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COPD discharge bundle and pulmonary rehabilitation referral and uptake following hospitalisation for acute exacerbation of COPD

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ABSTRACT

Pulmonary rehabilitation (PR) following hospitalisations for acute exacerbation of COPD (AECOPD) is associated with improved exercise capacity and quality of life, and reduced readmissions. However, referral for, and uptake of, post-hospitalisation PR are low. In this prospective cohort study of 291 consecutive hospitalisations for AECOPD, COPD discharge bundles delivered by PR practitioners compared with non-PR practitioners were associated with increased PR referral (60% vs 12%, p<0.001; adjusted OR: 14.46, 95% CI: 5.28 to 39.57) and uptake (40% vs 32%, p=0.001; adjusted OR: 8.60, 95% CI: 2.51 to 29.50). Closer integration between hospital and PR services may increase post-hospitalisation PR referral and uptake.

INTRODUCTION

There is an established evidence base supporting the benefits of pulmonary rehabilitation (PR) following hospitalisation for acute exacerbations of COPD (AECOPD), including improved exercise capacity and health-related quality of life, and reduced readmissions and mortality.[1 2] However, PR referral and uptake rates are low. Previous data have shown that only 30% of eligible patients are referred for post-hospitalisation PR, with less than 10% completing a programme.[3] Barriers to referral and uptake are complex and multi-factorial.[4]

The COPD discharge bundle (a structured package of evidence-based measures which should be delivered to all individuals) was introduced to facilitate implementation of evidence-based care following hospitalisation for an AECOPD and includes offering referral to PR.[5] However, bundles can be challenging to implement and their impact unclear.[6 7]

The aim of this study was to determine predictors of referral for and uptake of post-hospitalisation PR. We hypothesised that delivery of a COPD discharge bundle by a PR practitioner would be associated with increased PR referral and uptake.

METHODS

This prospective cohort study included consecutive hospital episodes for an AECOPD at Hillingdon Hospital, London, UK, from 1 April 2018 to 31 March 2019 and was considered service evaluation by the Health Research Authority. Patients admitted previously during the study period (and therefore already included in the data collection) were excluded.

Patients were classified according to three exposures (no COPD discharge bundle received; COPD discharge bundle received from a current PR practitioner; COPD discharge bundle received from a practitioner with no involvement in PR) and followed-up for 4 weeks after hospital discharge. All COPD discharge bundles (online supplemental figure E1) were delivered by a hospital-based multidisciplinary respiratory team with responsibility for early supported discharge, admission avoidance and community respiratory clinics. Two out of six team members were current PR practitioners, defined as someone also employed to deliver PR (assessments and/or supervision of classes) for a minimum 20% of their job plan. The research team played no involvement in exposure allocation (no randomisation, no influence on care team assignment). The clinical team delivering the bundle were blinded to the study objectives.

The outcomes were referral for PR (defined as a referral received by PR service) and uptake of PR (defined as the proportion of those referred attending a PR assessment) within 4 weeks of hospital discharge.

Covariates were selected a priori as patient or hospital admission variables which have been shown to be predictors of non-referral and non-uptake of post-hospitalisation PR, including age, length of hospital stay and index of multiple deprivation (IMD) (http://imd-by-postcode.opendatacommunities.org/).[8 9]

The sample size calculations are available in the (online supplemental data). Outcomes were compared between the two COPD discharge bundle exposure groups using independent t-test (or Mann-Whitney for non-normally distributed data) or χ^2 tests. Associations were investigated using logistic regression. Adjusted ORs with 95% CIs were estimated with p values<0.05 considered significant, with all clinically relevant covariates inputted into the model using the enter method.

