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If you measure it, it matters!: a survey of factors influencing implementation of physical activity promotion in cardiac and pulmonary rehabilitation in Australia

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ABSTRACT

Objective: To identify factors related to the frequency of physical activity (PA) promotion by health professionals working in cardiac and/or pulmonary rehabilitation.
Methods: A cross-sectional online survey of health professionals working in cardiac and/or pulmonary rehabilitation in Australia was conducted between July and November 2022.
Results: A total of 71 health professionals from four disciplines (physiotherapy, nursing, exercise physiology, occupational therapy) completed the survey. The majority agreed that PA promotion was part of their role. Despite this, only half of the participants encouraged $\geq$ 10 patients per month to be more physically active. In logistic regression modelling, health professionals that measured patients' PA levels (odds ratio 8.04, 95% confidence level 1.45–44.19) and prioritised PA promotion regardless of other patient problems (odds ratio 3.3, 95% confidence level 0.74–14.82) were much more likely to frequently promote PA to patients.
Conclusion: Measurement of patients' PA levels within cardiac and pulmonary rehabilitation and making PA promotion a priority may impact the implementation of PA promotion within these programs.
Practical Implications: Physical activity measurement as a key performance indicator in cardiac and pulmonary rehabilitation is indicated. This may be an important strategy to increase physical activity promotion by cardiac and pulmonary rehabilitation health professionals.

1. Introduction

In people with coronary heart disease (CHD) and chronic obstructive pulmonary disease (COPD) increased physical activity decreases all-cause mortality [1–9]. Additionally, in people with CHD sufficient physical activity reduces the impact of CHD, slows its progress and improves modifiable risk factors for recurrent cardiovascular disease and other chronic disease [10–12]. Increased physical activity in people with COPD also reduces exacerbations, dyspnea, hospitalizations and improves health-related quality-of-life, exercise capacity and forced expiratory volume in 1 s (FEV1) [8,13,14]. Thus, exercise and physical activity are core components of cardiac rehabilitation [15–17] and pulmonary rehabilitation [18–20] internationally.

Comprehensive cardiac and pulmonary rehabilitation are very similar, consisting of weekly exercise and education sessions delivered by a multidisciplinary team in an outpatient setting [15,20]. Exercise is a subset of physical activity that is planned, structured, and repetitive and has an objective to improve or maintain physical fitness, for example, cardiorespiratory fitness [21]. Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure, for example, walking for transport, dancing, housework, gardening [21]. The World Health Organization (WHO) physical activity guidelines for adults with chronic disease recommend that individuals should complete 150–300 min of moderate intensity aerobic physical activity; or 75 – 150 min of vigorous intensity aerobic physical activity; or a combination of both per week [10]. However, both cardiac and pulmonary rehabilitation patients have found it difficult to meet and sustain these guidelines [22–25].

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Physical activity promotion by health professionals is a key strategy to improve the population's physical activity levels and can be effective to increase the physical activity levels of individuals with and without CHD or COPD over the short and long term [26–30]. Internationally and across disciplines, health professionals agree that physical activity promotion is part of their role, are confident in promoting physical activity and perceive that promotion of physical activity is important [31,32]. Despite this, physical activity promotion across disciplines and settings appears to be low-to-moderate, with variations in physical activity knowledge and lack of time to promote physical activity within consultations reported as the biggest barriers to implementation [31–33].

Currently, to the authors' knowledge, there is no research on physical activity promotion by health professionals in cardiac and pulmonary rehabilitation. Identifying determinants of physical activity promotion implementation behaviour among health professionals allows providers of cardiac and pulmonary rehabilitation programs to enhance facilitators and reduce barriers so physical activity interventions can be effectively implemented. Therefore, the aim of this study was to identify factors related to the frequency of physical activity promotion by health professionals working in cardiac and/or pulmonary rehabilitation in Australia to guide future implementation strategies.

2. Methods

2.1. Design

A cross-sectional cohort study sampling health professionals working in cardiac and/or pulmonary rehabilitation in Australia was conducted between July and November 2022 using an online questionnaire. Different phases of cardiac and pulmonary rehabilitation are delivered in Australia, with cardiac phase II and pulmonary outpatient rehabilitation programs the most common. These programs are similar nationally and are typically centre-based multi-disciplinary group exercise and education (comprehensive) programs that run for 6–12 weeks. Ethical approval was obtained from the University of Canberra Human Research Ethics Committee (HREC-11750). All participants provided informed consent.

