Spring 5-6-2023

# Implementation of Chronic Obstructive Pulmonary Disease Action Plan on the Step Down Critical Care Unit: A Pilot Study

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## Recommended Citation

**Implementation of Chronic Obstructive Pulmonary Disease Action Plan on the Step Down Critical Care Unit: A Pilot Study**

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**Author Note**

We have no conflicts of interest to disclose. Correspondence to this article should be addressed to Myra Schmaderer, College of Nursing, University of Nebraska Medical Center, 4111 Dewey Avenue, Omaha, NE 68198-5330. Email mschmade@unmc.edu

## Abstract

**Background:** Hospital readmissions due to chronic obstructive pulmonary disease (COPD) exacerbations are a significant economic and resource burden on the United States healthcare system. Current professional guidelines for the prevention of acute exacerbations of chronic obstructive pulmonary disease (AECOPD) include providing patient-focused education with a written action plan such as a COPD Action Plan.

**Aims:** The primary purpose of this project was to determine if providing an educational intervention to patients admitted for AECOPD would reduce hospital readmission rates for COPD and improve patient outcomes.

**Method:** We performed a quasi-experimental pilot study of 10 participants admitted with a COPD exacerbation to a single tertiary care facility in the Midwest. Primary outcomes included 30-day readmission rates, COPD symptoms, quality of life, and patient satisfaction.

**Results:** We were unable to show a relationship between using the COPD Action Plan and readmission rates, overall health related to COPD, and quality of life. However, clinically it was abundantly clear that COPD patients require close follow-up after being hospitalized and additional interventions that meet their needs and expectations.

**Limitations and Implications**: Small sample size and quasi-experimental design limit the generalizability of our findings.

**Conclusion:** The COPD Action Plan intervention was not sufficient in reducing 30-day readmission rates and improving COPD symptoms and overall health status and improving quality of life. A more aggressive intervention may impact patient outcomes.

*Keywords:* COPD, hospital readmissions, quality of life, education, patient outcomes

**Introduction**

In the United States, chronic obstructive pulmonary disease (COPD) remains a leading cause of mortality and morbidity (National Institutes of Health [NIH], 2020). In 2014, approximately 15.7 million Americans were diagnosed with COPD (Centers for Disease Control and Prevention [CDC], 2019). Many patients diagnosed with COPD are admitted for acute exacerbations two to three times a year (CDC, 2019). In the United States, the 30-day readmission rate for COPD patients is 22.6 percent (Portillo et al., 2018). Studies examining acute exacerbations of COPD (AECOPD) have shown that prevention, early recognition of symptoms, and appropriate interventions can reduce the severity of exacerbations (Feiring and Friis, 2019).

In the United States, COPD is a significant economic and social burden (Khakban et al., 2017). The United States was projected to spend approximately 49 billion dollars on COPD in 2020 (NHLBI, 2020). One of the primary drivers of these healthcare costs is the recurrent hospitalizations due to AECOPD (Khakban et al., 2017). The Agency for Healthcare Research and Quality reported approximately 822,500 hospital stays were due to COPD and 3.8 million hospital stays were due to COPD as a secondary diagnosis (Wier, Elixhauser, Pfuntner, & Au, 2011). In 2015, the Medicare Hospital Readmission Reduction Program started penalizing hospitals for patients readmitted within 30 days (Portillo et al., 2018).

In addition, AECOPD has been linked to a decreased quality of life and increased risk for mortality (McCurdy, 2013). A lack of knowledge about COPD has been directly correlated to patients' decreased adherence to medications and interventions to manage their COPD outside of the hospital (O' Conor et al., 2019). The current COPD educational standard for most hospital systems follows the Centers for Medicaid and Medicare Services (CMS) guidelines for COPD

management (CMS, 2021). This includes providing patients with generic informational handouts about the disease itself, along with general signs and symptoms of an exacerbation, and in some cases, information and resources on how to quit smoking upon discharge.

