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Physical Activity Behavior After a Diagnosis of Lung Cancer Differs Between Countries: An Observational Cohort Study

Jun Ni, MD[1,2], Linda Denehy, PhD, BAppSc(Phty)[3,4], Jian Feng, MMed[1], Liqin Xu, MMed[1], Yi Wu, MMed[1], and Catherine L. Granger, PhD, BPhysio(Hons)[3,4,5]

Abstract

Introduction. Physical activity (PA) is important in lung cancer. *Objectives.* To investigate PA levels and health-related quality of life (HRQoL) of patients with lung cancer in China and compare this to a similar cohort in Australia. *Methods.* Prospective cohort study. 71 patients from China (group CH) and 90 patients from Australia (group AU) with newly diagnosed lung cancer. Questionnaires assessed self-reported PA levels and HRQoL at baseline (diagnosis) and 8 weeks. *Results.* At baseline, group CH were engaged in less overall PA than group AU (Physical Activity Scale for the Elderly [PASE] total score: median [IQR] group CH, 56 [32-59]; group AU, 66 [38-116]; $P < .005$), and less occupational and household activity ($P < .005$). However, at baseline, group CH reported significantly more walking time than group AU (median [IQR]: group CH, 210 [150-315] min/wk; group AU, 55[0-210] min/wk; $P < .0005$). Global HRQoL scores were similar between groups ($P = .038$). Over 8 weeks, group CH increased their overall PA levels ($P < .005$) and walking time ($P = .008$), and HRQoL remained unchanged. The comparison group AU experienced a reduction in PA levels ($P = .02$) and HRQoL ($P < .005$). *Conclusions.* A diagnosis, patients in China were less physically active than those in Australia. Following diagnosis, patients in China increased their PA levels, whereas those in Australia reduced their PA levels. Research is required to explore potential reasons behind differences, and this may inform research/clinical services to facilitate patients with lung cancer to be more active.

Keywords

lung cancer, physical activity, exercise, quality of life, international

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Introduction

Lung cancer is the leading cause of cancer death worldwide and associated with high disease burden, significant symptoms, and poor health-related quality of life (HRQoL).[1] HRQoL is an important marker in lung cancer, particularly given its significance as an independent predictor of survival.[2] Physical activity (PA) plays an important role in alleviating physical and psychological symptoms, minimizing disease burden and maximizing HRQoL in lung cancer.[3-5] Given its importance in improving outcomes, international guidelines recommend that patients engage in at least 150 minutes of moderate-intensity PA per week and avoid sedentary time.[4,6] However, evidence from a number of studies from around the world, including the United States[7,8] and Australia,[9,10] show that the majority of patients do not meet these recommendations even before commencing treatment when symptom burden is generally low. Unfortunately, the evidence for PA and exercise has not effectively translated into the clinical practice worldwide, and exercise programs or PA interventions are not readily available in most countries.[3] Given that the PA clinical practice guidelines are for an international audience[4,6] and the fact that there is significant attention being placed on implementation of this evidence

[1]Affiliated Hospital of Nantong University, Jiangsu, China
[2]Nantong University, Jiangsu, China
[3]The University of Melbourne, Australia
[4]Institute for Breathing and Sleep, Heidelberg, Australia
[5]Royal Melbourne Hospital, Australia

Corresponding Author:
Catherine L. Granger, The University of Melbourne, Level 7 Alan Gilbert Building, 161 Barry Street, Parkville, Victoria 3010, Australia.
Email: catherine.granger@unimelb.edu.au

into practice at present, it is important to understand how PA behavior of patients with lung cancer compares between countries.

China has a large population of patients with lung cancer. It is the most commonly diagnosed type of cancer (651 053 patients in 2011)[11] and is the leading cause of cancer-related death. Consequently, lung cancer is responsible for significant burden to patients, families, and the country. Despite this, little is known about how physically active people with lung cancer in China are before and after treatment, nor how their PA levels compare to patients in other countries, which are more readily studied. This information would be useful to identify patient needs and develop appropriate follow-up health care services in China. Therefore, this study was conducted to expand our understanding of PA levels and HRQoL of people with lung cancer in China. The primary aims were to (1) measure the PA levels of people with newly diagnosed lung cancer in China at the time of diagnosis and (2) determine how PA levels change after diagnosis. Secondary aims were to compare the level of PA and HRQoL of patients with lung cancer in China with that of a similar cohort in Australia. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed to report this study.[12]

Methods

Study Design and Setting

The data in this cross-sectional study are from 2 prospective observation studies: one in China and the other in Australia. This includes a subset of data that were collected between December 2008 and October 2012 in Melbourne, Australia, and previously published (n = 50 of the data set of 90).[9,10] Data from China were collected at the Affiliated Hospital of Nantong University between December 2014 and June 2015. Ethics approval was obtained from all hospitals, and participants or their caregivers provided informed written consent.

