Predictors of poor attendance at an outpatient pulmonary rehabilitation programme

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Summary
Background: Pulmonary rehabilitation (PR) is recommended for patients with respiratory disease who feel limited by breathlessness. Poor attendance wastes finite resources, increases waiting times and is probably associated with poorer clinical outcomes. We investigated what factors, identifiable from routine hospital data, predict poor attendance once enrolled in a pulmonary rehabilitation programme (PRP).

Methods: Retrospective case note study of 239 patients (60% male) of mean (S.D.) age of 66.6 (8.7) years, mean FEV1 39.6 (14.6)% predicted, who attended a 6 (short) or 18 (long) week, 18 session, outpatient PRP. Attendance data was analysed using linear multiple regression analysis with the log transformed odds ratio of attendance as the dependant variable.

Results: Overall median attendance was 16 out of 18 sessions. Being a current smoker (p<0.05), attending a long PRP (p<0.05), more previous hospital admissions (p<0.01), higher Medical Research Council (MRC) dyspnoea score (p<0.01) or enduring a long journey (p<0.001) were independent risk factors for low attendance. Lower body mass index (BMI) and distance from PR centre were of borderline importance (p<0.1) but age, gender, co-morbidity, respiratory diagnosis, FEV1 and St. Georges Respiratory Questionnaire Score at baseline did not predict later attendance (p>0.2).

Conclusions: Attendance at PRPs is independently influenced by smoking status, the degree of breathlessness, frequency of hospital admissions, length of the programme and journey time.

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Introduction

Pulmonary rehabilitation (PR) is integral in managing patients with chronic respiratory disease and is recommended in all guidelines, based on grade A evidence. In addition to improving exercise capacity, reducing hospital admissions, reducing symptoms of dyspnoea and improving quality of life, patients who attend a pulmonary rehabilitation programme (PRP) also exhibit better emotional function and feel more in control of their illness. However, PR does not benefit all to whom it is offered. Patients may participate in programmes and not gain benefit but some may either fail to attend when invited or drop out of the programme without achieving an effective intervention. A retrospective analysis in the UK showed that although most patients benefited from PR, almost 23% of those who attended their PRP, did not improve their health status or exercise tolerance. Adequate attendance is important in deriving benefit from PRPs and is included in the joint ERS/ATS statement on PR. Poor attendance is likely to contribute to suboptimal improvements or may be a marker for more severe disease where gains may be less.

Patient attendance at PRPs has been variable with some centres reporting a dropout rate as high as 30%. However, few studies have investigated the causes of non-attendance. Young et al. found that social isolation, lack of support, continued smoking and non-compliance with other healthcare activities were significantly associated with patients declining entry into a PRP. However, this study only included 91 patients and did not examine what factors were associated with poor attendance after they were enrolled and had agreed to participate. Identifying factors associated with poor attendance should allow specific interventions to improve attendance, which should optimise outcomes and target finite resources most efficiently.

The aim of this study is to investigate what physiological or environmental factors, routinely available at baseline, could predict later attendance once enrolled at a PRP.

Methods

Patients

This was a retrospective analysis of consecutive case notes of patients who were already enrolled in an outpatient PRP. A total of 243 patients (146 males) with a mean (S.D.) age of 66.6 years (± 8.7 years) who attended at least one session our PRP between July 2000 and February 2004 were included. Patients were referred by primary and secondary care physicians; they were predominantly white from a range of social classes around a UK city. Two hundred and four patients had a diagnosis of chronic obstructive pulmonary disease (COPD), whilst 28 patients had a mixed asthma/COPD picture and 11 patients had chronic asthma. Eligibility criteria for our patients have been published previously. All data collection was approved by the local research ethics committee.

Data collection

The following predictors (pre-PRP data) of attendance were regarded as routine data in any PRP and were recorded from clinical records: (1) age; (2) gender; (3) diagnosis (COPD or other); (4) body mass index (BMI); (5)% predicted forced expiratory volume in 1 s (FEV1); (6) Medical Research Council (MRC) dyspnoea score; (7) St. George’s Respiratory Questionnaire (SGRQ) total score; (8) number of COPD exacerbations requiring hospital admission in the preceding 12 months; (9) self-reported smoking status; (10) presence of major co-morbidities, classified as cardiovascular, neurological or musculoskeletal conditions; (11) distance (in miles) between home and PRP (calculated using zip/post codes); (12) average length of journey reported by patients and (13) long (18 week) or short (6 week) PRP.