Some healthcare institutions have gone a step further and provided more patient-focused education to COPD patients upon discharge including home treatment plans and self-management education (Feiring & Friis, 2019; Howcroft, et. al., 2016; O'Conor, et. al., 2019; Parikh, Shah, & Tandon, 2016; Pedersen, et. al., 2017). Studies have been conducted on these interventions with promising results for both readmission rates and various secondary outcome measures (Jennings, et. al., 2015; Kong & Wilkinson, 2019; Parikh, Shah, & Tandon, 2016; Pederson, et. al., 2017; Zafar, et. al., 2019).

**Purpose**

Current professional guidelines for the prevention of AECOPD include providing patient-focused education with a written action plan (Criner, 2015). Despite recommendations, many hospitals aren't incorporating written action plans for COPD patients. The primary purpose of this project was to determine if providing an educational intervention, in the form of a COPD Action Plan to patients admitted for AECOPD, would reduce hospital readmission rates for COPD and improve patient outcomes in a healthcare system that does not currently provide such education. The primary aims of the study were to (1) compare 30-day hospital readmission rates for COPD to 30-day hospital readmissions one year prior,  (2) compare COPD symptoms and overall health status pre and post-intervention measured by the COPD Assessment Test (CAT), (3) evaluate pre and post quality of life measured by the EuroQol- 5 Dimension- 5 Level (EQ-5D-5L) questionnaire, and, (4) describe participants satisfaction with the COPD Action plan.

**Review of Literature**

As part of a Doctor of Nursing Practice project, a systematic review of the literature was completed to determine the effectiveness of focused patient education on recurrent hospitalization rates of COPD patients. A search was conducted in September 2020 using three electronic bibliographic databases including Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medline via EBSCO, and PubMed. The literature review was limited to relevant studies completed within the past 10 years. A total of 1,164 references were identified through preliminary database searching. After the screening process, thirteen studies were found to be clinically relevant.

The general findings of the selected research articles showed an improvement in overall patient condition when thorough, focused educational materials and resources were provided. Concerning the primary outcome of hospital readmission rates, the results were mixed. In one systematic review by Howcroft et al., (2016), the results of seven different randomized control trials involving COPD Action Plans showed a reduction in 12-month hospital readmission rates. A study by Jennings et al. (2015) assessed readmission and emergency department visits within 30 days and 90 days and did not find a significant difference with educational intervention. A similar study by Pedersen et al. (2017) also assessed follow-up at 180 days, 360 days, and time to COPD hospitalization, and showed a significant reduction in readmission rates. The study by Rice et al. (2010) assessed admissions and emergency visits related to COPD within one year, showing no difference in hospital readmission rates, but a significant reduction in emergency visits after the educational and disease management interventions.

Several studies utilized a "COPD Bundle," which uses many of the interventions included in the COPD Action Plan, showed a reduction in hospital readmissions (Lenferink et al., 2017; Zafar et al., 2019, Kong & Wilkinson 2019, Portillo et al., 2018). In Zafar et al. (2019)

study, participants were provided a "COPD Bundle" which included COPD inhaler regimen guidelines, personalized inhaler education, 30-day medication supply, standardized discharge instructions, and follow-up appointment made with the primary care provider within 15 days of discharge. The willingness of patients to follow-up with a pulmonologist after focused education was given upon discharge was also measured and resulted in a drastic increase from 18.2% in the control group to 59.1% adherence to follow-up appointments in the group that received a COPD care bundle (Parikh & Tandon, 2016).

The reviewed research articles also contained a wide variety of secondary outcome measures related to the patient's overall quality of life and knowledge of COPD self-management practices. Lenferink et al. (2017) found a statistically significant beneficial effect of self-management interventions with COPD action plans on health-related quality of life. Another study by Granados-Santiago et al. (2020) that implemented educational materials which fostered patient engagement and shared decision-making showed significant increases in the participant's overall health, activity level, COPD knowledge, and adherence to pharmacological treatment compared to the control group.

Given the varying results of these studies, further investigation as to the effectiveness of focused COPD education on hospital readmissions was warranted. A COPD Action Plan was directly used in many of the studies reviewed, and would serve as a comprehensive tool that included many of the strategic interventions and medication management principles highlighted in the literature review. The American Lung Association's COPD Action Plan was chosen as an appropriate tool for this study's intervention and will be discussed further in the Design and Methods section.

