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An Active Lifestyle Is Associated With Reduced Dyspnea and Greater Life Satisfaction in Spinal Cord Injury

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Abstract

Objective—Assess relationships between measures of activity with dyspnea and satisfaction with life in chronic spinal cord injury (SCI)

Design—Cross-sectional survey

Setting—Five SCI centers

Participants—Between 7/2012–3/2015, 347 subjects with traumatic SCI ≥ 1 year after injury who used a manual wheelchair or walked with or without an assistive device reported hours spent away from home or yard on the previous 3 days, sports participation, and planned exercise.

Interventions—Not applicable

Main Outcome Measures—Satisfaction With Life Scale (SWLS). Dyspnea was defined as shortness of breath when hurrying on the level or going up a slight hill, or going slower than people the same age on the level because of breathlessness, or stopping for breath when going at your own pace, or after about 100 yards (or after a few minutes) on the level.

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Results—Dyspnea prevalence was 30.0%. Adjusting for asthma or COPD, mobility mode, race, and season, there was a significant linear trend between greater SWLS and quartiles of time spent away from the home or yard (p=0.0002). SWLS was greater if participating in organized sports (p=0.010), although not significantly with planned exercise (p=0.093). Planned exercise was associated with a reduced odds ratio (OR) of dyspnea (0.57; 95% CI=0.34, 0.95; p=0.032), although not with organized sports (p=0.265). Dyspnea was not significantly increased in persons who spent the fewest hours outside their home or yard (≤7 hours) compared to the most time (>23 hours) (OR=1.69; 95%CI=0.83, 3.44, p=0.145).

Conclusion—In SCI, a planned exercise program is associated with less dyspnea. An active lifestyle characterized by greater time spent away from home or yard and sports participation is associated with greater SWLS.

Keywords

spinal cord injuries; exercise; quality of life

In chronic spinal cord injury (SCI), muscular weakness and paralysis result in a predisposition to a sedentary lifestyle, limiting full participation in daily activities, exercise programs, and sports. Persons with SCI also commonly report dyspnea, defined by an American Thoracic Society (ATS) working group as “a subjective experience of breathing discomfort”[1] while conducting daily activities[2–5]. Whereas physical activity refers to the typical daily level of activity for a person, exercise capacity reflects a person’s ability to perform a specific task, as reflected by exercising or by participation in sports. Previous studies in SCI have primarily focused on activities that reflect exercise capacity, such as participation in specific training programs or in sports[6]. Although most of these studies included few subjects, positive associations between measures of physical activity with quality of life were reported but did not include an assessment of dyspnea.

We previously reported that dyspnea while talking, eating, or dressing in persons with chronic SCI is associated with a reduced functional quality of life score and a lower overall health-related quality of life[7]. In a previous report, we used participation in SCI wheelchair athletics as a working definition of exercise[5]. We found that wheelchair athletes were less likely to report breathlessness than non-athletes, a finding that was independent of reduced pulmonary function. This finding is consistent with the effects of exercise on reducing dyspnea in persons with pulmonary impairment[8, 9] and suggests that regular physical activity may have effects on whether a person with SCI experiences dyspnea during their daily lives.

We recruited a large SCI cohort to assess relationships with exercise and participation in sports, and with time spent outside the home as a measure of physical activity. We hypothesized that planned exercise, participation in sports, and more time spent outside the home are associated with less dyspnea and greater Satisfaction with Life[10], a global measure of quality of life.

Methods

Population

Between 7/2012 and 3/2015, 468 adult subjects with traumatic SCI one or more years since injury were recruited from 5 SCI referral centers in the United States. These Centers included the Spaulding-Harvard SCI Model System, including the VA Boston Healthcare System, Boston, Massachusetts; University of Louisville-Frazier Rehabilitation and Neuroscience SCI Model System, Louisville, Kentucky; Rancho-Los Amigos National Rehabilitation Center, Downey, California; and University of Pittsburgh Model Center on Spinal Cord Injury, Pittsburgh, Pennsylvania. The subjects were a convenience sample of persons attending SCI programs including (1) out-patient clinics; (2) participants in the US Model Systems program, a questionnaire-based observational study assessing the natural history of SCI (see https://www.nscisc.uab.edu/sci-model-systems.aspx); (3) community based SCI-based activities, such as wellness, exercise, and sports; and (4) at VA Boston, participants in a community based longitudinal health study[11, 12]. The Institutional Review Boards at each institution approved the protocol and informed consent was obtained from each participating subject.