Rehabilitation programme

The programme has been described previously and includes outpatient multidisciplinary input from occupational therapists, physiotherapists, dietetics staff, physicians, specialist respiratory nurses, social workers and a smoking cessation counsellor. This PRP has a strong evidence base for a range of beneficial clinical outcomes. As part of another prospective study, patients were randomised to receive a “short” rehabilitation programme, consisting of three half-day sessions per week for 6 weeks, or a “long” rehabilitation programme, consisting of one half-day session per week for 18 weeks.

Long and short PRPs had identical content and format, each session lasting for approximately 2 h and including educational activities, individualised exercise prescription, and educational sessions addressing the psychological aspects of chronic disability. Individual goal setting, dietary intervention, physiotherapy and occupational therapy were also included. The order of sessions was similar and there was no provision made for additional sessions following non-attendance.

Attendance

At screening interview by a respiratory physician, medication is optimised and only when deemed medically stable (usually exacerbation free for at least 6 weeks) are patients offered PR. The programme is described and patients were strongly encouraged to attend every session and agreed in advance to do so whenever possible. Patients are then sent information regarding the PRP and what to expect prior to commencement. Those who felt they could not attend regularly were not enrolled. In addition, an administrator assists with queries and can organise patient transport for those requiring it. The dependant variable was the total number of sessions attended. Subjects were also categorised whether they had a 100% attendance record (complete attendance) or not. In addition, patients were arbitrarily categorized as “good attenders” if they attended 67% of available session or “poor” if they attended less.

Statistical analysis

Data analysis was performed with the Statistical Package for the Social Sciences, version 12.0 (SPSS Inc., Chicago, IL, USA). Between-group comparisons (good versus poor...
attenders and long versus short PRPs) were made using Student’s t-test, Mann–Whitney and \( \chi^2 \) tests.

**Log transformation**

Attendance data was positively skewed. To achieve a normal distribution, we performed a log transformation of the odds ratio of attendance, as shown by the equation:

\[
\ln \left( \frac{\text{attendances} + 1}{\text{absences} + 1} \right)
\]

Using this as our dependent variable, we calculated Pearson’s correlations for our continuous independent variables. For categorical variables, we compared attendance across each category using one-way analysis of variance. To assess the relationship between multiple predictor variables and attendance, we developed a linear regression model using forward stepwise procedures for all 13 independent variables.

**Results**

**Whole group**

One hundred and twenty-five (51%) patients were randomised to participate in a short PRP, and 118 patients were enrolled into a long PRP. Three patients from the short PRP and one patient from the long PRP withdrew before the programme commenced and were excluded from further analysis. Patients in the short and long PRPs had similar baseline demographics (details omitted).

Overall 52 patients (65% males) attended all 18 sessions; they had a mean age 68.4 (8.2) years, mean Body Mass Index \( \text{(BMI)} \) 27.3 (5.5) kg/m\(^2\), mean MRC score 3.5 (0.95), mean \( \text{FEV}_1 \) 40.1 (16)% predicted and a mean of 0.66 (0.9) hospital admissions in the preceding year. Seventeen percent reported still smoking, 64% were on the short PRP and they lived on average 8.8 (7.2) miles from the centre, with 50% reported taking less than 30 minute journey time.

**Comparison between “good” and “poor”-attenders**

Table 1 compares the baseline characteristics of the "good" attenders and "poor" attenders.

**Univariate analysis**

A positive relationship with attendance was found with higher BMI \( (p < 0.05) \), fewer hospital admissions in the last year \( (p < 0.01) \), current (self-reported) non-smokers \( (p < 0.01) \), a lower MRC dyspnoea score \( (p < 0.01) \) and a shorter journey time to reach the PRP \( (p < 0.001) \).

