Physiotherapy practice patterns for patients undergoing surgery for lung cancer: A survey of hospitals in Australia and New Zealand

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Vinicius Cavalheri,[1] Sue Jenkins[1,2,3] and Kylie Hill[1,2]

[1]School of Physiotherapy and Curtin Health Innovation Research Institute, Curtin University, GPO Box U1987, Perth, Western Australia, 6845

[2]Lung Institute of Western Australia and Centre for Asthma, Allergy and Respiratory Research, University of Western Australia, 35 Stirling Hwy, Crawley, Western Australia 6009

[3]Physiotherapy Department, Sir Charles Gairdner Hospital, Hospital Avenue, Block A, Nedlands, Western Australia, 6009

Corresponding author:

Dr. Kylie Hill

School of Physiotherapy, Curtin University, GPO Box U1987, Perth, Western Australia, 6845

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Telephone number: +61 8 9266 9443

Fax number: +61 8 9266 3699

Email address: K.Hill@curtin.edu.au

Abstract

Background: There has been a recent increase in the research available to guide physiotherapy management of patients who require surgical resection for lung cancer. It is unclear whether this evidence has influenced clinical practice. ***Aim:*** To describe physiotherapy practice patterns in the pre- and post-operative management of patients who undergo surgical resection for lung cancer. ***Methods:*** Physiotherapists involved in the management of patients who require surgical resection for lung cancer at hospitals across Australia and New Zealand were mailed a purpose-designed questionnaire. ***Results:*** The response rate was 91% (43/47). Prior to surgery, 40% (n=17) of the respondents indicated that patients were not assessed by a physiotherapist. In most hospitals (n=39; 91%) patients did not participate in supervised exercise training before surgery. Most commonly, physiotherapy was commenced on the day following surgery (n=39; 91%) with walking-based exercise being the treatment that was most frequently implemented in all patients (n=40; 93%). Seventy-two per cent of respondents referred less than 25% of patients to pulmonary rehabilitation on discharge from hospital. Physiotherapy assessment and treatment choices were influenced predominantly by established practice in the hospital and personal experience rather than research findings. ***Conclusion:*** In people who undergo surgical resection for lung cancer, physiotherapy services focussed on reducing or preventing post-operative pulmonary

complications. Despite recent data suggesting that exercise training is beneficial in this population, our data indicate that referral to pulmonary rehabilitation was uncommon.

Key-words: lung neoplasms; physical therapy specialty; rehabilitation; health care surveys; thoracic surgery.

Introduction

In Australia in 2007, more than 9,000 cases of lung cancer were diagnosed.[1] Cancers of the lung are the most commonly diagnosed cancers in men and the fourth most commonly diagnosed cancer in women. Throughout the world, they represent the leading cause of deaths from malignancy in both genders.[2, 3] Although surgical resection of the tumour is the treatment which offers the best chance of cure,[4] this procedure is associated with important short and long-term impairments. Specifically, short-term post-operative complications include lung collapse, pneumonia and prolonged mechanical ventilation.[5] Long-term impairments include reduced lung function and exercise capacity.[6, 7] Following resection, patients also report decreased health-related quality of life (HRQoL) when compared to healthy controls.[8]

Over the past six years, there has been an increase in publications pertaining to the effectiveness of physiotherapy for patients before and after surgery for lung cancer. Regarding pre-operative management, two recent studies[9, 10] have reported that brief exercise programs initiated prior to surgery served to decrease the length of hospital

stay, suggesting reduced post-operative morbidity and healthcare cost. Regarding post-operative management, a randomised controlled trial (RCT) conducted in New Zealand[11] examined the effects of physiotherapy, which included breathing exercises, ambulation and a progressive shoulder and thoracic cage mobility program, on the incidence of pulmonary complications (i.e., pneumonia), intensive care unit re-admissions and length of hospital stay, in patients following lung resection. This study failed to demonstrate between-group differences (i.e. treatment *versus* control) probably due, at least in part, to an overall rate of post-operative pulmonary complications of less than 4% (3 out of 76 patients). However, with respect to exercise training following resection, it appears that a supervised program of moderate intensity exercise in this population is feasible and safe, and may confer benefits in dyspnoea, exercise capacity[12, 13] and HRQoL, particularly among those who do not require concurrent chemotherapy.[14, 15] When commenced immediately following surgery, exercise training also assists with maintaining quadriceps muscle force.[16]

Given the results of these recent publications, the aim of this study was to report current pre- and post-operative physiotherapy practice patterns across hospitals in Australia and New Zealand for patients who require surgical resection for lung cancer. These results will extend those of Reeve et al[17] who described the physiotherapy management of patients undergoing thoracotomy in 2007. Of note, at the time their study was conducted there were very little data available to guide clinical practice. The current study will evaluate the extent to which findings of the recent studies in this area have been translated into clinical practice.

