Utilization of Health Care Resources in a High-Risk Medicaid Population with Chronic Obstructive Pulmonary Disease

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a respiratory illness that has a major impact on health care expenditures in the U.S.1,2 It is associated with a high morbidity rate and creates a deep economic burden on patients, health care providers, and society in general.3 Ten million physician visits and more than two million hospitalizations per year are attributable to COPD.4 In 2002, the estimated total economic costs of COPD in the U.S. were $32.1 billion; of this amount, $18 billion accounted for direct treatments.5 The estimated mean cost per COPD patient in 1997 was $5,093 for inpatient services, $5,042 for outpatient services, and $1,545 for prescriptions drugs.6 COPD continues to be the fourth leading cause of death, and the mortality rate attributable to COPD is on the rise. In addition, COPD imparts a burden on the daily lives of patients and has deleterious effects on their functional status, work productivity, and well-being.7

With the advent of better management of chronic diseases, it is not exactly clear how the comparative burden of COPD on the utilization of health care resources is taking its toll. Existing studies have taken the perspective of patients or physicians, but few trials have presented arguments for COPD treatment from the standpoint of a public policy.8,9 Most research has focused on patients with severe chronic pulmonary conditions10–12 or on specific elderly populations (e.g., Medicare beneficiaries).14–16 Relatively few studies have examined the impact of the cost of this disease in the general population,17–19 and even fewer have investigated disparities among COPD patients based on race and sex in their use of health care resources.20

The purpose of our study was to capture patterns of health care resource utilization by Medicaid COPD patients and to compare these patterns with those of matched cohorts. We also sought to identify any patterns of disparities in race or sex in the COPD Medicaid patients. Such information is relevant for clinicians and other health care professionals who develop disease-management programs and budget impact models.

To answer our research inquiry, we used observational, longitudinal, retrospective data from a Medicaid population consisting predominantly of black patients, women, and young subjects.

METHODS

Data Source

COPD Cohort

The study population consisted of Maryland Medicaid enrollees. More than 400,000 people receive help from state Medicaid; about 60% are female patients, and 50% are 17 years of age or younger. The data consisted of medical and pharmacy claims, extracted from a Medicaid database, for patients older than age 45 who were continuously enrolled between January 1, 2001, and December 31, 2003, and who had at least one medical claim pertinent to COPD (International Classification of Diseases, 9th revision [ICD-9] 491.xx, 492.xx, 496.xx) in their primary diagnosis. Dually eligible patients, as well as fee-for-service patients, were excluded from the study population.

Other Respiratory Disease–Matched Cohort

To identify a matched cohort, we selected a random sample of patients with respiratory diseases other than COPD (ICD-9 490.xx–490.xx, 493.xx–495.xx, and 497.xx–519.xx). The matching criteria (in a ratio of 1 to 1) were based on age (with a variation of five years) and sex.

Non-respiratory Disease–Matched Cohort

We extracted a random sample of 10,000 patients with non-respiratory disease who had medical and pharmacy claims for the period of January 1, 2001, to December 31, 2003, from the Medicaid database. The matching criteria (in a ratio of 1 to 1) were based on age (with a variation of five years) and sex for patients older than 45 years of age.

Data Analysis

To evaluate the use of health care by patients with COPD, we examined the yearly frequency of occurrence of each category of claims during the study period. Claims were classified as follows:

- office and outpatient claims (visits to physicians within or outside a hospital)
- inpatient hospital claims (a stay in the hospital)
- emergency claims (visits to the emergency department)
- pharmacy claims (filling of a prescription drug for a patient)

We studied yearly treatment patterns of these COPD patients and analyzed their uses of health care by comparing them with other respiratory-matched and non-respiratory–matched cohorts. We performed exploratory, and then bivariate, analyses to compare the study sample and the matched cohorts. Tukey

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tests were used to perform pairwise comparison of means. SAS version 9 was used for the statistical analysis.

RESULTS

A total of 5,672 patients with a diagnosis of COPD met the cohort selection criteria. Tables 1 and 2 present a summary of the baseline characteristics of the cohort. Medicaid patients with COPD were primarily women (61.02%) between 55 and 64 years of age (47.46%). Most of these patients were white (54.21%). We extracted a total of 1,067,756 medical claims and 720,127 pharmacy claims. Among the 1,067,756 medical claims (78.59% office and outpatient visits, 21.20% inpatient care, and 0.21% emergency visits), a total of 84,451 (7.91%) claims were directly related to COPD as a primary diagnosis. Those claims were disaggregated as follows:

- 35.39% of claims were related to chronic bronchitis (ICD-9 491).
- 5.77% of claims were related to emphysema (ICD-9 492).
- 58.84% of claims were related to chronic airway obstructive diseases (ICD-9 496).