2.2. Participants

Eligible participants were health professionals currently practicing and/or managing cardiac rehabilitation and/or pulmonary rehabilitation in Australia. Participants needed to have access to the internet via a computer or other electronic device, as the survey was only distributed online.

The Australian Cardiovascular Health and Rehabilitation Association (ACRA) endorsed the study and distributed the survey via email to their members (n = 484). Other potential participants were identified via professional networks (for example, the Australian Physiotherapy Association Cardiorespiratory National Group, Australian Pulmonary Rehabilitation Network) and contacts and invited to participate in the survey via email. Social media (Twitter, Facebook) was also used to distribute the survey.

2.3. Questionnaire design

The questionnaire contained 32 questions (Supplementary File 1) and was delivered via the Qualtrics online survey platform (Qualtrics, Provo, Utah, United States). Demographic and clinical questions (n = 12) were included, such as gender, age group, years of experience as health professionals and as providers of cardiac and/or pulmonary rehabilitation, type of work setting, prior training on physical activity and health behaviour interventions, and measurement of physical activity within the rehabilitation setting. Additional questions (n = 16) were adapted from the Determinants of Implementation Behaviour Questionnaire (DIBQ), which is based on the Theoretical Domains Framework (TDF) and has 18 domains [34]. The DIBQ is a valid and reliable questionnaire used to assess potential determinants of health-care professional implementation behaviour using the TDF [35,36]. The DIBQ items were modified to be relevant to physical activity promotion by health professionals working in cardiac and/or pulmonary rehabilitation. All DIBQ items were scored using a seven-point Likert-scale. Questions (n = 2) were also adapted from the questionnaire used in an Australian study of physical activity promotion by health professionals [31]. Items included frequency of physical activity promotion and feasibility of methods to promote physical activity. Finally, a multiple choice question was included to assess participants knowledge of the WHO Physical Activity guidelines for adults with chronic disease [10].

2.4. Data analysis

All returned surveys were included in the analysis. Responses were categorised according to established guidelines (complete: 80–100% questions answered; partially complete: 50–79% questions answered; incomplete: <50% questions answered) [37]. To facilitate analysis and reporting, the responses to some multiple choice and Likert-scale questions were dichotomised. A single score was calculated for each of the DIBQ 18-domains by determining the most frequent response (i.e.: mode) to the set of questions within each domain [38]. Each of the multiple-response options were then transformed into dichotomous variables (i.e., agree vs neutral/disagree). Data were analysed using descriptive analyses, including frequencies, percentages, medians and inter-quartile ranges, reporting numbers of responses for each item.

Responses of health professionals who more frequently promoted physical activity to their patients were compared to those who less frequently promoted physical activity to determine factors that are associated with greater frequency of physical activity promotion. This was achieved by dividing the total sample into two groups, 'encouraged < 10 patients per month (less often)' versus 'encouraged ≥ 10 patients per month (more often)' [31]. Associations between all demographic and behavioural variables were assessed using Spearman's rho. Logistic regression analysis with manual backward stepwise elimination was utilized, commencing with all potential predictor variables ($p < 0.1$) to identify the most parsimonious model for predicting encouraging patients more often compared to encouraging patients less often to be more physically active. The criterion of $p \leq 0.1$ was used to determine which variables were retained. Data are reported as adjusted odds ratios with 95% confidence intervals. The model was assessed for goodness of fit using the Hosmer-Lemeshow chi-square test and area under the receiver operator characteristic (ROC) curve. All statistical analysis was performed using SPSS v28 (Chicago, Illinois: IBM Corp).

3. Results

A total of 71 health professionals working in cardiac and/or pulmonary rehabilitation in Australia completed the survey. Fifty-two participants (73%) completed 80–100% of the survey (n = 48, 100%), nine completed between 50% and 79% and ten completed less than 50%. The majority of participants were female, physiotherapists, with greater than 8 years' experience working as a health professional (Table 1). Most had completed formal behaviour change training and were working in a public hospital in a cardiac rehabilitation phase II and/or an outpatient pulmonary rehabilitation program. Half of the participants were less than 40 years old, had completed post graduate training in exercise science or chronic disease management and had been working in cardiac and/or pulmonary rehabilitation for greater than 8 years. No health professionals from the Northern Territory participated in the survey, with all other Australian states and territories represented.