**Ethics**

Institutional Review Board approval (IRB 0119-22-EP) was sought before initiating the study. Informed patient consent was obtained in a private hospital room prior to data collection for each participant. The informed consent form included the purpose of the project, methods, risks, benefits, and alternatives. To ensure confidentiality and security anonymity, protected health information and other identifiers were not included in analyses or reports after the original data was collected and processed. In addition, data was secured on a safe server.

## Sample Selection

### Setting

The study took place on a step-down critical care (SDCC) unit at a large academic medical center in the midwestern United States. The SDCC unit was chosen for this study since they see a high volume of patients admitted for AECOPD. In 2020, 329 patients were admitted to the SDCC unit for AECOPD. The readmission rate for COPD patients at this facility was 21.1%, which was 5.9% higher than the overall all-cause readmission rate after discharge at this hospital (Center for Medicare and Medicaid Services, 2022).

### Sample

A sample size of 55 participants was needed to be a fully statistically powered study (effect size of 0.5, power of 0.8, and 0.05 level of significance). Participants were recruited by the charge nurse on the SDCC unit over 14 weeks. The charge nurse reviewed patient records for patient inclusion and exclusion criteria. Participants were identified for the study if they were 19 years or older and admitted or transferred to the SDCC unit with an admitting diagnosis of an AECOPD. The exclusion criteria was the following: non-English speaking patients, patients discharged to hospice care, coronavirus disease 2019 (COVID-19), and patients with any diagnosed cognitive impairment with a perceived inability to comprehend the COPD action plan.

Following this process, the charge nurse explained the study to eligible participants and obtained informed consent.

## Design and Methods

### Design

A quasi-experimental pilot study design utilizing the previous years' readmission data served as a control and a convenience sample was used to answer the research questions.

### Intervention

Participants received education on the COPD Action Plan, which was created by the American Lung Association. The COPD Action Plan includes focused education on how to effectively manage a COPD exacerbation based on the severity of symptoms. The COPD Action Plan includes a color-coded algorithm (green, yellow, red) to visually depict the severity of symptoms and associated treatment options. For example, the green zone means the participant's symptoms are well controlled, the yellow zone means the participant's symptoms have increased and the red zone means the participant's symptoms are sudden or severe. Participants received a laminated version of the COPD Action Plan to take home. To ensure the fidelity of the intervention, there was one researcher that followed standardized procedures to administer the COPD Action Plan to each participant. In addition, we evaluated for fidelity weekly by assessing the researcher's adherence to the protocols, delivery of the COPD Action Plan, and collection of data.

### COPD Clinical Outcome Tool

The COPD Assessment Test (CAT) is a short 8-item questionnaire that measures the effects of COPD on the participants' overall health. The 8-item questionnaire asks about cough, phlegm, chest tightness, breathlessness, activities, confidence, sleep, and energy. Items are scaled

using a 5-point Likert Scale. The CAT score ranges from 0 to 40 with a higher score indicating

COPD has a greater impact on a patient's overall health. A CAT score can further be categorized

into low, medium, high, and very high impact. The CAT is a highly valid and reliable instrument

with significant correlations between total score and mortality and outcomes in pulmonary

rehabilitation (Husebø et al., 2016; Dodd et al., 2011). Strong internal consistency with a

Cronbach's alpha of 0.88 has been reported (Jones et al., 2009). The intra-class correlation

coefficient was 0.88, which ensures reproducibility (Jones et al., 2009).

**Quality of Life Tool**

The EQ-5D-5L is a widely used, valid questionnaire that accurately gauges an

individual's quality of life as it relates to overall health. The instrument includes a descriptive

system (EQ-5D) and a visual analog scale (EQ VAS). The descriptive system consists of five

dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each

dimension has five scoring levels. Each of the five dimensions is combined to form a 5-digit

number that describes the patient's health state, which can be converted to an index 'utility'

score (EuroQOL Research Foundation, 2021). Health state index scores typically range from

zero to one with one representing 'full health' and high health utility (EuroQOL Research

Foundation, 2021). In addition, the EQ VAS asks patients to self-rate their health on a vertical

scale that ranges from zero which represents 'the worst health you can imagine' to 100 which

represents 'the best health you can imagine'. Research studies have confirmed EQ-5D-5L

validity and responsiveness in measuring the health status of COPD patients (Nolan et al., 2016).

