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Lung volume reduction eligibility in patients with COPD completing pulmonary rehabilitation: results from the UK National Asthma and COPD Audit Programme

Sara C Buttery ,[1] Adam Lewis ,[2] Samuel V Kemp,[3] Winston Banya,[1] Jennifer K Quint ,[1] Michael C Steiner,[4] Nicholas S Hopkinson [1]

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[1]National Heart and Lung Insititute, Imperial College London, London, UK
[2]Department of Clinical Sciences, Brunel University London, Uxbridge, UK
[3]Respiratory Medicine, Royal Brompton and Harefield NHS Foundation Trust, London, UK
[4]Department of Respiratory Sciences, Leicester Respiratory Biomedical Research Centre, University of Leicester, Leicester, UK

Correspondence to
Dr Nicholas S Hopkinson; n.hopkinson@imperial.ac.uk

ABSTRACT

Objectives To establish what proportion of patients completing a UK pulmonary rehabilitation (PR) programme meet the 2018 National Institute for Health and Care Excellence (NICE) chronic obstructive pulmonary disease (COPD) guideline (NG115) criteria to have a respiratory review to establish whether referral to a lung volume reduction multidisciplinary team would be appropriate. This respiratory review would include evaluation of the presence of hyperinflation and the presence of emphysema on CT scan. The NICE criteria include measures of breathlessness and exercise capacity but these parameters are not completely defined.

Design Observational study.

Setting PR programmes across the UK in 2015 (210 centres) and 2017 (184 centres) entering data into the Royal College of Physicians' National Asthma and COPD Audit Programme.

Participants 8295 (55.7%) of 14 889 patients in programmes using incremental shuttle walk test (ISWT) or 6-minute walk test (6MWT) as an outcome measure completed PR, and 4856 (32.6%) had complete data recorded (6MWT/ISWT, baseline spirometry, Medical Research Council (MRC) dyspnoea score).

Results Depending on the walking test safety threshold adopted for the ISWT (≥140 m or ≥ 80 m) and the MRC dyspnoea score threshold used (MRC score ≥3 or ≥4 at the end of PR), between 4.9% and 18.1% of PR completers met the NICE criteria for a lung volume reduction-focused respiratory review.

Conclusions Lung volume reduction therapies are beneficial in appropriately selected patients with COPD, but few procedures are performed, and treatment pathways are unclear. These data help to inform the feasibility of the approach recommended by NICE and highlight the need for future systematic pathways to reduce inequalities in patients being considered for effective treatments.

Strengths and limitations of this study

- The data analysed in this trial are from a national audit, which increases the generalisability of the findings.
- The study examines the impact of using different thresholds in the implementation of National Institute for Health and Care Excellence guidance to develop systematic pathways to lung volume reduction procedures.
- Due to the high rate of non-completion of pulmonary rehabilitation programmes, there are substantial missing data at discharge.
- This study does not consider patient preferences for these interventions when estimating eligibility.

BACKGROUND

Chronic obstructive pulmonary disease (COPD) is a progressive lung disorder where lung hyperinflation can cause respiratory muscle dysfunction and debilitating breathlessness associated with reduced exercise tolerance, poor quality of life and reduced life expectancy.[1–4] Treatment options for this group of patients are limited, and often individuals remain severely burdened by their symptoms despite optimal pharmacological therapy and pulmonary rehabilitation.[5 6] Alongside smoking cessation and oxygen therapy, lung volume reduction (LVR) therapies exist as one of a small number of disease-modifying treatments in COPD care.[7–10]

LVR procedures (surgery or endobronchial valve placement) have been shown to improve dyspnoea, lung mechanics, exercise capacity, quality of life and survival in appropriately selected patients with COPD.[11–15] Unfortunately, there has been an absence of formal referral pathways,[16] leading to a substantial disparity between the number of people likely to benefit and the number of procedures performed.[16–19]