Participants

The participants were adults, 18 years or older, with newly diagnosed lung cancer who had not started cancer treatment (surgery, chemotherapy, radiotherapy, or targeted therapy).

Procedures

Consecutive patients were screened prospectively for inclusion into the studies. A researcher screened the list of all new patients presenting to the lung cancer clinic at each hospital on a weekly basis. Participants were recruited any time from time of diagnosis to commencement of treatment for cancer. All patients meeting the eligibility criteria were invited to participate. Participants underwent testing at 2 time points: baseline (close to diagnosis) and 8-week follow-up.

Usual Care

Between time points of testing (baseline and 8 weeks), medical treatments were administered per usual care and included surgery, chemotherapy, and or radiotherapy for patients from Australia, or surgery and/or chemotherapy for patients from China (patients were not recruited from radiotherapy departments in China). In China, medical treatments were delivered according to the guidelines of National Comprehensive Cancer Network, American Society of Clinical Oncology, and Norms of Diagnosing and Treatment in Primary Lung Cancer in China. In the recruitment department in China, patients were only treated with surgery and or chemotherapy, whereas in Australia, patients were recruited from the radiotherapy departments as well. According to usual care, most patients from China were not told of their diagnosis of lung cancer, whereas all patients from Australia were told of their cancer diagnosis. Patients from both countries did not receive formal advice about PA or routine referral to exercise programs.

Outcome Measurement

Self-reported PA levels were measured using the International PA Questionnaire (IPAQ)[13] and the Physical Activity Scale for the Elderly (PASE)[14] in the group of participants recruited from China (group CH). For the group of participants from Australia (group AU), self-reported PA levels were measured using the PASE[14] only (the IPAQ was not performed in group AU because it was not measured in the primary studies contributing data to this analysis).

The IPAQ short form asks participants about PA over the past 7 days.[13] Each domain (vigorous PA, moderate PA, and walking) is given a score that is the mean metabolic equivalent (MET) minutes per week, calculated by multiplying the number of minutes per week of the performed activities by the estimated MET of the task.[13] The total activity score for the IPAQ is the sum of the domain scores.[13] The PASE is a questionnaire that asks the participant to recall their engagement in PA over the previous 7 days. The maximum score attainable is 400, and the average score for elderly individuals is 103 points.[14] Higher scores for both questionnaires represent higher levels of PA. The reliability and validity of Chinese Versions of IPAQ[15] and PASE[16] are established.

HRQoL was assessed in both groups with the European Organisation for the Research and Treatment of Cancer Questionnaire and Lung Cancer Module (EORTC QLQ-C30-LC13).[17,18] The EORTC QLQ-C30 is a core questionnaire designed to assess HRQoL over the full spectrum of

cancer diagnoses and is intended to be used with a tumor-specific questionnaire supplement.[19] The QLQ-LC13 is a supplementary module designed specifically for use in lung cancer.[18] The questionnaire assesses HRQoL over the previous week.[17] It is a widely used tool to assess HRQoL. The EORTC QLQ-C30 has been translated and validated in more than 100 languages.[20] We used the Chinese Mandarin and English versions, and the questionnaire was self-completed by the participant.

Demographic data were collected from participants using a questionnaire designed for the study. This included factors such as their work status, living arrangements, smoking status, and use of walking (gait) aids (Table 1). These questions predominantly involved multiple-choice answers asking the participant to choose the most applicable option (categories as listed in Table 1). Medical data were obtained, including age, sex, type of cancer/treatment, performance status (Eastern Cooperate Oncology Group–Performance Status [ECOG-PS]), and comorbidities (Table 1). Pathological cancer stage was determined in accordance with the TNM classification of the seventh edition of the American Joint Committee for Cancer Staging manual guidelines.[21]

Study Size

A convenience sample of patients was included for this study. There were 71 patients from China (recruited over the 12-month period) and 90 patients from Australia (previously recruited for the prior studies).

Statistical Analysis

All data were analyzed through SPSS Windows Version 22.0 (SPSS, Chicago, IL). Data were assessed for normality using the Kolmogorov-Smirnov statistic. Parametric data are presented as means and SDs, and nonparametric data are presented as medians and interquartile ranges (IQRs). Descriptive statistics were used to summarize baseline characteristics and outcome data by group (group CH and group AU). Groups were compared at baseline using independent *t*-tests, Mann-Whitney *U* tests, and χ^2 test for independence as appropriate for PASE, EORTC QLQ-C30, and demographics. Change over time in outcomes within groups for PA levels measured by the PASE and for HRQoL measured by the EORTC QLQ-C30 were assessed using Wilcoxon Signed Rank tests because these data were nonparametric. Mixed between-within subjects analysis of variance was performed to assess the difference between groups over time. Analyses were first run on the whole sample and then run on the subgroup of participants in both groups (group CH and group AU) who received chemotherapy (alone or after surgery) or targeted therapy (ie, patients were excluded from these analyses if they received radiotherapy). The value of α was set at .025 for all analyses, using Bonferroni correction (0.05/2) to account for the 2 primary statistical comparisons (differences between groups at diagnosis and change over time).

