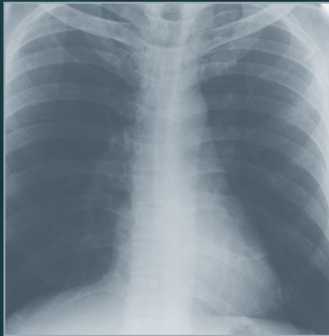


# National COPD Audit Programme

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## Pulmonary rehabilitation: Beyond breathing better

National Chronic Obstructive Pulmonary Disease (COPD) Audit Programme:  
Outcomes from the clinical audit of  
pulmonary rehabilitation services in  
England 2015

**National supplementary report  
December 2017**

Prepared by:

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**Royal College  
of Physicians**



**British  
Thoracic  
Society**

In partnership with:

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Commissioned by:



Working in wider partnership with:



Royal College of  
General Practitioners

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# Report at a glance

## Admissions

 = 1.0%

 = 1 day

 = 0.1%

### People with at least one admission

(Within 180 days of assessment for pulmonary rehabilitation (PR))

Days  
180



29.6%

### People who completed PR



24%

### People who did not complete PR



38%

### Mean number of bed days

(Within the 180 days post PR assessment)

Days  
180



7.3

### People who completed PR



4.8

### People who did not complete PR



9.6

## Mortality

### Mortality for all people assessed for PR

(From date of assessment)

Days  
90



0.7%

Days  
180



1.6%

### 90-day mortality for people included in the secondary care audit

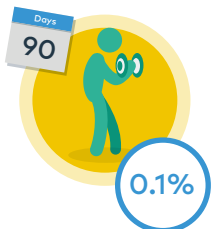
(From admission date for those discharged alive)

Days  
90



8.0%

### People who completed PR

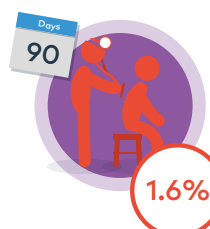


0.1%

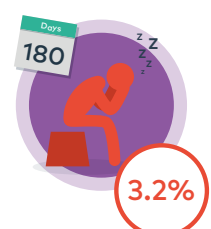


0.5%

### People who did not complete PR



1.6%



3.2%

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## How to use this report

This supplementary report contains the main messages and key recommendations derived from an extensive analysis of data. The full data analyses are available online (via [www.rcplondon.ac.uk/beyondbreathingbetter](http://www.rcplondon.ac.uk/beyondbreathingbetter)) for in-depth perusal. These can be accessed either in full (*Pulmonary rehabilitation: Beyond breathing better. National Chronic Obstructive Disease (COPD) Audit Programme: Outcomes from the clinical audit of pulmonary rehabilitation services in England 2015. Results and data analysis*) or in the following component sections:

- Admissions within 90 and 180 days post-pulmonary rehabilitation
- Bed days
- Mortality

The data are presented largely in tabular form, with explanatory notes throughout. Although these data are available to the interested reader, it is not necessary to review them to appreciate the key messages, which are outlined below. We strongly advise teams to discuss these findings between themselves and with their commissioners.

This report contains data from England only, although the original audit included patients from England and Wales. This, in combination with data incompleteness and subgroup analyses (for the full methodology, please refer to Appendix C in the accompanying data report), means that some tables of findings have different denominators. Therefore, for the sake of clarity and simplicity, this report does not include a total row on every table. If you have any questions about any of the report tables, please contact the audit team on [COPD@rcplondon.ac.uk](mailto:COPD@rcplondon.ac.uk).



