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# The Impact of a Home Respiratory Therapist to Reduce 30 day Readmission Rates for Exacerbation of Chronic Obstructive Pulmonary Disease

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**Title Page**

# The Impact of a Home Respiratory Therapist to Reduce 30 day Readmission Rates for Exacerbation of Chronic Obstructive Pulmonary Disease

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**Study Performed at Atlantic Health System locations (**At Home Medical, Morristown Medical Center, Newton Medical Center, Hackettstown Medical Center, Chilton Medical Center, Overlook Medical Center)

**Disclosures:**

This study was conducted for subjects that were discharged to their home from one of the 5 hospitals in the Atlantic Health System, in Northwest New Jersey, USA. This research was previously presented as a podium presentation at the 2020 Congress by the American Association for Respiratory Care. The abstract was published in *Respiratory Care* in October 2020. The authors do not have any financial relationship to disclose. The authors have not received grant money, research funding, or honoraria. The authors whose names are listed immediately above certify that they have no affiliations with or connection in any organization or entity with any financial interest, or non-financial interest in the subject matter or resources discussed in this manuscript. There are not potential conflicts of interest for this research.

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**Abstract**

INTRODUCTION:

In 2015, the Centers for Medicare and Medicaid Services (CMS) limited payments to hospitals with high readmission rates for patients admitted with COPD exacerbation. Decreasing readmissions in this patient population improves patient health and decreases healthcare utilization of resources. We hypothesized a COPD Disease Management Program, delivered by a respiratory therapist (RT) in the patient's home may reduce readmission rates for COPD exacerbation.

METHODS:

We performed a pre/post-interventional study comparing hospital readmissions for subjects with COPD exacerbation that received standard of care in the home versus an RT-led home COPD Disease Management Program. Subjects discharged home from Atlantic Health System with COPD exacerbation were enrolled in the pre-intervention group. Subsequently, an evidence-based home COPD Disease Management Program was implemented by an RT from At Home Medical in the home. The home COPD Disease Management Program was implemented from April 2017 until September 2019 and this served as the post-intervention group. The primary endpoint was readmission rates at 30 days. Secondary endpoints included 60 and 90 day readmission rates.

RESULTS:

A total of 1,093 participants were included in the study, 658 in the pre-intervention cohort and 435 participants in the post-intervention group. Approximately 22.3% (n=147) of subjects in the pre-intervention group were

readmitted within 30 days of discharge compared 12.2% (n=53) in the post-intervention group (p<0.001). A reduction in 60 day (33.9% vs. 12.0%, p<0.001) and 90 day all cause readmissions (43.5% vs. 13.1%, p<0.001) was also seen. Participation in the COPD Management Program was significantly associated with decreased 30, 60, and 90 day readmission rates adjusting for age, gender, race, ethnicity, and smoking status (OR [95% CI]=0.48 [0.33, 0.70], 0.26 [0.18, 0.38], 0.20 [0.14, 0.27]; p<0.001 for all three readmission rates).

CONCLUSIONS:

The Disease Management Program is significantly associated with decreased readmission adjusting for demographics and smoking status.

**Key Words**

Respiratory Therapy

COPD

Hospital readmission

Home Care Agency

Centers for Medicare and Medicaid Services (CMS)

Patient education

Patient centered care

Home visit program

Adherence

Home Care Program

**Introduction**

The Hospital Readmission Reduction Program (HRRP), a Medicare-value-based program, reduced payment to hospitals with excess readmissions starting in fiscal year 2013 with heart failure, pneumonia, and acute myocardial infarction.[1] In 2015, the Centers for Medicare and Medicaid Services (CMS) limited payments to hospitals with high readmission rates for patients admitted with Chronic Obstructive Pulmonary Disease (COPD) exacerbation and knee/hip replacement.[2] COPD remains the third most common cause of readmission among Medicare beneficiaries, occurring in 60% of patients within one year of hospital discharge and in 30% within three months of discharge.[3] In the Unites States, exacerbations of COPD leading to hospitalization, account for $13.2 billion of the nearly $50 billion annual direct costs for COPD.[4]

