3.3	2.9	2.6	3.3	0.0005
Severity of pain	4.1	2.9	2.4	2.2	2.8	0.0001
Frequency of dry coughing	3.3	2.5	2.1	2.3	2.6	0.10
Frequency of coughing with phlegm	4.0	2.4	2.2	2.0	2.6	0.001
Shortness of breath	6.0	4.7	3.6	3.6	4.4	<0.0001
Level of fatigue	6.2	4.8	4.4	3.8	4.7	<0.0001

All endpoints are on a scale from 0 to 10 with 10 being the best possible score.