Materials and Methods

Sample

Hospitals in Australia and New Zealand that provide thoracic surgery and physiotherapy services were identified using internet searches. That is, a list of major hospitals in Australia (http://en.wikipedia.org/wiki/List_of_hospitals_in_Australia) and New Zealand (http://en.wikipedia.org/wiki/List_of_hospitals_in_New_Zealand) was identified and, thereafter, individual hospital websites were examined to determine whether or not they provide thoracic surgery services. The list produced by this search was cross-referenced against one provided by the authors of a previous study.[17] Inconsistencies in the eligible sites between the two lists were resolved by contacting the hospitals directly.

Survey Instrument

A questionnaire was developed (see appendix) to collect information pertaining to characteristics of the hospitals and staff, the types of assessments completed prior to surgery as well as physiotherapy management both before and after resection of lung cancer. The questionnaire was piloted by four experienced physiotherapists in order to optimise its face validity, readability and structure. Thereafter, the questionnaire was sent to two physiotherapists with a doctoral degree in the area of cardiorespiratory practice who were asked to comment on the layout, terminology and content. The final version of the questionnaire comprised three sections, consisted of 22 questions, and took approximately 15 minutes to complete.

Approach

The Tailored Design Method (Dillman approach)[18] was used as it has been previously shown to reduce survey error and optimise response rate. The first contact with each hospital was with the manager of the physiotherapy department via email. If no response was obtained within four weeks, a reminder email was sent and this person was contacted via the telephone. The manager was asked to nominate the physiotherapist who had the most contact with patients who require thoracic surgery for lung cancer in their department (i.e. a senior cardiothoracic physiotherapist). Once identified, this physiotherapist was sent a letter (both via post and email) outlining the purpose and aims of the study. The questionnaire was then posted with a reply-paid envelope. For those who agreed to participate, four weeks were allowed for return of the questionnaire after which time a reminder letter was sent via email. Physiotherapists were asked not to answer questions if they were unsure of the correct response and were encouraged to contact other members of the healthcare team to seek information as appropriate. Where responses were not completed, the physiotherapist was contacted by telephone in an attempt to ascertain the most appropriate answer to each question.

Approval was granted from the Human Research Ethics Committee at Curtin University (approval number PT0185). Return of the questionnaire was taken as informed consent.

Data analysis

Responses were numerically coded for descriptive summaries and reporting of frequency. Analyses were undertaken using the Statistical Package for the Social Sciences (SPSS), version 19.0.

Results

A total of 54 hospitals (46 in Australia and eight in New Zealand) were deemed eligible to participate in the study. Staff in the physiotherapy department at five hospitals did not respond to our repeated attempts to make contact (i.e. emails, faxing and phone calls). Hence, 49 questionnaires were mailed out (43 to hospitals in Australia and 6 to hospitals in New Zealand). Staff from two sites declined participation after receiving the questionnaire as surgical resection for lung cancer was no longer performed at their facility. Of the 47 sites where both initial contact was made and surgical services for patients with lung cancer were provided, a total of 43 questionnaires were returned, yielding a response rate (RR) of 91%. The four questionnaires that were not returned were all from private hospitals. Data pertaining to the distribution of hospitals are provided in table 1.

Characteristics of the physiotherapists and hospitals

Most respondents (n=35; 81%) had more than five years of clinical experience with 31 (72%) having more than five years of experience treating patients with respiratory diseases. Thirty-three (77%) respondents had completed their entry level qualification in Australia, with a smaller proportion from the United Kingdom (n=5; 12%), New Zealand (n=4; 9%) and the Republic of Ireland (n=2; 5%). The majority of respondents held a bachelor's degree as their highest tertiary qualification (n=35; 84%). The number of patients with lung cancer who underwent surgery in the past month is shown in table 2.