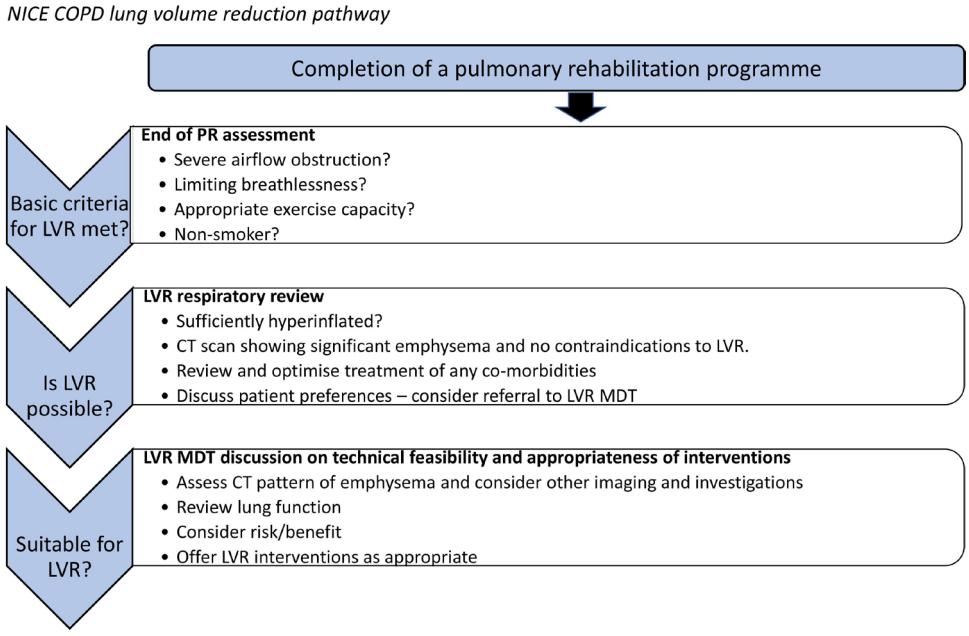

Figure 1 Three-step pathway for LVR procedures as set out in NICE COPD guideline update 2018 (https://www.nice.org.uk/guidance/ng115).[7] Depending on local arrangements, steps 2 and 3 may be more or less integrated. Contraindications to LVR include significant pulmonary fibrosis or major bronchiectasis. COPD, chronic obstructive pulmonary disease; LVR, lung volume reduction; MDT, multidisciplinary team including expert input from radiology, respiratory physician and thoracic surgery; NICE, National Institute for Health and Care Excellence.

Recent UK National Institute for Healthcare Excellence (NICE) guidance (NG115) recommends referral of patients with COPD for a specialist LVR respiratory review to determine the potential eligibility for LVR: if they have a forced expiratory volume in 1 s (FEV_1) <50%, do not smoke, have a 6-minute walk test (6MWT) of ≥140 m and have breathlessness affecting quality of life.[7] This assessment should ideally be undertaken after the completion of pulmonary rehabilitation (PR) which will be a point at which the patient's functional capacity and management of breathlessness should have been optimised. At this LVR respiratory review, subsequent to PR and depending on the presence of hyperinflation, an appropriate pattern of emphysema on CT and the absence of contraindications (FEV_1 and carbon monoxide transfer factor <20%, significant pulmonary fibrosis, major comorbidity limiting survival), referral to an LVR multidisciplinary team (MDT) to consider technical suitability for LVR is recommended. The NICE recommendation therefore sets out a three-step process (figure 1).

Some questions remain about the NICE criteria. First, the level of breathlessness to trigger consideration of possible LVR is not precisely defined, but typically would be significant self-reported breathlessness (Medical Research Council (MRC) dyspnoea score of ≥4) that the patient regards as imposing sufficient lifestyle restriction and symptom burden to warrant consideration of an LVR procedure. However, disability may deteriorate further in the time taken between referral, assessment and investigation at a specialist centre. It may therefore be more appropriate to consider a lower MRC dyspnoea score threshold for initial LVR consideration. Second, the NICE COPD guideline does not provide a safety threshold if the incremental shuttle walk test (ISWT), which is also frequently used to assess exercise capacity at the end of PR,[20] is available rather than the 6MWT.

