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The Future of Telerehabilitation in Lung Cancer: An Observational Study Investigating Access to Technology in the Lung Cancer Population

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Abstract

A growing body of evidence supports the efficacy of exercise training in the management of lung cancer. Home-based telerehabilitation may be a favourable model; however limited information is available about technology access, use and competency specifically in the lung cancer population.

Aims: To identify the proportion of patients with lung cancer who access and use mobile phones, tablet devices or computers; and the patient profile of such individuals.

Method: 23 participants (17 male, median ages 71 [IQR 63-72] years) with stage I-III non-small cell lung cancer, 1-13 months post diagnosis completed a technology questionnaire. Additional measures completed at time of diagnosis include: comorbidities, Eastern Cooperative Oncology Group- Performance Status (function), six minute walk distance (functional exercise capacity) and questionnaires (physical activity levels, symptoms, mood, health-related quality of life).

Results: 70% (n=16/23) of participants had a mobile phone, 4% (n=1/23) had a tablet device and 43% (n=10/23) had a computer. Thirty percent (n=7/23) of participants did not have a mobile phone, tablet device or computer; these individuals were older (p=0.013), had greater comorbidities (p=0.028), lower functional exercise capacity (p=0.048); and worse fatigue (p=0.002) and pain (p=0.006). The majority of participants with mobile phones did not have a smart phone (69%) and no participants used the internet on their phone. Seventeen percent (n=4/23) of participants used the internet daily on a computer, all other participants used the internet once a month or less. Only 13% (n=3/23) of participants rated their computer skills as adequate or higher. Skype and Facebook were only used by one participant.

Conclusion: Access and use of smart phones, tablet devices and computers is relatively infrequent in an elderly population with early stage lung cancer from a tertiary acute hospital setting. Further studies are warranted to explore the acceptability of technology in the delivery of exercise rehabilitation in this population.

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Abbreviations: 6MWD: Six-Minute Walk Distance; DT: Distress Thermometer; ECOG PS: Eastern Cooperate Oncology Group- Performance Status; EORTC: European Organisation for the Research and Treatment of Cancer Questionnaire; FEV_1: Forced Expiratory Volume in the First Second; HADS: Hospital Anxiety and Depression Scale, IQR: Inter-Quartile Range; Kg: Kilograms; M: Meters; N: Number; PA: Physical Activity; PASE: Physical Activity Scale for the Elderly; Qol: Quality of Life; SD: Standard Deviation; Temp: Temporary

Introduction

A growing body of evidence supports the efficacy of exercise training in the management of lung cancer [1-3]. Telerehabilitation, which uses information and computer technologies to deliver and monitor exercise in the home setting [4], may be a favourable model in lung cancer, particularly for people living in remote areas or those without transportation to access hospitals or rehabilitation centres [5]. Preliminary research from other respiratory disease populations, such as Chronic Obstructive Pulmonary Disease (COPD), suggest that telerehabilitation may be an efficacious model for delivery of exercise training [6]; however limited information is available about technology access and use specifically in the lung cancer population. The primary aims of this study were, to identify the proportion of patients with lung cancer who access and use mobile phones, tablet devices and computers; and the patient profile of such individuals. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed in reporting this study [7].

Methods

A prospective cross-sectional cohort study was conducted at a metropolitan tertiary hospital in Melbourne, Australia from November 2010 to October 2012. The site had ethical approval. English speaking individuals with stage I-IIIB Non-Small Cell Lung Cancer (NSCLC) were recruited at time of diagnosis into a multi-centre observational study assessing physical activity and functional decline in lung cancer [8]. Participants at one site were additionally invited to take part in this sub-study regarding technology access.

Technology access, use and competency were measured using a questionnaire specifically designed for this study. The twenty-item questionnaire was administered over the telephone and asked the participant to recall if they had access to and use a mobile phone, smart phone, tablet device or a computer. Frequency of internet, email and social media use were assessed, as well as participant's self-rated computer skills. Most questions were answered on a five-point Likert scale, for example from 'daily' to 'never' (frequency of use) or 'strong' to 'none' (computer skills). Additional measures taken at time of cancer diagnosis included: function measured using the Eastern Cooperative Oncology Group Performance Status score (ECOG-PS) rated by the participant and physician [9]; and functional exercise capacity measured using the Six Minute Walk Distance (6MWD) [10]. Physical activity levels, mood and HRQoL were measured using questionnaires: the Physical Activity Scale for the Elderly (PASE) [11]; Hospital Anxiety and Depression Scale (HADS) [12]; Distress Thermometer [13] and European Organization for the Research and Treatment of Cancer Questionnaire and Lung Cancer module (EORTC QLQ-C30-LC13) [14] respectively. Demographic and medical data were obtained including: age, social situation, employment status, highest level of education obtained, body mass index, respiratory function, smoking history, cancer type, cancer stage and comorbidities. Comorbidities were scored with the simplified Colinet comorbidity score [15].