RESULTS

Of 411 hospital episodes screened, 120 were excluded (24 were due to the patient being ineligible for PR and 96 as it was a readmission of a

Table 1 Baseline characteristics of cohort according to COPD discharge bundle exposure status

Variable	No bundle received (n=63)	Bundle received from a hospital practitioner involved in PR delivery (n=25)	Bundle received from a hospital practitioner with no involvement in PR (n=203)	Between group comparison for those who received bundles (p value)
Age (years)	72 (9)	72 (11)	72 (9)	0.975
Male (n (%))	29 (46)	12 (48)	105 (52)	0.725
FEV_1 % predicted	42 (26 to 62)	41 (30 to 63)	37 (26 to 48)	0.131
Smoking status: Never / former / current (n (%))	2 (3) / 42 (67) / 18 (29)	1 (4) / 17 (68) / 7 (28)	1 (1) / 132 (65) / 70 (34)	0.180
Median (IQR) duration of inpatient stay (days)	4 (2 to 9)	3 (2 to 8)	3 (1 to 6)	0.438
Review of respiratory specialist within 24 hours (n (%))	44 (70)	24 (96)	203 (100)	0.116
Non-invasive or invasive ventilation required during admission (n (%))	4 (6)	5 (20)	23 (11)	0.213

Data expressed as mean (SD) or median (IQR) unless otherwise stated; Independent t-test (or Mann-Whitney for non-normally distributed data) or χ^2 test was used to compare groups according to involvement in PR delivery of the hospital practitioner delivering the bundle for those who receive bundles.
FEV_1, forced expiratory volume in 1 second; PR, pulmonary rehabilitation.

patient already included) (online supplemental figure E2). Baseline demographics of the 291 episodes included in the study were: 145 women, 146 men; 33% current smokers; age 72 (SD: 9) years, FEV_1 38 (IQR: 26 to 52) per cent predicted; length of stay 3 (IQR: 2 to 7) days. Baseline demographics according to COPD discharge bundle exposure are shown in table 1.

Of the 63 episodes where the COPD discharge bundle was not used, none were referred for PR. Significantly higher referral and uptakes rates were observed for those who received a COPD discharge bundle from a current PR practitioner (referral: 60% vs 12%, p<0.001; uptake: 40% vs 32%, p<0.001).

In adjusted multivariate logistic regression, COPD discharge bundle delivered by a current PR practitioner was a predictor of increased PR referral and uptake (table 2), with length of inpatient stay also an independent predictor for PR referral (table 2).

DISCUSSION

In this prospective cohort study, provision of a COPD discharge bundle was an important factor in determining referral and uptake rates for post-hospitalisation PR. No resulting PR referrals or uptake occurred when a COPD discharge bundle was not delivered to the patient. Our data supports earlier observations that the introduction of COPD discharge bundles can generate increased referrals for post-hospitalisation PR.[10]

A novel aspect of our study examined whether the role of the practitioner delivering the bundle is influential. Intriguingly, we demonstrated that referral rates were significantly increased when the practitioner delivering the bundle also had responsibilities for delivering PR. Although this could simply represent referrer bias, we were reassured to also observe a higher PR uptake rate in those patients referred by current PR practitioners. After multivariate analysis, taking into account potential confounders such as patient demographics and hospital admission factors, the practitioner's current involvement in delivering PR remained an independent predictor for both increased PR referral and uptake (table 2). We did not collect data on patient face-to-face exposure time with healthcare professionals but there was no difference between the COPD bundle groups in the proportion receiving specialist respiratory review within 24 hours of admission (table 1). Furthermore, respiratory outpatient review took place at 6 weeks post-discharge, and therefore did not influence the primary outcomes (uptake and referral within 28 days of discharge).

