

# Sex Differences in Ambulatory Visits for Chronic Obstructive Pulmonary Disease, Based on the National Ambulatory Medical Care Survey and the National Hospital Ambulatory Medical Care Survey from 1995 to 2004

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**BACKGROUND:** Chronic obstructive pulmonary disease (COPD) is a rapidly growing public health problem in the United States. It is unclear whether men and women differ in their utilization of ambulatory care or medications prescribed for COPD. **OBJECTIVE:** To evaluate sex-related trends in physician-office and out-patient department COPD visits from 1995 through 2004. **METHODS:** We pooled data from the National Ambulatory Medical Care Survey (NAMCS) and National Hospital Ambulatory Medical Care Survey (NHAMCS) to derive national estimates of out-patient ambulatory COPD visits. For trend analysis we stratified the data into 2-year periods and by sex. The main variables of interest were the number of out-patient visits for COPD, patient characteristics, comorbidities, and medications prescribed. **RESULTS:** From 1995 to 2004, COPD-related out-patient visits increased among women and men; oral corticosteroids and short-acting bronchodilators were the most commonly prescribed drugs for both women and men; and prescriptions for inhaled corticosteroid decreased in both women (from 20% to 11%) and men (from 20 to 17%). In 2004, women surpassed men in out-patient COPD visits. **CONCLUSIONS:** COPD visits increased among both sexes, but the upward trend in COPD visits among women indicates that COPD is no longer a male-dominated disease. Providers should be aware of this shift in patient demographics and the differences between the sexes in COPD management. *Key words:* chronic obstructive pulmonary disease, National Ambulatory Medical Care Survey, NAMCS, National Hospital Ambulatory Medical Care Survey, NHAMCS. [Respir Care 2008;53(11):1461–1469. © 2008 Daedalus Enterprises]

## Introduction

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality and the only leading

cause of death that continues to increase in prevalence.<sup>1</sup> In the United States it is estimated that 10.2 million adults (5.9%) report having COPD.<sup>2</sup> The worldwide prevalence is 4–10%.<sup>3</sup> By 2020, COPD is expected to be the third most common cause of death worldwide.

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COPD is often associated with routine physician visits and medication use. Frequently COPD exacerbations require urgent care, emergency care, or hospitalization.<sup>4</sup> In 2000 there were about 8 million physician-office and hospital out-patient visits, 1.5 million emergency-department visits, 726,000 hospitalizations, and 119,000 deaths due to COPD.<sup>5</sup> In 2001 the financial burden of COPD was \$32.1 billion.<sup>6</sup> The third National Health and Nutrition Exami-

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nation Survey indicated that 24 million United States adults have evidence of impaired lung function, which suggests that COPD is markedly under-diagnosed and the costs are greatly underestimated.<sup>7</sup>

The greatest risk factor for COPD is smoking, which accounts for > 85% of cases.<sup>8,9</sup> The smoking rate among women is approaching that among men, and women may be at greater risk from the effects of smoking.<sup>10</sup> Until recently, sex (male vs female) was believed to be an independent risk factor for COPD (men were thought to have the greatest risk of COPD), but recent data indicate increasing prevalence of COPD among women, possibly associated with increased smoking.<sup>1,10</sup>

Evidence suggests that women have greater susceptibility to the effects of tobacco use, have more severe COPD, and respond differently to current COPD therapies than do men.<sup>11</sup> In contrast, previous studies indicated that women were less likely to receive adequate COPD screening tests, which resulted in underdiagnosis.<sup>1,10,12</sup>

The increasing prevalence and changing demographics of COPD warrant evaluation of the impact on out-patient care.<sup>13</sup> COPD prevalence among women in the United Kingdom has increased, whereas it has stabilized among men.<sup>14</sup> There is a similar trend in COPD mortality in the United States.<sup>13</sup>

Our objectives were to examine trends in sex differences in the rate of COPD-related ambulatory physician-office and hospital out-patient department visits, and differences in patient characteristics, comorbidities, and prescriptions for COPD treatments between female and male patients. This analysis was based on data from the National Ambulatory Medical Care Survey (NAMCS) and the National Hospital Ambulatory Medical Care Survey (NHAMCS), which are national probability sample surveys of ambulatory medical encounters, administered by the National Center for Health Statistics of the United States Centers for Disease Control and Prevention.<sup>15,16</sup>

## Methods

### Data Sources

Data on ambulatory COPD visits were culled from the NAMCS and NHAMCS data sets from 1995 through 2004, which was the most recent data available.

