Enhancing Cost-Effective Care with a Patient-Centric Chronic Obstructive Pulmonary Disease Program

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Abstract

Chronic obstructive pulmonary disease (COPD) is an escalating health problem for individuals, their families, and the public at large, resulting in considerable morbidity and mortality. A 1-year pilot program was conducted at a managed care medical group to empower COPD patients with self-management skills and improve their quality of life through enhancing cost-effective care. A total of 141 COPD patients were enrolled in the intervention group that imparted self-management principles, and provided telephonic nursing outreach and an action plan for symptom exacerbation. The same number of patients in the control group accessed care from their physician or urgently through emergency departments. At the conclusion of this program, paid claims in the intervention group were significantly \( P < 0.001 \) decreased compared to the control group. Primary care physician visits were also significantly \( P < 0.001 \) greater in the intervention group than in the control group. Although not statistically significant, hospital admissions, bed-days, and emergency department visits showed downward trends in the intervention group. Working with their clinical team, motivated patients can gain health benefits through self-management in an era of rising COPD prevalence and cost of care. (Population Health Management 2011;14:133–136)

Introduction

Chronic obstructive pulmonary disease (COPD) is an escalating public health problem and a cause of chronic morbidity and mortality; it contributes to substantial health service use and overall cost of care. COPD is an airflow limitation in the patient that is progressive and not fully reversible.\(^1\) The National Heart, Lung, and Blood Institute estimates that by 2020, it will be the third leading cause of death in the United States. Whereas 24 million individuals in the United States are estimated to have COPD, only 12 million are diagnosed and actively managed.\(^1\) Early identification for diagnosis and treatment remains paramount to reduce disease progression and acute exacerbation. The 4 components of active management include (1) assessment and monitoring, (2) risk factor reduction, (3) management of stable COPD, and (4) exacerbation management.\(^1\) Furthermore, patient education is important to help manage COPD and should include disease awareness, medication administration, lifestyle changes, and disease exacerbation recognition.\(^1\) Early exacerbation recognition can reduce hospital admissions, bed-days, and emergency department (ED) visits, thus improving patient quality of life and decreasing cost of care.

While the rate of cigarette smoking is currently decreasing in the United States, the prevalence of COPD continues to increase as a result of the “Virginia Slims” effect of increased cigarette smoking among women in the 1970s. COPD is an incipient disease, occurring 20–30 years after the patient begins smoking. Despite COPD prevalence, studies that examine patient quality of life, service utilization, intermediate measures of disease control, and chronic disease guideline adherence remain scant.\(^2^–^6\)

HealthCare Partners Medical Group (HCP) is an accountable care organization that accepts global capitation in Southern California, Florida, and Nevada, and employs a coordinated care model aimed at enhancing innovative, high-quality, cost-effective care. HCP’s communities present a culturally diverse patient population with a wide array of socioeconomic classes, varying degrees of health status, and ages.

At HCP, the current prevalence of COPD comprises approximately 21,000 individuals. The economic burden of COPD is considerable, with inpatient hospitalization accounting for approximately half of the per member per month (PMPM) cost. COPD is consistently one of the top 10 diseases at our medical group that results in hospital admissions and readmissions.

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To help prevent COPD progression and detect early exacerbation recognition, our medical group developed and implemented a disease management program to improve patient screening, diagnosis, and treatment with supplemental education. A 1-year pilot COPD management program was conducted. The primary goal was to evaluate if a patient-centric program could enhance cost efficiency while empowering patients with self-management skills, thereby improving their quality of life.

Methods

Enrollment

The sample in this program was drawn from HCP patients in Southern California whose medical records indicated a diagnosis of COPD. HCP has sophisticated computer technologies to facilitate selection of patients with COPD and to document clinical service utilization. The average patient age was approximately 75 years. Patients were excluded if they or their primary care physician (PCP) declined or opted out, were no longer an active patient in the HCP health maintenance organization, or expired. Individuals were also excluded if they were enrolled in hospice, institutionalized in custodial nursing facilities, unable to participate due to severe dementia or organic brain disorder, on chronic hemodialysis due to end-stage renal disease, or undergoing chemotherapy for active malignancies.

Patient identification was performed using a disease registry of International Classification of Diseases, Ninth Revision codes for all related diagnoses of COPD. Power calculations determined that a sample size of 258 individuals would result in an 80% chance of detecting statistically significant differences in cost reduction between the intervention and control groups. A risk stratification tool (developed at SCAN Health Plan) helped prioritize patients for inclusion in the program with prospective designation of matched intervention and control groups. Nurse case managers then telephonically contacted the patients on the list in a 1-to-1 alternating fashion, to enroll patients into the intervention group until the end of the 6-month enrollment period. Enrollment was confirmed when the patient agreed to participate in the program and no exclusion criteria were identified. Physicians were also informed of the nurse case managers’ intent to enroll their patients. These clinicians were encouraged to endorse this enrollment; however, enrollment was not dependent on their endorsement.

