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Dear Editor,

Please find enclosed the edited manuscript in Word format (file name: ESPS Manuscript NO: 1755)

Title: Seasonal variation and living alone are related to pulmonary rehabilitation non-completion

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The manuscript has been improved according to the suggestions of reviewers in the following pages. We have underlined the changes in the manuscript in the response to reviewer's comments section in this document and incorporated these changes into the manuscript.

Yours Sincerely

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Reviewer 1 - Comments to authors

Pulmonary rehabilitation is an effective intervention in managing chronic obstructive pulmonary disease (COPD). However, non-completion rates have been reported between 20-30%. It is important to improve the understanding of factors associated with program non-completion to ensure optimal use of this limited health care resource. The study is to identify baseline characteristics that independently predict pulmonary rehabilitation non-completion and compare these findings against the participant's reasons for non-completion. They found that despite winter commencing programs and participants who lived alone being independent predictors of program non-completion, neither measure was reported by participants as a reason for non-completion.

Classification: Grade B - very good

Language evaluation: Grade A - priority publishing

Conclusion: Minor revision

There are several questions:

Question 1: The participant's reasons for non-completion should be illustrated in figure.

Our response: We have outlined the participant's reasons for non-completion in Table 4 as we felt the information was presented more clearly in a Table. However, we have added the reasons given for non-completion and grouped into: medical reasons (75%), other personal reasons (30%) and external barriers (45%) into the Figure 1.

Question 2: Why there is no relationship between program non-completion in winter and illness as the reason reported for non-completion?

Our response: Illness was the most common reason given for program non-completion (13/20). However, there was no relationship between illness being the participant's reason for non-completion during the programs commenced in winter (70% (7/10)) when compared to programs commenced during the remaining seasons (60% (6/10); $p=0.135$).

We have clarified this finding in the Results section (paragraph 5) to read:

"There was no relationship between illness being the participant's reason for non-completion during the programs commenced in winter (70% (7/10)) when compared to programs commenced during the remaining seasons (60% (6/10); $p=0.135$)."

We have clarified this finding in the Discussion section (paragraph 2) to read:

"Despite illness being more commonly reported as a reason for program non-completion during winter (70%) when compared to the remaining seasons (60%), this findings was not statistically significant ($p=0.135$)."

Question 3: A survey consisting of both closed response and open-ended questions was developed by the study's investigators. How about the validity of the questionnaires?

Our response: The survey's content was developed by the study's investigators, the pulmonary rehabilitation program's clinical staff and from the previous literature. Prior to study commencement, the face and content validity of the questionnaire was tested on participants from two pulmonary rehabilitation courses at program completion. The participants were asked to indicate possible factors that affected program completion and feedback was sought regarding the readability of the survey. The final version of the survey included both specific questions and more generic questions around reasons for program non-completion and the survey was performed by an investigator unknown to the participants and not related to the pulmonary rehabilitation program.

We have clarified the survey's validity in the Materials and Methods - Measurements section (paragraph 2) to read:

"Prior to study commencement, the face and content validity of the questionnaire was tested on participants...."

Reviewer 2 - Comments to authors

This is an interesting study to explore the reasons why some participants who joined an 8-week pulmonary rehabilitation program could not complete the course. Authors investigate a total 111 COPD patients and analyzed baseline characteristics. Non-completers also reported their personal and external factors contributed to their non-completion. Authors concluded that despite winter commencing programs and participants who lived alone being independent predictors of program non-completion, neither measure was reported by participants as a reason for non-completion.

The manuscript was well prepared and written.

Classification: Grade C - good

Language evaluation: Grade B - minor language polishing

Conclusion: Minor revision

However, there are several queries and comments needed to be clarified and revised before acceptance for publication.

Major critiques:

Question 1. Authors should provide inclusion and exclusion criteria in "Materials and Methods part.

Question 2: How many participants were enrolled initially? How many were excluded during initial survey?

Our response (to Questions 1 and 2):

One hundred and twenty-one participants with COPD were enrolled into the pulmonary rehabilitation program during the study period. However, despite being enrolled into the program, ten of these participants did not attend even one session. Therefore, as one of the study aims was to identify participant characteristics at baseline assessment that independently predict pulmonary rehabilitation program non-completion, the ten individuals who did not complete their baseline assessment were not considered for this study. Consequently, one hundred and eleven

participants who completed the pulmonary rehabilitation program's baseline assessment were included into this study. Participants (6/26 non-completers) who declined to participate in the survey or were unable to be contacted by telephone were excluded from the survey component of this study.