NAMCS collects data on a sample of patient visits from non-federally-employed physician offices and private non-hospital based clinics. Physicians in the specialties of anesthesiology, radiology, and pathology are excluded. NAMCS employs a multi-stage probability sampling design with geographic primary sampling units, physician practices within primary sampling units, and patient visits within physician practices. Primary sampling units are groups of counties, county equivalents (such as parishes),

towns, townships, minor civil divisions, or metropolitan statistical areas. Participating physicians (or their office staff) are required to complete an encounter form for a systematic random sample of patient visits during a randomly selected 1-week period.

NHAMCS collects information on ambulatory visits to hospital out-patient and emergency departments of non-institutional general and short-stay hospitals (ie, hospitals with an average stay of < 30 d) in the United States, excluding federal, military, or Veterans Affairs hospitals. Similar to NAMCS, the NHAMCS uses a 4-stage probability sampling design with geographic primary sampling units, hospitals within primary sampling units, clinics within the out-patient departments, and emergency-service areas within the emergency departments of those hospitals, and patient visits to these clinics and emergency-service areas. Hospital staff are instructed to complete a patient encounter form, as in NAMCS, to collect a systematic random sample of patient visits during a randomly selected 4-week period. These databases have been used to assess changes in characteristics of ambulatory care visits for procedures in respiratory systems, diabetes, obstetrics/gynecology, any primary care, and to examine changes in the prescribing patterns of psychotropic medications.<sup>17-21</sup>

We analyzed NAMCS and NHAMCS data on patient demographics (eg, age, sex, and race), diagnoses, services provided, and medications prescribed (including the physician's record of all new and continued medications ordered, supplied, or administered).

### Identification of COPD-Related Ambulatory Care Visits

Figure 1 shows the aggregation of the visit data. We combined the NAMCS and NHAMCS visits classified as COPD visits. Each visit entry included up to 3 clinical diagnostic codes per the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM).<sup>22</sup> Ambulatory care encounters for COPD and related conditions were identified on the basis of the following ICD-9-CM codes:

- 490: Bronchitis not specified as acute or chronic
- 491: Chronic bronchitis
- 492: Emphysema
- 496: Chronic airway obstruction

ICD-9-CM codes 491, 492, and 496 were taken as COPD visits. We excluded code 490 from our analysis because including code 490 would make it difficult to know whether the visit was for COPD or some other respiratory condition, due to the diverse characterization of code 490 to include acute or short-term respiratory conditions.

A total of 2,500 sample visits (1,282 from the 266,456 NAMCS visits, and 1,218 from the 310,133 NHAMCS visits) were identified as COPD visits. Visits that had a