A total of 141 patients in the control group were prospectively identified, and matched by age, sex, and risk stratification severity scores, as well as medical delivery model (group staff model versus independent practice associations [IPA]). Control and intervention group patients were also matched based on hospital admissions, ED visits, prescriptions, and comorbidities.

Of 424 patients screened for potential participation in this program, 141 patients were enrolled over 6 months (94 patients from the medical group and 47 patients from the IPA group). Thirty-six patients were excluded based on the exclusionary criteria described; 80 patients declined to enroll who would otherwise have qualified. A total of 167 patients who were contacted denied having COPD and were not enrolled. These patients were subsequently contacted by their PCP for diagnosis.

Protocol

In the control group, patients received “usual” care by accessing treatment from their PCP and pulmonologist, or urgently through the ED. For the intervention group, staffing included 2 nurse care managers, 1 care coordinator, “wrap-around” coverage by overnight nursing triage, and physician support. Nurse care managers were formally trained in the fundamentals of COPD diagnosis and management, proper use of spirometry and various types of inhalers, standardized encounter scripts, and a COPD algorithm. Nurses were educated in triaging COPD exacerbation by using a disease management script and an algorithm that assisted patients with self-management.

Intervention group patients received an initial face-to-face nurse assessment during which spirometry and a basic health evaluation were performed for comprehensive COPD staging, and determination of the BODE index. Regularly scheduled educational and disease management nurse telephonic outreach was conducted at intervals based on the patient’s COPD stage, BODE index, and evolving condition.

Nursing staff contacted patients at least weekly, or more frequently depending on their patients’ COPD symptoms; call duration was approximately 20 minutes. Case reviews, sharing of managed care benchmark “best practices,” continuing education, and motivational interview training for nurse care managers addressed quality assurance and helped optimize the patient experience, all under the supervision of the lead pulmonologist.

Written educational materials were also provided to the intervention patients and reviewed during phone calls. COPD disease management nurses followed scripts for the telephonic educational sessions. Self-management strategies were emphasized, highlighting symptom recognition and action plans based on the National Jewish Health Research and Science Program COPD Self-Management Plan.8 The action plan consisted of various colored zones indicating increasing severity of symptoms; the green zone, yellow zone, and red zone contained questions pertaining to 4 categories of COPD symptoms: breathing, sputum, thinking, and energy. The red zone indicated an emergent situation requiring physician intervention, whereas the yellow zone indicated symptoms of lesser severity that necessitated case manager initiation of the action plan. The green zone was the baseline for the patient and did not require case management intervention or provider involvement. Finally, patients were provided rescue medications to help facilitate action plans for periods of acute exacerbation. Patients were also provided a wallet-sized “premier-card” that contained descriptive COPD symptoms and an action plan. This card also contained information to help facilitate access to the nurse care managers and “after-hours” support if patients had questions or changes in their condition.

Quarterly patient “report cards” were generated to update PCPs and pulmonologists about their patients’ status and to solicit emergency prescriptions for action plan initiation. Evaluations contained the patients’ COPD stage, BODE index, medication lists, compliance, advanced directives, and smoking status. These regularly scheduled assessments helped facilitate clinical delivery and optimize intervention for those patients who required more comprehensive care.
Intervention

All paid claims ($) 7,070 (1872) 4,661 (924)
Prescription medication costs ($) 402,553 (100,211) 415,154 (105,733) 0.7673
PCP visits 683 (123) 887 (95)
Emergency department visits 92 (42) 71 (29) 0.1646
Bed-days 190 (110) 115 (105) 0.1011
Hospital admissions 57 (27) 40 (27) 0.1365

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FIG. 1. Cost of all paid claims per member per month in the COPD intervention group were significantly lower ($P < 0.001) than in the control group. COPD, chronic obstructive pulmonary disease; PMPM, patient member per month; SEM, standard error of the mean.

Statistical analyses

Statistical analyses were performed on clinical and financial metrics using GraphPad software (GraphPad Software Inc., La Jolla, CA). Comparisons between groups were made using the unpaired Student t test. In our power calculations, we determined that a sample size of 258 individuals would result in an 80% chance of detecting statistically significant differences in cost reduction (using a 2-tailed z level of 0.05) with an effect size of 0.35 SD between intervention and usual care groups. The tests were conducted using a 95% confidence interval.

Results

All paid claims (PMPM and 12-month totals) in the intervention group were significantly ($P < 0.001) decreased compared to the control group ($388 vs. $589 PMPM, respectively) (Fig. 1 and Table 1). This represented a 34% reduction in cost compared to the control group. The program cost and cost savings difference between the control and intervention groups resulted in a 46% return on investment (ROI) (Table 2). Total program costs were $225,012, of which the majority (97%) comprised staff salaries and benefits. The remaining difference (3%) was equipment purchases directly related to the program, including Opti-Chambers, spirometry, and print materials (Table 2). Moreover, PCP visits were significantly ($P < 0.001) greater in the intervention group than in the control group (887 vs. 683 visits, respectively), representing a 23% increase in clinical appointments (Table 1).