**Participant Satisfaction Tool**

The COPD Action Plan Utilization survey was designed for this study by investigators to

determine the usage, functionality, and convenience of using the COPD Action Plan. Participants

were asked complete the COPD Action Plan Utilization survey 30 days after they were

discharged from the hospital. Participants were asked how many times they used the COPD

Action Plan and how many times they were in each zone (green, yellow, or red) since being

discharged from the hospital. In addition, participants were asked if the COPD Action Plan

helped them become more independent and if the COPD Action Plan was convenient and easy to

use.

**Data Collection**

Data was collected for every study participant while hospitalized and 30 days after being

discharged from the hospital. The first phase of the data collection process was collecting pre-

intervention CAT and EQ-5D-5L, as well as chart audits for participant baseline and

demographic data. The second phase of data collection involved sending an online link to the

participant's email and calling participants for the post-intervention CAT, EQ-5D-5L, and COPD

Action Plan Utilization questionnaire 30 days after admission. If participants did not respond to

the online link then up to two calls were made in an attempt to get data. The last phase of the

data collection process was done via electronic health record review to gather information on 30-

day hospital readmission rates for study participants. Readmission results were only obtained

from the index hospital where the participant was enrolled. Previous years' data from COPD

readmission rates at the institution was obtained to compare to the readmission rates in this

study.

**Statistical Methods**

All statistical analyses were completed using SPSS software. The readmission rates for

COPD after implementing the COPD Action Plan were compared to the readmission rates one

year prior with frequency and proportions. Descriptive statistics (frequencies, means, medians,

standard deviations) were used for each of the demographic and baseline clinical variables.

Descriptive statistics were also used to describe the participants' satisfaction and utilization of

the COPD Action Plan. The CAT and EQ-5D-5L instruments were scored based on the

published scoring manual. The comparative analysis of the pre-test and post-test of the CAT,

EQ-5D index, and EQ VAS was performed using the Related-Sample Wilcoxon Signed Test

with an a priori alpha level of  0.05. The effects of demographic and baseline clinical information

on COPD were analyzed using Spearman's rank correlation coefficient.

### Findings

There were 20 people that were eligible for the study, however, only 10 participants

agreed to participate in the study. Reasons for not enrolling in the study was anxiety about

beginning a new task in addition to their care plan and lack of an electronic device for follow-up

(email or cell phone). Three participants completed post-surveys. The mean age of participants

was 63.4 years (see Table 1). A majority of participants were female (80%), Caucasian (80%),

had a smoking history (90%) and had Medicaid or Medicare insurance (80%).

The average length of COPD diagnosis for our participants was 6 years (see Table 2).

Comorbidities included the following: anemia (40%), anxiety (40%), arthritis (10%), asthma

(10%), depression (60%), diabetes (50%), acid reflux (40%), heart disease (100%), high blood

pressure (100%), and sleep apnea (60%). Out of the 10 participants, 4 participants were

readmitted within 30 days for COPD exacerbations. Participants were admitted on average 12

days after they were discharged from the hospital.

Ten participants completed the pre-CAT survey while three participants completed the

post-CAT survey (see Table 3). The pre-CAT survey mean was 18.3 with a standard deviation of

7.1, while the post-CAT survey mean was 16.7 with a standard deviation of 13.6. Similar to the

CAT survey, ten participants completed the pre-EQ-5D-5L survey, and three participants completed the post-EQ-5D-5L survey (see Table 3). The pre-EQ VAS mean (SD) was 48.0 (17.67), while the post-EQ VAS mean (SD) was 58.3 (13.58). The pre-EQ-5D index mean (SD) was 0.69 (0.18) and the post-EQ-5D index mean (SD) was 0.74 (0.10).