## Executive summary

*PR services can make a substantial contribution to reducing the considerable healthcare burden of COPD on patients and the NHS.*

This completes the series of three reports from the 2015 pulmonary rehabilitation (PR) audit. It follows previous audits of resources and organisation of PR<sup>1</sup> and the clinical outcomes of PR.<sup>2</sup> In this report, we present outcome data on hospitalisation (from Hospital Episode Statistics (HES)) and mortality (from the Office for National Statistics (ONS)) at 90 and

180 days after assessment for PR. These time points were specifically chosen to ensure that outcomes *after* completion of PR (which typically lasts 6–8 weeks) were captured. The data relate to patients who were assessed for PR (or, if not assessed, began their programme) between 12 January and 10 April 2015, and were included in the clinical audit of PR. These data provide insight into how successful completion of PR impacts on these wider, clinically important outcomes, and how the characteristics of the PR population compare with those seen in other parts of the programme, particularly the secondary care audit.<sup>3,4,5</sup>



The data indicate low mortality rates in patients assessed for outpatient PR (0.7% at 90 days, compared with 8.0% after admission for those discharged from hospital).<sup>5</sup> Higher case severity in the post-hospital discharge population is likely to explain these differences.

However, it is clear that many such ‘sicker’, potentially more disabled patients – who may have substantial rehabilitation needs – are not being referred to and/or assessed by PR programmes. This echoes the findings of the 2014 national secondary care audit, which reported that only 14.7% of those admitted to hospital for an acute exacerbation of COPD were referred for PR on discharge. This suggests that the offer of PR following admission (a time of clear rehabilitation need where the intervention has been shown to be effective) is often not made or not taken up by patients. Additionally, the primary care audit in Wales<sup>6,7</sup> revealed that only around one-third of patients with Medical Research Council (MRC) breathlessness scores of 3, 4 or 5 had ever been referred for PR.

*... enrolment into and completion of PR are associated with improved outcomes (reduced hospital admission rates and better survival).*

Despite the low death rate overall, mortality at 180 days in those who did not complete PR was significantly higher than in those who completed it (3.2% vs 0.5%). Only 19.0% of patients who died in this time period completed PR (for context, the clinical audit reported that 60.1% of patients completed their PR programme).<sup>2</sup> These observations might be confounded by case severity, but it is

*Importantly, we can infer that undertaking PR is safe and that completion of therapy is an indicator of a better prognosis.*

possible that improvements in fitness and general health accruing from PR are also mediating factors in the lower mortality seen in the group that completed treatment. Importantly, we can infer that undertaking PR is safe and that completion of therapy is an indicator of a better prognosis.

The data on hospital admissions show a similar pattern. Admission rates at 90 days were lower for patients in the PR audit than for the cohort included in the secondary care audit<sup>5</sup> (18.6% vs 43.1%); however, a substantial proportion (29.6%) of patients in the PR audit had at least one hospital admission at 180 days. At 180 days from the time of assessment, attending and completing PR was associated with fewer admissions and fewer days spent in hospital: substantially fewer patients who completed treatment were admitted than those who did not (24.0 vs 37.9%). Some



patients were admitted during the course of PR, contributing to the failure to complete, but this observation also held true between 90 and 180 days, suggesting (in line with other clinical trial evidence<sup>8,9,10,11,12</sup>) that completion of PR is associated with reduced subsequent admission rates. The causal contribution of the intervention itself is suggested by the observation that greater gains in walking performance were associated with reduced risk of hospital admission.

*... transforming referral practice in acute and primary care settings to enhance access to and uptake of PR should be a priority for healthcare commissioners and partner providers along with ensuring sufficient PR service capacity to meet such demand.*

These data suggest that enrolment into and completion of PR is associated with improved outcomes (reduced hospital admission rates and better survival). The findings also reiterate a key conclusion of previous PR audits – that referral and access to PR for patients with COPD are low. As outlined in our recommendations, we believe that transforming referral practice in acute and primary

care settings to enhance access to and uptake of PR should be a priority for healthcare commissioners and partner providers, along with ensuring sufficient PR service capacity to meet such demand. If these challenges can be met, PR services can make a substantial contribution to reducing the considerable healthcare burden of COPD on patients and the NHS.



## Methods

The first national clinical audit of pulmonary rehabilitation (PR) services in England and Wales aimed to capture data for all patients with a primary respiratory diagnosis of COPD who were assessed (or, if not assessed, began PR) between 12 January and 10 April 2015. 7413 patient records were included.

Outcomes data, extracted automatically from HES and ONS in order to compute mortality and hospital admission within the 180-day period after the initial assessment, were available **for England only** (please see the methodology for more details). The outcomes report denominator is, therefore, **7135**.