Hospitalizations and mortality associated with COPD are caused by intermittent declines in respiratory symptoms such as shortness of breath. Healthcare systems can identify and alleviate risk factors to prevent readmissions. In the United States, approximately 19% of COPD patients are readmitted within 30 days. CMS has examined readmissions as a measure of the quality of care given by healthcare systems. Globally, preventing readmissions among patients with COPD has been identified as a high-priority management process.[5]

Healthcare systems and providers are expected to collaboratively direct clinical efforts to decrease hospital readmission rates, which are difficult due to the lack of clear agreement and evidence-based guidelines on how best to project and prevent 30 day readmissions.[5] Care bundles are evidence-based clinical interventions that ensure high-quality care is provided consistently across the course of healthcare.[5] COPD care bundles can help standardize medications patients receive for COPD exacerbations including antibiotics and steroids, education on disease state and inhaler devices, discharge instructions, and follow up homecare and provider appointments. Utilizing a care bundle and providing consistent care may improve patient outcomes. One study found that 30 day readmissions were lower in the bundle group compared to the placebo group($10.0\%$ versus $38.1\%$, $P = 0.04$) and ED visits were reduced.[6]Although care bundles can be beneficial at providing consistent care, patients transitioning to home safely is equally important to preventing readmissions. Health coaching and education by a health care professional after a hospitalization, in the patient's home, can identify barriers earlier and improve treatment adherence. A patient and family-centered approach providing comprehensive pulmonary services in the home after discharge is

key to preventing readmissions.[7] The home COPD Disease Management Program integrates the key components of the Ideal Transitions of Care framework which includes: discharge planning, communication of information, timeliness of information, medication safety, educating patients on self-management, community support, advance care planning, coordination with team members, managing symptoms post discharge, and follow up care.[8] Multiple pulmonary interventions from hospital to home are required to support the hospital discharge transition.

Patient outcomes improve when patients have uninterrupted care transitions from one setting to another, For COPD exacerbations, these include: availability to conduct home visits, reviewing pulmonary medication in the home, education on the COPD Action Plan and self-management, hospital referral to the RT, discussions regarding end-of-life issues such as intubation and mechanical ventilation, coordinating care in the home, implementation of the CAT (COPD Assessment Test) at home to monitor for deterioration of respiratory symptoms, and confirming early pulmonary follow-up appointments.[8] We hypothesized education of timely identification of exacerbation symptoms and the delivery of short acting medications can decrease the risk of hospital readmissions. Patient health coaching can improve treatment compliance as a key component of self-management approaches, which can be conducted during the home care visits. There are currently no studies demonstrating the effectiveness of home care visits post care bundle discharge to readmission rates. The objective of the study was to evaluate the effect of RT-lead home care visits on readmission rates following a COPD exacerbation.

**Methods**

A retrospective chart review was performed with a pre/post-intervention design study, comparing hospital readmissions for subjects with COPD exacerbation, that received standard of care at home versus an RT-led COPD program. Subjects, 65 years and older, were included in the pre-intervention group if they had a diagnosis of COPD and were admitted to one of five hospitals in a New Jersey mid-size healthcare system from January 2016 until March 2017. Subjects, 65 years and older, admitted from April 2017 until September 2019 were included in the post-intervention group. Subjects were excluded if they left against medical advice at the index discharge, expired during the hospital admission, were transferred to another acute care hospital outside our healthcare system, received

hospice care at discharge, refused home care, refused the COPD care bundle during hospitalization, or were unable to participate in the pulmonary education.

