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Scheduling 7-day Follow-up Appointments to Help Prevent Readmissions in Patients with Acute Exacerbation Chronic Obstructive Pulmonary Disease

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Abstract

Objectives: Prior studies have shown that patients hospitalized for acute exacerbation of chronic obstructive pulmonary disease (AECOPD) have a high hospital readmission rate and that close outpatient follow-up may reduce the need for hospital readmission. The objective of this study is to analyze the effect of scheduled 7-day post-hospital follow-up appointments on 30-day readmission in patients hospitalized with AECOPD.

Methods: A quasi-experimental, multicenter, prospective cohort design with retrospective observation as part of the Integrated Michigan Patient-Centered Alliance in Care Transitions (I-MPACT) was used. Each of the four participating hospitals in Michigan selected AECOPD as their target intervention and were incentivized to increase overall rates of scheduled 7-day post-hospital follow-up for all patients discharged in this target population using a pay-for-performance system. A random sample of patients discharged with AECOPD was included and patients were excluded if discharged or transferred to another hospital, left against medical advice, died during initial hospitalization, were known to have died within 30 days of discharge without readmission, or were discharged to a skilled nursing facility. Analyses were done using Pearson chi-square and multivariate logistic regression modeling.

Results: Of the 686 patients with a diagnosis of AECOPD, 29.5% (N=202) received a scheduled follow-up while 70.65% (N=484) did not. The sample was 57% female, 73% White, and 13% on Medicaid with a mean age of 66 years. Based on a risk-adjusted model, patients who received a 7-day post-hospital follow-up appointment had a 43% lower likelihood of readmission compared to patients who did not receive an appointment (OR=0.57; p=0.03). Additionally, patients who received a scheduled follow-up with a Primary Care Provider had a 53% lower likelihood of readmission compared to patients who did not receive a scheduled appointment (OR=0.47; p=0.01).

Conclusion: For patients hospitalized for AECOPD, scheduling outpatient follow-up appointments within 7 days of hospital discharge was associated with a reduction in 30-day hospital readmissions. Scheduling early post-hospital follow-up appointments for patients with AECOPD may reduce readmission rates.

Keywords: Acute exacerbation chronic obstructive pulmonary disease • Discharge planning • Hospital readmission • Quasi-experimental study design • Quality improvement • Care transitions • Early follow-up

Introduction

Hospital discharge is a complex process, requiring multidisciplinary coordination by hospital teams and outpatient providers as well as patients and their caregivers. Despite reimbursement strategies implemented by U.S. policymakers emphasizing high-quality discharge with corresponding low hospital readmission rates as a national priority, 30-day, all-cause readmissions remain unacceptably high, at 20%, with an annual cost of $18 billion to Medicare [1]. Patients hospitalized for AECOPD have a similar readmission rate and account for the third most common cause of hospital readmissions [2].

Studies have demonstrated that effective interventions that reduce hospital readmissions are complex, involve more than one discipline from both the inpatient and outpatient settings, and empower patients to meaningfully care for themselves [3-6]. Early follow-up care has received attention as an effective intervention, with evidence suggesting that the highest risk patients benefit from outpatient follow-up within 7 days of discharge [7]. Early follow-up allows a careful review of the discharge care plan and an opportunity to make any needed changes to prevent readmission [8].

However, a large systematic review of patients admitted for AECOPD or heart failure focusing on the effectiveness of 7-day follow-up after discharge noted a lack of large, methodologically robust studies demonstrating an improved outcome with this intervention [9]. In the current study, we analyzed the data registry of a large Collaborative Quality Initiative (CQI) to study the effect that scheduling a 7-day follow-up appointment had on 30-day all-cause readmissions after hospitalization for an AECOPD.

Research Methodology

We followed SQUIRE guidelines while conducting this quasi-experimental,

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multicenter, prospective cohort study as part of the Integrated Michigan Patient-Centered Alliance in Care Transitions (I-MPACT). I-MPACT is a patient-centered Collaborative Quality Initiative (CQI) that engages hospitals, physician organizations, and patients throughout Michigan and supports the development and implementation of innovative approaches for improving care transitions. The collaborative is composed of numerous "clusters;" each of which consists of a hospital, a partnering outpatient provider organization(s) (PO), and a patient/caregiver team. Each cluster selects one predefined disease-specific target population and is incentivized to implement three different interventions aimed at reducing readmissions for this target population.