Results

In China, between December 2014 and June 2015, 206 patients with lung cancer were screened, of whom 42% (n = 87) were eligible and approached for inclusion; the remaining 119 patients were ineligible because they had already commenced treatment. The consent rate was 82%. The main reasons for nonconsent were "too distressed/anxious with diagnosis" 13% (n = 11), "too busy" 3% (n = 3), and "treatment to be received in another hospital" 2% (n = 2). In Australia, between December 2008 and October 2012, 90 patients with newly diagnosed lung cancer were recruited to 2 multicenter prospective cohort studies,[9,10] and these data were combined and used for comparison. Overall, 71 participants from China (group CH) and 90 participants from Australia (group AU) were included.

Demographics are reported in Table 1. At baseline, significant differences between groups existed (Table 1) for age (mean difference = 4.2 years; 95% CI = 1.0-7.3; P = .009), social situation (P < .005), employment status (P < .005), residential location (P = .001), smoking status (P < .005), ECOG-PS (P < .005), cancer stage (P < .005), type of treatment (P < .005), and length of hospital stay following surgery (P < .005).

Physical Activity Levels

At baseline, group CH were engaged in less overall PA than group AU, as measured by the PASE total scores (median [IQR]: group CH, 56 [32-59]; group AU, 66 [38-116]; P < .005; Table 2). Group CH also had significantly lower scores for the PASE occupational and household activity domain subscores (Table 2). There was no difference in the leisure-time activities domain subscore between groups (Table 2). Group CH reported significantly more time spent walking per week than group AU at baseline (median [IQR]: group CH, 210 [150-315] min/wk; group AU, 55 [0-210] min/wk; P < .0005; Table 2).

Over 8 weeks, group CH demonstrated a statistically significant increase in overall PA levels as measured by the IPAQ (total MET minutes per week; Table 2). However, there was no change in the PASE scores over time (Table 2). In group CH, the time spent walking increased over 8 weeks, as measured by both the IPAQ and PASE (Table 2). The IPAQ also showed an increase in vigorous PA per week (Table 2). There was no change in sitting time (Table 2). In contrast, over 8 weeks, group AU experienced a statistically significant reduction in overall PA levels as measured by the PASE (Table 2). Given that the IPAQ was not completed in group AU, results from the IPAQ cannot be compared.

Table 1. Demographic Characteristics of Groups at Baseline.

Variable	Group CH: China (n = 71)	Group AU: Australia (n = 90)	*P* Value
Age at baseline, years			
Mean (SD)	61.7 (10.4)	65.9 (9.7)	.009
Gender			
Male, n (%)	37 (58.9%)	52 (73.2%)	.083
Social situation, n (%)			<.005
Home alone independent	1 (1.4%)	11 (22.0%)	
Home with family	66 (93.0%)	33 (66.0%)	
Home with supports	0	5 (10.0%)	
Retirement village	0	1 (2.0%)	
Other	4 (5.6%)	0	
Residential location, n (%)			
Rural	40 (56.3%)	27 (30.0%)	.001
Employment status, n (%)			.001
Working	0	9 (10%)	
Sick leave	18 (25.3%)	17 (18.9%)	
Home duties	5 (7.0%)	6 (6.7%)	
Not employed/retired	48 (67.6%)	56 (62.2%)	
Other	0	3 (3.3%)	
Smoking status, n (%)			<.005
Never smoker	26 (36.6%)	9 (10.0%)	
Ex-smoker	26 (36.6%)	64 (71.1%)	
Current smoker	19 (26.8%)	17 (18.9%)	
Smoking history, pack-years			
Median [IQR]	25.0 [0-40.0]	40.0 [20.0-54.2]	<.005
Use of gait aid at baseline, n (%)			
Yes	8 (8.9%)	0	.156
ECOG-PS, n (%)			<.005
0	2 (2.8%)	36 (40.0%)	
1	57 (80.3%)	34 (37.8%)	
2	9 (12.7%)	17 (18.9%)	
3	2 (2.8%)	3 (3.3%)	
4	1 (1.4%)	0	
Weight loss at diagnosis, n (%)	32 (45.1%)	35 (38.9%)	.529
Histological type, n (%)			.094
Squamous	25 (35.2%)	31 (34.4%)	
Adenocarcinoma	37 (52.1%)	49 (54.4%)	
Large cell	0	4 (4.4%)	
Other	9 (12.7%)	5 (5.5%)	
Missing	0	1 (1.1%)	
Cancer stage, n (%)			<.005
Stage IA	1 (1.4%)	12 (13.3%)	
Stage IB	7 (9.9%)	9 (10.1%)	
Stage IIA	12 (16.9%)	7 (7.9%)	
Stage IIB	2 (2.8%)	3 (3.4%)	
Stage IIIA	6 (8.5%)	31 (34.8%)	
Stage IIIB	1 (1.4%)	16 (18.0%)	
Stage IV	42 (59.2%)	11 (12.4%)	
Missing	0	1	
Medical treatment, n (%)			<.005
Chemotherapy only	30 (42.3%)	5 (5.6%)	
Surgery and chemotherapy	24 (33.8%)	12 (13.3%)	
Surgery only	0	14 (15.6%)	