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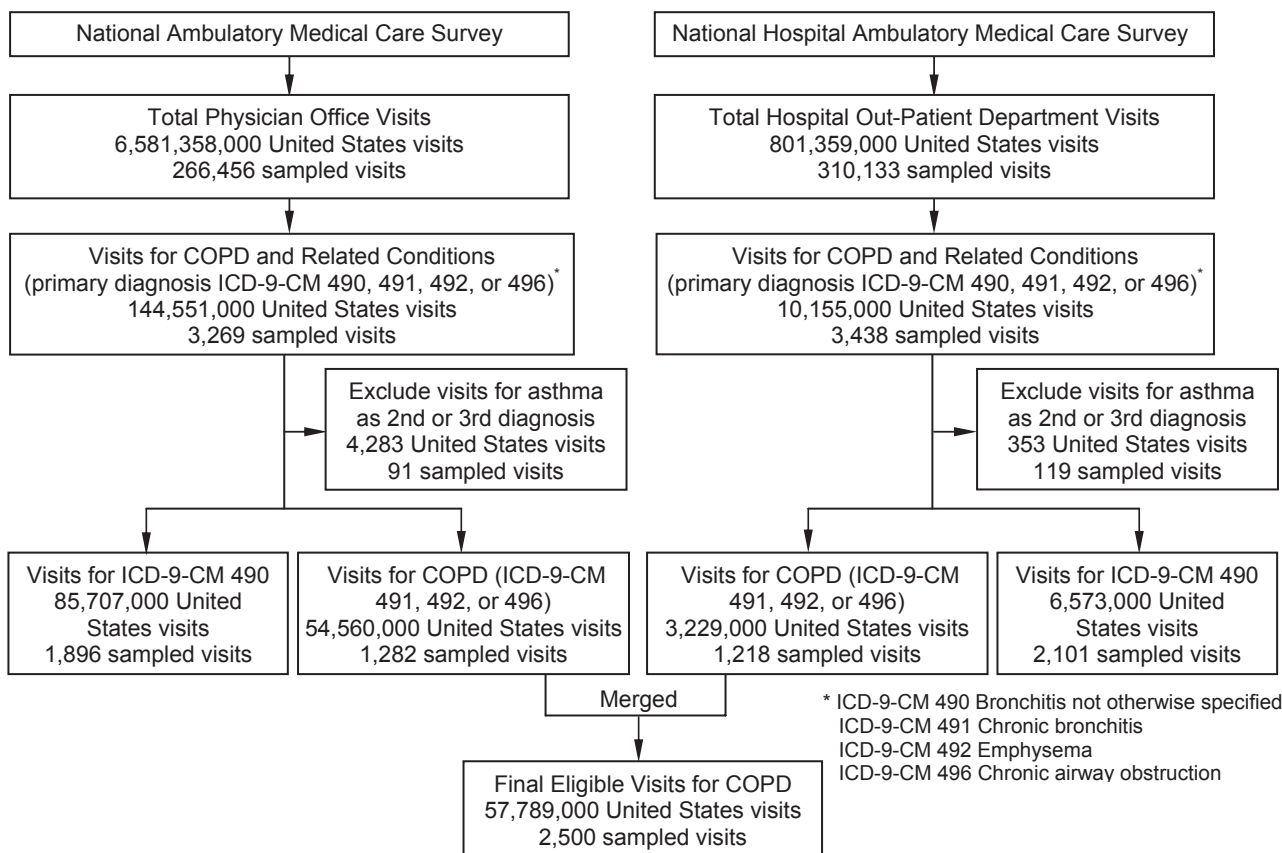


Fig. 1. Ambulatory care visits for chronic obstructive pulmonary disease (COPD) in 1995 through 2004. ICD-9-CM = International Classification of Diseases, 9th Revision, Clinical Modification.

secondary or tertiary diagnosis of asthma (ICD-9-CM 493) were excluded to minimize confounding, on the assumption that health-care-utilization may be markedly different between patients with asthma and those with COPD. Patients with asthma may require more episodic-type care, peaked by periodic exacerbations, whereas patients with COPD may have progressively worsening disease and a more stable pattern of disease management. A total of 2,500 COPD visits were identified from the over 45-million COPD visits in the United States in 1995 to 2004.

We stratified the data by sex, age, race, region, and comorbidities. The latter included evaluation of secondary and tertiary comorbidity diagnoses, such as hypertension (ICD-9-CM 401), heart failure (ICD-9-CM 428), diabetes mellitus (ICD-9-CM 250), other respiratory conditions (ICD-9-CM 786, symptoms that involve the respiratory system and other chest symptoms), and acute respiratory infections (ICD-9-CM 460–466: acute nasopharyngitis, acute sinusitis, acute pharyngitis, acute tonsillitis, acute pharyngitis and tracheitis, acute upper-respiratory infection, and acute bronchitis and nasopharyngitis).