Subjects in the pre-intervention group received standard of care at the admission facility and were not provided scheduled follow up home care at hospital discharge but may have received telehealth post discharge. Subjects in the post-intervention group received standard of care at the admission facility and were referred to home care at hospital discharge. Subjects were contacted via telephone within two business days of discharge and a respiratory therapist (RT) had three home visits over a four-week period. Subjects may have qualified for an additional or two home visits based on progress. Home care visits included COPD self-management education, COPD Action Plan, COPD assessment test, smoking cessation education, inhaler device training, proper medication reconciliation, importance of pulmonary rehabilitation, nutrition counseling, coping methods for anxiety and depression, and adherence to hospital discharge medications/instructions. The RT worked with subject's pulmonologist to overcome any barriers and referrals to other providers were made based on need. Convenience sampling was used, and all subjects seen by the RT were included in the intervention group. The primary endpoint was the difference in composite risk of hospitalizations between the pre/post intervention groups in the 30 days following discharge. A secondary endpoint was the 60 day and 90 day rate of readmission.

Descriptive analyses were performed for baseline patient characteristics. P-values were calculated using 2-sample t-tests and chi-square or 2 proportions for categorical variables. 30, 60 and 90 day readmission rates were compared pre and post intervention using 2 sample Poisson. Multivariable logistic regression was used to determine if the intervention was significantly associated with readmission adjusting for demographics and baseline variable. Repeat analyses were performed on a subset of the data matching on significantly different demographic and baseline variables. $P<0.05$ indicates statistical significance. All analyses were performed with MINITAB version 17.1.0. This study was approved by the Atlantic Health System Institutional Review Board.

**Results**

A total of 1,093 participants were included in the study, 658 in the pre-intervention cohort and 435 participants in the post-intervention group. There was a higher proportion of black and African American subjects and never or current smokers in the pre-intervention group. Subjects in the post-intervention group had higher proportion of Caucasian subjects and were more commonly former smokers. Other baseline demographics had no difference.

(Table 1) In the pre-intervention group, 22.3% (n=147) of subjects were readmitted within 30 days of discharge compared 12.2% (n=53) in the post intervention group (p<0.001). There was also a reduction in 60 day (33.9% vs. 12.0%, p<0.001) and 90 day all cause readmissions (43.5% vs. 13.1%, p<0.001). (Table 2) Receiving intervention was significantly associated with decreased 30, 60, and 90 day readmission rates adjusting for age, gender, race, ethnicity, and smoking status OR (95%CI) = 0.48 (0.33, 0.70), 0.26 (0.18, 0.38), 0.20 (0.14, 0.27), respectively, p<0.001 for all rates. (Table 3)

Additional analyses using a subset of matched data included 852 Subjects. Demographics and baseline variables were well balanced between the two groups. (Table 4) Decreased post-intervention 30, 60, and 90 day readmission rates remained significantly less compared to the pre-intervention group (p<0.001 for all rates). (Table 5) When adjusting for variables that were not matched in the data selection (adjusting for age, gender, and ethnicity only), receiving intervention was significantly associated with decreased readmission rates (OR [95% CI] = 0.49 [0.33, 0.73], 0.27 [0.18, 0.39], 0.20 [0.14, 0.28], p<0.001 for all rates). (Table 6)

**Discussion**

Although some COPD readmissions are unavoidable due to progression of disease or worsening of comorbidities, they may also result from an uncoordinated transition between the hospital to home.[9] In this study, we examined the role of home care on readmission rates with COPD subjects. Our research demonstrated a 10.1% reduction in 30 day readmission when utilizing a COPD Disease Management Program in the subject's home. There was also a significant reduction in 60 day and 90 day readmission, 21.9% and 30.7%, respectively. The distribution of race and smoking status differed between pre and post intervention groups, but the invention was found to be significantly associated with a decrease in 30, 60, and 90 day readmission rates in both analyses, using the full dataset adjusting for all demographic and baseline variables and in the matched data subset adjusting for remaining non-matched data variables. The home care program focused on providing comprehensive pulmonary services at home after discharge. Key components of the program included reviewing pulmonary medication safety, creating a COPD Action Plan, smoking cessation, referral to pulmonary rehabilitation, and appropriate follow up. Our research indicates that a home care visit helped reduce 30, 60, and 90 day readmission rates. Similarly, Benzo and colleagues, found interventions such as health coaching, COPD action plans, and brief exercise advice reduced readmission rates.[10]