Measures

Standardized questionnaires were completed by interview (89%) or were self-completed (11%). These included the Satisfaction With Life Scale (SWLS), scored by summing the response (1–7 on a Likert scale) to each of 5 statements[10] and questions based on the ATS respiratory health questionnaire[13] inquiring about doctor-diagnosed heart disease, chronic respiratory disease (COPD or asthma), cough, wheeze and breathlessness. The breathlessness questions, modified for use in SCI, included: a. Are you troubled by shortness of breath when hurrying on the level or going up a slight hill?; b. Do you have to go slower than people of your age on the level because of breathlessness?; c. Do you ever have to stop for breath when going at your own pace on the level? ; d. Do you ever have to stop for breath after going about 100 yards (or after a few minutes) on the level. A 3-day activity recall was completed based on the Physical Activity Recall Assessment for People with SCI[14, 15]. Persons reported how many hours spent away from their home or yard on each of the past 3 days. This approach is commonly used to assess leisure time physical activity in persons without SCI[16]. Persons were also asked “do you participate in any organized sports” and asked to indicate up to 3 sports, time in a typical week in a planned exercise program, and “what best describes how you usually get around? “with usually defined as more than half the time, with choices of a hand-propelled or motorized wheelchair, or walking with or without a crutch, cane or similar assistive device.

Analysis

Dyspnea was defined as a positive answer to any breathlessness questions (a–d). Chronic cough was defined as cough on most days for 3 consecutive months or more during the year, and any wheeze defined as wheeze or whistling in the chest with a cold, apart from colds, or on most days or nights. Body mass index (BMI) was calculated from reported height and weight and season was based on date of questionnaire completion. Logistic regression was used to assess associations with dyspnea (PROC LOGISTIC, SAS 9.2; SAS Institute Inc.,

Cary, NC) and general linear models (Proc GLM) was used to assess associations with SWLS score. SWLS score linear trend was assessed using the median value of each quartile of hours away from home or yard. T-tests, general linear methods, and Chi-square tests were used to compare means and proportions and the Wilcoxon Rank sum test used for skewed distributions. Variables significant at the $p<0.10$ level were retained in all multivariable models. Sample size calculations were based on Wien et al[5] where 27% persons using manual wheelchairs reported participation in a sport. Of these persons, 16% reported dyspnea compared to 36% who were not taking part in sports. We assumed we could detect similar differences at 80% power and $\alpha = 0.05$, assuming a 27% participation rate in a sports or exercise program. We projected an enrollment of 560 persons based on the SCI Model System database[17] where 40% used manual wheelchairs (224 subjects estimated). Since dyspnea assessment was based on activities related to mobility, motorized wheelchair users were excluded from analysis.

Results

We recruited 464 subjects, including 357 who walked with or without an assistive device or used a manual wheelchair. There were 347 who had complete data, including 261 who used a manual wheelchair. The most common report of dyspnea was when hurrying on the level or going up a slight hill (n=85, 24.5%). Thirty-three persons (9.5%) reported going slower than people of their own age on the level because of breathlessness; 44 (12.7%) reported stopping for breath when going at their own pace on the level; and 50 (14.4%) reported stopping for breath after going about 100 yards (or after a few minutes) on the level. The prevalence of answering yes to at least one of the dyspnea questions was 30.0 % (Table 1). There was no difference in age, injury duration, BMI, gender, or heart disease treated in the past 10 years between persons with and without dyspnea (Table 1). Persons with dyspnea were significantly more likely to have asthma, COPD, or either asthma or COPD (defined as chronic respiratory disease), report wheeze or chronic cough, be non-Caucasian, and walk with an assistive device. More persons with dyspnea were former smokers (p=0.075). Dyspnea was more likely to be reported by participants who completed questionnaires in the fall compared to the winter, but inclusion of a weekend day in the 3-day report of hours away from home or yard did not alter the prevalence of dyspnea (Table 1). There was no significant difference in the prevalence of dyspnea between persons with cervical motor complete & AIS C SCI or high thoracic motor complete & AIS C SCI with AIS D SCI (Table 1). There was also no significant relationship between SWLS score with age, injury duration, BMI, gender, wheeze or chronic cough, asthma, COPD, or chronic respiratory disease, heart disease, season, inclusion of a weekend day in the report of hours away from home or yard, SCI level/severity, or mobility category. SWLS score was reduced among former smokers compared to never smokers (p=0.096) and among non-Caucasians (p=0.070) (Table 1).