Of the 720,127 pharmacy claims, 148,341 (20.60%) were directly associated with drug prescriptions that could be related to COPD, such as ipratropium bromide (e.g., Atrovent, Boehringer Ingelheim), salmeterol xinafoate (e.g., Serevent Diskus, GlaxoSmithKline), albuterol (e.g., Proventil, Schering; Ventolin, GlaxoSmithKline), and theophylline (e.g., Theo-Dur, Key; Theolair, 3M).

Use of Health Care Resources by Medicaid Patients with COPD

We measured patients' use of health care resources by the annual average number of claims related to each of the categories of claims defined. Table 3 (see page 264) shows a comparison of annual use of medical resources by patients with COPD, patients with other respiratory disease (ORD), and patients with non-respiratory disease (NRD). As shown in the table, for COPD patients, outpatient and office visits accounted for the highest rates of utilization (52.77%), followed by prescription drugs (32.52%), in-patient services (14.59%), and emergency-department services (0.12%).

On average, COPD patients in our data had about 90 claims per year for office and outpatient visits; 56 claims for prescription drugs; 25 claims for inpatient hospitalization; and, at most, one claim for an emergency visit.

Compared with male patients, female COPD patients, on average, used fewer inpatient services ($P < .05$), used more outpatient services and had more office visits ($P < .05$), and used more prescription drugs ($P < .05$).

Compared with black patients, white COPD patients used fewer inpatient services ($P < .05$), used fewer outpatient services and office visits ($P < .05$), made more emergency visits ($P < .05$), and used more prescription drugs ($P < .05$).

Compared with patients who were 56 years of age and younger, older COPD patients used fewer outpatient services and made fewer office visits ($P < .05$), and they used more prescription drugs ($P < .05$).

COPD versus Other Respiratory Disease–Matched Cohort

A total of 5,004 patients (in a ratio of 1 to 0.88) with other respiratory disease (non-COPD) matched the criteria based on age and sex. Tables 2 and 3 present the results.

These patients primarily made office and outpatient visits (65.77%), followed by the use of inpatient services (19%), prescription drugs (15.15%), and emergency-department services (0.07%). Conversely, utilization was absorbed primarily by office and outpatient visits for both COPD patients and patients with other respiratory diseases.

Compared with the matched cohort, COPD patients used, on average, more prescription drugs ($P < .05$) and more emer-
ergency services ($P < .05$), but they made fewer inpatient and outpatient hospital and office visits ($P < .05$).

In the other patient cohort with respiratory disease, as was the case with the COPD cohort, there was disparity among the sexes with regard to the use of inpatient services, outpatient and office visits, and prescription drugs ($P < .05$). Racial disparity was also significant in the utilization of inpatient services.

**COPD versus Non-respiratory Disease—Matched Cohort**

A total of 2,405 subjects (in a ratio of 1 to 0.42) matched the criteria based on age and sex. Table 2 presents the matched sample demographics; Table 3 presents the average annual health care resource utilization by matched non-respiratory patients. The results show that the use of drugs by patients with non-respiratory disease represented approximately 10.6% of the total use of health care resources.

The highest type of utilization involved office and outpatient visits (68.24%), followed by prescription drugs (10.6%), inpatient hospitalization (16.83%), and emergency-department visits (4.31%). Medicaid patients with non-respiratory disease, on average, had 32 office and outpatient claims per year, five prescription drug claims, eight inpatient hospital claims, and three emergency-department claims. However, both COPD and non-respiratory patients used office and outpatient services most often.

As shown in Table 3, compared with the non-respiratory-matched cohort, COPD patients generally used more prescription drugs per year, visited physicians’ offices and used inpatient hospital resources more frequently, but used emergency resources less frequently ($P < .05$).

**Adjusting for Age and the Charlson Comorbidity Index**

To determine the significance of the dissimilarities in means, we had to adjust for any differences in age and comorbidities of the COPD population, for patients with other respiratory diseases, and for non-respiratory patients. We applied the method suggested by Charlson et al. and Deyo et al. to compute a comorbidity index. To minimize bias, we then adjusted the means for age and the Charlson Comorbidity Index (Table 4).

Even after the adjustment, differences in the annual average number of claims filed persisted between COPD, patients with other respiratory disease, and patients with non-respiratory disease ($P < .05$). In addition, women with COPD made more office visits, used outpatient services more often, and used more prescription drugs than men did. Black patients used significantly fewer emergency services and prescription drugs than white patients who were the same age and had the same Comorbidity Index scores.

**DISCUSSION**

The prevalence of COPD in our sample population was, on average, 1.4%. Compared with prevalence worldwide, our rate fell within the general established range of 0.8% to 6%. Several investigators have tried to estimate the prevalence of COPD in the U.S. using different measures for diagnostic criteria. Mueller et al. and Mannino et al. used the ratio of forced expiratory volume to forced vital capacity (FEV/FVC). Mueller found a prevalence of 13% for men and 2% for women, whereas Mannino found a prevalence of 6.8% for patients older than age 17.