(continued)

Table 1. (continued)

Variable	Group CH: China (n = 71)	Group AU: Australia (n = 90)	*P* Value
RT only	0	15 (16.6%)	
Chemotherapy and RT	0	42 (46.7%)	
Surgery, chemotherapy, and RT	0	1 (1.1%)	
Erlotinib or gefitinib	9 (12.7%)	0	
No treatment	8 (11.3%)	1 (1.1%)	
Type of surgery, n (%)			.191
Lobectomy	15 (57.7%)	13 (52.0%)	
Wedge resection	5 (19.2%)	6 (24.0%)	
Lobectomy and wedge resection	3 (11.5%)	2 (8.0%)	
Sleeve resection	1 (3.8%)	0	
Segmentectomy	2 (7.7%)	0	
Pneumonectomy	0	4 (16.0%)	
Length of stay postsurgery			
Median [IQR], days	16.0 [14.7-17.2]	8.0 [7.0-13.0]	<.005
Aware of cancer diagnosis, n (%)	23 (32%)	90 (100%)	<.005

Abbreviations: IQR, interquartile range; ECOG-PS, Eastern Cooperate Oncology Group–Performance Status; RT, radiotherapy.

HRQoL and Symptoms

At baseline there was no difference in global HRQoL between groups; however, compared with group AU, group CH had better HRQoL in the questionnaire domains of physical function, role function, emotional function, and cognitive function and lower overall dyspnea and insomnia scores (Table 2), whereas group CH had worse chest pain and appetite loss than group AU (Table 2). Over 8 weeks, group CH did not record a change in global HRQoL, whereas group AU had a reduction in global HRQoL as well as both physical function and role function (Table 2).

Exploratory Subgroup Analyses of Patients Who Received Chemotherapy or Targeted Therapy

There were 63 participants in group CH (mean ± SD age = 62.1 ± 10.6 years; 71% male) and 17 participants in group AU (mean ± SD age = 67.5 ± 6.9 years; 67% male) who received chemotherapy (alone or after surgery) or targeted therapy. This subgroup from China was significantly younger than the subgroup from Australia (mean difference = 5.3 years; 95% CI = 1.1-9.6; $P = .015$); however, there was no statistically significant difference in cancer stage between subgroups (China: stage I, 11%; stage II, 21%; stage III, 11%, stage IV, 57%; Australia: stage I, 22%; stage II, 28%; stage III, 28%; stage IV, 22%; $P = .231$). Full results of the subgroup analyses comparing PA levels and HRQoL between countries and within groups over time are available in the online Supplementary Table 1 (available at http://ict.sagepub.com/supplemental). At baseline, the subgroup from China were engaged in less overall PA than the subgroup from Australia (PASE total scores: median [IQR] group CH, 56 [32-59]; group AU, 70 [46-96]; $P = .007$; Supplementary Table 1), consistent with results from the whole-group analyses (Table 2). The subgroup from China also had a significantly lower score for the PASE occupational activity domain (Supplementary Table 1). There were no differences in the household or leisure-time activity domain scores between countries, or the time spent walking per week (Supplementary Table 1). Over 8 weeks, the subgroup from China increased their overall PA levels as measured by the IPAQ (total MET minutes per week $P < .005$) and increased their time spent walking (Supplementary Table 1), consistent with results from the whole-group analyses (Table 2). There was no change in PASE scores in this subgroup over time (Supplementary Table 1). In the subgroup of patients receiving chemotherapy (alone or after surgery) or targeted therapy from Australia, there were no statistically significant changes in PASE scores over time (Supplementary Table 1), which is different from the whole-group results.