Three out of the ten participants completed the COPD Action Plan Utilization survey. The three participants used the COPD Action Plan at home approximately 19 times over 30 days. A majority of the participants were in the green and yellow zone over 30 days while none of them were in the red zone. One of the participants agreed the COPD Action Plan helped them become independent in managing their COPD while two of the participants were neutral. Two of the participants agreed and one of the participants strongly agreed that the COPD Action Plan was convenient and easy to use.

**Discussion**

In this study, we were unable to show a statistical relationship between using the COPD Action Plan and readmission rates, overall health related to COPD, and quality of life. The results from the EQ-5D, EQ-VAS, and CAT were not statistically significant. Despite many attempts to recruit participants, the convenience sample for this study was much lower than our projected sample size. This could have been due to several reasons. During this project, the institution allowed new bilevel-positive airway pressure (BiPAP) patients to be admitted to two additional units besides the SDCC units. Previously, the SDCC unit was one of the only units that could accommodate new BiPAP patients, which were predominately COPD patients. This unforeseeable change could have played a role in recruiting patients. Additionally, one exclusion criteria was patients with COVID-19. If this diagnosis was not excluded, then we potentially

would have got a larger sample. Future studies should focus on recruiting a larger sample to enhance generalizability.

The pre-test and post-test for the CAT survey were 18.3 and 16.7, respectively. A CAT score between 10 to 20 suggests that participants' COPD has a medium impact on their daily life (CAT Governance Board, 2022). In other words, participants with COPD were having a few good days a week and typically had one or two exacerbations a year (CAT Governance Board, 2022). Despite our small sample reporting that COPD only had a medium impact on their daily life, 4 out of 10 of the participants were readmitted to the hospital within 30 days of being discharged. A medium impact on the CAT instrument also suggests there is room for improvement in their COPD management. Healthcare providers can help patients optimize the management of their COPD at this stage (CAT Governance Board, 2022).

 In the study, a majority of participants rated their overall health, using the EQ VAS pre-test and post-test scores, as average. In terms of health state, the EQ-5D index was closer to 'full health'. The average score for the post-EQ VAS and post-EQ-5D was slightly higher than the pre-EQ VAS and pre-EQ-5D results. Previous studies have shown there is a wealth of data and multiple peer-reviewed studies indicating that utilizing a focused COPD Action Plan for patients improves their perceived quality of life (Choi et al., 2013; McCurdy, 2013).

The 30-day readmission rates for this study were 40% while the previous years' readmission rates for this institution were 21.1%. This was a significant difference which further suggests that COPD patients require more than a single educational intervention. In addition, the median time from discharge to readmission was 12 days which was similar to previous studies using COPD Action Plans (Jenning et al., 2015). Based on these findings, COPD patients may benefit from a more rigorous, focused intervention such as a "COPD Bundle" during this critical

time following hospitalization. Research studies using the "COPD Bundle" typically scheduled follow-ups in the first week or second week following hospitalization. This close follow-up would provide COPD patients with the additional support that is needed for improving patient outcomes (Lenferink et al., 2017; Zafar et al., 2019).

## Limitations

This research study had several limitations that should be mentioned. Despite aggressive attempts to recruit and retain participants, we had a very small sample size. Statistical significance could not be established due to the small sample size. Second, the study design was quasi-experimental, thus lacking a true control group. Ultimately, the small sample size and research methodology limited the interpretability and generalizability of this study.

## Recommendations for Future Research

Overall, previous research studies and our research study have been less than clear on COPD Action Plans' impact on costly hospital readmissions. Future studies should include randomized control trials with appropriate sample sizes. Future studies may benefit from implementing COPD Action Plans in other settings like outpatient clinics as well. It may be beneficial to incorporate the COPD Action Plan in a "bundle" with other strategies to improve outcomes. Additional strategies might include COPD inhaler regimen guidelines, personalized inhaler education, a 30-day medication supply, discharge instructions, and a scheduled follow-up appointment (Zafar et al., 2019). Further research on the use of COPD Action Plans may bring more clarity to the strategic process of developing ways to reduce COPD readmissions and improve overall health and quality of life for COPD patients. Our small study's readmission rates exemplify the need to focus on interventions to increase self-management and education on the COPD disease process.