We classified the prescribed drugs by therapeutic class, based on commonly prescribed COPD therapies: inhaled corticosteroids, oral corticosteroids, short-acting broncho-

dilators, long-acting bronchodilators, anticholinergics, methylxanthine, mucolytics and expectorants, and antibiotics.<sup>23-25</sup>

**Statistical Analysis**

The number of COPD visits and 95% confidence intervals were taken to represent the national numbers of United States visits, based on sample weights, and accounting for the multi-stage sample design and non-response of in-scope practitioners of the NAMCS and NHAMCS.

We stratified the data into 2-year intervals to obtain more reliable estimates of changes over the study period, given that national estimates were obtained from a relatively small number of visits in each year. The estimated number of COPD visits for each 2-year period represents the annualized mean number of COPD visits for that period. The difference in the number of COPD visits between men and women was determined via analysis of variance, and the trends of COPD visits were analyzed with the Cochran-Armitage trend test.<sup>26</sup> The trend lines were plotted with the 5-point moving average, which removed most of the short-term fluctuation and made it possible to see the long-term trend of the COPD visits.<sup>27</sup>

The analyses were carried out with statistics software (SAS, SAS Institute, Cary, North Carolina, and Suddan, RTI International, Research Triangle Park, North Carolina).<sup>28,29</sup> Estimates of standard errors were made via Taylor series approximation (computed with Suddan), taking into account the complex sampling design.<sup>30</sup>

## Results

### Trends in COPD Visits by Sex

Table 1 shows the demographics of the sample. Overall, the estimated total number of visits for all causes, as well as visits for COPD and related conditions, had an increasing trend.

The number of COPD visits increased, and the increase was significantly larger among women. Overall, the estimated total number of COPD visits and visits for all causes had an increasing trend, and the increase was significantly larger among women. In terms of COPD visits per year, more visits were made by men until 2000, followed by a sharp increase in the number of visits by women, which led to a higher number of visits by women than men.

From 1995 to 2004, COPD visits by women increased 54% (from 2.2 million to 3.3 million), while visits by men increased 1% (from 3.0 million to 3.1 million). Nonetheless, in 2003-2004, COPD visits still accounted for a larger proportion of the total out-patient visits by men (0.8%) than by women (0.6%).

The average age of patients who made COPD visits did not change during the study period; about two thirds of the patients were  $\geq 65$  years old. The COPD visits were predominantly made by white patients. Over 60% of the patients had comorbidities at the time of the visit, and the proportion of comorbidities was significantly different between women and men ( $P < .001$ ). The most common comorbidity was hypertension (in 10–16% of the women and 7–13% of the men).

Figure 2 illustrates the yearly trends in the number of COPD visits. COPD visits gradually increased. COPD visits by women were fewer than those by men until 2001, after which that trend was reversed for the remainder of the study years.

### COPD Medication Prescriptions

Table 2 shows the COPD medications prescription data. The proportion of visits with COPD medication prescriptions was consistently higher in visits by women than in visits by men.

The frequency of COPD medications prescribed to women decreased overall by 7% (from 73% to 67%) during the study period. The average number of COPD medications prescribed per visit decreased for both women

(from 1.8 to 1.3) and men (1.6 to 1.4), and the trends were significantly different between men and women ( $P < .001$ ).

Figure 3 shows the COPD medications prescribed. Overall, oral corticosteroids and short-acting  $\beta$  agonists were the most frequently prescribed. Oral corticosteroids prescriptions steadily decreased in men. Antibiotics are commonly used with oral corticosteroid to treat COPD exacerbation. Prescriptions for antibiotics at ambulatory visits was constant for women but decreased for men.

Inhaled corticosteroids were less commonly prescribed than oral corticosteroids. Long-acting  $\beta$  agonists were seldom prescribed at COPD visits. Prescription of methylxanthines decreased in visits by women and men, whereas prescription of anticholinergics increased continuously in the recent years.