On the other hand, Lebowitz et al. and Adams et al. used the patient-reporting method to assess the prevalence of chronic bronchitis. For all age ranges, Lebowitz found a prevalence of 6.6%, and Adams found a prevalence of 5.4%.

Studies have also noted that the recent prevalence in the U.S. had not changed significantly from that reported previously. In our study of Medicaid patients, the prevalence was lower than that reported in other studies in the U.S., perhaps because of the baseline demographic characteristics of the Medicaid population of patients, who tend to be largely female, black, and younger than the general population. In addition, prevalence varied in the studies, depending on the method used by researchers to evaluate and define COPD.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Demographics of Patients with Chronic Obstructive Pulmonary Disease (COPD) and Their Matching Cohorts</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD Cohort</td>
<td>Matched Sample for Other Respiratory Disease</td>
</tr>
<tr>
<td><strong>No.</strong></td>
<td><strong>%</strong></td>
</tr>
<tr>
<td><strong>Total patients</strong></td>
<td>5,672</td>
</tr>
<tr>
<td><strong>Age (mean = 56 yrs)</strong></td>
<td></td>
</tr>
<tr>
<td>45–54 yrs</td>
<td>2,421</td>
</tr>
<tr>
<td>55–64 yrs</td>
<td>2,692</td>
</tr>
<tr>
<td>65+ yrs</td>
<td>559</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2,211</td>
</tr>
<tr>
<td>Female</td>
<td>3,461</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>2,379</td>
</tr>
<tr>
<td>White</td>
<td>3,075</td>
</tr>
<tr>
<td>Other</td>
<td>218</td>
</tr>
</tbody>
</table>
A major finding of our study points to the burden of COPD, in relation to other diseases, in a high-risk Medicaid population. Compared with patients who had other non-respiratory conditions, COPD patients claimed a proportionately higher share of office visits, inpatient hospitalizations, and prescription drugs. They also consumed more emergency services and used more prescription drugs than patients with other respiratory disease (non-COPD).

These results support earlier findings in the literature. Even though most of the previous studies were based on the cost of treating COPD, some statistics related to length of stay for hospitalized inpatients. The National Health Interview Survey in 1997 and the National Hospital Discharge Survey in 2000 revealed the following results per 10,000 patients:

### Table 3  Average Total Number of Patient Claims Per-Year

<table>
<thead>
<tr>
<th>Inpatient Claims</th>
<th>Outpatient and Office Visit Claims</th>
<th>Emergency Visit Claims</th>
<th>Pharmacy Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD</td>
<td>ORD</td>
<td>NRD</td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td>ORD</td>
<td>NRD</td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>24.75</td>
<td>27.94*</td>
<td>7.89*</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>26.02</td>
<td>33.39</td>
<td>8.35</td>
</tr>
<tr>
<td>Female</td>
<td>23.94†</td>
<td>24.61†</td>
<td>7.6</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>28.23</td>
<td>29.39</td>
<td>7.49</td>
</tr>
<tr>
<td>White</td>
<td>21.87‡</td>
<td>25.69‡</td>
<td>8.84</td>
</tr>
<tr>
<td>Other</td>
<td>27.41</td>
<td>25.25</td>
<td>7.35</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>56 yrs or younger</td>
<td>25.63</td>
<td>25.9</td>
<td>7.35</td>
</tr>
<tr>
<td>Above 56 yrs</td>
<td>23.8</td>
<td>30.09§</td>
<td>8.44</td>
</tr>
</tbody>
</table>

* Significantly different from the mean for COPD patients.
† Significantly different from the mean for male patients.
‡ Significantly different from the mean for black patients.
§ Significantly different from 56 years of age or below the mean.
COPD = chronic obstructive pulmonary disease; NRD = non-respiratory disease; ORD = other respiratory disease.
Population: COPD, 5,672 patients; NRD, 2,405 patients; ORD, 5,004 patients.
Note: A type I error threshold of 0.05 was used for testing statistical significance.