We have clarified the inclusion and exclusion process in the Materials and Methods section (paragraph 1) to read:

"Participants with COPD who attended the tertiary hospital's pulmonary rehabilitation program (located in the sub-tropics, latitude 27° 29' south), between 2010 and 2012 were considered for inclusion. All participants with COPD who completed the pulmonary rehabilitation program's baseline assessment were included in the study. Participants who declined to participate in the survey or were unable to be contacted by telephone were excluded from the survey component of the study."

We have also clarified the participants studied in the Results section to read:

"One hundred and eleven pulmonary rehabilitation participants with COPD, mean (±SD) age was 67.4 ± 9.2 years and FEV₁ 54.6 ± 22.3%, were included in the study."

Minor critiques:

Question 3: Introduction,-- Authors have mentioned in the second paragraph that only Fischer's study had compared the independent factors associated with pulmonary rehabilitation program non-completion against the participant's described reasons for non-completion. Some of their results should be described here in the part. What was the difference?

Our response: The study by Fischer *et al* assessed non-completion for programs with 12 weeks duration, and three different program centres involved.^[1] The programs in this study either offered three supervised days a week or in one location a five days

a week (outpatient or inpatient) program.^[1] The study by Fischer *et al* used the criteria of participants who stopped attending appointments and who missed the end of program assessment to classify non-completers.^[1] Their finding suggested that no baseline socio-demographic, clinical or psychological variables predicted program non-completion.^[1] However, the pulmonary rehabilitation programs investigated by Fischer *et al* was ≥ 3 supervised days per week for a twelve week period^[1] which may be more intensive than the standard pulmonary rehabilitation program.^[2, 3]

We have amended our manuscript's introduction (paragraph 2) to read":

"Furthermore, only the study by Fischer *et al* has compared, in the same dataset, the independent factors associated with pulmonary rehabilitation program non-completion against the participant's described reasons for non-completion.^[1] This study suggested that no baseline socio-demographic, clinical or psychological variables predicted program non-completion.^[1] However, the pulmonary rehabilitation programs investigated by Fischer *et al* were ≥ 3 supervised days per week for a twelve week period^[1] which may be more intensive than the standard pulmonary rehabilitation program. ^[2, 3]"

Question 4: Materials and Methods,---The description "Individuals who failed to attend ≥ 1 session of the pulmonary rehabilitation program were excluded from both study components." in the fifth line from the bottom of paragraph 1 should be given in a more straightforward manner for readers.

Our response:

We have clarified this question in our response to Questions 1 and 2 above from this reviewer. The manuscript in the Materials and Methods section reads:

"Participants with COPD who attended the tertiary hospital's pulmonary rehabilitation program (located in the sub-tropics, latitude 27° 29' south), between

2010 and 2012 were considered for inclusion. All participants with COPD who completed the pulmonary rehabilitation program's baseline assessment were included in the study. Participants who declined to participate in the survey or were unable to be contacted by telephone were excluded from the survey component of the study."

Question 5: Materials and Methods-Pulmonary rehabilitation program,---The description "Along with the two supervised...training each week."In the third line from the bottom should be given in a more straightforward manner for readers. Was this one of the reasons why participants could not complete the courses?

Our response:

We tailored the pulmonary rehabilitation to be compliant with current pulmonary rehabilitation recommendations which recommend twice-weekly supervised exercise training and ≥one unsupervised session at home.^[2] The number of exercise sessions were not a reason for program non-completion with only two non-completers indicated that they did not like the exercise sessions (Table 3). These two non-completers provided additional comments which were: "does not normally enjoy structured exercise but happy to participate"; and "found the exercise sessions time consuming with other company."

We have clarified this sentence in the Material and Methods - pulmonary rehabilitation program section to read (*The description "Along with the two supervised...training each week."In the third line from the bottom should be given in a more straightforward manner for readers*)::

"All participants were encouraged to complete at least one additional unsupervised exercise session of lower limb endurance and strength training each week"

Question6:. Results,---" Eleven separate courses were completed with four programs commenced during winter, three during summer, and two each during autumn and spring." in line 5 of paragraph 1. Please described more clearly about the "eleven separate courses".