In addition, the home care visits conducted were done in a timely manner within two days of hospital discharge. Home care visits had frequent follow up with at least 3 visits within the first 30 days of discharge. Home care visits by the RT were communicated to other disciplines, when applicable, and referrals were made. Prior research has demonstrated that poor communications and lack of follow up has contributed to readmissions.[11]

The improvements in communication included effective pulmonary guidance in the home after discharge, confirmation of early outpatient follow-up within 7-days of discharge, increase patient and family engagement with the pulmonary discharge plans, and assessment of the affordability of inhaler therapies. The RT can help patients with home health goals such as improving symptom management and mitigating total health care expenditures by reducing acute care hospital readmissions.[12] The RT is key to the success of this initiative and focused on the following educational objectives in the patient's home: (1) Education on COPD after discharge; (2) Completion of an individualized self-management COPD action plan; and (3) completion of the CAT.[13] It requires a complete understanding of respiratory therapy to facilitate a smooth transition between care in the hospital to that of managing a patient recovering from COPD exacerbation in the home.

Similar research, by Silver et al, suggests that a comprehensive RT disease management program can be associated with reduced hospital readmissions and fewer hospital days from COPD exacerbations.[14] The use of an RT-led home COPD Disease Management Program and a COPD Care Bundle included criteria for appropriate patient selection and addressed all the needed home health care necessary to return the patient to a greater quality of life. This care allowed for RT management over a four-week period in the home setting, to decrease the potential for emergency room visits and hospitalizations.

Depression is an independent risk factor for both short-and long-term readmissions for COPD exacerbation and should be addressed with all patients.[15] The RT addressed coping with anxiety, depression, and smoking session during home visits. Early pulmonary rehabilitation (PR) initiated following hospitalization for COPD, has been associated with significantly improved patient mortality at 1 year; evidence based current guidelines recommend that subjects begin PR within 3-4 weeks of hospitalization for COPD exacerbation.[16] Studies have demonstrated that a high prevalence of current or ex-heavy smoking were significantly associated with frequent past hospital readmissions.[17] Utilizing RT to provide education on these important issues related to COPD may have been a reason for the reduction of readmission rates, however the independent variables did not find a statistical difference.

A few limitations to the study included: a retrospective analysis of data, difficulty contacting potential subjects following discharge and maintaining contact with some subjects during the four-week intervention, and unknown readmission rates from outside facilities. Another limitation included differences with race and smoking status with our preintervention group and post intervention group. In the preintervention group, there were more subjects that were smoking, which can lead to worsening outcomes related to COPD. When evaluating the matched data set (Table 4), baseline demographics had no statistical difference. Although subjects could have received care outside our healthcare system; the majority of pulmonary offices in the area refer subjects back to our healthcare system. Subjects sometimes were difficult to reach and required multiple phone calls to schedule appointments. In addition, our subjects were selected from a patient population that had high health care utilization for their COPD either in the ED or the hospital. Thus, these results may not be applicable to a population with milder COPD. Socioeconomic status is an important determinant of readmissions and was not captured in our study.

Readmission were lower in subjects who had RT visits at home. This quality improvement project demonstrated RT home visits could help reduce readmission rates and prevent penalties.

**Conclusion**

There was a significant reduction of 30, 60, and 90 day readmissions for subjects with COPD. It is imperative to involve RT in a home COPD disease management program. The duration of interventions included three home visits over the course of four weeks, which focused primarily on patient education, COPD action plan, and the importance of follow up. This home health strategy was cost-effective for payers but not cost-prohibitive for our healthcare system, which contributed significantly to the success in reducing COPD hospital readmissions. Intervention at home can be easily incorporated into hospital discharge plans while simultaneously not being overbearing for patients, families, or providers.

