

# Decreasing Hospital Readmissions Utilizing an Evidence-Based COPD Care Bundle

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## Research Article

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# Abstract

## Purpose

Chronic obstructive pulmonary disease (COPD) is a chronic condition that leads to significant morbidity and mortality. Management of COPD hospitalizations utilizing an evidence-based care bundle can provide consistent quality of care and may reduce readmissions.

## Methods

This single center retrospective cohort study evaluated readmission rates in patients hospitalized with a COPD exacerbation. Patients in the pre-intervention cohort received usual care while post-intervention cohort received an innovative inpatient COPD care bundle. The bundle focused on optimizing care in five areas: consults, inpatient interventions, education, transitions of care, and after discharge care. To ensure consistency of interventions, a formal checklist of items was maintained.

## Results

In this study, 149 subjects were included in the pre-intervention cohort and 214 subjects were included in the post-intervention cohort. Thirty-day readmission rates were lower in the post-intervention cohort, 22.4% vs. 38.3% ( $p=0.001$ ). A reduction in 60-day and 90-day readmission rates was also observed, 13.7% vs. 40.3% ( $p<0.001$ ) and 10.1% vs. 32.2% ( $p<0.001$ ), respectively.

## Conclusion

Bundled care is an effective and inexpensive method for institutions to provide consistent and quality care. The findings of this study demonstrate that the implementation of a COPD care bundle is an effective strategy to decrease hospital readmissions.

## Background

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory condition associated airflow limitation and is a major cause of morbidity and mortality [1]. As of 2021, COPD is the fourth leading cause of death in the United States [2]. Hospitalizations, emergency department visits, and economic costs create a significant health care burden. In the United States, COPD results in over two million emergency department visits and 652,000 hospitalizations annually, with an associated economic cost approaching \$50 billion [3].

COPD is the third most common cause of hospital readmission and approximately one in five patients hospitalized for COPD will have rehospitalization within 30 days [4,5]. Outside of the United States, 30-

day and 90-day readmission rates have been reported as high as 24% and 43%, respectively [6]. Hospital readmissions are costly and preventable. Health care facilities are now accountable for excess 30-day readmissions through the Hospital Readmissions Reduction Program for select conditions, including COPD. The Centers for Medicare and Medicaid Services limit payments to hospitals with high readmission rates via this program, providing a financial incentive for institutions to improve care coordination to reduce avoidable readmissions [7].

In order to reduce readmissions, delivery of guideline-directed care for maintenance and prevention is essential. To provide consistent care during hospitalization, care bundles can be utilized. The Institute of Healthcare Improvement defines care bundles as “a structured way of improving the processes of care and patients’ outcome” [8]. These bundles standardize the care process and play an important role in management of chronic conditions, such as COPD [9]. One study conducted by Laverty et al. evaluated a COPD care bundle that implemented smoking cessation assistance, pulmonary rehabilitation referral, patient education, inhaler technique assessment, and a follow-up appointment prior to discharge. This bundle was associated with a reduction in hospital readmission rate [10]. Another study conducted by Ko et al. randomized patients discharged after an acute COPD exacerbation to receive a care bundle or usual care. The intervention consisted of a comprehensive, individualized care plan delivered by an interdisciplinary group, which included education from a respiratory nurse, pulmonary rehabilitation, three-monthly telephone calls by a respiratory nurse over one year, and follow-up at a respiratory clinic once every three months for one year. At one year, the adjusted relative risk of readmission was 0.668 (95% CI 0.449 to 0.995,  $p=0.047$ ) for the patients receiving the care bundle compared to those who received usual care, indicating that the COPD program reduces hospital readmissions. Those receiving the intervention also had a shorter length of stay and greater improvements of symptoms and quality of life [11]. Additionally, ensuring care coordination between inpatient and outpatient providers has been shown to not only reduce patient hospitalizations, but also improve patient quality of life [12].

Incorporation of supplemental elements into the COPD care bundle may also help optimize comprehensive patient care. For example, depression and anxiety are risk factors for COPD exacerbation and may have implications in COPD treatment compliance [13, 14]. Screening for and treating these ailments may have utility in a COPD care bundle. Nutritional support may also help target the extrapulmonary effects of COPD, such as the physical and metabolic adaptations. Studies have shown that patients with a body mass index (BMI) less than 20 kg/m<sup>2</sup> have a higher risk of exacerbation than those with a higher BMI [15]. Implementation of a dietary consult can help effectively manage the nutritional depletion seen in COPD and improve quality of life [16]. Another supplemental intervention can include early mobilization, as it has been shown to reduce physical disability in older patients hospitalized with COPD and decrease length of stay [17, 18]. Lastly, ensuring medication affordability prior to discharge helps enhance transitions of care given the high cost and few available generic options. Medication cost is one of the most significant determinants of nonadherence in the COPD patient population [19]. Confirming patients are discharged on inhalers covered by their health plan or

helping to facilitate enrollment to patient assistance programs are additional interventions that can help improve overall care for patients with COPD.