Our response:

We have modified the manuscript in the Results section (paragraph 1) to read:

"Participants from eleven separate programs were included in this study, with four programs commenced during winter, three during summer, and two each during autumn and spring."

We have also modified the manuscript in the Materials and Methods section (pulmonary rehabilitation program) to read:

"The pulmonary rehabilitation program was a standardised twice weekly, eight week program^[2, 3], with five separate programs completed each year."

Question 7:---A higher percentage of non-completers commenced pulmonary rehabilitation during winter (37.8% (17/45)) when compared to the remaining seasons (13.6% (9/66); $p=0.006$).This data should be presented in Table 1.

Our response:

In order to present this data in Table 1, we have modified the results section of the manuscript to read "A higher percentage of non-completers commenced pulmonary rehabilitation during winter when compared to completers ($p=0.006$)."

and we have added the data to Table 1:

Table 1: Participant's baseline demographic data.

	Completers	Non-completers	
Number	85	26	
Age (years)	67.4 ± 9.1	67.2 ± 9.5	<i>p</i> =0.930
Sex (female)	36/85 (42.3%)	12/26 (46.2%)	<i>p</i> =0.822
Social support (living alone)	22/85 (25.9%)	14/26 (53.8%)	<i>p</i> =0.015*
Currently smoking	6/85 (7.1%)	4/26 (15.4%)	<i>p</i> =0.240
Programs commencing in Winter	28/85 (32.9%)	17/26 (65.4%)	<i>p</i> =0.006*
FEV ₁ % predicted	55.4 ± 22.4	51.4 ± 22.5	<i>p</i> =0.452
FVC% predicted	76.8 ± 18.5	71.4 ± 19.5	<i>p</i> =0.243
Charlson Co-morbidity index	1.9 ± 1.1	1.9 ± 1.0	<i>p</i> =0.851
BODE index	2.6 ± 1.9	3.1 ± 2.1	<i>p</i> =0.256
BMI (kg.m ⁻²)	27.6 ± 5.2	26.6 ± 4.2	<i>p</i> =0.383
Quadriceps strength (%)	62.3 ± 22.5	60.1 ± 21.8	<i>p</i> =0.681
6MWD (m)	406 ± 107	350 ± 134	<i>p</i> =0.030*
COPD self-efficacy score (mean score/question)	2.8 ± 0.8	2.8 ± 0.8	<i>p</i> =0.924
Chronic Respiratory Questionnaire	86.7 ± 21.5	73.2 ± 29.9	<i>p</i> =0.012*
CRQ- Dyspnea domain (mean score/question)	4.2 ± 1.4	3.9 ± 1.3	<i>p</i> =0.279
CRQ- Fatigue domain (mean score/question)	3.6 ± 1.3	3.1 ± 1.0	<i>p</i> =0.064
CRQ- Emotional domain (mean score/question)	4.6 ± 1.2	4.3 ± 1.3	<i>p</i> =0.179
CRQ- Mastery domain (mean score/question)	4.7 ± 1.3	4.4 ± 1.4	<i>p</i> =0.456

Categorical data expressed as a ratio (%). Continuous data expressed as the mean ± standard deviation. FEV₁ = forced expiratory volume in one second, FVC = forced expiratory volume, DLCO = Diffusing capacity of the lung for carbon monoxide, BMI = body mass index, 6MWD = six minute walk distance, CRQ = Chronic Respiratory Questionnaire.

* *p*<0.5.

Question8: Discussion,---Beginning of the second paragraph, "Participants who lived alone...as the only independent predictors of program non-completion. However, no surveyed participant indicated that living alone was a reason for program non-completion."There is no further discussion of why this is the case of the results.