Intervention

Two of the three interventions (called "other") are determined at the cluster level based on local gaps in the transition of care process collaboratively identified by the cluster team. A third intervention, increasing the rate of 7-day post-hospital follow-up with any outpatient provider, has been predetermined by the CQI as a required intervention for all participating clusters. Hospitals and POs collaborate on improving local transition of care processes and a pay-for-performance system rewards both entities specifically for increasing 7-day follow-up rates.

Measures and Definitions

An ongoing retrospective chart review by trained data abstractors conducted within a cluster's electronic medical records (EMRs), which includes about 24 patients each month from the target population, is randomly generated from the cluster's selected billing and coding data and confirmed via manual review of the EMRs. All abstractors are audited within the first three months of data abstraction and annually to spot check validity of data points including 7-day follow-up appointments. Registry data elements include patient demographics, presence of specific transition of care quality metrics, interventions deployed, outcomes, reason for readmission, and hospital characteristics. We studied the readmission rates for patients with AECOPD who were scheduled to receive a "7-day follow-up" compared to those who were not scheduled for "7-day follow-up" from four clusters from October 1, 2017, to March 30, 2019. Detailed patient and hospital characteristics were used as covariates for analysis (Tables 1 and 2), including patients who received the other I-MPACT intervention(s) (yes/no), race (White/Non-white), median neighborhood income (measured in quintiles), length of stay (LOS) (measured in days and categorized as 0-2, 3-4, 5-7, >7), and admissions in prior 180 days (0, 1, 2 or more). As noted, we focused on four clusters located in Michigan with COPD as their target population. Three out of four hospitals in the study are nonprofit; two are teaching hospitals, bed numbers ranged from 180-1, 100, and all are located in developing urban and urban settings. Five clusters in the CQI identified AECOPD as their target population; however, one of these clusters was excluded due to a significantly low (2%), 7-day follow-up intervention rate. Patients were excluded if they were discharged/transferred to another acute care hospital, left against medical advice, died during the initial hospitalization, were known to have died within 30 days of discharge without being readmitted, or were discharged to a skilled nursing facility (SNF), as the follow-up process for all of these patients differed from those discharged home.

For this study, all-cause hospital readmission is defined as all patients who were hospitalized and experienced an unplanned return to the hospital for any cause within 30 days of hospital discharge. In our analysis, we excluded planned readmissions and included readmissions related to progression of the same condition or comorbidity that caused the initial hospitalization; new condition not previously present and/or not present on the initial hospitalization; end of life; and other reasons.

Outcome

The primary outcome was a hospital readmission within 30 days of discharge. For patients with more than one readmission within 30 days, only the first event for each outcome was included and analyzed.

Statistical analysis

Sample characteristics were assessed using descriptive statistics on patient demographics, clinical factors, and transition of care elements including 7-day follow-up. Significant tests based on Pearson chi-square were used to evaluate whether patients who received a 7-day follow-up visit were significantly different from the sample of patients who did not receive a 7-day

Table 1. Patient characteristics overall and by 7 day scheduling status (N=686)[a].