Approximately half of the health professionals reported encouraging physical activity to 10 or more patients per month, with group sessions reported the most feasible method for physical activity promotion

Table 1
Participant characteristics and association with frequency of physical activity promotion in cardiac and/or pulmonary rehabilitation.

Characteristic (n = 71)	n (%)	*p-value* [*]
Gender, Females	57 (80)	0.62
Age, ≤ 40 years	33 (47)	0.09
Occupation		0.75
Physiotherapist	34 (48)	
Nurse	26 (37)	
Exercise Physiologist	9 (13)	
Occupational Therapist	2 (3)	
Years of Practice as a health professional, > 8 years	55 (78)	0.16
Years of Practice in cardiac/pulmonary rehabilitation, > 8 years	31 (44)	0.32
Post-graduate studies exercise science/chronic disease management, yes	34 (48)	0.17
Behaviour change formal training, yes	46 (65)	0.62
Work setting[#a]		0.71
Public Hospital	44 (72)	
Private Hospital	6 (10)	
Community	18 (30)	
Private Clinic	3 (5)	
Other	1 (2)	
Work State[a]		0.20
New South Wales	19 (31)	
Australian Capital Territory	4 (7)	
Victoria	17 (28)	
Queensland	5 (8)	
Tasmania	1 (2)	
South Australia	10 (16)	
Western Australia	5 (8)	
Program Phase[#a]		0.90
Cardiac Rehabilitation Phase I	8 (13)	
Cardiac Rehabilitation Phase II	41 (67)	
Cardiac Rehabilitation Phase III	12 (20)	
Cardiac Rehabilitation Phase IV	4 (7)	
Pulmonary Rehabilitation (inpatient)	2 (3)	
Pulmonary Rehabilitation (outpatient)	35 (57)	
Patients/month[a], median (IQR)	20 (15, 38)	0.05
CR/PR sessions/week[b], median (IQR)	3 (2, 6)	0.07
Length of cardiac/pulmonary rehabilitation session[c] (hours), median (IQR)	1 (1,2)	0.64
Encouraged patients to be more physically active[c], ≥ 10 patients/mth	41 (57)	N/A
Currently measuring physical activity[a], yes	40 (56)	0.003
Method for measuring patient's physical activity[#]		0.42
Questionnaire	25 (63)	
Pedometer	5 (13)	
Accelerometer	1 (3)	
Smartphone app	8 (20)	
Wearable activity tracker	12 (30)	
Other	14 (35)	
Feasibility of physical activity promotion strategies[d], feasible		
Brief counselling integrated into regular consultation	43 (90)	0.78
Separate one-on-one interactions	43 (90)	0.98
Group sessions	47 (98)	0.48
Distribution of resources (e.g. brouchures)	46 (96)	0.05
Other	17 (35)	0.76
Physical activity guidelines for adults with chronic disease[c], correct	43 (60)	0.15

[*] *p*-value for association with frequency of encouraging patients to be more physically active
[#] multiple responses allowed
[a] Missing: n = 10
[b] Missing: n = 12
[c] Missing: n = 11
[d] Missing: n = 23

(Table 1). Participants also suggested that telehealth, text messaging and smartphone applications could be feasible strategies to promote physical activity (Table 2). Approximately half of the participants were measuring the physical activity levels of their patients and the most frequent method for measurement was with a questionnaire (Table 1).

Table 2
Participant open-text responses for 'other' feasible physical activity promotion methods and further comments about physical activity promotion in cardiac and pulmonary rehabilitation.

Other kinds of physical activity promotion that is feasible to deliver to patients
referral onto community program
Use of SMS and email to deliver resources / education
Online/App exercise programming
TeleHealth virtual group education sessions out of hours
Telehealth coaching
Referral to other allied health professionals to assist with barriers to PA
Activity monitor
Goal setting and problem solving specific to the patient
links to video educational resources which pt can watch in session or at home, esp with pt experience and stories