Our response: We have discussed the finding of living alone being an independent predictor of program non-completion and possibly related to the transport barriers in attending pulmonary rehabilitation - discussion section (paragraph 2):

"Despite, no surveyed participant directly indicating that living alone was a reason for program non-completion, living alone has been previously related to participants with poorer motivation and an increased challenge of getting to the pulmonary rehabilitation program.^[1, 4] In the present study, this relationship is also relevant, with 70% of the non-completers who lived alone indicating that there were transport difficulties in attending the program."

and in the Discussion section (paragraph 5):

"However, it is important to note that transport barriers in attending pulmonary rehabilitation were discussed by thirteen of the surveyed non-completers with seven of these participants indicating that transport difficulties were a reason for non-completion. Participants with greater resources such as social and emotional support have previously been shown to have better adherence,^[5] with increased social support probably assisting participants to overcome the reported challenges such as transport difficulties and poor motivation required to complete a pulmonary rehabilitation program. Therefore, better recognition and support for participants who are living alone may reduce the reported challenges of transport difficulties and poor motivation, and increase program adherence.^[6]"

and we have also clarified these findings in the results section (paragraph 5) to read:

"Transport barriers in attending the program, including parking costs (n=10), limited disabled parking (n=3) and limited public transport (n=1) were discussed by thirteen non-completers (65%) including 70% (7/10) non-completers who lived alone.

However, despite transport being a barrier, only seven participants indicated that transport difficulties was a reason for program non-completion with four of these seven respondents living alone."

Reviewer 3 - Comments to authors

General comments: In this study Walsh et al, investigated the reasons for non completion of a rehabilitation program in COPD patients. The results of the study showed that winter commencing program and living alone were the only independent predictors of non completion of the rehab program. The topic of this study is of importance since non-adherence is the major limitation for the rehab programs.

Classification: Grade C - good

Language evaluation: Grade A - priority publishing

Conclusion: Major revision

Specific comments:

Major comments

Question 1: My major concern for this study is that authors have not included specific questionnaires for evaluation of specific psychological factors such as depression, anxiety disorder, and trait personality etc. These factors might influence the results and could explain in a significant percentage the non-completion of the rehab program. It is well known that that there is a high prevalence of depression in COPD patients in relation to disease severity. Please include in the limitation section and add a paragraph in discussion section discussing their role in non completion of rehabilitation programs.

Our response: We have added this to the discussion section- study limitations to read:

"Similarly, the present study did not assess the influence of psychological factors, such as depression or anxiety, on program non-completion despite these comorbidities being prevalent in people with COPD. Therefore it is unknown what influence these psychological factors have on the current study's findings."

and paragraph 2:

"It is possible that there are other factors, including the presence of depression as a comorbidity, not investigated during the current study that may have influenced this relationship between winter programs and non-completion."

and (paragraph 4):

"The study by Fischer et al also found that program non-completion was not related to medical and psychosocial variables, including illness perception.^[1]"

Question 2: Illness remains one of the most important factors for non completion of a rehabilitation program. Did you analyze separately COPD patients based on severity of COPD (GOLD stages, greater than III versus lower than III?)

Our response: In response to the reviewer's comments we have categorised the COPD participants into their respective GOLD stages and assessed the influence of more severe disease on program non-completion. Fifty participants were categorised into class III or IV and sixty-one participants were categorised into class I or II. There was no relationship between these classes of disease and program non-completion ($p=0.613$). However, in the submitted manuscript, we assessed the influence of respiratory function, using the FEV1% predicted and FVC% predicted, as continuous variables and these measures were found to be not related to program non-completion (Table 1).

Minor comments

Question 1: Introduction section- Please state a clear hypothesis in the study based on the current literature

We have added a hypothesis to the manuscript's introduction (paragraph 3) to read:

"We hypothesized that the reasons for program non-completion, including medical reasons and external barriers, would be related to the participant's baseline characteristics identified."

Question 2: Materials and methods- The definition of non completion is rather random. Please add the reasons for these definition criteria (references if there are).

Our response: There is no clear consensus in classifying program non-completion with criteria ranging between: participant were classified as "poor attenders" with <67% attendance of the total sessions^[7], and participants being classified as a non-completer if one session was missed^[8] or by participants not completing the final program assessment.^[1] We believe that a participant missing only one session of their program would still gain the majority of the benefit and consequently should not be considered a non-completer. Therefore as there is no clear consensus, a non-completer was arbitrarily classified as a participant who attended <12/16 of the program's sessions. While this figure for classifying program non-completion was arbitrary, in our study, no participant classified as a non-completer (attending <12/16 sessions) completing the end of program assessment.