Variables	Overall	7 Day=Yes (N=202)	7 Day=No (N=484)	P-value
	N (%)	N (%)	N (%)	
Female	392 (57.1)	125 (61.9)	267 (55.2)	0.105
White	501 (73.0)	157 (77.7)	344 (71.1)	0.074
Age quintiles				0.269
1st ≤ 54	92 (13.4)	30 (14.9)	62 (12.8)	
2nd 55-64	218 (31.8)	68 (33.7)	150 (31.0)	
3rd 65-74	205 (29.9)	65 (32.2)	140 (28.9)	
4th 75-84	133 (19.4)	29 (14.4)	104 (21.5)	
5th ≥ 85	38 (5.5)	10 (5.0)	28 (5.8)	
Married	237 (34.6)	67 (33.2)	170 (35.1)	0.623
Living alone	201 (29.3)	67 (33.2)	134 (27.7)	0.150
Medicaid	90 (13.1)	24 (11.9)	66 (13.6)	0.535
Median income quintiles				0.215
1st (14.2-32.8)	127 (18.5)	27 (13.4)	100 (20.7)	
2nd (32.9-45.6)	147 (21.4)	46 (22.8)	101 (20.9)	
3rd (45.8-53.4)	226 (32.9)	74 (36.6)	152 (31.4)	
4th (54.0-66.0)	140 (20.4)	40 (19.8)	100 (20.7)	
5th (68.2-126.0)	46 (6.7)	15 (7.4)	31 (6.4)	
Length of stay (days)				0.889
0-2	146 (21.3)	43 (21.3)	103 (21.3)	
3-4	261 (38.1)	81 (40.1)	180 (37.2)	
5-7	195 (28.4)	55 (27.2)	140 (28.9)	
>7	84 (12.2)	23 (11.4)	61 (12.6)	

[a] P-values for categorical patient measures are based on chi-square test, while p-values for continuous measures are based on linear regression.

follow-up. Multivariate logistic regression models were estimated to determine the effect of 7-day follow-up on readmission while adjusting for confounders. Multivariate model selection was done using stepwise logistic regression and 35 transition-of-care, demographic, clinical, and COPD-specific covariates, and hospital indicators (descriptive statistics are provided in Table 1). Stepwise model selection used forward-estimation and a p-value threshold of 0.1. However, this estimation process allowed 7-day follow-up, other I-MPACT interventions, and site indicators to be included in the model without being subjected to selection criteria. We estimated two models to determine the effect of provider follow-up on 30-day readmission. The first model tested the effect of scheduling a 7-day follow-up with any provider on 30-day readmission. We estimated a second model that tested the effect of scheduling with a specific provider type on 30-day readmission. All analyses were implemented using Stata software version 16.

Ethical and regulatory oversight

This study was reviewed by the Institutional Review Board at the University of Michigan (IRB# HUM00126940) and determined to be exempt.

Results

In total, 686 patients were included in the analysis. Tables 1 and 2 describe patient and clinical characteristics of these patients. Of these patients, 57% female, 73% White, and 13% were on Medicaid (Table 1). Mean age of the sample was 66 years. According to Table 2, 29.5% (N=202) patients had a scheduled follow-up appointment upon discharge while 70.7 (N=484) patients did not have a scheduled follow-up appointment upon discharge. Among patients receiving a 7-day follow-up, 73.8% (N=149) had an appointment scheduled

Table 2. Clinical characteristics overall and by 7 day scheduling status (N=686)[a].