Although not statistically significant, with standard deviations indicating high variance, the average prescription medication costs showed an upward trend in the intervention group compared to the control group (Table 1). Furthermore, 12-month totals of hospital admissions, bed-days, and ED visits showed a decreased trend in the intervention group compared to the control group, yet were not statistically significant.

Discussion

COPD programs can improve patient quality of life and impart self-management skills while reducing costs.3–6 Unlike congestive heart failure disease management programs, there is scant literature with regard to remote monitoring of COPD patients. Feasibility studies examining remote monitoring detection of early acute exacerbation have been performed,2,9 these preliminary programs are ongoing and are not universally available for clinical diffusion yet. This can be explained by remote pulse-oxygen determinations being potentially error prone. For example, by the time pulse oximetry results are abnormal, it is usually too late to avoid acute COPD exacerbation resulting in either ED visits or hospitalization.

Notably, potential speech impairment due to wheezing is another inherent limitation for remote monitoring technologies such as interactive voice recognition and automated speech recognition. Our program was specifically designed to create a patient-centric disease program that imparted self-management skills with nursing outreach, and an action plan to manage exacerbations without the inherent barriers of remote monitoring COPD programs.

Despite demonstrating a significant reduction in all paid claims and a positive ROI in the intervention group, there are several important limitations. The program population consisted of noninstitutionalized patients with health insurance. Therefore, these findings may not apply to other populations without insurance. Whereas HCP’s communities present a culturally diverse patient population with a wide array of socioeconomic classes, it does not represent rural medical practices. Implementation and adoption of this program may be different in these areas compared to more urban locales.

Patient adherence to self-management principles and emergency medication administration may have decreased clinical metrics such as admissions, bed-days, and ED visits. In the intervention group, COPD medication use also showed an upward, although not statistically significant, trend. This finding is consistent with increased medications administered to the intervention group via emergency prescriptions for COPD exacerbation. The number of enrolled

Table 1. Clinical and Financial Outcomes at 12 Months

<table>
<thead>
<tr>
<th>Metrics</th>
<th>Control Group Mean (SD)</th>
<th>Intervention Group Mean (SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital admissions</td>
<td>57 (27)</td>
<td>40 (27)</td>
<td>0.1365</td>
</tr>
<tr>
<td>Bed-days</td>
<td>190 (110)</td>
<td>115 (105)</td>
<td>0.1011</td>
</tr>
<tr>
<td>Emergency department visits</td>
<td>92 (42)</td>
<td>71 (29)</td>
<td>0.1646</td>
</tr>
<tr>
<td>PCP visits</td>
<td>683 (123)</td>
<td>887 (95)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Prescription medication costs ($)</td>
<td>402,553 (100,211)</td>
<td>415,154 (105,733)</td>
<td>0.7673</td>
</tr>
<tr>
<td>All paid claims ($)</td>
<td>7,070 (1872)</td>
<td>4,661 (924)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

PCP, primary care physician; SD, standard deviation.
patients was determined using power calculations to detect changes in financial metrics. Perhaps the sample size was insufficient to detect significant differences in clinical metrics, given the statistical uncertainty (“noise”) demonstrated by standard deviations.

During the beginning of this program, patients and nursing staff were learning the COPD scripts and algorithms, which may have resulted in greater variances in clinical metrics. IPA providers were also less likely to write COPD emergency prescriptions, thus resulting in patients seeking care from the ED or being hospitalized.

Additionally, there were significantly more PCP visits in the intervention group. This can be explained by nurse case managers making clinical follow-up appointments for these patients when they entered the yellow zone of the action plan, thus contributing to increased PCP visits.

Furthermore, some patients requested that the nurse case manager call them less frequently. These individuals may have had less meticulous care than those with more intensive oversight. Also, some individuals required medical attention regarding matters unrelated to COPD, thus increasing nurse case manager burden.

Lack of engagement of patients and IPA clinicians led to the enrollment of fewer than anticipated. For example, some individuals were unaware of their diagnosis or denied having COPD, and did not choose to participate in the program. This potential educational barrier regarding their diagnosis required teaching patients about their disease symptoms and the current management options available. Lack of IPA clinician engagement resulted in greater representation by the medical group. Therefore, communication, flagging, and tracking of COPD patients may not have been optimal. Also, IPA PCPs were generally more reluctant to write emergency COPD prescriptions, which limited action plan efficacy during exacerbation.

**Conclusion**

In summary, a patient-centric COPD program that enhances higher quality, cost-effective care is described. Working with their provider and case management team, motivated individuals can gain sustainable self-management skills, thus promoting positive health behaviors. Early detection and treatment of acute exacerbations is vital to enhance patient care and allow more appropriate use of health resources. Further expansion and replication of this program may help optimize clinical outcomes in the current era of rising COPD prevalence and cost of care.

**Acknowledgment**

The authors gratefully acknowledge HealthCare Partners Medical Group clinicians, independent physician associates, and allied staff for developing and implementing the patient-centric COPD program.

**Author Disclosure Statement**

Drs. Chuang, Levine, and Rich do not report any relationship, (personal, professional, or financial) that would pose a conflict of interest for this publication.

**References**


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