Pre-operative assessment, education and exercise training

The majority of respondents stated that the most common assessments completed by patients prior to surgery were spirometry (n=36; 84%) and computerised tomography (CT) scans (n=31; 72%). Patients in 16 hospitals (37%) usually underwent measures of diffusing capacity for carbon monoxide (D_LCO) and five respondents (12%) stated that the cardiopulmonary exercise test (CPET) was routinely measured at their facility. Measures of HRQoL and six-minute walk distance (6MWD) were collected at two sites (5%) with the exercise responses via a stair climbing test and maximal respiratory pressures assessed at one hospital each. Eight respondents reported collecting "other" measures such as blood tests, urine tests, the positron emission tomography scan, bronchoscopy/mediastinoscopy and CT-guided biopsy.

The involvement of the physiotherapists in the pre-operative assessment and education of patients with lung cancer undergoing surgery is shown in figure 1. In 40% (n=17) of the hospitals, respondents indicated that patients were not assessed by a physiotherapist prior to resection for lung cancer. Nine respondents (21%) reported assessing all patients with lung cancer before surgery. When assessments were undertaken, common procedures comprised auscultation, cough, subjective reports of exercise tolerance, and spirometry. Pre-operative education was provided by physiotherapists to all of the patients in 19 hospitals (44%); the topics are summarised in table 3.

Four respondents (9%) reported that pre-operative exercise training was provided in their hospitals to a 'few' patients. In these hospitals, it was most often the surgeon who initiated the referral.

Post-operative management

The majority of respondents (n=39; 91%) reported that patients commenced physiotherapy on the first post-operative day with four (9%) responding that patients were routinely treated on the day of surgery. Table 4 summarises the types of exercises/techniques implemented by physiotherapists as part of post-operative patient care. The most common treatments applied to all patients were walking exercises, cough/huff and breathing techniques. Following surgery, 40 respondents (93%) reported that all patients participated in walking exercise and in most facilities (n=38; 88%) this was initiated as part of an early mobilisation program by the physiotherapist. Cough/huff and breathing techniques were also used frequently as post-operative techniques for all patients (n=36; 84% and n=35; 81%, respectively). Of the 13 respondents (30%) that included 'other' exercises in the answer, 10 described shoulder range of motion and thoracic exercises as techniques undertaken by the physiotherapists.

Figure 2 shows the proportion of patients referred to outpatient exercise training programs (pulmonary rehabilitation). Seventy-two per cent of respondents (n=31) refer less than 25% of patients to pulmonary rehabilitation on discharge from hospital. Of these, two respondents mentioned that the existing pulmonary rehabilitation programs in their region do not accept patients with a diagnosis other than chronic obstructive pulmonary disease.

Respondents were asked to indicate (on a five-point Likert scale) which factors had most influenced their management of patients with lung cancer. The results are shown in table 5.

Discussion

This survey detailed the current management and practice patterns of Australia's and New Zealand's physiotherapy services for people undergoing resection for lung cancer. The main findings were that; (i) prior to surgery, in 40% of the hospitals, patients were not assessed by a physiotherapist, (ii) the majority of respondents did not provide pre-operative exercise training for patients with lung cancer, (iii) post-operatively, physiotherapy was most commonly commenced on the day following surgery with walking-based exercise being the most frequently implemented treatment and, (iv) on discharge from hospital, 72% of respondents referred less than 25% of patients to pulmonary rehabilitation. Our RR of 91% is greater than that achieved by previous studies, conducted in the same countries, in the area of physiotherapy for patients following thoracic surgery (RR = 80%),[17] pulmonary rehabilitation (RR = 83%)[19] and cancer care (RR = 51%).[20] The high RR suggests that our results are unlikely to be influenced by a responder bias and thereby provide a representative snapshot of current physiotherapy practice patterns for patients with lung cancer across in Australia and New Zealand.

Pre-operative assessment, education and exercise training

International guidelines[21-24] recommend that the risk of peri- and post-operative complications for those individuals who have a resectable tumour be based, at least in

part, on measures of lung function and exercise capacity. Our finding that forced expiratory volume in 1 second (FEV_1) and D_LCO were the most commonly used pre-operative assessments in this population is in agreement with these guidelines. The CPET is recommended to further refine the peri-operative risk of surgery for patients with predicted post-operative values for either FEV_1 or D_LCO of below 40%.[21, 22] Notably, a peak rate of oxygen uptake (VO_{2peak}) <15mL·kg^{-1}·min^{-1} appears to be a better predictor of post-operative complications than resting cardiac and pulmonary function.[25, 26] Notably, this measurement was collected in a small number of facilities (i.e. 12%).