Data were analysed through SPSS Windows Version 22.0 (SPSS, Chicago, IL, USA). Descriptive statistics and graphical displays were used to identify missing and out-of-range values and to assess distributional characteristics of test scores prior to formal analysis. Descriptive statistics were used to summarize characteristics and outcome data. Independent samples t-tests and Mann-Whitney U tests were used to compare differences in

variables between participants with access to technology (mobile phone, table device and or computer) compared to those without access to technology (no mobile phone, tablet device or computer). Pearson's χ^2 were used to assess the relationships between outcome data. Alpha was set at 0.05 (two-tailed) for analyses.

Results

Between November 2010 and April 2012, 23 participants (17 male; median [IQR] age 71.0 [63.0 – 72.0] years) took part in this study. Seventy percent (n=16) of participants had a mobile phone, 4.3% (n=1) had a tablet device and 43.5% (n=10) had a computer. In addition, one person had access to a computer outside of their home. Overall, 30.4% (n=7) of participants did not have access to any form of technology (mobile phone, tablet device or computer). Compared to participants who did have access to technology, the participants without access were older, with greater comorbidities, poorer functional exercise capacity, and worse fatigue and pain (Table 1). There were no differences in employment status, highest level of education obtained, function (ECOG-PS), physical activity levels, global quality of life or mood between participants with and without access to technology (Table 1).

Table 1: Participant characteristics

Variable	No Technology (n = 7) n (%)	Technology (n = 16) n (%)	p value
Age, years, median [IQR]	72.0 [71.0 – 76.0]	64.5 [58.5 – 71.0]	**0.013**
Gender, male	5 (71.4%)	12 (75.0%)	1.000
Body mass index, kg/m^2, mean ± SD	27.4 ± 5.7	28.5 ± 8.2	0.754
Colinet comorbidities score, mean ± SD	11.9 ± 3.6	7.6 ± 4.2	**0.028**
FEV1, % predicted, mean ± SD	64.2 ± 7.7	67.6 ± 26.0	0.747
Smoking history in pack years, mean ± SD	47.4 ± 12.8	33.5 ± 29.3	0.244
Smoking status			0.343
Never smoker	0	3 (18.8%)	
Current smoker	2 (28.6%)	6 (37.5%)	
Ex-smoker	5 (71.4%)	7 (43.8%)	
Lung cancer diagnosis			0.331
Squamous	4 (57.1%)	3 (18.8%)	
Adenocarcinoma	3 (42.9%)	8 (50.0%)	
Large cell	0	3 (18.8%)	
Other	0	2 (12.6%)	
Cancer stage			0.883
Stage I	4 (57.1%)	10 (62.5%)	
Stage II	1 (14.3%)	3 (18.8%)	
Stage III	2 (28.6%)	3 (18.8%)	
Social situation			0.619
Home alone independent	1 (14.3%)	5 (31.3%)	

Home with family	5 (71.4%)	10 (62.5%)	
Home with council support	1 (14.3%)	1 (6.3%)	
Employment status			0.371
Working	0	3 (18.8%)	
Temp/ permanent sick leave	1 (14.3%)	4 (25.0%)	
Home duties	0	1 (6.3%)	
Not employed / retired	6 (85.7%)	8 (50.0%)	
Highest level of education obtained			0.177
Completed university	0	0	
Some university	1 (33.3%)	0	
Completed trade certificate	0	2 (16.7%)	
Completed secondary school (age 18)	1 (33.3%)	1 (8.3%)	
Some secondary school	1 (33.3%)	8 (66.7%)	
Completed primary school (age 12)	0	0	
Some primary school	0	1 (8.3%)	
Missing	[4]	[4]	
ECOG PS, patient rated			0.065
0	2 (28.6%)	12 (75.0%)	
1	4 (57.1%)	4 (25.0%)	
2	1 (14.3%)	0	
6MWD, meters, mean ± SD	321.0 ± 147.2	447.9 ± 94.4	**0.048**
Level of PA according to PA guidelines[1]			0.800
Sufficient PA	3 (42.9%)	7 (43.8%)	
Insufficient PA	3 (42.9%)	5 (31.3%)	
Sedentary	1 (14.3%)	4 (25.0%)	
PASE,[2] mean ± SD	54.7 ± 38.1	94.1 ± 60.5	0.135
Depression,[3] mean ± SD	6.0 ± 4.2	3.9 ± 3.3	0.248
Anxiety,[3] mean ± SD	7.0 ± 5.1	5.5 ± 3.6	0.439
Distress,[3] mean ± SD	4.7 ± 3.8	3.3 ± 3.0	0.378
Fatigue,[3] median [IQR]	72.5 [38.5 – 83.5]	22.0 [0.0 – 17.0]	**0.002**
Pain,[3] median [IQR]	50.0 [24.7 – 83.0]	8.9 [0 – 17.0]	**0.006**
Global QoL,[4] median [IQR]	62.5 [45.7 – 92.0]	75.0 [58.0 – 83.0]	0.503

