Title
Pulmonary rehabilitation in Australia: a national survey.

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Abstract

Objective: To determine the current structure and content of pulmonary rehabilitation programs in Australia.

Design: A cross sectional, observational design using a purpose designed anonymous written survey.

Setting and participants: The National database of Pulmonary Rehabilitation Programs maintained by the Australian Lung Foundation was used to identify all known programs in all states and territories of Australia (n=193). All pulmonary rehabilitation programs listed on the database were included. Respondents were health professionals who coordinated programs.

Results: The response rate was 83% (161/193). Programs were coordinated by physiotherapists (75/147, 51%) and/or nurses (49/147, 33%), were hospital based (97/147, 66%) and ran for 8 weeks or longer (95/147, 65%). Pre (145/147, 99%) and post (137/147, 93%) program assessment was undertaken using a variety of measures. The Six Minute Walk Test (138/147, 94%) was the most commonly used test of exercise capacity. Exercise training was included in 145 programs (99%). Most patients attended at least two supervised exercise sessions per week (106/147, 72%) and exercised for at least 20 minutes (135/147, 92%). Lower limb endurance, upper limb endurance, strength training, and stretching/flexibility exercises were the most commonly included modes of exercise. Intensity prescription for exercise training was variable. Many respondents (93/147, 63%) indicated that they perceived a gap between their clinical practice and current evidence.

Conclusions: Pulmonary rehabilitation programs in Australia generally meet the broad recommendations for practice in terms of components, program length, assessment and exercise training. The prescription of exercise training intensity is an area requiring deeper exploration.

Keywords

Pulmonary rehabilitation

Survey

Introduction

Chronic obstructive pulmonary disease (COPD) is an increasingly common cause of morbidity and mortality worldwide [1]. In addition to significant impact on patient functional capacity, quality of life and participation in activities of daily living, COPD is an increasing burden on health care systems. It is estimated that COPD costs the Australian community approximately $800 million annually [2] and, as the population ages, it is expected that these costs will continue to increase. Pulmonary rehabilitation, consisting of a number of components including exercise training, patient education, psychosocial support and self management, is an essential strategy for the management of patients with chronic respiratory diseases such as COPD [3-5]. There is an extensive body of published evidence for the effectiveness of pulmonary rehabilitation in increasing functional exercise capacity, reducing symptoms, improving health related quality of life (QOL) and reducing health care utilisation and associated costs [3, 5-7].

Recent statements and guidelines from international professional bodies recommend pulmonary rehabilitation as a first line management strategy for people with COPD [3,4,8]. The National Australian Guidelines for the management of COPD (COPD-X) emphasise pulmonary rehabilitation as an essential component of managing both established disease and exacerbations [9]. While there are published evidence-based recommendations for pulmonary rehabilitation it is not known if gaps exists between current clinical practice and these guidelines. Such gaps have been shown in other areas of health care [10,11] highlighting the need for effective implementation and knowledge translation strategies to ensure that pulmonary rehabilitation programs are providing optimal evidence-based care for patients. Surveys characterising pulmonary rehabilitation services in a number of countries have been published in recent years [12-16]. Apart from a short survey

focusing on access and barriers [17], detailed information about pulmonary rehabilitation in Australia is lacking. The aim of this study was to determine the structure and content of pulmonary rehabilitation programs in Australia.

Methods

Study Design

The study was a cross sectional, observational design. Ethics approval was granted from the University of Sydney, Human Research Ethics Committee.

Survey instrument

Previous surveys of pulmonary rehabilitation services have used either a 17 item instrument [12,14] or purposefully designed questionnaires [13,16]. Detailed information, specific to the Australian context, was desired and therefore a questionnaire was designed for this study. Development of the questionnaire content was informed by expert opinion and current literature. The questionnaire was piloted at two sites, feedback on readability, structure and utility was provided and minor modifications were made. The final questionnaire was in hard copy paper format to facilitate ease of completion by all respondents including those without internet access.

The questionnaire consisted of 47 questions divided into six sections with the majority of questions in closed categorical form. A copy of the questionnaire is provided in Appendix 1.

Sampling frame

The national database of Pulmonary Rehabilitation Programs maintained by the Australian Lung Foundation (ALF) was used to identify all known programs in Australia (n=193) and all listed were eligible for inclusion in the study.