Overall, the distribution of hours away from home or yard was similar comparing all walkers and manual wheelchair users (Table 2). The percentage who engaged in planned exercise was high, ranging from 61.4% in persons who walked unassisted to 72.8% among manual wheelchair users, and without significant difference comparing all walkers and wheelchair users. Planned exercise in a typical week was not limited to physical therapy or stretching

exercises, as nearly all persons also reported an additional exercise activity. Manual wheelchair users spent significantly more hours in planned exercise activities compared to all persons who walk. Persons who used a manual wheelchair were also more likely to report participation in organized sports (24.5%) compared to all walkers (9.3%). A large number of sports were reported, including basketball, swimming, hand cycling, hunting, archery, shooting, rowing, fishing, golf, canoeing/kayaking, body building/weight lifting, tennis, sailing, skiing, rugby, bowling, billiards, and sled hockey. There was no significant difference in the prevalence of chronic respiratory disease based on hours away from the home or yard, planned exercise, or participation in organized sports (Table 3).

Persons who spent the fewest hours outside their home or yard (≤7 hours in the previous 3 days, a median of 4.0 hours) were more likely to report dyspnea compared to persons who spent the most time away from their home or yard (>23 hours, median of 30 hours, Table 4, OR=2.12; 95% CI =1.08, 4.17; p=0.029). In successive multivariable models adjusting for mobility mode and chronic respiratory disease, race, and then season, the odds ratio was no longer significantly elevated (1.69; 95%CI=0.83, 3.44; p=0.145) However, there was a significant linear trend between a greater SWLS and more time spent away from the home or yard (Table 5) in models including the same covariates.

Persons who took part in planned exercise activities had a significantly reduced odds ratio of reporting dyspnea in univariate and multivariate models (Table 4). The odds ratio of reporting dyspnea associated with participation in organized sports was not significantly reduced. Life satisfaction was significantly greater in persons who participated in organized sports but not significantly greater in persons who took part in planned exercise (Table 5).

When included in each of the multivariate models in Tables 4 and 5, adjusting for mobility and chronic respiratory disease, cigarette smoking category was not a significant predictor of dyspnea or SWLS (p=0.146 to 0.847). SCI level and severity of injury was available in 335 subjects (97%). Analyses adjusting for level and severity of injury in four groups (Table 1) as an alternative to mobility mode did not change relationships with dyspnea and SWLS.

Discussion

In this chronic SCI cohort we assessed three measures of activity associated with an active lifestyle that included time spent away from one’s home or yard, participation in organized sports, and time in a typical week in a planned exercise program. Participation in a planned exercise program was associated with a significant 43% reduction in the odds ratio of reporting dyspnea. In multivariable models adjusting for mobility mode, history of COPD or asthma, race, and season, the odds ratio for dyspnea in persons with the least time spent away from their home or yard compared to persons with the most time was not significantly elevated. Participation in organized sports also was not significantly associated with less dyspnea. However, more time spent away from one’s home and yard was linearly and positively associated with SWLS and participation in organized sports was also associated with a significantly greater SWLS. Participation in a planned exercise program in a typical week was not significantly associated with an increased SWLS (p=0.093).