### Table 4  Adjusted Average Total Number of Patient Claims Per-Year

<table>
<thead>
<tr>
<th>Inpatient Claims</th>
<th>Outpatient and Office Visit Claims</th>
<th>Emergency Visit Claims</th>
<th>Pharmacy Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>COPD</td>
<td>ORD</td>
<td>NRD</td>
<td></td>
</tr>
<tr>
<td>COPD</td>
<td>ORD</td>
<td>NRD</td>
<td></td>
</tr>
<tr>
<td>All patients</td>
<td>24.21</td>
<td>26.02*</td>
<td>13.17*</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24.56</td>
<td>33.39</td>
<td>8.35</td>
</tr>
<tr>
<td>Female</td>
<td>24.76</td>
<td>24.61†</td>
<td>7.6</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>25.59</td>
<td>28.13</td>
<td>7.23</td>
</tr>
<tr>
<td>White</td>
<td>23.77</td>
<td>27.99</td>
<td>9.25‡</td>
</tr>
<tr>
<td>Other</td>
<td>27.64</td>
<td>26.82</td>
<td>7.66</td>
</tr>
</tbody>
</table>

* Significantly different from the mean for COPD patients.
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COPD = chronic obstructive pulmonary disease; NRD = non-respiratory disease; ORD = other respiratory disease.
Population: COPD, 5,672 patients; NRD, 2,405 patients; ORD, 5,004 patients.
Note: A type I error threshold of 0.05 was used for testing statistical significance. Means were adjusted for age and the Charlson Comorbidity Index.

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• For patients with chronic bronchitis, the average number of days of care was 106.3 days, and the average length of stay in the hospital was 5.8 days.
• For patients with asthma, the figures were 51.4 days of care and 3.3 days in the hospital.
• For patients with diabetes mellitus, the figures were 97.3 days of care and 5.2 days in the hospital.

Our findings emphasize the fact that patients with COPD used relatively more health care resources than patients with non-respiratory disease.

We also observed, from previous studies, that total direct costs for COPD patients were higher than those for matched-cohort patients. Indeed, Mapel et al. developed a case–control study to compare direct costs of health care resource utilization with those of a non-COPD matching cohort based on age and sex for patients enrolled in Lovelace Health Systems between January 1, 1996, and December 31, 1997. They noted the following:

• Total inpatient costs for patients with COPD were 151% greater than those for the matched cohort ($5,093 vs. $2,026).
• Total outpatient costs were 65% higher for COPD patients ($5,042 vs. $3,050).
• Total pharmacy costs were 109% greater for COPD patients ($1,545 vs. $739).

The differences between COPD and non-COPD patients were statistically significant in all categories of health care resources. Those findings supported our results, thus underscoring the fact that the rate of health care resource utilization for patients with COPD was significantly higher than that for patients with non-respiratory diseases, who otherwise had the same demographic and morbidity characteristics (except for patients using emergency services).

Our study also confirmed that physician office and outpatient visits were the most widely used source of health care for COPD patients. This was consistent with the study by O’Brien et al., in their analysis, physician visits were the most common source of care for COPD patients, and about one third of the COPD patients visited a physician once every 30 days.

Another key finding of our study is that even after adjusting for age and comorbidities, sex and racial disparity in the use of health care resources existed within our Medicaid COPD population. Women made more outpatient and office visits and used more prescription drugs than male COPD patients. Black patients needed fewer emergency services and used fewer prescription drugs than white patients of the same age who had the same Comorbidity Index scores.

Those results are in conformity with those of Schore et al. In the Schore study, among dual-eligible (Medicaid and Medicare) beneficiaries, white patients spent $146 on drugs and filled an average of five prescriptions per month; black patients spent $126 and filled 4.3 prescriptions per month.

It is worth noting that the lower use of prescription drugs by black patients does not appear to be a result of their having less access to physician services. Indeed, there was no significant difference between the average number of inpatient claims and outpatient and office visits for white and black patients.

STUDY LIMITATIONS

Our study does have some limitations. Because we extracted the data from a claims data set, these data might not capture all episodes of care, specifically drugs that are obtained over the counter, for example.

There might also be issues of external validity. This study was conducted according to Medicaid data from one state; therefore, results might not be comparable to those of other state Medicaid plans or Medicare, commercial, or other types of health plans.

Our matching cohort, which was based on other respiratory diseases, might have included patients with then-undiagnosed COPD; COPD can be confused with other respiratory diseases, and it sometimes remains unrecognized.

We could not obtain a one-to-one match of patients with a diagnosis of non-respiratory disease. The Maryland Medicaid population tends to be young, whereas COPD patients are usually older than 45 years of age.

Our data did not capture patient behaviors such as smoking. Such information might be important to assess whether patients’ smoking behavior affects their use of health care resources.

Finally, because cost data were not available from Medicaid, we limited our analysis to reporting the rates of utilization.

CONCLUSION

Our study illustrates the significant burden that COPD imposes on society and underscores the existence of disparities in race and sex in the use of health care resources by Medicaid patients with COPD.

As disease-management programs set out to decrease the morbidity of COPD through early diagnosis and care protocols, it is important that they be used to assess the comparative economic burden of this disease and that they address any demographic disparities in patients’ use of resources. Such information is crucial to health care and managed care professionals who develop budget impact models.

REFERENCES

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