Variables	Overall	7 Day=Yes (N=202)	7 Day=No (N=484)	P-value
	N (%) / Mean (SD)	N (%) / Mean (SD)	N (%) / Mean (SD)	
Readmission				0.080
No	560 (81.6)	173 (85.6)	387 (80.0)	
Yes	126 (18.4)	29 (14.4)	97 (20.0)	
Total	686 (100.0)	202 (100.0)	484 (100.0)	
7-day scheduled by provider type				
7-day with PCP[b]	149 (21.7)	149 (73.8)		
7-day with Pulmonologist[c]	17 (2.5)	17 (8.4)		
7-day with Other Provider[d]	36 (5.3)	36 (17.8)		
Transition of Care (TOC) Elements				
Patient received other IMPACT intervention/s[e]	471 (68.7)	153 (75.7)	318 (65.7)	0.010
Education about reason for hospitalization	599 (87.3)	188 (93.1)	411 (84.9)	0.003
Provided with name/number to call with concerns	431 (62.8)	140 (69.3)	291 (60.1)	0.023
PCP identified in Discharge Summary	499 (72.7)	170 (84.2)	329 (68.0)	<0.001
Clear Medication Discharge Instructions	652 (95.0)	196 (97.0)	456 (94.2)	0.122
Education on Warning Signs	394 (57.4)	137 (67.8)	257 (53.1)	<0.001
Scheduled Pulmonary Rehabilitation	241 (35.1)	87 (43.1)	154 (31.8)	0.005
DS completed prior to discharge	504(73.5)	149 (73.8)	355 (73.4)	0.911
Discharged with home health	420 (61.2)	131 (64.9)	289 (59.7)	0.208
DS / AVS medication discrepancy	224 (32.7)	72 (35.6)	152 (31.4)	0.281
Admitted from Emergency Department	642 (93.6)	192 (95.1)	450 (93.0)	0.312
ED visits in prior 180 days				0.051
0	403 (58.8)	108 (53.5)	295 (61.0)	
1	159 (23.2)	59 (29.2)	100 (20.7)	
≥2	124 (18.1)	35 (17.3)	89 (18.4)	
Discharged on Antiplatelets	399 (58.2)	125 (61.9)	274 (56.6)	0.202
Discharged with ≥10 medications	533 (77.7)	171 (84.7)	362 (74.8)	0.005
Admissions in prior 180 days				0.676
0	356 (51.9)	107 (53.0)	249 (51.5)	
1	154 (22.5)	41 (20.3)	113 (23.4)	
≥2	176 (25.7)	54 (26.7)	122 (25.2)	
Treated in Intensive Care Unit during admission	70 (10.2)	19 (9.4)	51 (10.5)	0.655
Discharged on opioids/narcotics	284 (41.4)	87 (43.1)	197 (40.7)	0.566
COPD labeled severe or oxygen requiring	355 (51.8)	111 (55.0)	244 (50.4)	0.278
Concomitant pneumonia	171 (24.9)	47 (23.3)	124 (25.6)	0.516
Patient goals addressed during hospitalization	22 (3.2)	6 (3.0)	16 (3.3)	0.820
Charlson Comorbidity Index (1-12)	3.20(2.04)	3.26 (2.00)	3.18 (2.05)	0.649
Social Determinants of Health (SDOH)				
Substance Abuse Status documented in DS	82 (12.0)	27 (13.4)	55 (11.4)	0.461
Substance Abuse				0.153
No history	548 (79.9)	169 (83.7)	379 (78.3)	
Former	45 (6.6)	8(4.0)	37 (7.6)	
Current	93 (13.6)	25 (12.4)	68 (14.1)	

Depression	283 (41.3)	88 (43.6)	195 (40.3)	0.427

[a] P-values for categorical patient measures are based on chi-square test, while p-values for continuous measures are based on linear regression.
[b] PCP - includes PCP or PCP plus other providers
[c] Pulmonologist - pulmonologist or pulmonologist plus PCP/other
[d] Other Providers - non- PCP/non-pulmonologist only
[e] Other intervention(s) – intervention(s) determined at the cluster level excluding 7 day follow up;
[f] **Abbreviations:** AVS: After Visit Summary; COPD: Chronic Obstructive Pulmonary Disease; DS: Discharge Summary; ED: Emergency Department; PCP: Primary Care Provider.

with a primary care provider (PCP), 8.4% (N=17) with a pulmonologist, and 17.8% (N=36) with a provider other than a PCP or pulmonologist. The average readmission rate among all patients was 18.4%. Some differences were also noted with regard to transition of care among patients who received a 7-day follow-up and Some differences were also noted with regard to transition of care among patient's who received a 7-day follow-up and those who did not. Thus, as compared to patients who did not receive the 7-day follow-up intervention, patients who received the intervention were more likely to receive another intervention, receive education about the reason for hospitalization, be provided with name or number to call with concerns, and have a PCP identified in the discharge summary. Patients who received the intervention were also more likely to be discharged with 10 or more medications, have been educated on warning signs, and scheduled for pulmonary rehabilitation. Patients who did not receive the intervention were more likely to have renal disease requiring dialysis and to be discharged from a teaching hospital.