As expected, persons with chronic respiratory disease were more likely to report dyspnea and dyspnea was associated with other respiratory symptoms. Persons who walked with an assistive device were more likely to report dyspnea compared to persons who used a manual wheelchair, a finding possibly attributable to the greater energy expenditure associated with an assistive device compared to manual wheelchair propulsion[18]. Since manual wheelchair users in the current cohort included the greatest proportion of persons participating in organized sports and who exercised longer, it is possible that they were more fit than others.

The association between measures of physical activity as assessed by time away from home and yard and sports with SLWS is consistent with previous results focusing on the positive effects of sports and activity programs, although in the current study, report of participation in an exercise program was not significantly associated with greater SWLS. Ravenek et al.[6] noted that in 13 studies in SCI assessing effects of exercise programs and participation in sports using 9 different quality of life outcome measures, positive associations were reported in 12 studies. Most of these were small studies since of the 13 studies, 11 included only 7 to 40 subjects. One of the larger studies included 277 wheelchair users[19] where 51.5% reported being active in sports. These individuals were more likely to be employed, an association that we have also reported[12], and have greater physical, psychological, and social quality of life scores. In a more recent longitudinal study among 130 manual wheelchair users, improvements in exercise capacity assessed by formal exercise testing was associated with concurrent increase in life satisfaction[20]. In 2,183 persons participating in the SCI Model Systems in the late 1990's, persons with a higher CHART mobility score was associated with higher SWLS[21]. The CHART mobility score includes responses to questions asking about nights spent away from the home, incorporating a measure of physical activity similar to our current study. Although the mechanism explaining the association between physical fitness and a higher quality of life is unknown, based on ability to modulate the hypothalamic-pituitary axis, fit persons appear to respond more favorably to stress[22].

Our current findings also extend previous observations regarding dyspnea in persons with chronic SCI. Spungen et al[2] reported a prevalence of breathless that ranged from 58% in 33 persons with C6 to C8 tetraplegia, 43% in 15 persons with T1–T7 paraplegia, and 29% in 17 persons with T8 and below paraplegia in response to the question " Do you ever have breathlessness?". The results reported by Spungen et al[2] are not directly comparable to ours since dyspnea was not assessed based on activities related to mobility. In our previous study in 183 subjects with SCI who used a manual wheelchair, 31% reported breathlessness in response to at least one of the same breathlessness questions used in the current study[5], a prevalence similar to our current study. Adjusting for factors that included obstructive lung disease and pulmonary function, non-athletes were 2.3 times more likely to report dyspnea than athletes. These results are consistent with the results of our current study where persons who reported participation in planned exercise had a reduced odds ratio for dyspnea. In the current study, the question about participation in sports was not specifically directed at activities conducted by wheelchair athletes, potentially explaining the non-significant relationship between organized sports and dyspnea. Our findings are consistent with evidence supporting the benefits of exercise in patients with COPD, another population of persons who experience dyspnea in the setting of pulmonary dysfunction. In COPD, exercise programs result in less dyspnea[9].

Study limitations

It is not possible to extrapolate the rates of physical activity, exercise, and participation in sports reported by this cohort to other populations with SCI. We pursued a recruitment strategy that included persons participating in sports and wellness programs that allowed us to include sufficient numbers of participants to study these activities that contribute to an active lifestyle. Although possibly influenced by self-reporting bias, rates of participation in exercise programs and in sports were high, reflecting this strategy. In addition, in a cross-sectional study, it is not possible to separate cause and effect regarding the relationship between physical activity, exercise, and sports with dyspnea and SWLS since dyspnea may make it more difficult for persons to have an active lifestyle. Although this is a large SCI cohort, we did not achieve our overall recruitment goal, and additional subjects may have resulted in additional findings of statistical significance.

Conclusions

Our results suggest that participation in a planned exercise program by persons with SCI is associated with less dyspnea. An active lifestyle characterized by more time spent away from home or yard and participation in sports is associated with greater satisfaction with life.