The benefit of providing physiotherapy for patients prior to thoracic surgery is unclear. Educating patients before their surgery about the post-operative physiotherapy management appears to have no effect on the incidence of post-operative pulmonary complications.[27] Nevertheless, our data suggest that 44% of the respondents provided pre-operative education with respect to post-operative physiotherapy management.

The evidence for implementing physiotherapy treatment for patients prior to thoracic surgery is limited. Specifically, in patients awaiting surgery for lung cancer, Pehlivan et al[10] demonstrated that a one-week package of physiotherapy treatment comprising breathing and coughing exercises as well as treadmill walking reduced the incidence of post-operative pulmonary complications (from 17% to 3%) and length of hospital stay (from 9.7 to 5.4 days) of patients with lung cancer compared with a control group that did not receive any pre-operative physiotherapy . Although the study design precluded the determination of which physiotherapy intervention was responsible for the between-

group differences, it is likely that treadmill walking was an important factor contributing to these results. That is, pre-operative exercise training has been consistently shown to optimise exercise capacity in patients with lung cancer,[28-30] and this may serve to minimise the incidence of post-operative pulmonary complications. Although implementing a program of high-intensity exercise may be advantageous in this population, our data indicate that such services are offered by very few hospitals; data that concurs with the findings of an earlier survey.[17] Referrals to such programs are likely to remain low, due at least in part to the fact that patients would like their cancer to be removed as soon as possible,[9] and delaying surgery by a few weeks until a program of exercise training has been completed is unacceptable. Nevertheless, perhaps there is a role for pre-operative exercise training for those who have resectable tumours but are not eligible for surgery due to their poor exercise capacity.

Post-operative management

Early mobilisation and the use of upright position are established as best practice in the management of patients following major abdominal, cardiac or thoracic surgery.[31] In keeping with this, most of the respondents reported early mobilisation and walking exercises as common post-operative treatments. The role of adding physiotherapy techniques, such as deep breathing exercises, to a program of early mobilisation to minimise the incidence of post-operative pulmonary complications is controversial. A systematic review[32] of 35 studies (13 RCTs) concluded that there was little evidence for the effectiveness of respiratory physiotherapy in the prevention of pneumonia after abdominal surgery. Since this review, two high quality RCTs[11, 33] have explored the effect adding deep breathing exercises to a program of early mobilisation following

abdominal and thoracic surgeries. Neither study demonstrated an effect on preventing pulmonary complications. Nevertheless, it is important to note that the incidence of post-operative pulmonary complications and length of hospital stay in these two studies were both very low and thus the opportunity to confer a significant effect was limited. It is possible that such interventions are most appropriate for those who develop a post-operative pulmonary complication or have limited capacity to participate in early mobilisation. Our study suggests that most physiotherapists continue to implement breathing exercises frequently. This practice is likely to reflect a strong historical precedent for this treatment and is reflected in our data demonstrating that the single greatest influence on physiotherapists' choice of treatment was the established practice at their hospitals and personal experience.

In addition to minimising the incidence of post-operative pulmonary complications, the physiotherapist plays an integral role in restoring the patient to their pre-operative functional status. Evidence from a recent RCT[34] demonstrated that a post-operative program of shoulder exercises improved shoulder function and decreased pain following open thoracotomy. Such a program has yet to be implemented consistently given that only 24% of the respondents mentioned shoulder range of motion and thoracic range of movement exercises as techniques undertaken by the physiotherapists.