One explanation for our observation includes increased referrer knowledge about local referral pathways and processes. Referrer knowledge and attitudes may also influence the

Table 2 Multivariate logistic regression for predictors of PR referral and uptake within 28 days of hospital discharge for those with completed bundles

	PR referral within 28 day of hospital discharge			PR uptake within 28 days of hospital discharge		
	Adjusted multivariate			Adjusted multivariate		
Variable	OR	95% CI	P value	OR	95% CI	P value
Practitioner delivering bundle involved in PR delivery (ref: not involved in PR delivery)	14.46	5.28 to 39.57	**<0.001**	8.60	2.51 to 29.50	**0.001**
Age (years)	0.98	0.94 to 1.02	0.277	0.99	0.99 to 1.05	0.717
Gender (ref: male)	0.56	0.25 to 1.24	0.152	1.83	0.54 to 6.19	0.325
Smoking status (ref: current)	0.87	0.37 to 2.06	0.748	0.93	0.24 to 3.65	0.917
Index of multiple deprivation	1.00	1.00 to 1.00	0.481	1.00	1.00 to 1.00	0.227
Non-invasive or invasive ventilation required (ref: no)	1.31	0.36 to 4.72	0.680	1.53	0.23 to 3.64	0.917
Duration of inpatient stay (days)	0.89	0.80 to 0.99	0.037	0.88	0.72 to 1.03	0.178

P value significance = ≤0.05 (in bold); all variables were entered in the model using the enter method.
.PR, pulmonary rehabilitation.;

patient–referrer interaction, which in turn shape the patient's understanding and demystify their expectations of PR. Knowledge is frequently identified as a barrier/enabler for PR referral and participation.[11] We propose that further research is needed to test whether improving referrer knowledge and experience, perhaps through formal training or closer integration between hospital and PR practitioners, can increase referral and uptake for post-hospitalisation PR. This is particularly important given the paucity of effective interventions that address this area.[9]

A limitation was that this was a single-centre study with small number of practitioners involved, and therefore our results may not be generalisable. However, our results seem mechanistically plausible, and we are confident about the accuracy of the exposure data as the recruiting hospital was financially incentivised to keep rigorous audit records around bundle completion. Furthermore, as the recruiting hospital was served by a single PR service, collection of PR outcome data was simplified. Another limitation is that our study used routinely collected data as part of service evaluation and audit. It is possible that our findings could be explained by confounding factors not collected in our data set, with differences in patient knowledge, beliefs and attitudes between the exposure groups potentially relevant.[11]

In summary, we have demonstrated that COPD discharge bundles are associated with increased referral and uptake rates for post-hospitalisation PR. In particular, COPD discharge bundle delivered by a practitioner delivering PR within their workplan is an independent predictor of PR referral and uptake. Closer integration between clinical services could increase post-hospitalisation PR referral and uptake.

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Competing interests REB, SSCK, SFC, JW, CMN, SEJ, SP, JAW, MM, MF and NSH have no competing interests to report. WM reports personal fees from Jazz Pharmaceuticals, personal fees from Mundipharma, personal fees from Novartis, grants from Pfizer, non-financial support from GSK, grants from National Institute for Health Research, grants from British Lung Foundation, outside the submitted work.

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ONLINE DATA SUPPLEMENT

Title

COPD discharge bundle and pulmonary rehabilitation referral and uptake following hospitalisation for acute exacerbation of COPD

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COPD discharge bundle

The COPD discharge bundle is a structured list of evidence-based practices delivered prior to hospital discharge following admission for an acute exacerbation of chronic obstructive pulmonary disease to attempt to standardise post-discharge care in the UK. The bundle delivered in this cohort study incorporates all five items recommended by the British Thoracic Society COPD Discharge Bundle (https://www.brit-thoracic.org.uk/quality-improvement/clinical-resources/copd-spirometry/), namely: 1) Review of medication and providing inhaler technique education; 2) Provision of a self-management plan; 3) Assess and offer referral for smoking cessation; 4) Arrangement of post-hospitalisation follow-up; and 5) Assess suitability and refer for pulmonary rehabilitation. Figure E1 below provides an example of the standardised paperwork which requires completion when delivering the COPD discharge bundle.