Data collection

A package consisting of a participant information letter, paper copy of the questionnaire, site identification card and postage paid envelope was mailed to all programs listed on the ALF database. The package was addressed to the "pulmonary rehabilitation coordinator", one questionnaire per site was sent and the request was made that the person most involved in the day to day running of the program complete the questionnaire anonymously. Return of the completed questionnaire constituted consent. The site identification cards, which could not be matched to the completed questionnaires and were intended to track returns and maximise response rate, were sent separately to a second investigator to maintain anonymity. Reminder letters and repeat packages were sent one and two months after the original mailout to all sites with unreturned site identification cards. Sites without active pulmonary rehabilitation programs were advised to inform the researchers to facilitate tracking of responses and identification of non active programs.

Data analysis

All data was coded and entered into a database. Simple descriptive statistics were used. All closed categorical responses were analysed using frequencies and percentages. Open written responses were transcribed verbatim and thematic analysis undertaken.

Results

Responses

The questionnaire response rate and exclusions from the final analysis are shown in Figure 1. Completed questionnaires were returned from all states and territories in Australia and from all geographical regions (Table 1).

Figure 1

Table 1

Respondent demographics

Respondents were primarily physiotherapists (104/147, 71%) and nurses (40/147, 27%). Most respondents (97/147, 66%) had more than 10 years experience since their initial qualifications with 47 (32%) having worked in pulmonary rehabilitation for more than five years. As part of their entry-level training, 70 (48%) reported they did not receive lectures or practical classes and 105 (71%) reported no exposure to pulmonary rehabilitation while on clinical placement. Since graduation all but eight respondents had undertaken some form of ongoing training in pulmonary rehabilitation including informal training (37/147, 25%), specific workshops (89/147, 61%) and postgraduate education (13/147, 9%).

Program structure and content

Programs were predominantly hospital-based (97/147, 66%), of block type (88/147, 60%), accepted referrals from various sources and ran for a duration of 8 weeks or longer (95/147, 65%) (Table 2). Programs were coordinated by physiotherapists (75/147, 51%), nurses (49/147, 33%) or a combination of the two (16/147, 11%). Exercise was the most common program element with nearly all respondents (145/147, 99%) reporting the inclusion of exercise training. Group education and individualised self management were the other program elements included in variable combinations (Table 2).

Table 2

Patient assessment procedures and outcome measures

The inclusion of pre and post-program assessment of patients was reported by 145 (99%) and 137 (93%) respondents respectively. The measures utilised in these assessments are presented in Table 3.

Table 3

The most commonly used test of exercise capacity was the Six Minute Walk Test (6MWT) (138/147, 94%). Upper limb exercise testing was not regularly used with only 13 respondents (9%) reporting the use of any form of upper limb exercise test in their program. Exercise testing was carried out by physiotherapists (125/147, 85%) and, less commonly, nurses (41/147, 28%), exercise physiologists (8/147, 5%) and medical staff (3/147, 2%).

Exercise prescription and training

Physiotherapists were responsible for exercise prescription and training in most programs (135/147, 92%). Other staff participating in exercise training were nurses (18/147, 12%) and exercise physiologists (8/147, 5%). Respondents designated their training program as either having a set duration for each activity (33/147, 22%) or an individualised duration for each activity for each patient (107/147, 73%). Details of content, frequency and duration of exercise training programs are displayed in Table 4. All respondents reported that patients were encouraged to exercise at home in addition to supervised sessions.

Table 4

Respondents were asked to indicate how the starting intensity of exercise was generally prescribed in their program by selecting only one of the following options: exercise test, symptoms, set time or no basis. Details of the responses to this question are shown in Table 5. Nearly one third of the responses to this question were either invalid or omitted.

Table 5

Evidence based practice in pulmonary rehabilitation

Respondents were indicated their awareness of pulmonary rehabilitation statements/guidelines from major thoracic professional associations [3,8,17]. Seventy percent of respondents were aware of one or all of the major statements and 104 (71%) were aware of the Australian evidence-based recommendations for practice (The Pulmonary Rehabilitation Toolkit)[18]. Ninety three (63%) indicated that they perceived a gap between current evidence and their clinical practice in exercise

training., 34 (23%) perceived no gap and 17 (12%) reported that they were unsure of current evidence.

Discussion

This is the first published survey comprehensively detailing the structure and content of Australian pulmonary rehabilitation programs. The main findings were that most programs contained exercise training and patient education, were run by physiotherapists and nurses in outpatient settings and included both pre and post program assessment. The 6MWT was the most commonly used measure of exercise capacity and some form of lower limb endurance training was employed in all programs. Many respondents were aware of at least one of the major evidence-based statements relating to pulmonary rehabilitation however a large number indicated that they thought there was a gap between their practice and current evidence.