A low proportion of referrals to pulmonary rehabilitation after discharge were demonstrated by the current study. This may be due to both the lack of RCTs of supervised exercise training following discharge from hospital after resection for lung cancer as well as the fact that pulmonary rehabilitation programs focus on patients with

respiratory conditions other than lung cancer. Nevertheless, over the past 6 years, several studies have been conducted to investigate the role of supervised exercise training for patients after surgery for lung cancer.[12-15] They have demonstrated that exercise training is safe, feasible and may confer benefits on exercise capacity and HRQoL. To date, one RCT has investigated the effects of exercise following surgical resection for lung cancer. In this study the intervention group received twice daily strength and mobility training for the first five days after surgery followed by an additional 12 weeks of unsupervised home-based exercise.[16] The control group received usual care which included airway clearance techniques, early ambulation and pain medication. The results showed that exercise assisted with maintaining quadriceps muscle force during the immediate post-operative period but was not associated with additional benefits in exercise capacity or HRQoL when re-assessed 12 weeks following discharge. An important limitation of this study was the relatively minimal interaction with a healthcare professional during the home exercise program (i.e., once a month over the 3 month program) as well as the lack of standardisation of the home exercises (i.e. they were individualised according to patient hobbies). Further RCTs are being performed to ascertain the effects of exercise training following surgery.[35]

Limitations

The limitations of this study relate to those inherent within any survey of responder and recall bias. Our RR of 91% suggests minimal responder bias. Further, inaccuracies related to recall bias were limited by; (i) ensuring that the questionnaire went to the physiotherapist who most frequently treated patients with lung cancer, (ii) instructing the respondents consult with other members of the healthcare team if they were unsure

of the correct response and, (iii) following up with a phone call to address any perceived ambiguities in the questionnaire. For individual treatment approaches (e.g. walking-based exercise), we did not attempt to elicit specific prescription details such as frequency, intensity or duration as we believed these variables were likely to vary considerably between patients within any given hospital.

Conclusions

This study has documented current physiotherapy practice patterns for patients with lung cancer undergoing surgical resection throughout Australia and New Zealand and has demonstrated that physiotherapy services currently focus on minimising the immediate risk of post-operative pulmonary complications. Referral to pulmonary rehabilitation is uncommon for this patient population and well-designed studies are needed to confirm the role of supervised exercise training in facilitating post-operative recovery in this patient population.

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Table 1: Numbers and distribution of hospitals on a state-by-state basis.

	Deemed eligible (n=54)	Public / Private (n=35 / 19)	Responded to contact attempts (n=49)	*Declined participation (n=2)	Included in the analysis (n=47)	Questionnaires returned (n=43)
Australia	**46**	**30 / 16**	**43**	**2**	**41**	**37**
ACT	2	2 / 0	2	0	2	2
NSW	17	9 / 8	16	1	15	13
QLD	4	3 / 1	4	0	4	4
SA	5	3 / 2	5	0	5	5
NT	0	-	-	-	-	-
TAS	1	1 / 0	1	0	1	1
VIC	13	9 / 4	11	1	10	8
WA	4	3 / 1	4	0	4	4
New Zealand	**8**	**5 / 3**	**6**	**0**	**6**	**6**
NI	6	3 / 3	4	0	4	4
SI	2	2 / 0	2	0	2	2

* Declined participation after receiving the questionnaire.
ACT – Australian Capital Territory; NSW – New South Wales; QLD – Queensland; SA – South Australia; NT – Northern Territory; TAS – Tasmania; VIC – Victoria; WA – Western Australia; NI – North Island; SI – South Island.

Table 2: Number of patients with lung cancer who underwent surgery in the past month (n=43).

Number of patients	***Lobectomy***	***Pneumonectomy***
< 4	15 (35%)	41 (95%)
4 - 8	16 (37%)	1 (2.5%)
9 - 12	5 (12%)	0 (0%)
> 12	5 (12%)	0 (0%)
Unsure	2 (5%)	1 (2.5%)

Table 3: Topics covered as part of pre-operative education.

	Proportion of patients who were provided with pre-operative education				
Topic; n (%)	None of them	A few of them	Some of them	Most of them	All of them
Breathing techniques (n=30)	1 (3%)	4 (13%)	4 (13%)	3 (10%)	18 (60%)
Cough/huff (n=30)	0 (0%)	5 (17%)	3 (10%)	4 (13%)	18 (60%)
Explanation about the importance of upright positioning (n=30)	1 (3%)	6 (20%)	2 (7%)	3 (10%)	18 (60%)
Explanation about the importance of early ambulation (n=30)	0 (0%)	4 (13%)	3 (10%)	4 (13%)	19 (63%)
Shoulder exercises (n=29)	1 (3%)	7 (24%)	4 (14%)	2 (7%)	15 (52%)
Thoracic range of movement exercises (n=29)	4 (14%)	7 (24%)	5 (18%)	3 (11%)	9 (32%)
Explanation of post-operative physiotherapy sessions (n=29)	0 (0%)	4 (13%)	3 (10%)	3 (10%)	20 (67%)
***Other:**	1 (3%)	0 (0%)	2 (7%)	0 (0%)	8 (28%)

n (physiotherapists who answered that do not provide education were excluded from the analysis);
* Other : lifting + wound precautions / mobility and exercise tolerance assessment / side lying (contralateral side) - pain relief / circulation exercises.