The observed readmission rate among patients receiving the 7-day intervention was 14.4% while this rate among patients not receiving the intervention was 20% (p=0.08). Variation in observed readmission rates was also noted for several covariates (data not shown). The readmission rate among females was 14.8%, while the rate among males was 23.1% (p=0.006). A higher readmission rate was also observed for patients hospitalized within 180 days preceding the index admission, with a 11.8% readmission rate among patients without a prior admission, 18.2% among patients with one admission (p=0.06), and 31.8% among patients with two or more admissions (p<0.001). A higher readmission rate was also observed for patients with a longer LOS. Patients with a LOS of 0-2 days had an 11.6% readmission rate, while patients with a LOS of 7 or more days had a 33.3% readmission rate (p<0.001).

Based on adjusted logistic regression results (Table 3), patients who received any 7-day follow-up had a 43% lower likelihood of readmission compared to patients who did not receive a follow-up (OR=0.57; p=0.03). Results in Table 3 also provide preliminary evidence that the association between scheduling 7-day follow-up and readmission might be moderated by provider type. According to Table 3, scheduling an appointment with a PCP had highly protective effect on readmission (OR=0.47; p=0.01); however, a statistically significant protective effect was not observed for scheduling with a pulmonologist (OR=1.54; p=0.5) or a provider other than a PCP or pulmonologist (OR=0.66; p=0.42).

Based on adjusted logistic regression models, some patient demographics were independently associated with readmission. Female patients had a lower rate of readmission than male patients (OR=0.55, p=0.01). Other patient factors associated with increased rate of readmission included LOS (patients with LOS >7 days have higher odds of readmission compared to the reference group: OR=3.79, p=0.001) and prior admissions (patients who had >=2 prior admissions have higher odds of readmission compared to patients who had no prior admissions; OR=3.51, p<0.001). A higher Charlson Comorbidity Index (indicating increased predicted mortality) was also associated with higher risk of readmission (OR=1.21, p<0.001). There was not a statistically significant difference in readmission rates among the four clusters.

Discussion

We found that patients who were scheduled for a 7-day follow-up appointment after hospitalization for AECOPD had a reduction in 30-day readmission rates. To our knowledge, this is the first study of the effect of a scheduled 7-day outpatient follow-up on readmission rate for patients admitted with AECOPD.

Our overall readmission of 18% is similar to prior reported rates [1,2]. Our data is similar to a large cohort study on another patient population, patients admitted for heart failure, which showed that 7-day follow-up with PCP or cardiologist had a protective effect on readmission rates [10]. Two large cohort studies of patients with AECOPD who had a 30-day follow-up with PCP or pulmonologist demonstrated a decreased readmission rate [11,12], whereas a third cohort study found no effect on readmission rate but a substantially decreased 30-day mortality [13].

When analyzed by provider type, reduction in 30-day readmission was observed for scheduled appointments with PCPs but not for pulmonologists or other providers. Conflicting with this data, Gavish et al. found a protective effect in 3-month readmission for patients with AECOPD who had follow-up with a pulmonologist within 30 days [14]. However, our findings for pulmonologists and other providers is limited due to significantly lower numbers of scheduled appointments for those providers. A possible explanation for the low rate of follow-up with a pulmonologist is that access to pulmonology clinics is limited and was not specified as a requirement for participation in the CQI, but further studies will be helpful to address this issue.

We found that female patients had a lower rate of readmission, consistent with prior studies [15,16]. White patients in our study had a higher rate of readmission whereas a prior study found that African Americans hospitalized for AECOPD had a higher rate of readmission [15]. Additionally, our data suggests that patients in higher neighborhood income quintiles may have reduced readmission rates. We initially attempted to assess for more patient characteristics related to the social determinants of health (SDOH, Table 2) in the registry (substance abuse and depression), but we found SDOH content to be highly variable within each institution and across different clusters and EMRs. Further study is needed to examine the behavioral and socioeconomic aspects that may contribute to these findings. Longer LOS was associated with a higher rate of readmission, which has also been previously demonstrated [12,17]. A systematic review showed that comorbidities, previous exacerbations and hospitalizations, and increased LOS were significant risk factors for 30- and 90-day all-cause readmission post-index hospitalization with AECOPD [8]. There was a positive correlation between the Charlson Comorbidity Index and readmission rates, which is consistent with prior studies [18].