The excellent response rate, and participation by respondents from a variety of geographical settings and all states and territories, means that this survey is highly representative of practice in Australia. Non-responders were from all geographical settings but no other characteristics of these sites could be identified. It is possible that at least some of these represent sites without active programs. The response rate and representativeness of this study compares favourably with surveys of pulmonary rehabilitation undertaken in other countries [12-14,16].

Respondent and program demographics

The two main professional groups forming the bulk of respondents to this survey (physiotherapists and nurses) are also the predominant professional groups *coordinating* pulmonary rehabilitation in

Australia. This is a similar situation to the experience in the United Kingdom (UK), Northern Ireland and Canada [12-14] but different to the United States (US) where registered respiratory therapists, exercise physiologists and certified respiratory therapist technicians have a higher representation as coordinators of programs [16]. Many of the respondents to this survey indicated that they obtained their initial health professional qualifications over 10 years ago and a large percentage identified little related content in their entry-level training. This is not unexpected as the evidence base for, and expertise in, pulmonary rehabilitation has advanced significantly in recent years. Now current Australian entry-level health professional students (particularly in physiotherapy) would be exposed to greater academic content relating to pulmonary rehabilitation.

Program structure and content

Most programs in Australia were conducted in outpatient settings associated with hospitals or community health centres. Pulmonary rehabilitation is effective across a number of settings however most research has been undertaken in hospital outpatient-based programs [3]. Outpatient settings have been traditionally used as they provide access to a variety of health professionals and appropriate infrastructure. Only 6 programs in this study were reported to be home based. Home based programs may continue to increase in number with increasing emphasis on providing community based management for patients with chronic disease.

Program length was most commonly reported as at least 8 weeks. While some programs were less than 8 weeks, none were reported to be less than 4 weeks. An optimal program length is yet to be definitively established but longer programs may result in greater benefits and improved maintenance of gains [4]. Australian recommendations are for program durations of 6-8 weeks [18] and it would appear that most programs met this recommendation.

Essential components of pulmonary rehabilitation include exercise training, education and psychosocial support (such as anxiety and depression management, patient support and counselling)[3,4]. Exercise training, used in isolation, has high level evidence of efficacy in improving functional exercise capacity, symptoms and QOL [19,20]. The evidence is less strong for the benefits of education and psychosocial support in the absence of exercise training. Evidence based recommendations (such as those contained in the Pulmonary Rehabilitation Toolkit) state that in order to achieve maximum benefit, programs must contain exercise training and preferably also education and psychosocial support [3,4,18]. The survey results indicate that exercise training is included in nearly all programs in Australia. The inclusion of exercise training was not included in two instances (both home based programs) however these respondents did indicate, in answer to another question, including some exercises in their program. Most programs also incorporated group education and approximately half (51%) contained exercise training, group education and individual self management. These results are very similar to those reported in the UK [12] where exercise training occurred in 99% of cases and education in 94%. Program elements cannot be specifically compared to the other international populations studied as frequencies of inclusion of exercise and education as distinct elements were not reported in those studies [13,14,16]. It is encouraging that almost all Australian programs contained exercise training - currently the best evidenced component of pulmonary rehabilitation. Further investigation related to the inclusion of psychosocial support in programs in Australia would be useful.

Patient assessment procedures and outcome measures

Comprehensive patient assessment is a vital aspect of the process of pulmonary rehabilitation [3] allowing the identification of contraindications, precautions and modifications for exercise training,

facilitating exercise prescription and delineating patient goals and needs. The use of valid, sensitive and reliable assessment tools enables outcomes to be quantified and programs evaluated and benchmarked. Essentially all programs (99%) reported that assessment was undertaken prior to patient commencement. The most common assessments included were patient history, exercise testing, measurement of disease specific QOL, spirometry and assessment of nutritional status. These results are similar to those reported in other international studies particularly with respect to the inclusion of exercise testing and QOL measurement. In comparison to Australian programs those in the US had a greater emphasis on the use of physiological or laboratory-based tests (such as electrocardiogram, chest X-ray, blood biochemistry) [16]. Diagnosis of respiratory pathology is usually established prior to referral in Australia, this may explain why many programs did not include spirometry in program assessment.