Discussion

We found significant differences in both PA levels and patterns of change in PA after diagnosis of lung cancer between patients recruited from different countries. Over 8 weeks from diagnosis (during a time when patients received medical treatment), patients from China increased their PA levels and maintained their HRQoL, whereas patients from Australia reduced their PA levels and had a reduction in HRQoL over this time. The fact that PA levels increased in the group from China is interesting, given this occurred

Table 2. Comparison of Physical Activity, Symptoms, and HRQoL Between Groups and Over Time.[a]

Measure	Group CH: China					Group AU: Australia					Baseline Comparison, *P* Value
	n	Baseline, Median [IQR]	n	Follow-up, Median [IQR]	*P* Value	n	Baseline, Median [IQR]	n	Follow-up, Median [IQR]	*P* Value	
PASE											
Total score	71	56.0 [32.2-58.6]	62	56.4 [33.6-58.6]	.624	66	65.7 [38.5-116.2]	52	37.5 [25.0-85.0]	.018	<.005
Leisure score	71	8.6 [6.4-10.8]	62	8.6 [7.2-11.4]	.865	66	9.0 [2.0-25.1]	52	8.9 [0.5-15.0]	.446	.760
Household score	71	50.0 [25.0-50.0]	62	50.0 [25.0-50.0]	.317	66	50.0 [25.0-82.0]	52	25.0 [25.0-70.0]	.010	.001
Occupational score	71	0 [0.0-0.0]	62	0 [0.0-0.0]	1.000	66	0 [0.0- 0.0]	52	0 [0.0-0.0]	.735	.005
Walking, min/wk	71	210 [150-315]	62	280 [210-420]	.008	50	55 [0-210]	43	20 [0-150]	.104	<.005
IPAQ[b]											
Total MET, min/wk	71	1386 [655-2586]	62	1686 [693-3546]	<.005						N/A
Vigorous MET min/wk	71	0 [0-0]	62	0 [0-1440]	<.005						N/A
Moderate MET min/wk	71	160 [0-720]	62	240 [0-720]	.196						N/A
Walk, MET min/wk	71	924 [495-1386]	62	1386 [684-1386]	.018						N/A
Sitting, min/wk	71	300 [240-360]	62	300 [180-360]	.058						N/A
EORTC QLQ-C30											
Global QoL	71	66.7 [58.3-83.3]	62	58.3 [66.7-83.3]	1.000	86	66.7 [50.0-83.0]	71	50.0 [41.2-75.0]	<.005	.038
Physical function	71	93.3 [93.3-100.0]	62	93.3 [86.7-100.0]	<.005	86	80.0 [65.0-93.1]	73	66.7 [53.3-86.8]	<.005	<.005
Role function	71	100.0 [83.3-100.0]	62	100.0 [83.3-100.0]	.020	86	75.0 [50.0-100.0]	73	66.7 [33.0-100.0]	.004	<.005
Emotion function	71	100.0 [83.3-100.0]	62	100.0 [83.3-100.0]	.180	86	75.0 [66.7-100.0]	73	83.0 [66.7-100.0]	.569	<.005
Cognitive function	71	100.0 [100.0-100.0]	62	100 [100.0-100.0]	1.000	86	83.3 [66.7-100.0]	73	83.3 [66.7-100.0]	.937	<.005
Social function	71	66.7 [66.7-66.7]	62	66.7 [66.7-83.3]	1.000	86	83.3 [50.0-100.0]	73	67.0 [50.0-100.0]	.742	.294
Fatigue	71	22.2 [22.2-33.3]	62	22.2 [22.2-44.4]	.467	86	33.0 [11.1-47.2]	73	44.4 [22.2-66.7]	<.005	.567
Nausea/vomiting	71	0 [0.0-0.0]	62	0 [0.0-16.7]	.009	86	0 [0.0-16.7]	73	0 [0.0-17.0]	.056	.351
Pain	71	16.7 [16.7-33.3]	62	16.7 [0.0-20.8]	.317	86	0 [0.0-33.3]	73	17.0 [0.0-33.3]	.178	.262
Dyspnea	71	0 [0.0-33.3]	62	0 [0.0-33.3]	.527	86	33.2 [0.0-33.3]	73	33.3 [33.0-66.7]	.014	<.005
Insomnia	71	0 [0.0-33.3]	62	0 [0.0-33.3]	.023	86	33.3 [0.0-33.3]	72	33.2 [0.0-66.7]	.023	.012
Appetite loss	71	33.3 [33.3-33.3]	62	33.3 [0.0-33.3]	.014	86	0 [0.0-33.3]	73	33.0 [0.0-33.3]	.032	<.005
Constipation	71	0 [0.0-66.7]	62	33.3 [0.0-66.7]	.059	86	0 [0.0-33.3]	72	0 [0.0-33.0]	.121	.200
Diarrhea	71	0 [0.0-0.0]	62	0 [0.0-0.0]	1.000	86	0 [0.0-33.3]	73	0 [0.0-0.0]	.164	.005
Financial problems	71	33.3 [33.3-33.3]	62	33.3 [33.3-33.3]	.564	86	0 [0.0-33.3]	73	0 [0.0-33.3]	.008	<.005
LC-13											
Dyspnea	71	11.1 [11.1-11.1]	62	11.1 [11.1-11.1]	.008	83	33.0 [11.1-55.6]	69	33.0 [11.1-55.6]	.103	<.005
Coughing	71	33.3 [0.0-33.3]	62	33.3 [25.0-41.7]	.005	86	33.3 [33.0-66.7]	71	33.3 [33.0-66.7]	.527	.730
Hemoptysis	71	0 [0.0-0.0]	62	0 [0.0-0.0]	1.000	86	0 [0.0-0.0]	71	0 [0.0-0.0]	.677	.400
Sore mouth	71	0 [0.0-0.0]	62	0 [0.0-0.0]	1.000	86	0 [0.0-0.0]	71	0 [0.0-0.0]	.653	<.005
Dysphagia	71	0 [0.0-0.0]	62	0 [0.0-0.0]	1.000	85	0 [0.0-33.3]	71	0 [0.0-33.3]	.775	<.005
Peripheral neuropathy	71	0 [0.0-0.0]	62	0 [0.0-0.0]	.025	86	0 [0.0-33.3]	71	0 [0.0-33.3]	.378	.003
Alopecia	71	0 [0.0-0.0]	62	0 [0.0-0.0]	1.000	86	0 [0.0-0.0]	71	0 [0.0-33.3]	.390	.305
Chest pain	71	33.3 [33.3-33.3]	62	33.3 [25.0-33.3]	.083	86	0 [0.0-33.3]	71	0 [0.0-33.3]	.461	<.005
Arm pain	71	0 [0.0-0.0]	62	0 [0.0-0.0]	.025	86	0 [0.0-33.3]	71	0 [0.0-33.3]	.889	<.005
Other pain	71	0 [0.0-0.0]	62	0 [0.0-0.0]	.046	80	0 [0.0-33.3]	69	0 [0.0-33.3]	.431	<.005