We also observed a higher readmission rate for patients who were identified as having a medication discrepancy between the document sent to the outpatient provider (discharge summary) and the written discharge instructions given to the patient. It is well established that deficits in communication and information transfer at hospital discharge are common and may adversely affect patient care [19]. A prior study demonstrated that 64% of patients used at least one medication that was not ordered by the physician at discharge, and 73% failed to use at least one medication according to the way it was ordered [20]. This is likely an issue that warrants further investigation or intervention to streamline and improve the transition of care at hospital discharge.

We acknowledge that there are numerous factors that play an important role in readmission. Additional interventions that have been shown to have a protective effect include early pulmonary rehabilitation [21], which ranks as one of the most cost-effective treatment strategies [8], and enrollment in a comprehensive AECOPD care plan [22]. In the future, it would likely be beneficial to incorporate early outpatient follow-up in a comprehensive discharge care plan. We plan to study how other local interventions including care management, medication reconciliation, and patient-tailored education interact with 7-day follow-up appointments with providers. We also plan to further engage patients and their caregivers by developing discharge instructions that emphasize the importance of early outpatient follow-up and encouraging patients to make early contact with their primary care team.

Table 3. Adjusted logistic models for the association between scheduling a follow-up and 30-day re-admission (N=686)[a].

Variables	Model 1				Model 2			
	OR	P-Value	Lower CI	Upper CI	OR	P-Value	Lower CI	Upper CI
7-day scheduled	0.574	0.030	0.347	0.948				
7-day scheduled by provider type								
7-day with PCP[b]					0.474	0.014	0.261	0.860
7-day with Pulmonologist[c]					1.538	0.498	0.442	5.353
7-day with Other Provider[d]					0.665	0.426	0.243	1.819
Patient received other IMPACT intervention/s[e]	1.178	0.520	0.716	1.937	1.163	0.554	0.748	1.920
Education on COPD warning signs	1.735	0.096	0.908	3.317	1.679	0.119	0.875	3.224
Female	0.556	0.008	0.361	0.856	0.546	0.006	0.355	0.843
White	1.957	0.051	0.996	3.845	1.907	0.062	0.968	3.758
Medicaid	1.775	0.078	0.937	3.364	1.739	0.093	0.911	3.320
Median income quintiles - 1st (14.2-32.8 Reference)								
2nd (32.9-45.6)	0.660	0.328	0.287	1.517	0.642	0.299	0.278	1.481
3rd (45.8-53.4)	1.154	0.724	0.522	2.552	1.173	0.695	0.528	2.602
4th (54.0-66.0)	0.427	0.066	0.173	1.057	0.427	0.066	0.173	1.057
5th (68.2-126.0)	0.406	0.144	0.121	1.359	0.425	0.165	0.127	1.424
Charlson Comorbidity Index	1.208	0.000	1.089	1.341	1.207	0.000	1.087	1.340
Length of Stay 0-2 days (Reference)								
3-4	1.793	0.082	0.928	3.463	1.799	0.081	0.929	3.482
5-7	1.734	0.116	0.873	3.443	1.760	0.107	0.886	3.498
>7	3.787	0.001	1.761	8.143	3.786	0.001	1.757	8.159
Hospital Admissions prior to 180 days - 0 (Reference)								
0-2	1.623	0.087	0.932	2.827	1.591	0.104	0.909	2.784
≥2	3.514	0.000	2.124	5.814	3.542	0.000	2.134	5.879
DS/AVS medication discrepancy	2.001	0.002	1.280	3.127	2.025	0.002	1.293	3.170

[a] Table 3 reports coefficients from two adjusted logistic models. The key predictor in the first model is having a scheduled appointment with any provider, while the key predictor in the second model is 7-day provider type. The coefficients reported for covariates are estimates from the first model.
[b] Primary Care Provider (PCP) - includes PCP or PCP plus other providers
[c] Pulmonologist - Pulmonologist or pulmonologist plus PCP/other
[d] Other Providers - Non- PCP/non-pulmonologist only
[e] Other intervention(s) – Intervention(s) determined at the cluster level excluding 7 day follow up
[f] **Abbreviations:** AVS: After Visit Summary; COPD: Chronic Obstructive Pulmonary Disease; DS: Discharge Summary; PCP: Primary Care Provider.