We have amended what we have written in the Materials and Methods section (paragraph 1) to read:

"There is no clear consensus in classifying program non-completion with criteria ranging between: participant were classified as "poor attenders" with <67% attendance of the total sessions^[7], and participants being classified as a non-completer if one session was missed^[8] or by participants not completing the final program assessment.^[1] Therefore for the purpose of this study, a non-completer was arbitrarily classified as a participant who attended <12/16 of the program's sessions."

Question 3: Information on current treatment is missing. Was there any modification during the rehabilitation program?

Our response: We have clarified the progression of the lower limb endurance training in the Materials and Methods - pulmonary rehabilitation section to read:

"The lower limb endurance training intensity was progressed as tolerated for each participant throughout the program."

Question 4: Please report other co-morbidities present in these patients if there are, that might influence results (CHF, CHD, diabetes etc.)

Our response: The participant's comorbidities were also classified into the following categories: the presence of musculoskeletal (osteoporosis and arthrosis), cardiac (ischaemic heart disease, chronic heart failure and cardiac arrhythmias) and metabolic (systemic hypertension, diabetes and dyslipidaemia) diseases as described previously by Crisafulli et al.^[9] Depending upon the number of comorbid categories, participants were also categorised into: zero (no associated comorbidity), one, two or three comorbidity categories. In our cohort of pulmonary rehabilitation program participants, seventy-one participants (64.0%) were categorised with \geq one comorbid category. Thirty-three participants were categorised with musculoskeletal disease, twenty-nine participants were categorised with cardiac disease and thirty-six participants were categorised with metabolic disease. However, there was no relationship between program non-completion and musculoskeletal ($p=0.469$), cardiac ($p=0.205$), metabolic disease ($p=0.238$) or the participant's number of comorbidity categories ($p=0.257$).

We have amended what we have written in the methods section to read:

"The participant's comorbidities were classified into the categories of musculoskeletal, cardiac and metabolic diseases as described previously by Crisafulli et al.^[9] The influence of multiple comorbidities was assessed with the number of participant's comorbidities categorised into: zero (no associated

comorbidity), one, two or three comorbidity categories and by using the Charlson Comorbidity index.^[10]"

We have altered what we have written in the results section (paragraph 1) to read:

"Seventy-one participants (64.0%) were categorised with \geq one comorbid category. Thirty-three participants were categorised with musculoskeletal disease, twenty-nine participants were categorised with cardiac disease and thirty-six participants were categorised with metabolic disease."

and in the results section (paragraph 2) to read:

"There was no relationship between program non-completion and participants with musculoskeletal ($p=0.469$), cardiac ($p=0.205$), metabolic disease ($p=0.238$), the participant's number of comorbidity categories ($p=0.257$) or any other participant characteristics."

Question 5: Results Extensive description of the data is reported from the authors, besides Tables' presentation. Please consider deleting repetitive data.

Our response: We have deleted the repetitive data in the results section to read (paragraph 2):

" Non-completers had a lower baseline 6MWD ($p=0.030$), lower total CRQ score ($p=0.012$), and more non-completers lived alone ($p=0.015$) when compared to program completers (Table 1). A higher percentage of non-completers also commenced pulmonary rehabilitation during winter when compared to program completers ($p=0.006$)."

and (paragraph 4):

"Most of the participants provided positive general comments, liked the program structure and reported benefits from the program despite non-completion (Table 3).

The reported benefits included improved understanding of the lung condition (n=6), given an exercise program (n=4) and improved breathing control (n=3)."

and (paragraph 5):

"75% medical reasons (illness, musculoskeletal injury, medical investigations and slow to recover after illness), 30% other personal factors (family commitments, work commitments and hard to motivate themselves to leave the house), and 45% external factors (transport difficulties, the weather and program location; Table 4). Ten non-completers (50%) reported more than one reason for non-completion. Although, programs that commenced in winter was identified as independent predictors of non-completion, only the heat and/or humidity (n=3) and air pollution (n=1) were the reasons given. There was no relationship between illness being the participant's reason for non-completion during the programs commenced in winter (70% (6/10)) when compared to programs commenced during the remaining seasons (38% (6/10); p=0.135)."

References

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