Abbreviations: HRQoL, health-related quality of life, IQR, interquartile range; PASE, Physical Activity Scale for the Elderly; IPAQ; International Physical Activity Questionnaire; MET, metabolic equivalents; EORTC QLQ-C30, European Organization for the Research and Treatment of Cancer; LC-13; lung cancer module.

[a] Higher scores in the PASE, IPAQ, and EORTC HRQoL/function domains represent higher physical activity levels or better status. Lower scores in the EORTC QLQ-C30 symptom categories and LC13 represent fewer symptoms.

[b] IPAQ only completed in group from China.

without specific prompting or intervention to target this positive behavior change. This is in contrast to findings from other countries, where prior studies have consistently found a decline in PA levels after diagnosis/during treatment in the absence of targeted PA interventions.[7,22,23] We cannot be certain of the exact cause of the differences in PA between the groups; however, they may arise from cultural and medical differences. Understanding of the reasons for differences in PA would be of great benefit to be able to target at-risk patients for low or declining PA levels and to inform the development and delivery of PA interventions.

In China, most patients with lung cancer receive treatment according to international guidelines such as the European Society for Medical Oncology and the National Comprehensive Cancer Network (similar to those in Australia) as well as the Chinese guidelines on the diagnosis and treatment of primary lung cancer.[24] Usually, early-stage non-small-cell lung cancer is treated with surgery, and postoperative radiotherapy is also used to reduce local relapses and improve the rate of survival in IIIA-N2 disease.[24] Medical treatments are used according to different pathological and genetic types. Traditional Chinese medicine, as a supportive care, plays an important role in improving some patients' HRQoL. Applications of pulmonary rehabilitation in patients with lung cancer are still exploratory in China.[25] Similarly, in Australia, rehabilitation or exercise programs are not currently part of the lung cancer care model because more evidence is needed to change guidelines. Therefore, in the absence of exercise/PA interventions, understanding patients' natural change in PA as they go through lung cancer treatment is highly important before we can look to implement the most effective PA programs into the model of care.