To reduce healthcare burden and optimize patient care, sustainable interventions need to be established. Previous studies have evaluated the implementation of a limited number of interventions, many of which consist of smoking cessation, patient education, and follow up. Authors of this study designed an innovative, comprehensive COPD care bundle to be used during hospitalization and enhance care coordination. It was hypothesized this intervention would reduce readmission rates for patients hospitalized with COPD.

## **Purpose**

The purpose of this study was to evaluate the effect of the implementation of an innovative inpatient COPD care bundle on 30-day readmissions for patients admitted with a COPD exacerbation. The primary objective of this study was to measure the 30-day readmission rates in patients who received the care bundle versus those who received standard of care. Secondary outcomes evaluated 60- and 90-day readmission rates and length of stay.

## **Methods**

This study utilized a retrospective cohort design with pre- and post-intervention arms. Patients admitted to a 700-bed community teaching hospital were screened for inclusion. Patients in the pre-intervention cohort were admitted from April to September 2016 and received standard of care for a COPD exacerbation. Patients in the post-intervention cohort were admitted from April to September 2017 and received the inpatient COPD care bundle by an interdisciplinary team. Patients were included if they were 18 years of age or older and had an International Classification of Diseases (ICD)-10 code of COPD with exacerbation. Patients were excluded if they were admitted to the intensive care unit (ICU), received hospice services, or if they were unable to participate in patient education.

An interdisciplinary team developed and implemented an evidence-based care bundle utilizing the COPD GOLD Guideline recommendations. The bundle focused on optimizing care in five areas: consults, inpatient interventions, education, transitions of care, and after discharge care. Each patient received a pulmonary and dietary consult on admission to ensure guideline-directed pharmacotherapy and proper nutrition. During hospitalization, there was a focus on early mobility, and subjects were screened for depression, anxiety, and lung cancer. The bundle also included inhaler and disease state education, smoking cessation, assessment of inhaler technique via an In-Check™ DIAL device, delivery of pulmonary medications prior to discharge, and development of a COPD Action Plan. The COPD Action Plan was reviewed daily with the patient and caregivers, and it included education on signs and symptoms of COPD exacerbations. Prior to discharge, subjects were referred to pulmonary rehabilitation, home care, mobile integrated health services, and outpatient community support groups. All patients had a follow up appointment with a pulmonologist within seven days and received a follow up phone call

within 72 hours of discharge. To ensure consistency of interventions, a formal checklist of items was maintained, and corresponding team members would sign off upon patient receipt.

Variables collected included age, gender, smoking status, comorbidities, and hospitalizations within one year. The primary objective of the study was to compare 30-day readmission rates in both groups. Secondary outcomes included 60- and 90-day readmission rates and length of stay. Sixty-day readmissions were defined as a readmission between day 31 and 60 and 90-day readmissions were defined as a readmission between day 61 and 90. Data was extracted using University Health System Consortium and ChartMaxx<sup>®</sup>. Statistical analysis was conducted using Minitab<sup>®</sup>. A two-sample proportion or Fisher's Exact Test was used for the categorical variables and a Mann-Whitney Test was used on continuous variables. An institutional review board application was submitted and approved.

## Results

In this study, 149 subjects were included in the pre-intervention cohort and 214 subjects were included in the post-intervention cohort. The average subject age was 74 years old. Baseline characteristics including age, sex, and past medical history were similar between both groups. A higher proportion of patients in the pre-intervention group had a hospitalization in the past year (75.8% vs. 29.7%,  $p < 0.001$ ). Additionally, there were fewer current smokers in the pre-intervention cohort (20.8% vs. 32.9%,  $p = 0.009$ ) (Table 1).

Thirty-day readmission rates were significantly lower for subjects who received the COPD care bundle (38.3% vs. 22.4%,  $p = 0.001$ ). The 60- and 90-day readmission rates were also significantly lower in subjects who received the care bundle ( $p < 0.001$ ) (Table 2). The median length of hospital stay was 6 days in the pre-intervention cohort and 7 days in the post-intervention cohort. Discharge locations between the two cohorts were similar and included: home, subacute rehabilitation, and long-term care (Figure 1). Over 60% of subjects in both groups were discharged to home.

## Discussion

This study identified that implementation of an evidence-based COPD care bundle significantly reduced 30-day readmission rates without increasing hospital length of stay. Reductions in readmissions were consistently observed at 60 and 90 days. These findings aligned with previously published literature related to COPD care bundles. Similar to other published studies, the bundle focused on initiating pulmonary consults, smoking cessation, inhaler education and technique, referral to pulmonary rehabilitation, and follow up appointments. Unique elements of this study's care bundle include the comprehensive evaluation of other co-existing chronic and acute conditions. Subjects received depression and anxiety screenings, early mobility with physical therapy, and proper nutrition with a dietician consult. In addition, the bundle included other COPD focuses such as assessment of inhaler device technique via an In-Check<sup>™</sup> DIAL device, development of a COPD Action Plan, and pulmonary medications delivery prior to discharge. The use of an objective technique assessment is valuable as one study found up to 80% of patients utilize their inhalers incorrectly in the community setting [20]. The

COPD Action Plan promotes recognition of exacerbation and patient self-management. Hegelund and colleagues demonstrated that a COPD Action Plan at discharge significantly reduced the incidence of readmissions and it was an effective self-management tool to support recovery and to reduce unnecessary readmissions [21].