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Abbreviations

ATS	American Thoracic Society
BMI	body mass index
CI	confidence interval
COPD	chronic obstructive pulmonary disease
OR	odds ratio
SCI	spinal cord injury
SWLS	satisfaction with life scale

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Table 1

Cohort characteristics

	Dyspnea Yes n=104, 30.0%	**Dyspnea No n=243, 70.0%**	**P**	**Satisfaction With Life Mean (SD)**	**P**
Age, yrs mean (SD)	45.0 (16.2)	44.9 (15.2)	0.943	---	0.778
range	19–83	18–83			
Injury duration, yrs, median; IQR	10.0 (2.5 – 21)	9.0 (2 – 18)	0.349	---	0.691
range	1 – 60	1 – 49			
Gender Male	87 (83.7%)	206 (84.8%)	0.792	23.3 (7.5)	0.179
Female	17 (16.4%	37 (15.2%)		24.8 (7.4)	
Race					
Caucasian	77 (74.0%)	205 (84.4%)	0.024	23.9 (7.4)	0.070
Non-Caucasian	27* (22.1%)	38* (11.1%)		22.1 (7.4)	
	*23 African-American	*27 African-American			
BMI (kg/m^2) mean (SD)	26.5 (5.7)	25.6 (5.5)	0.172	----	0.688
Normal or less	47 (45.2%)	122 (50.2%)	ref	23.5 (7.22)	ref
Overweight	33 (31.7%)	79 (32.5%)	0.764	23.7 (7.91)	0.777
Obese	24 (23.1%)	42 (17.3%)	0.199	23.7 (7.49)	0.853
Cigarette smoker					
Never	42 (40.4%)	115 (47.3%)	ref	24.3 (7.7)	ref
Former	40 (38.5%)	68 (28.0%)	0.075	22.8 (7.4)	0.096
Current	22 (21.2%)	60 (24.7 %)	0.999	23.2 (7.1)	0.257
Mobility[+]					
Manual wheelchair	68 (65.4%)	193 (79.4%)	ref	24.3 (8.2)	ref
Walk with an assistive device	20 (19.2%)	22 (9.1%)	0.004	21.9 (8.9)	0.205
Walk unassisted	16 (15.4%)	28 (11.5%)	0.157	23.7 (7.1)	0.664
Hours away from home/yard in previous 3 days (quartiles)					
≤ 7 (median=4.0)	32 (30.8%)	57 (23.5%)	0.028	21.1 (6.9)	<0.0001
> 7 to ≤ 14 (median=10.9)	27 (26.0%)	59 (24.3%)	0.118	21.6 (7.0)	0.032
>14 to ≤ 23 (median=18.0	27 (26.0%)	59 (24.3%)	0.118	24.2 (7.5)	0.148

	Dyspnea Yes n=104, 30.0%	Dyspnea No n=243, 70.0%	P	Satisfaction With Life Mean (SD)	P
>23 (median=30.0)	18 (17.3%)	68 (28.0%)	ref	25.8 (7.0)	ref
				Yes No	
Participation in organized sports	16 (15.4%)	56 (23.0%)	0.107	25.6 (7.3) 23.0 (7.4)	0.009
Planned exercise in a typical week	65 (62.5%)	182 (74.9%)	0.022	24.0 (7.3) 22.5 (7.8)	0.101
hrs/week, median (interquartile range)	6.3 (3 –9.6)††	5.0 (2.0 – 8.7)	0.175	-------	0.560
Chronic medical conditions and respiratory symptoms				Yes No	
Asthma	24 (23.1%)	28 (11.5%)	0.006	23.5 (8.2) 23.6 (7.4)	0.937
COPD	10 (9.6%)	7 (2.9%)	0.008	23.4 (7.9) 23.6 (7.4)	0.870
Asthma or COPD (Chronic respiratory disease)	28 (26.9%)	34 (14.0%)	0.004	23.4 (7.9) 23.6 (7.4)	0.870
Heart disease treated in past 10 years	13 (12.5%)	18 (7.4%)	0.128	23.7 (7.6) 23.6 (7.5)	0.937
Any wheeze	57 (54.8%)	69 (28.4%)	<0.001	23.3 (7.4) 23.7 (7.5)	0.627
Chronic cough (n=346)	25 (24.0%)	16 (6.6%)	<0.001	23.1 (7.1) 23.6 (7.5)	0.646
Season Fall	41 (39.4%)	69 (28.4%)	0.045	23.2 (8.1)	0.210
Spring	22 (21.2%)	61 (25.1%)	0.560	22.9 (7.3)	0.128
Summer	26 (25.0%)	62 (25.5%)	0.344	23.8 (7.2	0.471
Winter	15 (14.4%)	51 (21.0%)	ref	24.7 (6.9)	ref
Weekend Day Yes	61	147	0.749	23.8 (7.2)	0.500
No	43	96	ref	23.2 (7.9)	
SCI level/severity (n=335)	n=99	n=236			
Cervical motor complete &AIS** C	13 (13.1%)	38 (16.1%)	0.132	23.7 (7.4)	0.963
High thoracic† motor complete &AIS	27 (27.3%)	41 (17.4%)	0.839	23.1 (8.4)	0.708
Other motor complete &AIS C	27 (27.3%)	105 (44.5%)	0.005	24.0 (7.0)	0.735
AIS D	32 (32.3%)	52 (22.0%)	ref	23.6 (8.4)	ref