The primary aim of this study was to assess the proportion of patients with COPD who were appropriate to have an LVR respiratory review (CT scan and full lung function tests) for possible LVR MDT referral at the time of completion of PR and how this varied according to the criteria used to better understand the practicalities of implementing NICE recommendations.

METHODS

We pooled data from all patients completing PR, recorded in the UK National Asthma and COPD Audit Programme (NACAP)[10] in 2015 (n=7413) or 2017 (n=7476) (table 1). Based on NICE guideline (NG115) recommendations, we first investigated what proportion would be eligible if criteria included patients with an MRC dyspnoea score ≥4, FEV_1 <50% predicted, and a 6MWT or ISWT of ≥140 m, who were not current smokers. In the absence of an agreed LVR safety threshold for ISWT, we used (1) ≥140 m based on the same distance as the 6MWT and (2) ≥80 m based on the equivalent 6MWT and ISWT thresholds in the multidimensional BODE/iBODE prognostic indices, respectively.[21] We then relaxed the criteria and looked at the same variables but including all with MRC dyspnoea score ≥3.

Patient and public involvement

The focus of this research was developed following thematic analysis of patient focus groups conducted in

Table 1 Pulmonary rehabilitation participant characteristics

	n (%)	2015 (n=7413)	2017 (n=7476)	2015 and 2017 combined (n=14 899)
Age (years)	14 886 (99.9)	69 (9.5)	69 (9.3)	69 (9.4)
Sex (female), n (%)	14 889 (100)	3465 (46.7)	3548 (47.5)	7013 (47.1)
Ethnicity (white British), n (%)	13 857 (93.0)	6523 (88.0)	6443 (86.2)	12 966 (87.1)
Smoking status, n (%) Ex-smoker/never smoked	14 478 (97.2)	5628 (75.9)	5614 (75.1)	11 242 (75.5)
BMI (kg/m^2)	9907 (66.5)	27.5 (6.6)	27.9 (6.7)	27.7 (6.6)
Oxygen therapy, n (%) Prescribed oxygen	14 883 (99.9)	723 (9.8)	513 (6.6)	1236 (8.3)
Referral method, n (%)	14 889 (100)			
GP/practice team		3810 (51.4)	3788 (50.7)	7598 (51.0)
Hospital consultant		1521 (20.5)	1498 (20.0)	3019 (20.3)
Community services		903 (12.2)	1120 (15.0)	2023 (13.6)
Hospital specialist/COPD team		841 (10.6)	636 (8.5)	1477 (9.9)
Specified post-AECOPD early PR pathway		174 (2.3)	219 (2.9)	393 (2.6)
Other		219 (3.0)	215 (2.9)	434 (2.9)
FEV_1 (L)	8943 (60.0)	1.38 (0.60)	1.42 (0.63)	1.40 (0.62)
FEV_1 (% predicted)	8943 (60.0)	55.1 (20.0)	55.7 (20.0)	55.4 (19.9)
ISWT (m)	4666 (31.3)	270.8 (153.1)	276 (152.4)	273 (152.6)
6MWT (m)	3740 (25.1)	324.1 (133.3)	314.6 (115.1)	319 (123.9)
MRC dyspnoea score at assessment, n (%)	13 567 (91.1)			
Grade 1		115 (1.7)	127 (1.9)	242 (1.8)
Grade 2		1080 (15.8)	1071 (15.8)	2151 (15.9)
Grade 3		2656 (39.0)	2648 (39.3)	5304 (39.1)
Grade 4		2328 (34.1)	2301 (34.1)	4629 (34.1)
Grade 5		643 (9.4)	598 (8.9)	1241 (9.1)
MRC dyspnoea score at discharge, n (%)	6831 (45.8)			
Grade 1		177 (5.3)	225 (6.5)	402 (5.9)
Grade 2		1020 (30.5)	1061 (30.5)	2081 (30.5)
Grade 3		1345 (40.2)	1430 (41.0)	2775 (40.6
Grade 4		671 (20.0)	668 (19.2)	1339 (19.6)
Grade 5		134 (4.0)	100 (2.8)	234 (3.4)
SGRQ total score	514 (3.5)	49.9 (16.6)	48.9 (17.3)	49.4 (17.0)
CAT score	5495 (36.9)	19.9 (7.9)	18.6 (7.8)	19.3 (7.9)