Table 4: Types of exercises/techniques used following surgery.

	Proportion of patients receiving the described exercises/techniques				
Exercises/techniques; n (%)	None of them	A few of them	Some of them	Most of them	All of them
Breathing techniques	1 (2%)	1 (2%)	5 (12%)	1 (2%)	35 (82%)
Airway clearance techniques (other than cough/huff	4 (9%)	8 (19%)	15 (35%)	3 (7%)	13 (31%)
Cough/huff	1 (2%)	1 (2%)	1 (2%)	4 (9%)	36 (84%)
Inspiratory muscle training	30 (70%)	6 (14%)	2 (5%)	2 (5%)	3 (7%)
Aerobic (walking)	0 (0%)	0 (0%)	0 (0%)	3 (7%)	40 (93%)
Aerobic (cycling)	29 (67%)	9 (21%)	5 (12%)	0 (0%)	0 (0%)
Strength (lower limbs)	15 (35%)	12 (28%)	8 (19%)	4 (9%)	4 (9%)
Strength (upper limbs)	20 (46%)	7 (16%)	10 (23%)	2 (5%)	4 (9%)
***Other:**	0 (0%)	0 (0%)	1 (2%)	4 (9%)	8 (19%)

* Other – the other topics mentioned were: shoulder range of movement and thoracic exercises (24%); posture re-education (2%); CPAP – NIV (2%) and stair climbing (2%).

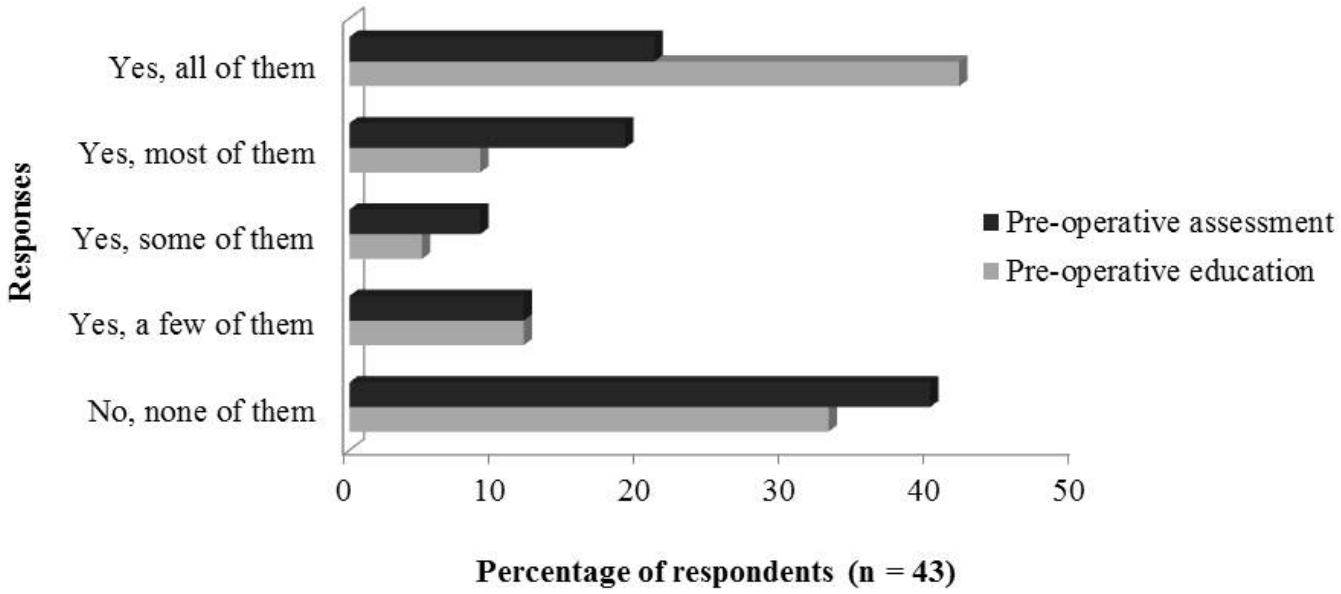
Table 5: Factors influencing physiotherapy management of patients with lung cancer.