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**Quick Look**

*Current Knowledge*

In 2015, the Centers for Medicare and Medicaid Services (CMS) limited payments to hospitals with high readmission rates for subjects admitted with COPD exacerbation. COPD remains the third most common cause of readmission among Medicare beneficiaries, occurring in 60% of subjects within one year of hospital discharge and in 30% within three months of discharge. Problems that arise at the time of transition, increase the risk for readmission when subjects leave the hospital and return home. Studies have identified that home visits focusing on home COPD Disease Management Program can reduce readmission rates in this population.

*What this paper contributes to our knowledge*

Given the complexities of the patient with COPD and the urgency to decrease readmission rates, one approach to decreased hospital readmissions is a comprehensive RT-led home COPD Disease Management Program. This program focused on a patient and family-centered approach providing comprehensive pulmonary services in the home after discharge. Utilizing an evidence-based RT-led home COPD Disease Management Program approach, in the post discharge period is efficacious to prevent recurrent hospitalizations. This original strategy implemented by an RT in the discharge period reduced 30 day, 60 day, and 90 day readmission rates.

RT-Led Home COPD Program

**Table 1: Baseline Demographics**

| | Pre-Intervention | Post-Intervention | p-value |
|---|---|---|---|
| | n=658 | n=435 | |
| Age, mean (SD) | 76.58 (7.62) | 77.3 (7.16) | 0.10 |
| Gender, n (%) | | | 0.25 |
| Male | 272 (41.34%) | 195 (44.83%) | |
| Female | 386 (58.66%) | 240 (55.17%) | |
| Race, n (%) | | | 0.001 |
| Asian | 5 (0.79%) | 5 (1.17%) | |
| Black/African American | 24 (3.75%) | 1 (0.23%) | |
| Caucasian | 611 (96.37%) | 422 (98.60%) | |
| Ethicity, n (%) | | | |
| Hispanic | 9 (1.37%) | 13 (2.99%) | 0.31 |
| Non-hispanic | 454 (69.00%) | 422 (97.01%) | |
| Smoking Status, n (%) | | | <0.001 |
| Never | 79 (12.01%) | 28 (6.47%) | |
| Current | 114 (17.33%) | 42 (9.70%) | |
| Former | 417 (63.37%) | 363 (83.83%) | |

**Table 2: Readmission Rates**

| | Pre-Intervention | Post-Intervention | P-value |
|---|---|---|---|
| 30 day readmission, n (%) | 147 (22.3%) | 53 (12.18%) | <0.001 |
| 60 day readmission, n (%) | 223 (33.9%) | 52 (11.98%) | <0.001 |
| 90 day readmission, n (%) | 286 (43.8%) | 57 (13.13%) | <0.001 |

**Table 3: Intervention Regression Analyses**

| Independent Variable | 30 day readmission | | 60 day readmission | | 90 day readmission | |
|---|---|---|---|---|---|---|
| | Odds Ratio (95%CI) | p-value | Odds Ratio (95%CI) | p-value | Odds Ratio (95%CI) | p-value |
| Intervention | | <0.001 | | <0.001 | | <0.001 |
| No | - | | - | | - | |