Exercise testing in the Australian setting is most commonly performed by physiotherapists using the 6MWT. Field walking tests, such as the 6MWT and the incremental shuttle walk test (ISWT), were also reported to be frequently used in the UK, Northern Ireland and Canada [12-14] but not in the US [16]. Laboratory-based exercise tests were not reported to be used in any programs in Australia, a finding which is in contrast to the US [16] where Bickford et al [16] report that an “exercise stress test” was used by 65% of programs surveyed as part of pre-program assessment. The US data is now more than 15 years old and it is unknown whether practice has changed over time. Graded exercise tests were also less commonly used in Canada [14] and their use was not reported at all in the UK [12]. The ISWT was more widely used, and the 6MWT less commonly used, in the UK than Australia [12,13]. Given the widespread use of the 6MWT in Australia it is important to consider whether the test is performed in an accurate and standardised manner. More than one 6MWT is necessary to ensure accuracy of measurement and to account for learning effects [21]. Most

programs reported using only one test pre (54%) and post (77%) program. This is an area where further education may be required to ensure that research evidence is effectively translated into clinical practice.

Exercise prescription and training

Exercise training is the key element of pulmonary rehabilitation [3] and programs should incorporate lower and upper limb endurance and strength training [3,4]. Frequency of training is recommended to be at least twice a week (supervised) with a total session training duration of at least 30 minutes [3,8]. Most programs surveyed met recommendations for exercise mode, frequency, duration, and number of supervised exercise sessions per week. The modes of exercise reported also met recommendations with upper and lower limb endurance exercise being included in nearly all programs.

The reported prescription of exercise training intensity was more variable. While guidelines for optimal exercise intensity for all patients have not been definitively established, there is evidence that higher intensity training is more effective than low intensity training in achieving outcomes such as physiological benefits [4,22,23]. Prescription of exercise intensity for patients with COPD can be based on exercise tests or symptom levels [18]. The Pulmonary Rehabilitation Toolkit recommends the use of 6MWT results as a basis for a starting prescription of intensity for a walking program and the use of symptom levels (eg Borg dyspnoea score) as a basis for starting intensity in cycle training [18]. It is acknowledged that the method used to prescribe exercise intensity may need to vary between individual patients, so for the purpose of this survey, respondents were asked to indicate their “usual” basis for prescribing starting intensity for walking and cycle training.

The intensity prescription methods recommended in the Toolkit were used by approximately half the respondents for walking (56%) and cycle (54%) training.

Some respondents selected a “set time” or “no basis” as their means of prescribing a starting intensity for both walking (14%) cycle (17%) training. There were also a large number of either invalid or omitted answers to this question. Despite piloting the questionnaire the wording of the question itself may have been confusing or ambiguous. Alternatively the concept of intensity prescription may have been poorly understood by the respondents resulting in no response. While there is limited research investigating current practice training intensity prescription, it has been previously suggested that this is an area needing improvement in pulmonary rehabilitation in Australia [24]. Further research into the exact nature of practitioner understanding and use of exercise intensity prescription is needed and the results could inform the development of a comprehensive strategy for translating current evidence into clinical practice.

Evidence-based practice in pulmonary rehabilitation

A preliminary investigation of issues surrounding the use of evidence-based recommendations in pulmonary rehabilitation was undertaken. The majority of respondents (63%) thought there was a gap between evidence and their practice in terms of exercise training. Others (12%) reported that they were unaware of current evidence. These findings are the first to suggest that such a gap may exist and further research to establish the exact nature of, and reasons for, any gaps between evidence and clinical practice in pulmonary rehabilitation is needed.

Limitations

This study only sought a response from one individual per program and it is possible that other health professionals at the same site might have given different responses. As most questions related to factual information, and the survey was to be completed by the person most involved in the day to day running of the program, it is likely that responses between individuals from the same site would be consistent. Different responses may have been given to the questions relating to personal opinion and therefore such questions can be taken to represent only the individual answering and not the program in general. The survey did not include any questions relating to the characteristics of patients participating in pulmonary rehabilitation in Australia. This may limit interpretation of the appropriateness of the interventions used. However the intent of the survey was to describe program structure and content, characteristics of those delivering and adherence to published recommendations rather than specific patient characteristics.

This comprehensive survey of pulmonary rehabilitation provides a baseline against which to measure changes in the provision of pulmonary rehabilitation in Australia. The results demonstrate that current programs are generally meeting the broad recommendations for practice found in the Toolkit [18] in terms of included components, program length, patient assessment and exercise training (duration, frequency and mode). Areas requiring further elucidation are psychosocial support (both provision and content), exercise testing (standardisation and accuracy of 6MWT performance) and the prescription of exercise training intensity.