Ensuring inhaler affordability and coverage prior to discharge also facilitates adequate transition of care from inpatient to community. Following discharge, subjects had a respiratory therapist visit at home to evaluate progress and work with mobile integrated health services. Prior to the implementation of this quality initiative, patients received therapy based on the COPD GOLD guidelines and verbal instructions to follow up with a physician in two to three weeks.

Another strength of this study includes evidence-based care conducted by an interdisciplinary team. All subjects received care based on the GOLD COPD guidelines and the team included physicians, nurses, social workers, care managers, respiratory therapists, pharmacists, physical therapists, and dieticians. The objectives set by the COPD care bundle were part of a hospital-wide quality improvement initiative and supported all subjects hospitalized for COPD to receive standardized care. In order to ensure consistent delivery, the interdisciplinary team maintained a formal checklist for each patient.

This retrospective cohort design with pre-and post-intervention arms should be interpreted in the context of several limitations. While the pre- and post-intervention cohort had similar baseline characteristics, there were differences that may indicate unbalanced cohorts. The pre-intervention group had more hospitalizations in the past year compared to the post-intervention cohort, and the post-intervention cohort also had a higher proportion of current smokers. Additionally, the 30-day readmission rate in the pre-intervention cohort was higher than what has been previously cited in literature [4,5]. In regard to outcomes, readmissions could only be identified if the subject was readmitted within the health care system. Hospitalizations outside of the system were not captured and unable to be reported in this study. The small sample size and single center retrospective design may limit its generalizability. A prospective controlled study may have been more suited for this research based on the potential to delineate the cause-and-effect relationship between implementation of the COPD care bundle and hospital readmissions. Lastly, this study did not include patients in the ICU, in hospice care, and those who were unable to participate in education; thus, the findings do not apply to all patients hospitalized with COPD exacerbation.

## **Conclusion**

COPD is a prevalent, chronic condition that may result in hospitalization. Readmissions are costly and preventable if patients are managed using guideline-directed therapy. Previous studies have demonstrated various interventions are effective to promote patient self-management and reduce hospitalizations for COPD. Bundled care is an effective and inexpensive method for institutions to provide consistent and quality care. The findings of this study demonstrate that the implementation of an evidence-based COPD care bundle is an effective strategy to decrease 30-, 60-, and 90-day readmissions.

Future studies should look to expand established care bundles across the health care system as well as incorporate their use in multiple settings – both inpatient and outpatient. Additionally, integration of the care bundle into the electronic medical record can enhance consistent delivery and transitions of care.

## Declarations

### Conflict of Interest

None

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### Author Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Moira Kendra, Rupal Mansukhani, Nicole Rudawsky Lisa Landry, Stephanie Chiu. The first draft of the manuscript was written by Moira Kendra, Rupal Mansukhani, Nicole Rudawsky, and Natalie Reyes. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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## Tables

**Table 1.** Baseline Patient Demographics

	Pre-Intervention (n=149)	Post-Intervention (n=219)	p-value
Age, mean (SD)	75.3 (10.5)	73.4 (10.7)	0.091
Female Sex, n (%)	87 (58.39%)	129 (58.9%)	0.922
Current Smoker, n (%)	31 (20.8%)	72 (32.9%)	0.009
Hospitalized in Past Year, n (%)	113 (75.8%)	65 (29.7%)	<0.001
Past Medical History			
Asthma, n (%)	6 (4%)	13 (5.9%)	0.4
Cancer, n (%)	19 (12.8%)	31 (14.2%)	0.697
Chronic renal disease, n (%)	14 (9.4%)	31 (14.2%)	0.156
Coronary artery disease, n (%)	34 (22.8%)	39 (17.8%)	0.244
Congestive heart failure, n (%)	22 (14.8%)	32 (14.6%)	0.968
Diabetes mellitus, n (%)	34 (22.8%)	64 (29.2%)	0.165
Obstructive sleep apnea, n (%)	17 (11.4%)	23 (10.5%)	0.785
Pulmonary fibrosis, n (%)	1 (0.7%)	2 (0.9%)	>0.999

**Table 2.** Outcomes

	Pre-Intervention	Post-Intervention	p-value
	(n=149)	(n=219)	
30-day Readmission	57 (38.3%)	49 (22.4%)	0.001
60-day Readmission	60 (40.3%)	30 (13.7%)	<0.001
90-day Readmission	48 (32.2%)	22 (10.1%)	<0.001
Length of Stay, median (IQR)	6 (4, 11)	7 (5, 10)	0.0992

## Figures

### Figure 1

Discharge Location