AECOPD, acute exacerbation of chronic obstructive pulmonary disease; BMI, body mass index; CAT, COPD assessment test; COPD, chronic obstructive pulmonary disease; FEV_1, forced expiratory volume in 1 s; GP, general practitioner; ISWT, incremental shuttle walk test; MRC, Medical Research Council; 6MWT, 6-minute walk test; SGRQ, St George's Respiratory Questionnaire.

2016.[22] Patients and public were not involved directly in the design and execution of this analysis of data from the UK NACAP PR audit.[10] Ethical approval was not required for this specific analysis as patient consent was obtained at the time of original data collection. The data set was anonymised prior to being provided to the research team.

RESULTS

In all, 8295 (55.7%) of 14 889 patients (table 1) in programmes using ISWT or 6MWT as an outcome measure completed PR, and 4856 (32.6%) had complete data recorded (6MWT/ISWT, baseline spirometry, MRC dyspnoea score). Of those who completed PR with all required data recorded, 238 (4.9%) were eligible for LVR assessment, based on NICE criteria with an MRC dyspnoea score ≥4 (figure 2). This estimate used the same numerical threshold for the ISWT as the 6MWT (≥140 m). Using instead the equivalent iBODE score criterion (≥80 m) for ISWT cut-off, we found that up to 310 patients (6.4%) were eligible. If the criteria were relaxed to include MRC dyspnoea score ≥3, 763 (15.7%) would be eligible based on an ISWT of ≥140 m or 881 (18.1%) based on an ISWT of ≥80 m.

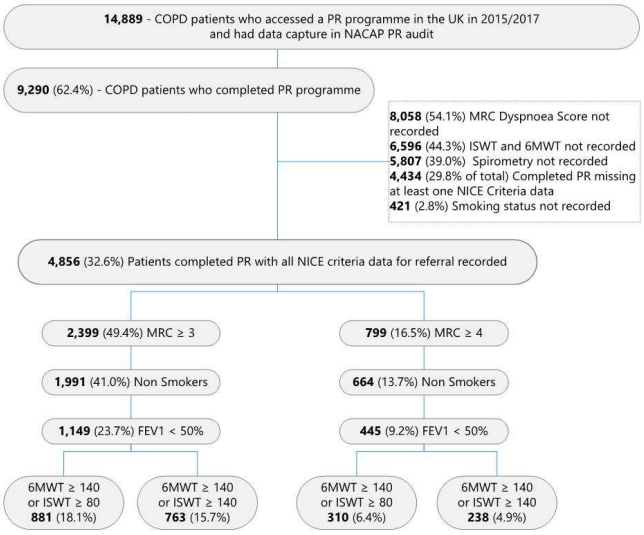

Figure 2 Flow diagram to represent patients at discharge in the 2015/2017 PR cohorts who meet the criteria to be assessed for a possible lung volume reduction procedure depending on criteria used. NICE criteria: FEV_1 <50%, do not smoke, have a 6MWT of ≥140 m and have breathlessness affecting quality of life . COPD, chronic obstructive pulmonary disease; FEV_1, forced expiratory volume in 1 s; ISWT, incremental shuttle walk test; NACAP, National Asthma and COPD Audit Programme; NICE, National Institute for Health and Care Excellence; PR, pulmonary rehabilitation; MRC, Medical Research Council; 6MWT, 6-minute walk test.

DISCUSSION

These data indicate that between 4.9% and 18.1% of people with COPD completing PR may be eligible for an LVR respiratory review to consider onward referral to an LVR MDT. This proportion varies mainly according to the threshold MRC dyspnoea score set for breathlessness and, to a lesser extent, depending on what ISWT distance is chosen to match the NICE recommendation to include a 6MWT of ≥140 m as a safety criterion. The proportion of individuals who fail to complete PR suggests that careful consideration should be given as to whether PR discharge is the most suitable or only time point for assessing eligibility for LVR.