## Key findings



### Hospital admissions and bed days

To see the data analysis in full, please access the 'Hospital admissions' at [www.rcplondon.ac.uk/beyondbreathingbetter](http://www.rcplondon.ac.uk/beyondbreathingbetter)



### Overall hospital admissions and bed days

- Of those assessed for PR, **18.6%** had **at least one admission within 90 days**, and **29.6%** had at least one admission within 180 days.
- For those who were admitted, the **mean number of days spent in hospital** within 90 days was **5.5**, and within 180 days was **7.3**. Median values were **substantially lower** (2 days within 90 days, and 3 days within 180 days), indicating the skew of the data.
- **COPD was the most common coded cause for admission**; however, it accounted for just less than **20%** of coded episodes within both 90 and 180 days.
- There were **associations**, as expected, between **admission rates and other disease/demographic indices**, such as:
  - **Age** (the admission rate for the over 70s was **32.5%** within 180 days),
  - **Global Initiative for Chronic Obstructive Lung Disease (GOLD) stage** (for those with a forced expiratory volume (FEV<sub>1</sub>) score of under 50%, the hospital admission rate was **29.8%** within 180 days),
  - **MRC breathlessness score** (in those with an MRC score of 5, the admission rate was **41.9%** within 180 days),
  - **Number of comorbidities** (in those with four or more comorbidities, the admission rate was **41.9%** within 180 days),
  - **Previous admissions** (those who had been admitted three times or more for their COPD within the past 12 months had an admission rate of **52.2%** within 180 days).



## Hospital admissions and bed days in relation to PR uptake and completion

- Cumulative admission rates within 180 days were **substantially higher** in patients who were assessed but **did not complete PR** (37.9%) than in those who did complete PR (24.0%).
- The **mean number of days spent in hospital** (for those admitted) within 180 days was also **higher** for patients who were **assessed but did not complete PR** (9.6) than in those who did complete PR (4.8).
- Admission rates were **slightly lower for those on cohort programmes**:<sup>\*</sup>
  - 15.8% of cohort programme patients were admitted at least once within 90 days, compared with 17.6% of rolling programme patients; and
  - 26.2% of cohort programme patients were admitted at least once within 180 days, compared with 29.0% of patients on a rolling programme.
  - These reduced admission rates (ie for patients who were in a cohort rather than on a rolling programme) may be at least partly explained by the lower rates of enrolment of patients on early post-discharge PR pathways (as opposed to those referred from, for example, primary care) to these programmes.



## Hospital admissions and bed days in relation to clinical outcomes of PR

- Admission rates within 180 days were slightly **lower in patients who achieved a minimally clinically important difference (MCID) in measures of exercise performance following PR** than in those who did not show any change. The differences were small in magnitude (22.2% vs 24.9%) and the group that achieved a positive change (but one below the MCID) had the worst results, indicating that the data may not be meaningful. The number of days spent in hospital within 180 days was not statistically significantly different.
- The **admission rates and number of days spent in hospital** were **not substantially different between patients achieving or not achieving MCID thresholds** for health status after PR.
- There was **no meaningful relationship between admissions or days spent in hospital and time to enrolment** at PR.



## Interpretation

- Nearly one in three patients **attending a PR assessment have had at least one admission** within 180 days, although the rates at 90 days were **lower** than the readmission rates following discharge from hospital **observed in the 2014 secondary care audit** (18.6% vs 43.1%).<sup>3</sup>

<sup>\*</sup> Cohort programmes have a set start date, and patients are enrolled for the course. Rolling programmes are ongoing, and patients can join at any point.