** AIS=American Spinal Injury Association Impairment Scale;

† T1–T6;

+ more than half the time;

†† 64 persons

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Table 2

Participation in activities and mobility mode. P value indicates comparison of all walkers with manual wheelchair users.

	Walking				P*
Activity	**Walk unassisted n=44**	**Walk with an assistive device n=42**	**All walkers n=86**	**Manual wheelchair n=261**	
Hours away from home/yard in previous 3 days (quartiles)					
≤ 7 (median=4.0)	10 (22.7%)	15 (35.7%)	25 (29.1%)	64 (24.5%)	0.139
> 7 to ≤ 14 (median=10.9)	13 (29.5%)	14 (33.3%)	27 (31.4%)	59 (26.1%)	0.053
>14 to ≤ 23 (median=18.0)	9 (20.5%)	9 (21.4%)	18 (20.9%)	68 (26.1%)	0.702
>23 (median=30.0)	12 (27.3%)	4 (9.5%)	16 (18.6%)	70 (26.8%)	ref
Planned exercise in a typical week	27 (61.4%)	30 (71.4%)	57 (66.4%)	190 (72.8%)	0.247
hrs/week, median (interquartile range)	4.5 [1.5–7.0]	3.5 [1.0–7.9]	3.8 [1.2–7.0]	6.0 [3.0–9.8] †	0.031
Stretching /ROM or other physical therapy ††	18 (40.9%)	22 (52.4%)	40 (46.5%)	116 (44.8%)	0.781
Other exercise activities ††	27 (61.4%)	25 (59.5%)	52 (60.5%)	183 (70.7%)	0.079
Participation in organized sports	5 (11.4%)	3 (7.1%)	8 (9.3%)	64 (24.5%)	0.003

† hrs/week available in 189 persons who used a manual wheelchair.

†† 2 manual wheelchair users did not indicate specific exercise activities

Table 3

Participation in activities and chronic respiratory disease

Activity	No chronic respiratory disease n=285	Chronic respiratory disease n=62	P
Hours away from home/yard in previous 3 days (quartiles)			
≤ 7 (median=4.0)	76 (26.7%)	13 (21.0%)	0.925
> 7 to ≤ 14 (median=10.9)	65 (22.8%)	21 (33.9%)	0.126
>14 to ≤ 23 (median=18.0)	71 (24.9%)	15 (24.2%)	0.680
>23 (median=30.0)	73 (25.6%)	13 (21.0%)	ref
Planned exercise in a typical week	205 (71.9%)	42 (67.7%)	0.509
hrs/week, median (interquartile range)	5.4 [2.0–8.7] †	5.3 [2.3–12.5]	0.627
Stretching /ROM or other physical therapy ††	130 (45.9%)	26 (41.9%)	0.567
Other exercise activities ††	194 (68.6%)	41(66.1%)	0.767
Participation in organized sports	58 (20.4%)	14 (22.6%)	0.696

† hrs/week available in 204 persons without chronic respiratory disease

†† 2 persons without chronic respiratory disease did not indicate specific exercise activities