Our differences in PA change between China and Australia may be a result of a number of cultural factors. Cultural factors play an important role in medical issues and greatly affect peoples' beliefs and attitudes about health.[26] First, many patients from China (69%) did not know that they had lung cancer. In Chinese culture, cancer, to some extent, means death.[27] Chinese culture around dying and death is deeply influenced by Confucianism.[28] Confucianism is an important aspect of nondisclosure in China and influences Chinese medical ethics. As is the cultural norm in China, many patients are not informed of their cancer diagnosis at the wish of their family (it is also challenging for doctors to discuss death).[29,30] Therefore, although the doctor may prefer to inform patients of their diagnosis, often, the family prevents this in an attempt to avoid the adverse impact on their family member (ie, to protect them emotionally).[29,30] Families often elect to tell the patients about their diagnosis depending on whether they feel the patient has the ability to accept the reality, and it is customary for the doctor to respect families' wishes because of the family-oriented cultural context.[31,32] Some families organize for the patient to receive anticancer treatment in the respiratory department instead of the oncology department in order to maintain the "noncancer" perception. In many cases, patients believe that they have received treatment for their (nonmalignant) condition, and this affects their sense of well-being, which may then lead to more PA and minimal changes in their HRQoL domains. This practice is in contrast to Western culture, where patients are informed of their diagnosis. The psychological reaction to a cancer diagnosis, which can be extremely distressing, may immediately affect patients' PA levels. These cultural differences may be responsible for the differences in change in PA after diagnosis between groups. Unfortunately, we did not measure PA prior to cancer diagnosis; this would be interesting and provide insight into PA before the potential changes associated with the knowledge of the diagnosis. Additionally, it would be interesting to explore if patient outcomes, including PA levels, are different depending on whether or not they are aware of their diagnosis.

Another reason for our differences in PA may be the difference in cultural habits for transportation. The mean age of both groups was >60 years; in China, for most older people around this age, walking is their main form of transportation (very few elderly people drive),[33] and this may reflect in the long periods of time spent walking (median of 210 min/wk at diagnosis and 280 min/wk at 8 weeks). In Australia, however, driving by the elderly is common, and our cohort performed very little walking (median of 55 min/wk at diagnosis and 20 min/wk at 8 weeks). It would be interesting to further elaborate on the exact type of transport used by participants. After diagnosis, there was a statistical increase in the time spent walking in patients in China (change of 70 minutes), whereas those in Australia decreased their time spent walking. The increase in walking time in the group from China may be a result of the requirement after diagnosis to travel to the hospital regularly for clinic appointments and treatment, especially given that walking is a common form of transportation. The clinical implications of an increase of 70 minutes of walking time per week is unknown and is an area for future research, given the emerging evidence related to the positive effects of exercise on survival in cancer.[34]

Beyond cultural differences, potential explanations for the differing PA between cohorts are the different medical characteristics of recruited patients. First, the majority of patients in the group from China were treated with chemotherapy (alone or after surgery), and none of this group received radiotherapy, whereas more than half of the patients from Australia were treated with combined chemotherapy-radiotherapy. The treatment regimens are different in terms of the requirements of patients to attend hospital. Patients being treated with curative chemotherapy-radiotherapy (such as those in group AU) are usually required to come to the hospital on a daily basis from Monday to Friday

for approximately 6 weeks to receive daily radiotherapy and chemotherapy once per week. This schedule leaves very little time for the patients to perform PA outside of hospital visits. In contrast, patients receiving chemotherapy are usually required to come to the hospital once per week (for curative chemotherapy) or once every 3 to 4 weeks for palliative chemotherapy. Therefore, with a less time-intensive schedule, these patients may have more time for PA. Second, at the time of follow-up in our study (8 weeks after diagnosis), most patients receiving chemotherapy would only have received 1 or 2 cycles of treatment, especially those who had surgery first, and therefore, the worst chemotherapy side effects may not have manifested yet, compared with the side effects experienced by patients receiving daily radiotherapy, who would have completed more treatment by this time point. This could explain the increase in fatigue experienced by group AU at follow-up, which was not seen in group CH (Table 2). Fatigue is a significant determinant of PA in cancer,[35] and the most commonly cited limitation to PA in lung cancer.[36] Finally, more than half of the group CH had stage IV disease, whereas most of the group AU had stage III disease. Not only does this lead to differing treatment regimens (as previously discussed), but it also means that the patients' symptomatology may be different. At baseline, we would expect the patients with metastatic disease to be experiencing worse symptoms, and our results did show that group CH had worse chest pain and appetite loss at baseline but less dyspnea and insomnia than group AU. These symptoms are barriers to PA,[35] and therefore, it is surprising that group CH managed to remain active; but it may be that the impacts of stage IV disease are slower to develop (there was no change in fatigue over 8 weeks in group CH).

In an attempt to compare patients between countries who received similar treatments and those with a more comparable cancer stage, we conducted exploratory analyses comparing the subgroup of participants who received chemotherapy (alone or after surgery) or targeted therapy and excluded patients who received radiotherapy. Results were very similar to the findings from the whole group, except that we did not find a change in PA over time in the Australian subgroup (albeit this is likely to be underpowered, with only n = 14 in the Australian subgroup with repeated measures). The ability to identify patients who are at risk of low or declining PA levels after diagnosis is important and would allow health professionals to allocate finite resources accordingly and provide interventions to the right patient and at the right time. Factors such as treatment regime, hospital visits, and time to exercise are important to consider in the design and delivery of PA interventions because many of these are barriers to exercise[35] and will be different depending on the type of treatment the patient receives. For example, patients undergoing radiotherapy may be better suited to an in-hospital-based PA program, given that they are at the hospital on most days of the week, whereas patients receiving weekly chemotherapy may be better suited to a home-based program.