As this study used data from a national audit, these findings can be assumed to be representative of the UK population and therefore provide a reasonable estimation of the proportion of patients who may be eligible for consideration. However, it is important to note that other factors that might influence decision-making such as the presence of comorbidities and of course patient preference were not recorded. Not all these individuals would be suitable for an LVR respiratory review, and only a proportion of these would be likely to be referred to an LVR MDT. The data do suggest that a systematic approach could significantly reduce current inequalities in access to this form of treatment.[16–18]

Current NICE guidance proposes that patients should be considered for LVR referral on completion of a PR programme, as following this intervention patients should be optimised. A failure to complete PR is associated with worse long-term outcomes[20 23] and could be taken as a marker that an individual's ability to cope with LVR surgery is reduced. However, access to PR is limited,[6 24] and non-completion is common, approximately 38% between assessment and completion in NACAP data, which may be due to issues unrelated to individual fitness such as transport or location of programmes. Patients with more severe breathlessness who may derive more symptomatic benefit from LVR may be more likely to drop out[24] or may not be able to train at sufficient intensities to bring about improvement through PR and therefore may find the exercise very uncomfortable.[25] Beginning consideration for possible LVR referral at PR assessment may help to promote programme adherence and affords the opportunity to gather other data on comorbidities and previous investigations which may be relevant.

In 2017, we published a qualitative study looking at patient experience of LVR services from referral through to discharge.[22] Results from two focus groups highlighted the difficulties they faced when trying to access LVR centres, with patients reporting their 'fight' to get a referral, one aspect of the unmet need which is common in respiratory disease.[4 26] That article focused only on those patients who received LVR intervention and did not account for all those patients who were excluded from consideration for these important treatments because of the inequalities that exist in referral pathways. Selection criteria should identify people who meet the criteria for LVR and would benefit from a procedure but who are not at an unacceptably high risk of a poor outcome.[7 11 27] Further research is needed to develop more systematic patient pathways to identify these individuals.

Routine assessment of eligibility for LVR referral could be considered as an opportunity to improve standards of care for all patients with COPD .[19] Importantly, the present data do not indicate that this proportion of patients should be referred to a specialist centre,

but rather that every patient should be systematically reviewed to consider LVR referral and necessary investigations carried out to evaluate their eligibility, should they express an interest. Future research should focus on the development and refining of LVR referral pathways that can be practically implemented at an appropriate time point and setting.

CONCLUSION

Given the well-established benefits of LVR procedures in appropriately selected patients, these data provide information on the scale of activity that referral pathways will need to accommodate and how these are affected depending on the precise selection criteria used. Raising the potential to be considered for LVR with patients at the point of referral to PR may encourage programme adherence, thus improving health outcomes. Furthermore, linking LVR and PR pathways more formally may also help promote PR referral.[19]

Twitter Sara C Buttery @SaraButtery, Adam Lewis @apl104 and Nicholas S Hopkinson @COPDdoc

Contributors SCB, MS, JKQ and NSH developed the original idea for the research study. SCB and AL collected the data and analysed them with statistical support from WB. SCB produced the first draft. All authors edited and contributed to the final manuscript.

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Competing interests SCB, AL, NSH and WB have no competing interests to declare. SVK reports other relationship with PulmonX during the conduct of the study and personal fees from Boston Scientific, outside of the submitted work. JQ reports grants from the RCP during the conduct of the study and is the analysis lead for the NACAP. MCS reports personal fees from GSK and non-financial support from Boehringer-Ingelheim, outside the submitted work.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. Data from NACAP can be obtained by application to the Healthcare Quality Improvement Partnership (HQIP) https://www.hqip.org.uk/national-programmes/accessing-ncapop-data/#.XsfPjzI7I9M.

ORCID iDs

Sara C Buttery http://orcid.org/0000-0001-9410-414X
Adam Lewis http://orcid.org/0000-0002-0576-8823
Jennifer K Quint http://orcid.org/0000-0003-0149-4869
Nicholas S Hopkinson http://orcid.org/0000-0003-3235-0454

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