Table 4

Associations between activity and dyspnea

	Univariable		Includes mobility, chronic respiratory disease		Includes mobility, chronic respiratory disease, race		Includes mobility, chronic respiratory disease, race, season*	
Activity	**Odds ratio 95% CI**	**P**	**Odds ratio 95% CI**	**P**	**Odds ratio 95% CI**	**P**	**Odds ratio 95% CI**	**P**
Model 1								
Hours away from home/yard in previous 3 days (quartiles)								
≤ 7 (median=4.0)	2.12 1.08, 4.17	0.029	1.97 0.98, 3.94	0.057	1.83 0.91,3.69	0.092	1.69 0.83, 3.44	0.145
> 7 to ≤ 14 (median=10.9)	1.73 0.87, 3.45	0.120	1.44 0.71, 2.93	0.320	1.41 0.69 2.89	0.347	1.40 0.68, 2.88	0.360
>14 to ≤ 23 (median=18.0	1.73 0.87, 3.45	0.120	1.65 0.82, 3.34	0.160	1.58 0.78, 3.21	0.204	1.52 0.75, 3.11	0.248
>23 (median=30.0)	Reference		Reference		Reference		Reference	
Model 2								
Planned exercise in a typical week	0.56 0.34, 0.91	0.020	0.57 0.34, 0.94	0.029	0.57 0.34, 0.94	0.029	0.57 0.34, 0.95	0.032
Model 3								
Participation in organized sports	0.61 0.33, 1.12	0.110	0.66 0.35, 1.23	0.192	0.69 0.37, 1.30	0.252	0.69 0.36, 1.32	0.265

*Examples of effects of other covariates on dyspnea (from Model 1): Race OR=1.79 (0.99, 3.22), p=0.054; Chronic respiratory disease: OR=2.02 (1.12, 3.66, p=0.020); Walk with an assistive device OR=2.41 (1.20, 4.82, p=0.013) and Walk without an aide OR=1.59 (0.79, 3.20, p=0.198), ref=manual wheelchair; fall OR=1.91 (0.93, 3.92, p=0.080), spring OR=1.18 (0.54, 2.58, p=0.677), summer OR=1.41 (0.66, 3.02, p=0.382), ref=winter.

Table 5

Associations between activity and satisfaction with life score (SWLS)

	Univariable		Includes mobility mode and chronic respiratory disease		Includes mobility, chronic respiratory disease, race		Includes mobility, chronic respiratory disease, race, season	
Activity	**SWLS 95% CI**	**P**	**SWLS 95% CI**	**P**	**SWLS 95% CI**	**P**	**SWLS 95% CI**	**P**
Model 1								
Hours away from home/yard in previous 3 days (quartiles)								
≤ 7 (median=4.0)	21.1 19.6, 22.6	<0.0001 (trend)	21.0 19.2, 22.8	<0.0001 (trend)	20.7 18.8, 22.5	0.0002 (trend)	20.8 18.9, 22.7	0.0002 (trend)
> 7 to ≤ 14 (median=10.9)	23.3 21.8, 24.9		23.2 21.4, 24.9		22.7 20.9, 24.6		22.7 20.9, 24.5	
>14 to ≤ 23 (median=18.0	24.2 22.6, 25.7		24.0 22.1, 25.8		23.6 21.7, 25.5		23.8 21.8, 27.7	
>23 (median=30.0)	25.8 24.2, 27.3		25.5 23.6, 27.4		25.0 23.0, 27.0		25.1 23.1, 27.1	
Model 2								
Planned exercise in a typical week								
Yes	24.0 23.1, 24.9	0.101	23.7 22.4, 25.1	0.093	23.2 21.7, 24.7	0.093	23.3 21.8, 24.8	0.093
No	22.5 21.1, 24.0		22.2 20.5, 24.0		21.7 19.9, 23.5		21.8 20.0, 23.7	
Model 3								
Participation in organized sports								
Yes	25.6 23.9, 27.3	0.009	25.5 23.5, 27.4	0.011	24.9 22.8, 27.0	0.017	25.2 23.1, 27.3	0.010
No	23.0 22.2, 23.9		22.9 21.8, 24.1		22.5 21.2, 23.8		22.6 21.2, 23.9	

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