[1] Sufficient = 150 minutes of moderate intensity physical activity per week; insufficient = 1 – 149 minutes of moderate intensity physical activity per week; sedentary = 0 minutes of moderate intensity physical activity per week [30]

[2] Higher scores on the PASE represent higher levels of physical activity. Maximum score attainable is 400 and the average score for elderly individuals is 103 points [11]

[3] Higher scores on the HADS, Distress Thermometer and EORTC symptom domains represent worse status [12-14]

[4] Higher score on the EORTC quality of life domain represents better status [14]

The majority of participants with a mobile phone did not have a smart phone (69%, n=11/16). No participants used the internet on their smart phone. The overall frequency of internet usage with a computer was low (Figure 1), with only 17.4% (n=4) using the internet more frequently than once a month. More frequent internet usage was associated with better function (ECOG-PS physician rated r=0.716, p=0.013) and participants engaged in higher levels of physical activity (PASE score r=0.736, p=0.010). Thirty-percent (n=7) of participants had an email address. One participant used Skype and Facebook, however no participants used Twitter. Generally participants rated their computer skills as low and 70% (n=16) specified that they had no computer skills (Figure 2). Improved self-rated computer skills were observed in participants with higher function (ECOG-PS physician rated r=0.751, p=0.008) and those engaged in higher levels of physical activity (PASE score r=0.617, p=0.043).