- The causal relationship between hospital admission rates and completion of PR (the time period during which PR is undertaken after assessment) is complex, as admission to hospital may be a reason for non-completion of PR.
- However, there are **clear associations** (at 180 days and between 91 and 180 days) between **admission rates** and **days spent in hospital with enrolment and completion of PR**. It can be concluded that **failure to enrol or complete PR** is an **adverse risk indicator** for admission to hospital.
- These associations may be partly due to case severity variation, but the findings support clinical trial evidence indicating that PR reduces the risk of subsequent admission, **suggesting that these benefits are being delivered in real-life clinical practice.**<sup>8</sup>



## Mortality

To see the data analysis in full, please access the 'Mortality' section online at [www.rcplondon.ac.uk/beyondbreathingbetter](http://www.rcplondon.ac.uk/beyondbreathingbetter)



### Overall mortality

- **Mortality following assessment** for PR was **0.7%** within 90 days and **1.6%** within 180 days.
- This is **substantially lower** than observed in the 2014 secondary care audit (**8.0%** at 90 days from admission for those discharged from hospital).<sup>5</sup>
- There were **associations**, as expected, **between mortality and other disease/demographic indices**, such as:
  - **Age** (mortality for the over 70s was **2.2%** within 180 days),
  - **GOLD stage** (mortality for those with an FEV<sub>1</sub> of under 30% predicted was **2.6%** within 180 days),
  - **MRC score** (mortality for those with an MRC score of 5 was **4.3%** within 180 days),
  - **Number of comorbidities** (for those with four or more comorbidities, mortality was **3.2%** within 180 days),
  - **Previous admissions** (**3.6%** of those who had been admitted for COPD two or more times in the past 12 months died within 180 days).
- There was **no notable association** of mortality with either **smoking status** or **deprivation score** (index of multiple deprivation (IMD)).
- **The mortality rate was higher in men** (**0.8%** at 90 days and **2.1%** at 180 days for men, in contrast to **0.5%** at 90 days and **1.0%** at 180 days for women). More women than men, however, were under 65 years old (33% vs 26%), which may account for this mortality difference.



## Mortality in relation to programme uptake and completion

- Mortality was **higher in patients who were assessed for PR but did not complete PR (either not enrolled or enrolled but not completed)** than in those who completed PR within 90 (**1.6% vs 0.1%**) and 180 (**3.2% vs 0.5%**) days and between 91 and 180 (**1.6% vs 0.4%**) days.
- Mortality was **not associated with time to enrolment** (either from receipt of referral or from assessment).
- Only **8.0%** of patients who died within 90 days and **19%** who died within 180 days had **completed treatment**.



## Mortality in relation to clinical outcomes of PR

- Mortality was **lower** within 90 and 180 days (and between 90 and 180 days) in patients who **achieved an MCID in measures of exercise performance after PR,\*** but the numbers of deaths were too small for meaningful interpretation.
- Mortality was **not related to achieving the MCID in measures of health status after PR**, though again the numbers of deaths are too small for meaningful interpretation.

\* For the patients who performed the same exercise test at the start of their programme and at the end, the difference in said performance was measured. An increase in performance that was notable was marked as having achieved the MCID.



## Interpretation

- Mortality (within 180 days) in **patients being assessed for PR is very low**, and is substantially lower than that seen in patients being discharged from hospital.<sup>5</sup> It can be concluded firstly that attending PR is safe, and secondly that that **overall health is better and disease severity lower** in patients reaching assessment for PR. The implication is that sicker patients (with potentially high rehabilitation needs) are not being referred for, or accessing, PR.
- We could not distinguish patients referred for early PR following discharge from hospital, but it is feasible that these individuals have a **greater mortality risk**, and that services enrolling a higher proportion of patients from this clinical setting may observe higher death rates.<sup>9,10,11,12</sup>
- **Enrolling and completing PR is associated with lower mortality** at 180 days than not completing PR, and therefore is an indicator of a better prognosis. The outcome may be confounded by case severity variation, but it is possible that completion of PR itself also reduces the risk of death.

## Recommendations

### For healthcare staff and patients

- 1 Healthcare staff should be aware of the **association between completion of PR and better patient outcomes**, and:
  - a) ***prioritise the offer of referral of eligible patients during consultations***
  - b) *support eligible patients to **complete PR programmes** wherever possible. This may require specific **targeted interventions**.*
- 2 PR programmes should consider how best to **accommodate patients who interrupt programmes** as a result of hospital admission, so that they might in due course complete programmes that they have enrolled on.
- 3 **Healthcare staff should work with patient support organisations and charities** to make patients and the **public aware of the beneficial health outcomes** resulting from completion of PR, so as to encourage patients to seek referral from their clinical teams.