Influencing factor; n (%)	Not at all	A little	Somewhat	A lot	Very much
Published journal articles (n=41)	0 (0%)	8 (19%)	18 (44%)	13 (32%)	2 (5%)
Text books (n=41)	3 (7%)	14 (34%)	15 (37%)	5 (12%)	4 (10%)
Established practice in your hospital (n=43)	0 (0%)	4 (9%)	12 (28%)	15 (35%)	12 (28%)
Personal experience (n=42)	0 (0%)	1 (2%)	9 (21%)	18 (43%)	14 (33%)
Postgraduate education (n=38)	12 (32%)	7 (18%)	14 (37%)	4 (10%)	1 (3%)
Professional development (workshops, seminars etc.) (n=42)	4 (10%)	6 (14%)	21 (50%)	8 (19%)	3 (7%)
Initial academic education (n=41)	3 (7%)	13 (32%)	14 (34%)	7 (17%)	4 (10%)
***Other please specify:**	0 (0%)	1 (2%)	0 (0%)	0 (0%)	2 (5%)

* Other: protocol specified by the surgeon (twice) and intensive care consultant (once).

Fig. 1: Percentage responses to questions: (i) are you involved in the pre-operative assessment of patients with lung cancer undergoing surgery? (response in black bars) and, (ii) are you involved in the pre-operative education of patients with lung cancer undergoing surgery? (response in grey bars)

Fig. 2: Proportion of patients referred to outpatient exercise training programs (pulmonary rehabilitation).



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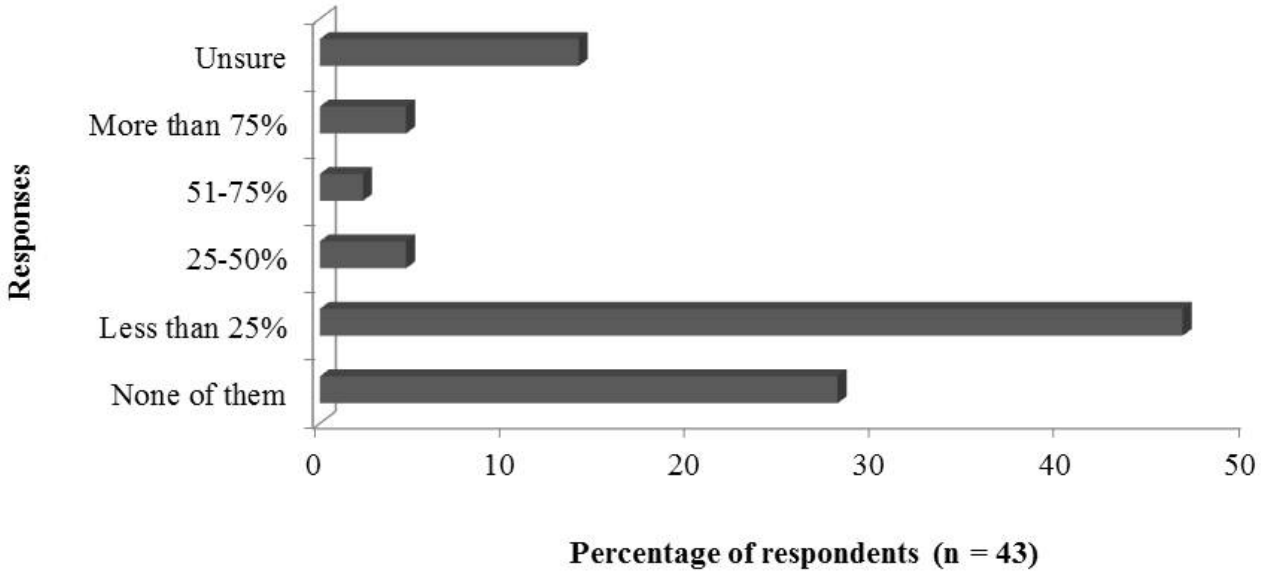

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