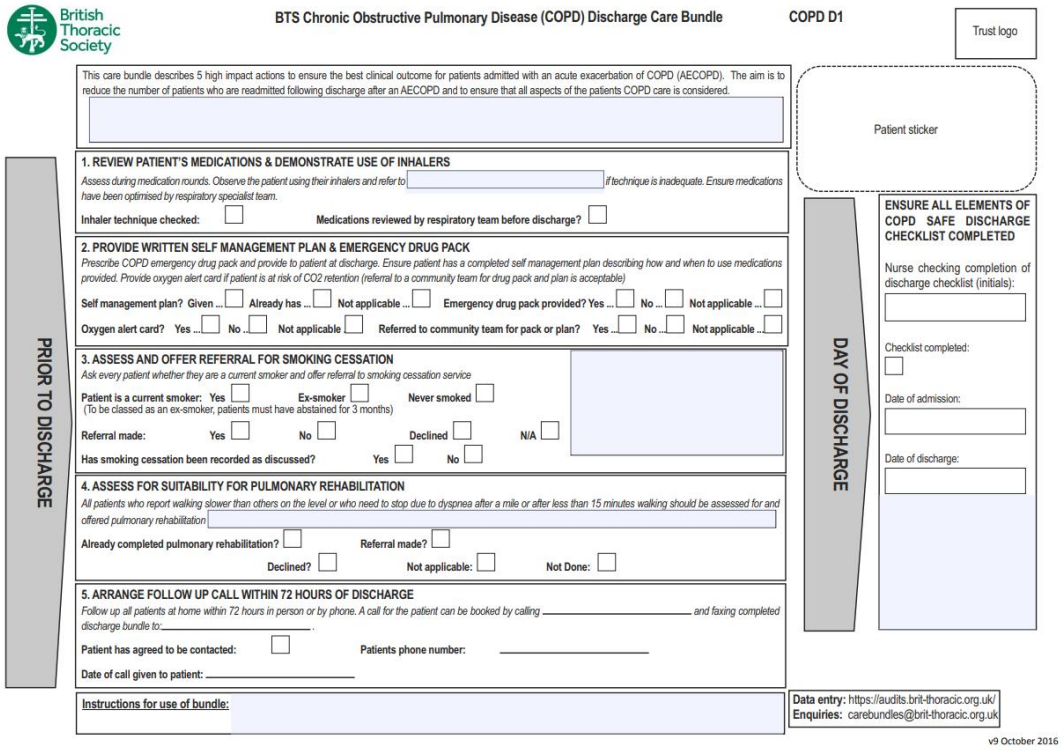

Figure E1. Example of standardised paperwork which requires completion for the COPD discharge bundle.

Sample Size Calculation

The sample size calculation was based on previous observations that approximately 30% of those receiving a discharge bundle are referred for pulmonary rehabilitation.(1) To demonstrate an increase in referral rate to 60% in those who received a discharge bundle from a pulmonary rehabilitation practitioner, with 80% power at the 5% significance level and assuming an exposure ratio of 1:9 (i.e. 10% of discharges would receive a bundle from a pulmonary rehabilitation practitioner) would require a minimum of 220 patients (MedCalc Software, Ostend, Belgium).

For the overall population at hospital discharge, we estimated the proportion taking up pulmonary rehabilitation to be 20%.(1) To demonstrate an increase in the proportion of those at hospital discharge taking up pulmonary rehabilitation to 50%, with 80% power at the 5% significance level and assuming an exposure ratio of 1:9 (i.e. 10% of discharges would receive a bundle from a pulmonary rehabilitation practitioner), would require a minimum of 190 patients (MedCalc Software, Ostend, Belgium).

We planned to collect data for a minimum of one year to take into account seasonal variations, and continue to collect if the planned sample size had not been recruited within one year.