### For commissioners

- 4 Commissioners should ensure that PR is **prioritised in the development of local care pathways for COPD** and in the development of local **sustainability and transformation plans (STPs)**, in conjunction with **provider partners and general practices**.
- 5 Commissioners should incentivise providers to **measure completion rates** as a **key performance indicator**.
- 6 Commissioners should incentivise providers to **enrol a higher proportion of patients discharged from hospital**.

### For further research

- 7 The findings of this report raise a number of questions that are yet to be clearly answered in the scientific literature. While not an exclusive list, we suggest that investigating the following research questions has the **potential to enhance the benefits of PR to patients, widen access to treatment and improve clinical outcomes**.
  - a) Investigating the **optimum timing of PR following hospitalisation** for an acute exacerbation of COPD.
  - b) Investigating the **relative contribution of casemix severity and intensity/duration of PR in determining subsequent health outcomes** such as admission to hospital.
  - c) **Developing, testing and targeting** of interventions aimed at **enhancing referral, uptake and completion** of PR.

## Pat's story



I was diagnosed with COPD in 1996. At that time I had very mild COPD, and so I wasn't struggling. But as time went on, I noticed that I wasn't as able to do my job as I used to be (I taught exercise to music and other aerobic exercise classes). I asked my doctors whether I could have lung volume reduction surgery, as I had read that might make my symptoms better, but I was told I was too well for it. So, I changed my career slightly to delivering classes to older people instead.

As my COPD developed, I was referred to PR by my GP surgery, and went on it for the first time in 2006.

I just felt great after doing it for the first time. I noticed improvements from day 1: my breathing was better, I felt great straight away. You know when you do an exercise class and you can feel it doing good to your body? That was how I felt. It was fantastic.

The PR service team were very supportive, and encouraged us to listen to our bodies, and to understand what we're capable of, and not to be scared of breathlessness. At the start I thought some of the exercises would be too difficult (such as sitting to standing for 3 minutes), but the nurses taught us to get used to being out of breath. They were fantastic. There were 12 people in the group and three nurses, and we became a very friendly group. We also had some educational speakers come and talk to us, about how to manage depression and diet and things like that, and that was excellent. The whole thing was absolutely smashing and I really enjoyed it.

At the end of the 8-week course I was given some follow-on exercises to do at home, and I found these very difficult to fit in. So I decided to go on the British Lung Foundation (BLF) Active Instructor course, and set up PR classes myself. I received some funding from a local organisation and started my own classes in 2011.

At the start we had very few people attend, and the funding had to be changed a few times, but we now have a good group of people – including one lady (who I call my 'founding member') who has been coming since it began! We do very similar exercises to those you do in PR and it allows patients to continue with their exercises.

The local PR service have been very supportive, and even gave us some of their spare equipment (weights and things like that). At the end of PR courses, they send their patients to us.

We're a good team, and have become like a self-help group. We are part of BLF BreatheEasy, and we deliver BreatheEasy once a month, and three times a month we do our PR classes. We run in one venue, and I have trained two other attendees of the classes to be instructors as well, so that they can run it in my absence. I make sure I do the exercises every time we run a class too!

Since 2006 I have also been on PR three more times, asking my surgery's respiratory nurse. I have become a real advocate for it.