Figure: 1

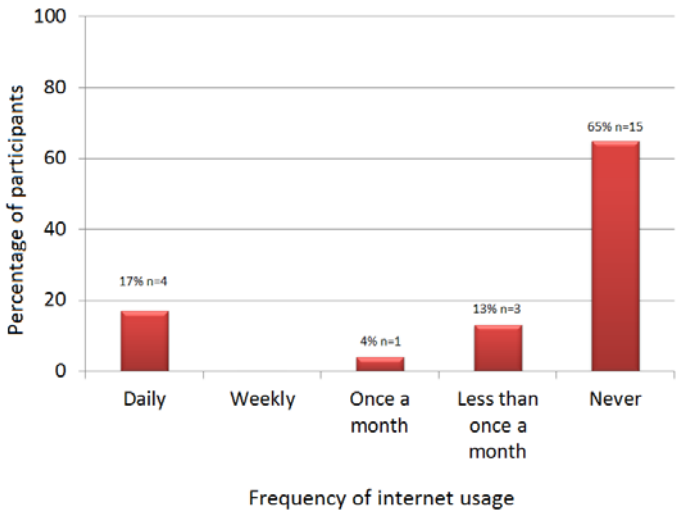

Figure 1: Frequency of internet usage of participants

Figure: 2

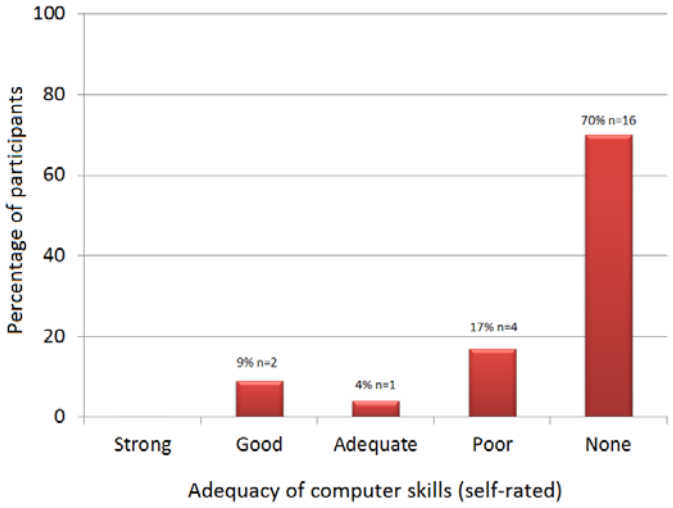

Figure 2: Adequacy of computer skills self-rated by the participants

Discussion

Our study has demonstrated that the use of smart phones, tablet devices and computers is relatively infrequent in people with lung cancer and only a minority of those with access to the internet rate their computer skills as sufficient. The usage of technology in our lung cancer cohort is less than comparative Australian data from similar age groups. In 2012, 15% of people aged 65 years and above had a smart phone and 8% had a tablet device [16]. In 2009, 47% of people aged 60 years and above had a computer [17]. These normative data are likely to underrepresent the status in 2014 and therefore the gap between the general population and the population with lung cancer may be even wider. Our findings have implications when considering the acceptability of telerehabilitation or rehabilitation that makes use of devices for the population with lung cancer.

Functional decline and inactivity are prevalent in lung cancer [8]. There is a growing evidence base suggesting that exercise is associated with improvements in functional exercise capacity and may mitigate functional decline [1-3]. The majority of studies conducted in this area to date have delivered the exercise intervention in a hospital setting, with participants training in a

supervised environment as inpatients or outpatients [1-3]. There are a small number of preliminary studies, predominantly non-randomised controlled trials, which also suggest that home-based exercise training may be beneficial in lung cancer [18-21]. There is strong rationale for delivery of exercise in the home setting for people with lung cancer. Patients are already required to attend the hospital on a frequent basis for medical appointments and to receive cancer treatments. Given the morbidity and burden of disease that occurs with lung cancer [22, 23], strategies to reduce additional external burden on patients are favourable. There is a push towards transitioning care, where appropriate, out of the hospital setting and into community and home environment. There are many positives of this including: reduced time and financial burden associated with travel to the hospital [24]; increased focus on wellness out of the hospital setting; and potentially the ability to achieve change in health behaviours more effectively.

The feasibility of unsupervised home-based exercise training in lung cancer remains questionable. Adherence and drop-out rates of two recent studies have been poor (8.5% adherence [21]; 67% drop-out [25]). A criticism of home-based exercise training is that it is predominately unsupervised and therefore participants cannot be monitored to promote encouragement and adherence. Additionally, it is difficult to monitor participants to ensure they are exercising at sufficient intensity or to effectively progress their exercises. Telerehabilitation poses a favourable alternative model of delivery because patients can exercise at home whilst being monitored and supervised by health professionals located in a different central location [5, 26]. Telerehabilitation also allows people who are unable to access hospital-based programs to participate, for example: those living in remote locations, those unable to afford travel costs and those unable to access transportation. In COPD, preliminary evidence suggests that telerehabilitation is a beneficial mode of exercise delivery [27, 28]. The efficacy of telerehabilitation has not been investigated in lung cancer [1]. Our study demonstrated that people with lung cancer lack access to technology and computer skills. This suggests that in order to successfully evaluate telerehabilitation in lung cancer, studies would need to provide participants with technology for their home and provide training in the use of this technology. It is questionable whether patients with lung cancer have the ability to learn new skills in the use of technology: given patients are also provided with an abundance of important new medical information, the ability to also learn technology skills at the same time may be challenging and warrants further research.

Our findings demonstrate that people with access to technology were younger than those without access. In the future, lack of technology and lack of skills is likely to be less of a problem as this generation grows older, however it may be that there is a subgroup of people with lung cancer who are already appropriate for this type of rehabilitation. Recently, Hoffman and colleagues reported that seven patients with lung cancer successfully used the Nintendo Wii Fit plus at home to complete walking and balance exercises [29]. The mean age of participants in the study by Hoffman and colleagues was 65 years [29], similar to the mean age of our cohort who had access to technology at 64 years. The feasibility of telerehabilitation in a younger subgroup of people with lung cancer needs further investigation.

Our study is limited by a small sample size and single-centre design. Further studies are required to externally validate our findings. The questionnaire used to examine technology access, use and competency was specifically developed for this study; therefore the validity of this questionnaire for use in the lung cancer population is un-tested. Whilst we did not find a difference in the highest level of education obtained between participants with technology versus those without access to technology, data for this variable were missing for 34.8% (n=8/23) participants.

Conclusion

Access and use of smart phones, tablet devices and computers is relatively infrequent in people with lung cancer. Further studies are warranted to explore the acceptability of technology in the delivery of exercise rehabilitation in this population.

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