Diagram for study flow

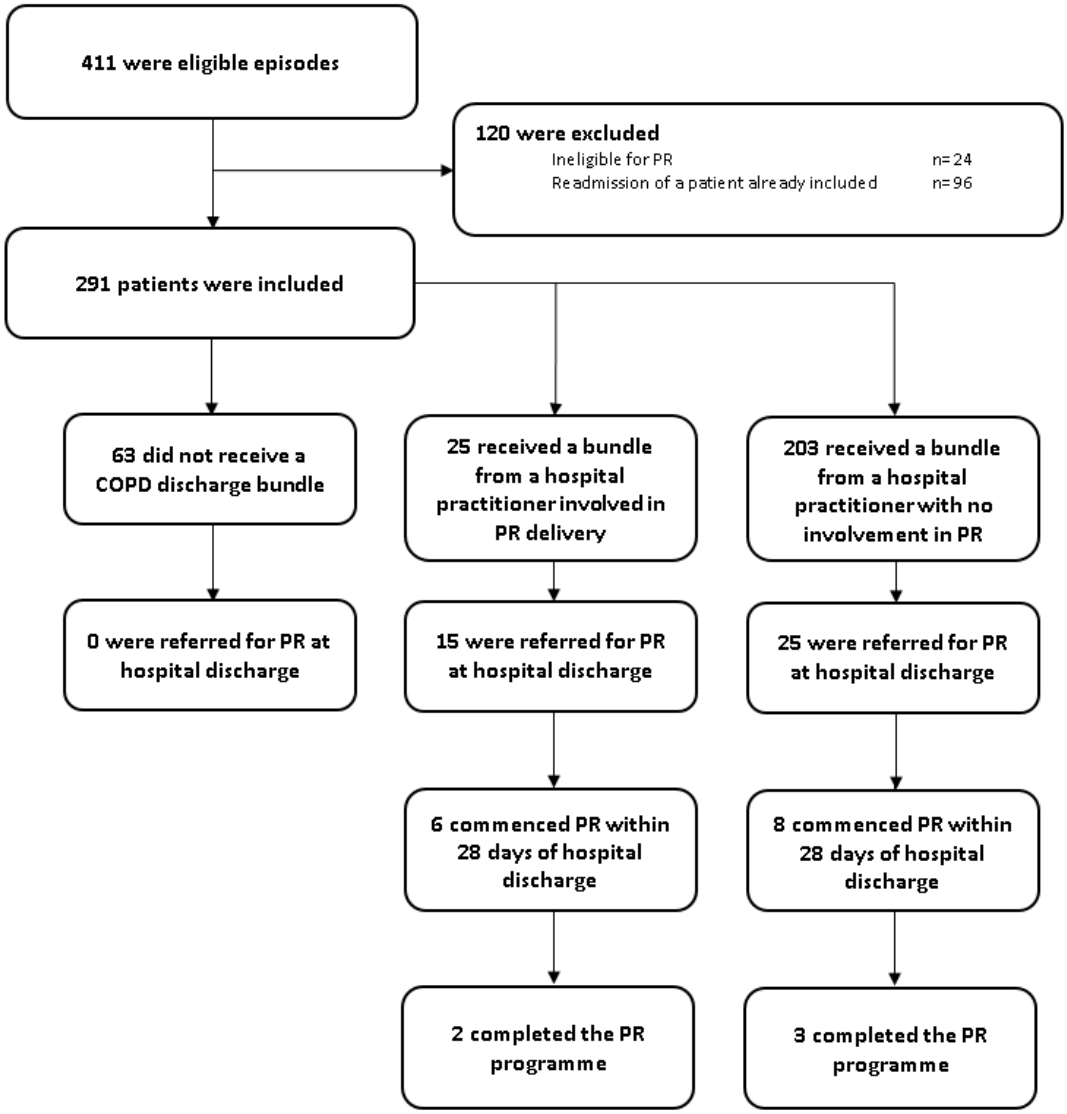

Figure E2. Diagram of study flow

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