**Regression analysis**

Table 2 shows the results of multiple regression analysis, including only those variables associated with poor attendance. The following were not significantly associated with attendance and were excluded from the linear regression model: age \( (p = 0.53) \), gender \( (p = 0.93) \), \( \text{FEV}_1 \)% \( (p = 0.90) \), co-morbidity \( (p = 0.84) \), respiratory diagnosis \( (p = 0.68) \), baseline SGRQ \( (p = 0.42) \) and BMI \( (p = 0.27) \). Distance from PRP centre showed a trend but was not a statistically significant predictor in our model \( (p = 0.08) \). Overall our regression model still only accounts for 18% of the variance in log ratio of attendance.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Good attenders ( n = 180 )</th>
<th>Poor attenders ( n = 62 )</th>
<th>( p )-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (%)</td>
<td>56.1</td>
<td>69.4</td>
<td>0.15</td>
</tr>
<tr>
<td>Age (years)</td>
<td>67.0 ± 9.0</td>
<td>67.6 ± 8.3</td>
<td>0.64</td>
</tr>
<tr>
<td>BMI (kg/m(^2))</td>
<td>26.4 ± 6.0</td>
<td>24.7 ± 5.8</td>
<td>0.06</td>
</tr>
<tr>
<td>COPD diagnosis (%)</td>
<td>81.8</td>
<td>87.9</td>
<td>0.44</td>
</tr>
<tr>
<td>Current smokers (%)</td>
<td>17.7</td>
<td>56.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>( \text{FEV}_1 ) (% pred)</td>
<td>40.5 ± 14.8</td>
<td>36.6 ± 14.2</td>
<td>0.07</td>
</tr>
<tr>
<td>MRC dyspnoea score*</td>
<td>4 (3–5)</td>
<td>5 (4–5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>SGRQ total score</td>
<td>62.4 ± 15.8</td>
<td>65.5 ± 14.8</td>
<td>0.20</td>
</tr>
<tr>
<td>Hospital admissions in last year</td>
<td>0.82 ± 1.34</td>
<td>1.42 ± 1.43</td>
<td>0.004</td>
</tr>
<tr>
<td>Major co-morbidities (%)</td>
<td>48.3</td>
<td>61.3</td>
<td>0.08</td>
</tr>
<tr>
<td>Distance from PR centre (miles)</td>
<td>9.8 ± 9.1</td>
<td>9.0 ± 7.0</td>
<td>0.55</td>
</tr>
<tr>
<td>Length of journey (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;5 min</td>
<td>2.2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6–15 min</td>
<td>27.2</td>
<td>8.1</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>16–30 min</td>
<td>44.4</td>
<td>33.9</td>
<td></td>
</tr>
<tr>
<td>&gt;30 min</td>
<td>25.6</td>
<td>58.1</td>
<td></td>
</tr>
<tr>
<td>Short rehabilitation (%)</td>
<td>56.1</td>
<td>43.5</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Data presented as mean ± S.D. or percentages.

*Median (interquartile range).*
Discussion

In this retrospective analysis using routine and easily accessible hospital data, we have demonstrated that patients are less likely to attend a PRP if they are current smokers, attend a long rehabilitation programme, previously had frequent exacerbations requiring hospital admission, have a high MRC dyspnoea score or endure a long journey.

Adherence is defined as “the extent to which a patient’s behaviour coincides with medical advice” rather than concordance where the patient and doctor both agree on and negotiate conduct. Patients were strongly advised to attend all 18 sessions so adherence is the more appropriate term. Human behaviour is a complex phenomenon, which is influenced by personal health beliefs, socio-cultural factors, physical and psychological factors. In general, patient non-adherence is one of the best documented but least understood health-related behaviours.

Although several studies have investigated non-adherence to medication in COPD, there is a paucity of data regarding poor adherence to attending PRPs. Young et al. investigated predictors of non-attendance in PR, but considered adherence as a dichotomous variable, defining patients as being “non adherent” if they refused participation or began but did not complete the whole programme. Most of their patients labelled as “non adherent” actually refused any participation in the programme. In our study, we have considered attendance as a continuous variable to measure the different degrees of patient attendance to the PRP. When also using a dichotomous definition of “good” versus “poor” attenders, we accept 12 out of 18 sessions is arbitrary but this is similar to others. Reduced health gains during PRP .6 For such symptomatic patients, an inpatient or home PRP, or one with less emphasis on exercise training may improve attendance. However, Wedzicha et al. found no improvement in exercise performance in severely dyspnoeic patients offered PR at home. We did not offer a home PRP.

We found patients with a high MRC dyspnoea score (4–5) had a worse attendance record irrespective of length of PRP. Such patients who are breathless at rest or on minimal exertion may not be able to cope with the physiological demands of the exercise training programme as well as the difficulties of transport to and from home. Garrod et al. found that severity of breathlessness or total SGRQ were not significantly associated (p > 0.05) with dropping out of a PRP but higher MRC score was associated with significantly smaller health gains during PRP .6 For such symptomatic patients, an inpatient or home PRP, or one with less emphasis on exercise training may improve attendance. However, Wedzicha et al. found no improvement in exercise performance in severely dyspnoeic patients offered PR at home. We did not offer a home PRP.