There are limited published data from China with which to compare our results. Ying et al[37] studied the changes in PA levels from prediagnosis, 3 months post–anticancer therapy, and 1 year postdiagnosis in 58 Chinese survivors with lung cancer. Compared with the PA recommendations,[38] they found that 76% of their patients met PA recommendations 1 year postdiagnosis. The authors suggested that differences from previously published articles from Western countries were based on culture differences or the differences in patient case selection. However, at the 3-month time point, PA levels were lowest. Patients in our study were still engaged in higher levels of PA at 2 months compared with PA at the time of diagnosis. Differences in our study may be a result of the higher proportion of patients treated surgically (73%) who were still recovering from this at 3 months when their PA levels were low, compared with only 37% of our patients receiving surgery.

At baseline, the Chinese and Australian cohorts had similar global HRQoL. However, over 8 weeks, there was a difference in the pattern of change: patients from China maintained their HRQoL, whereas those in Australia had a worsening of this. Patients with lung cancer have distressing symptoms, which can adversely affect HRQoL,[39] and as prior studies show, many patients experience deterioration in HRQoL after diagnosis.[40] Our results of declined HRQoL in the group from Australia are consistent with prior studies. The reason that the HRQoL of the group from China did not change could be as follows. First, many patients in the group from China did not experience the psychological reaction to the cancer diagnosis as previously discussed. Second, the Chinese group had more family support (1% lived alone compared with 22% in the Australian group). This was consistent with the study of Cai et al.[27] The emphasis on family in China is significant[27] (may differ slightly to Western culture).[41] It is common for the family to take on the responsibility of caring for the patient in China.[42] This may contribute to the patient's ongoing unchanged HRQoL, especially because social support is a predictor of HRQoL in patients with lung cancer.[43] Our findings are consistent with other studies, in that cross-cultural differences in HRQoL exist. Patients in Western countries have higher anxiety levels than those in East Asia,[44] also suggesting that differences in anxiety across countries might be related to different cultural norms. Finally, given that the patients from China were more active after diagnosis, this may have influenced their sustained HRQoL. Exercise has a positive impact on HRQoL, and a previous study[45] in China demonstrated that increased PA improved HRQoL of lung cancer survivors, presumably as a result of reduced anxiety and improved mood.[46]

This study was limited by a number of factors, which mean the results should be treated with caution. First, PA was measured using self-reported questionnaires rather than objective measurement, which adds to the potential bias of self-reporting. We did not measure PA levels before diagnosis, and therefore, it is possible that patients may have already changed their PA levels from their "usual" activities by the first testing time point, especially with the shock and distress associated with the new diagnosis. The recruitment source for participants was slightly different for the 2 groups (recruitment in China was from the respiratory department, whereas it was from a multidisciplinary lung service in Australia), which explains the difference in cancer treatments received between groups. The groups also had other significant differences at baseline, such as the group from China being slightly younger, more frequently living at home, and having lower smoking pack-year histories and slightly worse ECOG-PS (Table 1). These differences may influence the different PA findings; however, these group differences are interesting in themselves because we had broad inclusion criteria for patients coming through the lung cancer services, and this is representative of the slightly different populations in the hospitals in each country. Additionally, participants in this study were from a convenience sample, and thus, this study was not powered a priori to determine meaningful differences between groups. The subgroup analyses comparing patients receiving chemotherapy and targeted therapy between countries is likely to be underpowered because of the small numbers from Australia. Finally, the questionnaires used in this study were originally developed in English, whereas we used the available translated versions; these are not likely to be as culturally appropriate as questionnaires specifically developed in China.

Conclusion

In a cohort of patients with newly diagnosed lung cancer, we found patients in China to be less physically active at the time of diagnosis compared with those in Australia. However, following diagnosis, patients in China increased their PA levels over 8 weeks, whereas patients in Australia experienced a reduction in PA. This exploratory comparison between countries and cultures reveals that potential cultural differences may exist in the behavior of people with lung cancer. Further research is required to explore the reasons behind these differences in PA, which may inform the design of future research and clinical services to help people with lung cancer be more physically active.

Authors' Note

The Medical Ethics Committee of the Affiliated Hospital of Nantong University (China) and the Human Research Ethics Committees of the Austin Hospital, Royal Melbourne Hospital, and Peter MacCallum Cancer Centre (Australia) approved this study. All procedures performed were in accordance with the ethical standards of the institutional and research committee. Informed consent was obtained from participants included in the study or their next of kin.

Declaration of Conflicting Interests

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Author/s:
Ni, J; Denehy, L; Feng, J; Xu, L; Wu, Y; Granger, CL

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