*Pat Goodacre, 18 August 2017*



## Document purpose

Document purpose	To disseminate results of the clinical outcomes of the cohort of patients included in the 2015 pulmonary rehabilitation clinical audit. These patients were assessed/began pulmonary rehabilitation between 12 January and 10 April 2015.
Title	<i>Pulmonary rehabilitation: Beyond breathing better. National Chronic Obstructive Pulmonary Disease (COPD) Audit Programme: Outcomes from the clinical audit of pulmonary rehabilitation services in England 2015</i>
Author	Steiner M, McMillan V, Lowe D, Saleem Khan M, Holzhauer-Barrie J, Van Loo V, Roberts CM (on behalf of the National COPD Audit Programme: pulmonary rehabilitation workstream)
Publication date	13 December 2017
Audience	Healthcare professionals, NHS managers, chief executives and board members, service commissioners, policymakers, COPD patients, their families/carers, and the public.
Description	<p>This is the third of the 2015 COPD pulmonary rehabilitation audit reports, published as part of the National COPD Audit Programme.</p> <p>This report details national outcome data relating to the cohort of patients included in the 2015 clinical audit of pulmonary rehabilitation services in England. It complements the national clinical report published previously by the audit programme.</p> <p>The report is relevant to anyone with an interest in COPD and will enable lay people, as well as experts, to understand the outcomes of people who have undergone pulmonary rehabilitation, and where change needs to occur.</p> <p>The information, key findings and recommendations outlined in the report are designed to provide readers with a basis for identifying areas in need of change and to facilitate development of improvement programmes that are relevant not only to services, but also to commissioners and policymakers.</p>
Supersedes	<p>This report is a supplement to the pulmonary rehabilitation clinical report published in February 2016. It is not designed to be read in isolation, but rather to complement the recommendations and key findings from this report.</p> <p>This report will not be updated. A second round of pulmonary rehabilitation audit ran in 2017, the results of which will be published in 2018.</p>
Related publications	<ul style="list-style-type: none"> <li>Steiner M, Holzhauer-Barrie J, Lowe D, Searle L, Skipper E, Welham S, Roberts CM. <i>Pulmonary Rehabilitation: Time to breathe better. National Chronic Obstructive Pulmonary Disease (COPD) Audit Programme: Resources and organisation of Pulmonary Rehabilitation services in England and Wales 2015. National organisational audit report.</i> London: RCP, November 2015. <a href="http://www.rcplondon.ac.uk/projects/outputs/pulmonary-rehabilitation-time-breathe-better">www.rcplondon.ac.uk/projects/outputs/pulmonary-rehabilitation-time-breathe-better</a></li> <li>Steiner M, Holzhauer-Barrie J, Lowe D, Searle L, Skipper E, Welham S, Roberts CM. <i>Pulmonary Rehabilitation: Steps to breathe better. National Chronic Obstructive Pulmonary Disease (COPD) Audit Programme: Clinical audit of Pulmonary Rehabilitation services in England and Wales 2015. National clinical audit report.</i> London: RCP, February 2016. <a href="http://www.rcplondon.ac.uk/projects/outputs/pulmonary-rehabilitation-steps-breathe-better">www.rcplondon.ac.uk/projects/outputs/pulmonary-rehabilitation-steps-breathe-better</a></li> </ul>
Contact	<a href="mailto:COPD@rcplondon.ac.uk">COPD@rcplondon.ac.uk</a>

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- <sup>1</sup> Steiner M, Holzhauser-Barrie J, Lowe D, Searle L, Skipper E, Welham S, Roberts CM. *Pulmonary Rehabilitation: Time to breathe better. National Chronic Obstructive Pulmonary Disease (COPD) Audit Programme: Resources and organisation of Pulmonary Rehabilitation services in England and Wales 2015*. National organisational audit report. London: RCP, November 2015. [www.rcplondon.ac.uk/projects/outputs/pulmonary-rehabilitation-time-breathe-better](http://www.rcplondon.ac.uk/projects/outputs/pulmonary-rehabilitation-time-breathe-better) [Accessed September 2017].
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- <sup>3</sup> Stone R, Holzhauser-Barrie J, Lowe D, Searle L, Skipper E, Welham S, Roberts CM. *COPD: Who cares matters. National Chronic Obstructive Pulmonary Disease (COPD) Audit Programme: Clinical audit of COPD exacerbations admitted to acute units in England and Wales 2014*. National clinical audit report. London: RCP, February 2015. [www.rcplondon.ac.uk/projects/outputs/copd-who-cares-matters-clinical-audit-2014](http://www.rcplondon.ac.uk/projects/outputs/copd-who-cares-matters-clinical-audit-2014) [Accessed September 2017].
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**For further information on the overall audit programme or any of the workstreams, please see our website or contact the national COPD audit team directly:**

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