The fact that longer reported journey times were independently associated with poor attendance is important and the actual distance between patients’ homes and the PR centre was of borderline statistical significance. Transport difficulties are one of the biggest problems faced by PR patients, many of whom are too unwell or unfit to drive. Patients without personal or family transport may have to rely on expensive taxis or hospital transport, which in our experience results in longer journey times can be inefficient and at times unreliable. A longer journey time is likely to

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**Table 2 Results of multiple linear regression analysis for attendance using transformed data: Ln [(attendances+1)/(absences+1)].**

<table>
<thead>
<tr>
<th>Log attendance ratio</th>
<th>Change statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables added at each stage</td>
<td>Adjusted $R^2$</td>
</tr>
<tr>
<td>1. Journey duration</td>
<td>0.062</td>
</tr>
<tr>
<td>2. Journey duration and MRC score</td>
<td>0.117</td>
</tr>
<tr>
<td>3. Journey duration and MRC score and smoker</td>
<td>0.141</td>
</tr>
<tr>
<td>4. Journey duration and MRC score and smoker and type of PRP</td>
<td>0.164</td>
</tr>
<tr>
<td>5. Journey duration and MRC score and smoker and type of PRP and number of hospital admissions in the preceding year</td>
<td>0.176</td>
</tr>
</tbody>
</table>
cause greater inconvenience and stress to often very disabled patients. This issue of transportation is exacerbated by lack of PR at many centres in the UK, forcing patients to travel further (up to 65 miles in our study) to other places. This continues to be a problem despite the recommendations by the National Institute for Clinical Excellence.¹

Young et al.⁸ found that age, sex and physiological parameters such as FEV₁ did not predict attendance; we confirm these findings.

Non-attendance at PRPs may have a number of unwanted consequences. We know of no studies comparing medically led versus “distance learning” or self-education style PRPs but direct contact is likely to be important to encourage training under direct supervision and provide direct, personalised, support and feedback in teaching new skills/illness understanding. Identifying barriers to attending PRPs that we know will improve outcomes is crucial to developing strategies to improve outcomes further. Rather than excluding patients with risk factors for non-attendance, we feel such patients should be identified and offered extra support, perhaps even prior to commencing the study. After proving that patients are more likely to attend a short intensive PRP, we have now discontinued the once weekly PRP.

We do not know if those that completed the PRP had a better clinical response. Perhaps some people stopped attending once a certain goal was reached. Larger numbers would be needed to address this issue, preferably only using a single type (intensive short) PRP. Moreover, the exact primary clinical endpoint should be agreed on. The primary endpoint in this study is attendance. We did not record the reasons given by patients for non-attendance and in particular did not differentiate between “avoidable” and “non-avoidable” reasons. Certain life events would make it impossible to attend PRPs including intercurrent exacerbations, admission to hospital or the ill health of a spouse, whereas others such as transport delay or social commitments should be modifiable. We do not know if those with longer journey times relied more on hospital or public transport although this is quite possible as they lived on average only 1 mile further away. Type of transport should be routinely documented when organising a PRP. Although reasons for non-attendance may be difficult to document accurately, are self-reported and mainly retrospective, they may give further unique perspectives into patient behaviour. Data regarding non-attendance due to intercurrent exacerbations would be very interesting but still retrospective and open to interpretation and recall bias. It would serve no practical purpose in generating prediction models at baseline for people who have not actually had PR. We concentrated on variables we thought would be clinically important but also practical and easily collected before starting PRP, to make our findings applicable in an every-day setting. We did not focus in-depth on complex behaviour.

The issue of patient non-attendance is extremely multifaceted resulting from interactions between many variables, some of which are impossible to measure and their interplay is highly individual. However, we have identified five significant predictors of poor attendance at PR that are easily collected from routine hospital data sources. Offering supportive interventions, targeted to at least these five variables will improve our understanding of this complex health-related behaviour. The next steps are to see if better attendance leads to better gains and ultimately perform intervention studies to improve attendance. Only then can we target limited resources not only to those who need them most but also to those who will benefit most.

There were a number of limitations to our study. It was originally designed to compare two different types of rehabilitation programme. This is a post-hoc, retrospective analysis on prospectively gathered data. We did not record psychological parameters such as baseline anxiety and depression scores or measures of perceived self-efficacy. Many PRPs do not usually collect these and we wanted to see what routine data at baseline could be used to generate predictive models in all settings. We did not enter marital status and social support that are readily available to most PRPs and acknowledge that these should be included in future models. Although we had zip-code data we did not have reliable coding for the social economic groupings for the patients. Such factors have been shown to influence patient adherence in a number of clinical settings and could well play a vital role in determining attendance to our PRP. Our smoking status was not validated. We did not input baseline measures of exercise capability into our model because different assessment tools are used in different centres and we wanted to make our findings as generic as possible.

Conclusions

In this retrospective study, we have found that attendance at PRPs is independently influenced by patient issues such as smoking status, their degree of breathlessness and number of hospital admissions but also logistical issues such as length of the programme and journey time.

Conflict of interest statement

None of the authors have a conflict of interest related to this manuscript.

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