Further comments about physical activity promotion in cardiac and/or pulmonary rehabilitation
As a physiotherapist I think there should be a distinction between physical activity and exercise and that it is our role to educate patients about this and promote both.
Has been difficult to deliver PR in the past 2 years due to COVID restrictions - which has meant that a lot of our focus has been on interventions for increasing PA using remote methods, with patients not having the usual resources to do PA
It is part of our core role and is a major aspect of cardiac and pulmonary rehab
We integrate PA promotion into our programs and during our assessments. We find it challenging to find the time to assess outcome measures but have been working towards using sit to stand test measurements
I have found that a big part of our role is to be consistently available each week for participants to be able to complete exercises and build routine and confidence.
More training for nurse-led PA promotion and intervention. It seems to be the domain of EPs and PTs which is not always accessible to all patients engaged in CR.
Consistent funding across health funds needs to be addressed. Agreements within private hospitals is very inconsistent.
it is certainly important in overall but esp maintenance part of the PR program, esp as increasing waiting-list and referral numbers and COVID safe measures mean many hospital can no longer offer maintainence programs for PR patients, and many patient find it hard to sustain their exercises without the help of a hospital program. I think online exercise videos or promotion on ideas on how to stay active eg park car further and walk, always use stairs etc might be a good way to help pts continue with their incidental activity

PA, physical activity; PR, pulmonary rehabilitation; EP, exercise physiologist; PT, physiotherapist; CR, cardiac rehabilitation; pts, patients.

Other methods for measuring physical activity were verbally self-report and use of an exercise diary. Six out of 10 participants were able to correctly identify the WHO physical activity guidelines for adults with chronic disease.

For the included behavioural domains, more than 80% of participants felt it was part of their role to promote physical activity and they had the knowledge, skills, and confidence (Social/professional role and identity) to deliver the intervention (Table 3). Participants were planning to promote physical activity in the next 3 months (Intentions) as it was compatible with their daily practice (Innovation), and they believed patients were positive about the intervention (Patient). It was socially acceptable to deliver physical activity promotion (Social influences) and participants were optimistic about delivering the intervention (Positive and Negative emotions, Beliefs about consequences), had a clear plan how they would deliver the intervention (Behavioural regulation) and did this automatically (Nature of behaviours). Participants didn't feel as positively about the support they received from their organisation, insurance companies, local authorities, and the Government (Socio-political context) to deliver physical activity promotion, nor about the organisational support for training on physical activity promotion (Innovation strategy). General comments about physical activity promotion in cardiac and pulmonary rehabilitation highlighted additional needs for health professionals such as training for nurse-led interventions and strategies to promote physical activity over the longer term (Table 2).

Seven factors had an association ($p \leq 0.1$) with frequency of physical activity promotion (Tables 1 and 3): participant age; patients managed per month; cardiac and/or pulmonary rehabilitation sessions per week;

Table 3
Participant responses to the DIBQ TDF domains and association with frequency of physical activity promotion in cardiac and/or pulmonary rehabilitation.

Domain	Definition[#]	Agree, n (%)	*p*-value [*]
Knowledge[a]	An awareness of the existence of something	53 (93)	0.16
Skills[a]	An ability or proficiency acquired through practice	52 (91)	0.12
Social/professional role and identity[a]	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting	56 (98)	0.50
Beliefs about capabilities[b]	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use	47 (89)	0.40
Optimism[c]	The confidence that things will happen for the best or that desired goals will be attained	50 (82)	0.07
Beliefs about consequences[d]	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation	2 (4)	0.32
Intentions[d]	A conscious decision to perform a behaviour or a resolve to act in a certain way	50 (91)	0.53
Goals[e]	Mental representations of outcomes or end states that an individual wants to achieve	22 (42)	0.10
Innovation[a]	Any characteristics of the innovation that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour	53 (93)	0.77
Socio-political context[f]	Any characteristics of the socio-political context that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour	29 (60)	0.68
Organisation[g]	Any characteristics of the organization that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour	29 (64)	0.28
Patient[e]	Any characteristics of the patient that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour	41 (79)	0.67
Innovation strategy[h]	Any characteristics of the innovation strategy that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour	23 (50)	1.0
Social influences[i]	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours	32 (82)	0.25
Positive emotions[j]	A complex positive reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	41 (82)	0.96
Negative emotions[j]	A complex negative reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event	1 (2)	0.17
Behavioural regulation[e]	Anything aimed at managing or changing objectively observed or measured actions	46 (89)	0.97
Nature of the behaviours[j]	The nature of the aggregate of all responses made by an individual in any situation	45 (90)	0.50