RT-Led Home COPD Program

| | | | | | | |
|---|---|---|---|---|---|---|
| Yes | 0.4818 (0.3304, 0.7027) | | 0.2648 (0.1844, 0.3804) | | 0.1959 (0.1407, 0.2727) | |
| Age | 0.9947 (0.9709, 1.0191) | 0.667 | 1.0030 (0.9811, 1.0254) | 0.791 | 1.0002 (0.9812, 1.0196) | 0.98 |
| Gender | | 0.452 | | 0.208 | | 0.71 |
| Male | - | | - | | - | |
| Female | 0.8709 (0.6078, 1.2481) | | 0.8075 (0.5790, 1.1261) | | 1.0561 (0.7912, 1.4098) | |
| Race | | 0.457 | | 0.891 | | 0.28 |
| Caucasian | - | | - | | - | |
| Asian | 2.4120 (0.2986, 19.4827) | | 1.6068 (0.2111, 12.2315) | | 0.2408 (0.0289, 2.0099) | |
| Black/African American | 1.6103 (0.6413, 4.0434) | | 1.0771 (0.4448, 2.6083) | | 0.8593 (0.3691, 2.0004) | |
| Ethnicity | | 0.398 | | 0.358 | | unable to calc |
| Hispanic | - | | - | | | |
| Non-hispanic | 2.8743 (0.2074, 39.8447) | | 2.9530 (0.2447, 35.6397) | | | |
| Smoking Status | | 0.33 | | 0.497 | | 0.026 |
| Never | - | | - | | - | |
| Current | 0.7491 (0.3426, 1.6377) | | 0.7546 (0.3786, 1.5041) | | 0.7419 (0.4179, 1.3168) | |
| Former | 1.1069 (0.5790, 2.1161) | | 0.9917 (0.5555, 1.7706) | | 1.2776 (0.8032, 2.0322) | |

**Table 4: Demographics (matched data subset)**

| | Pre-Intervention | Post-Intervention | p-value |
|---|---|---|---|
| | n=426 | n=426 | |
| Age, mean (SD) | 76.74 (7.73) | 77.28 (7.17) | 0.28 |
| Gender, n (%) | | | 0.53 |
| Male | 183 (42.96%) | 192 (45.07%) | |
| Female | 243 (57.04%) | 234 (54.93%) | |
| Race, n (%) | | | >0.999 |
| Asian | 5 (1.74%) | 5 (1.74%) | |
| Black/African American | 1 (0.24%) | 1 (0.24%) | |
| Caucasian | 420 (98.59%) | 420 (98.59%) | |
| Ethnicity, n (%) | | | 0.32 |
| Hispanic | 2 (0.65%) | 6 (1.41%) | |

| | | | |
|---|---|---|---|
| Non-hispanic | 308 (99.35%) | 420 (98.59%) | |
| Smoking Status, n (%) | | | 0.96 |
| Never | 29 (6.81%) | 27 (6.34%) | |
| Current | 42 (9.86%) | 42 (9.86%) | |
| Former | 355 (83.33%) | 357 (83.80%) | |
| | | | |

**Table 5: Readmission (matched data subset)**

| | Pre-Intervention | Post-Intervention | p-value |
|---|---|---|---|
| | n=426 | n=426 | |
| 30 day readmission, n (%) | 96 (22.54%) | 52 (12.21%) | <0.001 |
| 60 day readmission, n (%) | 145 (34.04%) | 51 (12.00%) | <0.001 |
| 90 day readmission, n (%) | 185 (43.43%) | 57 (13.41%) | <0.001 |
| | | | |

**Table 6: Regression analysis (matched data subset)**

| Independent Variable | 30 day readmission | | 60 day readmission | | 90 day readmission | |
|---|---|---|---|---|---|---|
| | Odds Ratio (95%CI) | p-value | Odds Ratio (95%CI) | p-value | Odds Ratio (95%CI) | p-value |
| Intervention | | <0.001 | | <0.001 | | <0.001 |
| No | - | | - | | - | |
| Yes | 0.4881 (0.3285, 0.7251) | | 0.2684 (0.1841, 0.3914) | | 0.2023 (0.1441, 0.2838) | |
| Age | 0.9962 (0.9702, 1.0229) | 0.776 | 1.0063 (0.9822, 1.0311) | 0.61 | 0.9985 (0.9778, 1.0196) | 0.88 |
| Gender | | 0.908 | | 0.585 | | 0.31 |
| Male | - | | - | | - | |
| Female | 0.9769 (0.6566, 1.4533) | | 0.9018 (0.6228, 1.3060) | | 1.1794 (0.8566, 1.6240) | |
| Ethnicity | | 0.87 | | 0.626 | | unable to calc |
| Hispanic | - | | - | | | |
| Non-hispanic | 1.1908 (0.1404, 10.0980) | | 1.6683 (0.1897, 14.6724) | | | |
| | | | | | | |