Deeper exploration, clear identification and quantification of evidence-practice gaps in pulmonary rehabilitation, and the barriers and facilitators to using research findings in clinical practice are needed. This would enable development of specific, targeted and effective strategies for the

translation of evidence into practice in order to enhance the provision of pulmonary rehabilitation and provide patients with optimal healthcare.

Ethical Approval

Ethics approval for this study was granted by the University of Sydney Human research Ethics Committee. Approval Number 06-2006/9257.

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Conflict of Interest

There are no known conflicts of interest for any author.

References

1. Pauwels RA, Buist AS, Calverley PMA, Jenkins C, Hurd SS. Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med 2001;163:1256-1276.

2. Crockett A, Cranston J, Moss J. Economic Case Statement COPD. Australian Lung Foundation 2002.

3. Nici L, Donner C, Wouters et al. American Thoracic Society / European Respiratory Society Statement on Pulmonary Rehabilitation. Am J Respir Crit Care Med 2006;173:1390-1413.

4. Ries A, Bauldoff G, Carlin B et al. Pulmonary Rehabilitation, Joint ACCP/AACVPR Evidence-Based Clinical Practice Guidelines. Chest 2007;131:4S-42S

5. Lacasse Y, Goldstein R, Lasserson T, Martin S. Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease. Cochrane Database of Systematic Reviews 2006, Issue 4, CD003793.

6. Bourbeau J, Julien M, Maltais F, et al. Reduction of hospital utilization in patients with chronic obstructive pulmonary disease: a disease-specific self-management intervention.
Arch Intern Med 2003;163:585–591

7. Griffiths TL, Phillips CJ, Davies S, Burr ML, Campbell IA. Cost effectiveness of an outpatient multidisciplinary pulmonary rehabilitation programme. Thorax 2001;56:779–784

8. Morgan MDL, Calverly PMA, Clark CJ et al. Pulmonary Rehabilitation. British Thoracic Society Standards of Care Subcommittee on Pulmonary Rehabilitation. Thorax 2001;56:827-834.

9. Abramson M, Crockett AJ, Frith PA et al. The COPD-X Plan: Australian and New Zealand Guidelines for the management of Chronic Obstructive Pulmonary Disease. The Australian Lung Foundation and the Thoracic Society of Australia and New Zealand 2009.

10. Buchan H. Gaps between best evidence and practice: Causes for concern. MJA 2004;180:S48-S49.

11. Grol R. Improving the quality of medical Care. JAMA 2001;286:2578-2585

12. Yohannes AM, Connolly MJ. Pulmonary rehabilitation programmes in the UK: a national representative survey. Clinical Rehabilitation 2004;18:444-449.

13. O'Neill B, Elborn JS, MacMahon J, Bradley JM. Pulmonary rehabilitation and follow-on services: a Northern Ireland Survey. Chronic Respiratory Disease 2008;5:149-154.

14. Brooks D, Sottana R, Bell et al. Characterization of pulmonary rehabilitation programs in Canada in 2005. Can Respir J 2007;14:87-92.

15. Bickford L, Hodgkin J. National Pulmonary Rehabilitation Survey. J Cardiopulm Rehabil 988;11:473-491.

16. Bickford L, Hodgkin J, McInturff S. National Pulmonary Rehabilitation Survey, Update. J Cardiopulm Rehabil 2005;15:406-411.

17. Pulmonary Rehabilitation Survey. The Australian Lung Foundation 2007.

18. Alison J et al, The Pulmonary Rehabilitation Toolkit on behalf of The Australian Lung Foundation, 2009. www.pulmonaryrehab.com

19. Troosters T, Gosselink R, Decramer M. Short- and Long-term Effects of Outpatient Rehabilitation in Patients with Chronic Obstructive Pulmonary Disease: A Randomized Trial. Am J Med. 2000;109:207–212.

20. Bernard S, Whittom F, LeBlanc P et al. Aerobic and strength training in patients with chronic obstructive pulmonary disease. Am J Respir Crit Care Med 1999;159:896–901.

21. Spencer L, Alison JA, McKeough ZJ. Six-minute walk test as an outcome measure. Am J Phys Med Rehabil 2008;87:224-228

22. Troosters T, Casaburi R, Gosselink R, Decramer M. Pulmonary Rehabilitation in Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med 2005;172:19-38

23. Casaburi R, Porszasz R, Burns MR, Carithers ER, Chang RS, Cooper CB.
Physiologic benefits of exercise training in rehabilitation of patients with severe chronic obstructive pulmonary disease. Am J Respir Crit Care Med 1997;155:1541-1551

24. Spencer L., Speerin R, Scanlon K, Scott M. Rehabilitation in NSW: a report following rural visits. Proceedings of the 9th National APA Cardiothoracic Group Conference 2005.