[#] Definitiions obtained from Huijg et al. [34]
[*] *p*-value for association with frequency of encouraging patients to be more physically active
[a] Missing: n = 14
[b] Missing: n = 18
[c] Missing: n = 10
[d] Missing: n = 16
[e] Missing: n = 19
[f] Missing: n = 23
[g] Missing: n = 26
[h] Missing: n = 25
[i] Missing: n = 32
[j] Missing: n = 21

currently measuring physical activity; feasible method to promote physical activity (brochures); and TDF domains Optimism and Goals. Participant age, cardiac and/or pulmonary rehabilitation sessions per week and agreeing that brochures were a feasible method to promote physical activity were not retained in the final multivariable model. Health professionals that measured physical activity were eight times more likely to encourage 10 or more patients per month to be more physically active compared to those that didn't measure physical activity (Table 4). Those that weren't always optimistic about their work (Optimism) were seven times more likely to encourage physical activity to 10 or more patients per month. Health professionals that thought addressing other patient problems was not a higher priority than encouraging physical activity (Goals) were more than 3 times more likely to more frequently encourage physical activity compared to those that thought addressing other patient problems was a higher priority. If health professionals treated more patients per month, they were 10% more likely to encourage patients to be more physically active more frequently. The model demonstrated a good fit to the data.

4. Discussion and conclusion

4.1. Discussion

Australian cardiac and pulmonary rehabilitation health professionals believe that physical activity promotion is part of their role, and they have the physical activity promotion knowledge, skills and confidence to deliver this intervention, with a reasonable knowledge of the physical activity guidelines. Importantly, health professionals that measured cardiac and pulmonary rehabilitation patients' physical activity levels, made physical activity promotion a priority, and didn't always expect the best at work were three to eight times more likely to promote physical activity, regardless of their clinical experience, occupation, or level of training in behaviour change, exercise science or chronic disease management. Including the measurement of physical activity within the patient assessment may be an important factor to increase physical activity promotion by health professionals and improve the physical activity levels of cardiac and pulmonary rehabilitation patients.

Similar to other studies, the participants perceived physical activity promotion to be part of their role within cardiac and pulmonary rehabilitation programs [32]. Participant knowledge of the physical activity guidelines was fair, with 60% of participants able to correctly identify

Table 4
Logistic regression model for factors associated with more frequently encouraging patients to be more physical active in cardiac and/or pulmonary rehabilitation.

Variable	AOR	95% CI
Currently measuring physical activity[^]	8.04[*]	1.45, 44.19
Patients per month	1.09[*]	1.01, 1.17
Optimism[#]	7.34	0.64, 84.68
Goals[#]	3.3	0.74, 14.82
Hosmer-Lemeshow goodness of fit (*p*)	0.36	
Area under ROC curve	0.85	

[*] $p < 0.05$; AOR, adjusted odds ratio, [^]reference value = no, [#]reference value = agree

these guidelines in a multiple choice question. This is much higher than the physical activity guideline knowledge of Australian nursing and allied professionals found in a previous study (16%) [31]. However, in the earlier study knowledge of the guidelines was assessed using a different method (open text question) and participants were nursing and allied health professionals working in a variety of settings where exercise and physical activity may not have been considered a core component of the services they provide [31]. Both studies found that only half of Australian health professionals surveyed were encouraging 10 or more patients per month to be more physically active. The qualitative comments in the current study and other studies indicate that more training in physical activity promotion is needed, making use of a variety of methods (e.g., telehealth), and these factors may improve the frequency of physical activity promotion within cardiac and pulmonary rehabilitation [32]. In contrast to this, the logistic regression modelling found that training in exercise science, chronic disease management and behaviour change techniques and frameworks were not found to be factors influencing frequency of physical activity promotion.

Lack of optimism has not been previously reported as an influencing factor for physical activity promotion by health professionals. This is an interesting finding that requires further investigation as it may indicate that health professionals that make physical activity promotion a priority (Goals) regardless of what is happening at work (Optimism i.e.; uncertain times, not always expecting the best) are more likely to frequently promote physical activity. Systematic reviews have found positive associations between physical activity promotion by health professionals and importance or priority of physical activity promotion [33,39]. Measurement of physical activity was found to be the most influential factor for frequent promotion of physical activity by cardiac and pulmonary rehabilitation health professionals. Positive associations have been found between assessment of physical activity and physical activity promotion [39]. In three out of four studies included in this systematic review, assessment, or measurement of physical activity by psychologists and nurses led to an increase in physical activity promotion. Therefore, including routine measurement of physical activity within cardiac and pulmonary rehabilitation may be a simple and effective strategy to increase physical activity promotion by health professionals in these settings. Further research is required to explore the association between physical activity measurement and promotion, and when physical activity should be measured, for example, at baseline and discharge and/or during the program.