A major limitation in our study is that we were not able to ascertain whether patients attended their scheduled outpatient follow-up appointment, and therefore, we are only able to attribute the act of scheduling the appointment to the protective effect on readmission rates. While other studies have not found an association between 30-day readmission rate and attending a 10-day follow-up visit [23], this is the first study to our knowledge examining the association between the act of scheduling a 7-day follow-up visit and 30-day readmission. Scheduling the appointment alone engages the outpatient team and may have benefits regardless of whether the patient actually keeps the appointment. This engagement may trigger other downstream processes between the outpatient clinic and the patient that have the protective effect we see in this study. For example, scheduling an appointment may notify the outpatient provider team that the patient is in the hospital, which may cause the clinic to activate a discharge navigator or nurse to call the patient in the week after discharge. The scheduling of the appointment may also trigger the provider to review the discharge summary, evaluate the plan of care and review medications after hospitalization even if the patient is not present. Additionally, there are fewer inherent sampling biases with evaluating scheduled appointments compared to only "kept/attended" appointments that are based on outpatient claims data. Other studies that evaluate "kept/attended" appointments and the effect on readmissions potentially introduce selection bias, including only those patients who are more adherent, health aware, or do not have burdensome social factors limiting their ability to attend a scheduled follow-up appointment. In the future, we plan to capture kept appointments to determine their effect on readmission.

Another limitation in our study is that we did not capture or evaluate the difference in 7-day follow-up rates between patients seen by partnering POs versus those scheduled with non-partnering POs. If these rates of follow-up differed significantly between patients across these two groups, our findings may have been influenced by a strong and inherent collaboration between the partnering inpatient and outpatient teams that resulted in overall higher quality discharges and reduced readmissions.

Additional limitations include, as stated previously: there was a very small number of patients with scheduled 7-day follow-up with pulmonologists, making this data difficult to interpret. We would like to increase this number in future studies. There may have been uncaptured deaths (ie, not recorded in the EMR); therefore, reported deaths may be understated. We had difficulty interpreting data about "other" interventions due to the lack of details as to which "other" intervention the patient actually received. Due to smaller patient samples per site, we were unable to determine which other interventions were potentially making an impact by themselves or in conjunction with the 7-day follow-up. Also, clusters may have used slightly different definitions of AECOPD in their target population, resulting in the cluster not using the same billing and coding data during chart review and data abstraction. In addition, this study was unable to determine whether AECOPD was primary or secondary diagnosis for readmission. This study did not include collection of biomarkers to predict AECOPD exacerbation risk.

Our study has important clinical and health policy implications in that it highlights the significant impact that close outpatient follow-up can have on hospital readmission. Currently, access for post-hospital follow-up appointment within 7 days of hospital discharge is limited, as demonstrated by our low rate (29.5% scheduled), despite providing an additional pay-for-performance incentive for clusters that increased their rates of 7-day follow-up appointment. Scheduling such an appointment presents a challenge to

coordinate between hospitals, patients, and outpatient providers, which leads to a lower percentage of patients receiving this intervention. From the health system perspective, access to scheduling a 7-day post-hospital appointment is currently limited due to high outpatient volumes, leading to limited availability of follow-up within 7 days of discharge, as well as a paucity of evidence, prior to this study, demonstrating the benefit of scheduling early follow-up appointment for patients admitted for AECOPD. From other qualitative data collected through patient surveys, our patients voiced concerns with/identified barriers to attending outpatient appointments. These barriers included lack of transportation, financial concerns with copays, competing priorities, and other deficiencies in their social support system that make prioritization of close follow-up appointments difficult to achieve. Addressing these concerns from a health policy standpoint may improve early access to post-hospital follow-up and further reduce readmissions. We plan to further study the effect of 8-14 day follow-up appointments to determine if this time interval has comparable results.

Conclusion

In conclusion, for patients hospitalized for AECOPD, scheduling outpatient follow-up appointments within 7 days was associated with a reduction in 30-day hospital readmissions. Standardizing the scheduling of early post-hospital follow-up appointments for patients with AECOPD may reduce readmission rates.

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