**Nursing Implications**

It is evident that the implementation of patient-focused education like the COPD Action Plan requires a multidisciplinary approach. Nurses play a key role in educating patients from the time they are admitted to the hospital to the time they are discharged from the hospital. Nurses quickly build a rapport with patients and patients' families which is beneficial in multiple ways. This rapport helps nurses understand how their patients best learn and what education is needed.

Ultimately, patient education during their hospital visit helps patients improve their health status and outcomes. In this particular study and similar to previous studies, a nurse was in charge of educating patients on how to use the COPD Action Plan. While this study didn't impact practice and patient outcomes, it provided insight that further COPD education and support are needed for COPD patients. A greater emphasis needs to be placed on care transition times such as post-hospitalization.

**Conclusion**

A primary goal for many healthcare organizations is to improve patient outcomes. Decreasing readmission rates for COPD and improving overall health status and quality of life for COPD patients is not an exception. The implementation of focused education like the COPD Action Plan has been shown to improve readmission rates and various secondary outcome measures (Kong & Wilkinson, 2019; Parikh, Shah, & Tandon, 2016; Pederson, et. al., 2017; Zafar, et. al., 2019). On the other hand, our research study was not rigorous enough to show any statistical relationships between utilizing a COPD Action Plan and readmission rates, overall health status, and quality of life for COPD patients. However, further research should explore the value of utilizing specific education plans like the COPD Action Plan to improve outcomes for COPD patients.

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**Table 1**

*Participant Demographics*

| Participant Demographics (N=10) | |
|---|---|
| Age, mean (range), years | |
| Age | 63 (52-78) |
| Gender, n (%) | |
| Female, n (%) | 2 (20%) |
| Male, n (%) | 8 (80%) |
| Ethnicity, n (%) | |
| Non-Caucasian Ethnicity | 2 (20%) |
| Caucasian Ethnicity | 8 (80%) |
| Insurance Type, n (%) | |
| Medicaid/Medicare | 7 (70%) |
| Private Insurance | 2 (20%) |
| No Insurance | 1 (10%) |

**Table 2**

*Participant Baseline Clinical Information*

| Participant Baseline Clinical Information | |
|---|---|
| Body Mass Index (BMI), Mean | |
| BMI | 43 |
| COPD Baseline Data, Mean | |
| Length of COPD Diagnosis, years | 6 |
| FEV1 (%) | 67 |
| FEV1/FVC (%) | 66 |
| Incentive Spirometry Percent of Predicted | 75 |
| Pack Years Smoking | 43 |
| COPD Severity Using Global Initiative for COPD (GOLD), n (%) | |
| Mild | 3 (30%) |
| Moderate | 3 (30%) |
| Severe | 2 (20%) |
| High Severe | 1 (10%) |
| Smoking Status, n (%) | |
| Current Smoker | 3 (30%) |
| Former Smoker | 6 (60%) |
| Never Smoker | 1 (10%) |
| Current and Past Hospital Admissions for COPD | |
| Length of Current Hospital Stay, Mean (Days) | 4 |
| Hospitalized for COPD Exacerbation within the Past Year, n (%) | 7 (70%) |

**Table 3**

*Participant Outcomes*

| Participant Outcomes | | | |
|---|---|---|---|
| Readmission for COPD Exacerbations | | | |
| Readmitted within 30 days for COPD exacerbation, n (%) | 4 (40%) | | |
| Number of days from participant discharge to readmission, mean, days | 12 | | |
| Readmission Rates at the Institution in 2020, n (%) | 163 (21.1%) | | |
| COPD Health Status and Quality of Life Outcomes | | | |
| | N | Mean | Standard Deviation |
| Pre-EQ-5D Index | 10 | 0.69 | 0.18 |
| Post-EQ-5D Index | 3 | 0.74 | 0.10 |
| Pre-EQ-5D-5L VAS | 10 | 48.00 | 17.67 |
| Post-EQ-5D-5L VAS | 3 | 58.30 | 13.58 |
| Pre-CAT | 10 | 18.30 | 7.10 |
| Post-CAT | 3 | 16.70 | 13.6 |