Tables

Table 1: Geographical Distribution of responses.

Geographical Classification (population)	*Response (n, %)*
Metropolitan/Urban (>100 000)	57 (39)
Large Regional (30 000 – 100 000)	37 (25)
Small regional (10 000 – 30 000)	35 (24)
Rural (< 10 000)	18 (12)

TABLE 2 – Structure and content of pulmonary rehabilitation programs in Australia.

Program setting	n (%)
Hospital outpatient	97 (66)
Community or day centre	39 (27)
Home based	6 (4)
Other	4 (3)
No response	1
Type of program	
Block program	88 (60)
Rolling program	55 (37)
Other structure	3 (2)
No response	1
Elements included in program	
Exercise, group education and individual self management	75 (51)
Exercise and group education	55 (38)
Exercise only	8 (5)
Exercise and individual self management	7 (5)
Individual self management only	1 (1)
No response	1
Source of referrals	
Respiratory physician	138 (94)
Other or general physician	128 (87)
General practitioner	125 (85)
Physiotherapist	111 (76)
Nurse	94 (64)
Other health professionals	59 (40)
Self or carer referral	62 (42)
Program length (weeks)	
4-7	52 (36)
8	68 (46)
>8	27 (18)

TABLE 3: Assessment components

	Pre program	*Post program*
Assessment	*n (%)*	*n (%)*
Patient history	140 (95)	36 (24)
General observations at rest (HR, SpO_2, BP)	142 (97)	116 (79)
Spirometry	84 (57)	51 (35)
Exercise testing	134 (91)	131 (89)
Disease specific QOL questionnaire*	122 (76)	107 (73)
General QOL questionnaire**	27 (18)	24 (16)
Hospital anxiety and depression score	41 (28)	-
Measurement of body mass index or Fat free mass	59 (40)	29 (20)
Assessment of self efficacy	54 (37)	-
Other	22 (15)	24 (16)
Exercise testing procedure		
No exercise test	1 (1)	-
Measure observations during general exercise	3 (2)	-
One 6MWT	80 (54)	113 (77)
Two 6MWT	58 (39)	15 (10)
Three or more 6MWT	0 (0)	-
Incremental Shuttle Walk Test	3 (2)	3 (2)
Graded laboratory-based exercise test	0 (0)	-
Other	2 (1)	-

* St Georges Respiratory Questionnaire or Chronic Respiratory Disease Questionnaire

** For example SF-36

TABLE 4 - Exercise training included in pulmonary rehabilitation programs.

Mode of exercise	*n (%)*
Lower limb endurance exercise *	147 (100)
Stationary cycle	132 (90)
Walking inside (eg corridor)	128 (87)
Treadmill	105 (71)
Walking outside	39 (27)
Upper limb endurance exercise	144 (98)
Unsupported UL exercise with or without weights	143 (97)
Arm cranking exercise	68 (46)
Strength training	109 (74)
Lower limb exercises with weights	83 (56)
Exercise using resistance band or similar	82 (56)
Other modes of exercise	-
Stretching and flexibility exercises	134 (91)
Stepping up and down (stepper or block)	129 (88)
General whole body exercises (E.g. lunges, squats)	106 (72)
Rowing machine	25 (17)
Other**	19 (13)
Frequency of supervised exercise sessions (per week)	
none	5 (3)
1	35 (24)
2	93 (63)
3	8 (5)
>3	5 (3)
Duration of actual exercise each session (minutes)	
<20	12 (
20-30	19 (13)
30 - 40	65 (44)
>40	51 (35)

* Two respondents indicated that they had no formal exercise training component however both respondents answered this question and indicated that they included some form of exercise in their program.

** Other included: balance/fit ball, core stability, general balance exercises, dancing, tai chi.

TABLE 5 - Basis of usual starting prescription of exercise training intensity

	Walk	*Cycle*
Basis of starting exercise training intensity prescription	*n (%)*	*n (%)*
Exercise test	58 (39)	27 (18)
Symptoms	25 (17)	52 (35)
Set time	15 (10)	21 (14)
No basis	5 (3)	4 (3)
Invalid response*	33 (22)	25 (17)
No response	11 (8)	18 (12)

* Invalid responses were those where the respondent had indicated more than one answer to the question.

Figures

Figure 1: Questionnaire response rate and exclusions.