Physical activity levels can be assessed subjectively (e.g., questionnaire) or objectively (e.g., pedometer). Physical activity measurement determines whether an individual is insufficiently active (i.e., not meeting the physical activity guidelines) and at an increased risk of a recurrent cardiovascular event, COPD exacerbation, hospitalisation, and death in people with CHD or COPD. It is important to recognise that measuring cardiorespiratory fitness (e.g., 6-minute walk test distance) does not measure physical activity levels. The most common metrics used to measure physical activity are minutes of moderate-to-vigorous physical activity (MVPA) and step counts. Despite the importance of promoting physical activity to improve cardiac and pulmonary rehabilitation patients' health and well-being outcomes, physical activity measurement does not appear to be a routine key performance indicator for cardiac and pulmonary rehabilitation internationally [20,40,41], even though it is recommended these data are collected in clinical practice guidelines [15–17,19]. In Australia, national cardiac rehabilitation quality indicators are currently being tested and the assessment of physical activity levels is not included [40]. Globally, an international cardiac rehabilitation registry is being developed and change in self-reported MVPA pre and post-program is one of twenty-nine included variables, although this registry is yet to undergo usability testing and be implemented widely [41]. In a recent report from the American Thoracic Society defining modern pulmonary rehabilitation, physical activity counselling was described as a desirable component and not an essential component of pulmonary rehabilitation [20]. Considering that objective measurement of physical activity has been found to be the strongest predictor of all-cause mortality in people with COPD [9], and active people with CHD have a 50% lower risk of mortality compared to inactive counterparts [7], there is a strong argument that physical activity should be measured routinely in both pulmonary and cardiac rehabilitation around the world.

There are a number of limitations to this study. The results may not be generalizable to all health professionals working in cardiac and pulmonary rehabilitation as the participants were predominantly female, physiotherapists, and experienced clinicians that were currently working in Australia. However, cardiac and pulmonary rehabilitation guidelines are similar internationally and these findings may be applicable to other countries. Other factors that may impact the generalizability and interpretation of the results were different characteristics of the programs where participants worked, for example, group versus 1:1 offerings, virtual versus centre-based programs, which were not captured other than work setting, state and program phase. Selection bias may have occurred due to voluntary sampling, with participants more interested in physical activity more likely to complete the survey. The survey was also only offered online, which may have limited responses. Recall and social desirability bias may also be present. Additionally, the sample size was smaller than recommended for multiple regression analyses with four independent variables ($50 + 8[IVs] = 82$) [42]. Regardless, the use of a validated and reliable questionnaire following the TDF has allowed strategies to improve physical activity promotion within cardiac and pulmonary rehabilitation to be identified based on potential determinants of health professional implementation behaviour.

5. Conclusion

Health professionals working in cardiac and/or pulmonary rehabilitation feel that physical activity promotion is part of their role, and they have the knowledge, skills, and confidence to deliver this intervention. Despite this, only half of the participants were promoting physical activity to 10 or more patients per month and measuring the physical activity levels of their patients. If health professionals measured patient physical activity levels and made physical activity promotion a priority they were much more likely to frequently promote physical activity. Physical activity measurement as a key performance indicator in cardiac and pulmonary rehabilitation is indicated, potentially leading to increased physical activity promotion within these programs.

5.1. Practice Implications

Age, gender, occupation, years of practice, completion of behaviour change training and post-graduate studies in exercise science or chronic disease management, work setting and location, program phase, method of measuring physical activity and feasibility of physical activity promotion strategies did not influence frequency of physical activity promotion. Nor did physical activity promotion knowledge, skills, confidence, or role perception. Additional training in physical activity promotion may not result in increased frequency of physical activity promotion but reporting of physical activity as a key performance indicator may. Measuring physical activity routinely and making physical activity promotion a priority, regardless of other patient problems, may be important strategies to increase physical activity promotion within cardiac and pulmonary rehabilitation.

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CRediT authorship contribution statement

Zainuldin Rahizan: Writing – review & editing, Supervision, Project

administration, Methodology, Formal analysis, Data curation, Conceptualization. **Patterson Kacie:** Writing – review & editing, Methodology, Formal analysis. **Wong Yu Jie:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Chong Sarah:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Koh Wen Hui Jasmine:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Goh Chong Hui:** Writing – review & editing, Methodology, Formal analysis, Data curation. **Talbot Richie:** Writing – review & editing, Methodology, Investigation. **Freene Nicole:** Writing – review & editing, Writing – original draft, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2023.107994.

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