## Discussion

This analysis of NAMCS and NHAMCS data provides an update on the available data specific for COPD-related out-patient visits and prescriptions. Clearly, ambulatory COPD visits by both men and women are on the rise, and there was a marked increase in the number of visits by women in recent years. This trend is consistent with a study that found sex disparity in the prevalence of COPD.<sup>11</sup> Previous surveillance summaries from NAMCS and NHAMCS data of COPD-related trends from 1971 to 2000 found no consistent differences between men and women for physician-office and hospital out-patient department COPD visits, although rates of visits increasing by age were noted.<sup>13</sup> Our assessment further substantiates these findings for patients specifically diagnosed with chronic bronchitis, emphysema, or chronic airway obstruction. Note that patients who had diagnosis ICD-9-CM 490 were excluded from this analysis because of the diverse characterization of that diagnosis code, including for patients with acute, short-term respiratory conditions.

The higher risk of COPD in women may be attributable to sex differences in the prevalence of airway hyperresponsiveness, related to airway caliber.<sup>31,32</sup> Because women have smaller airways, COPD affects women differently than it affects men. Sex differences have also been found in the inflammatory processes, airway remodeling, destruction of lung parenchyma, and loss of lung elastic recoil in COPD,<sup>11</sup> so women may have greater susceptibility to severe, early-onset COPD<sup>32,33</sup> and may present with COPD symptoms different from those of men.<sup>10</sup> There are similar sex-related differences in the diagnosis of other diseases, such as cardiovascular disease and osteoarthritis.<sup>34-37</sup>

The increase in COPD visits by women may have several causes. Women seek health care more than men do for certain problems, including pain, gastrointestinal disorders, and mental health.<sup>38-41</sup> The increase may also be due to increased smoking among women, the greater adverse im-

Table 1. Demographics of COPD-Related Ambulatory Visits

	Ambulatory Visits												P (1995-1996 vs 2003-2004)
	1995-1996		1997-1998		1999-2000		2001-2002		2003-2004				
	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men			
Total ambulatory visits (n)	466,569,000	316,427,000	531,691,000	8,219,000	517,222,000	356,872,000	575,366,000	393,395,000	591,194,000	407,032,000	NA		
Visits for COPD and related conditions (n)*	7,244,000	7,936,000	7,982,000	8,219,000	6,297,000	5,582,000	9,409,000	6,666,000	8,497,000	7,203,000	< .001		
Visits for COPD only (n)†	2,154,000	3,046,000	2,636,000	2,983,000	2,037,000	2,077,000	3,890,000	3,686,000	3,316,000	3,069,000	< .001		
Rate of visits for COPD (%)	0.5	1.0	0.5	0.9	0.4	0.6	0.7	0.9	0.6	0.8	< .001		
Physician office visits (n)	2,012,000	2,882,000	2,507,000	2,847,000	1,854,000	1,831,000	3,768,000	3,526,000	3,175,000	2,880,000	< .001		
Hospital out-patient department visits (n)	143,000	164,000	129,000	137,000	184,000	246,000	122,000	160,000	141,000	189,000	< .001		
Age (mean ± SD y)	68.3 ± 12.3	67.3 ± 11.6	67.2 ± 12.6	67.8 ± 13.7	66.6 ± 14.4	68.3 ± 15.8	67.8 ± 16.2	66.2 ± 14.8	67.7 ± 13.6	68.7 ± 13.9	.64		
≤ 54 y	10.3	14.1	18.6	12.6	15.1	12.3	13.9	20.9	14.0	16.0	0.15		
55-64 y	21.5	22.2	14.9	20.7	21.0	15.7	19.0	15.0	19.8	15.4	< .001		
65-74 y	35.2	38.0	37.6	36.2	36.7	31.6	33.4	28.3	32.7	27.5	< .001		
≥ 75 y	33.0	25.8	29.0	30.6	27.2	40.5	33.8	35.4	33.6	41.2	.09		
Race (%)													
White	90.5	91.2	91.6	92.1	82.9	88.8	96.3	92.2	92.0	89.9	< .001		
Black/African American	8	4.7	6.3	7.8	14.0	8.2	2.6	5.7	7.7	4.9	.05		
Other	1.5	4.1	2.1	0.1	3.1	3.0	1.1	2.1	0.3	5.2	< .001		
Region (%)													
Northeast	17.9	22.5	17.0	18.1	25.2	26.1	25.7	24.0	15.7	21.5	< .001		
Midwest	32.9	33.3	17.6	26.6	20.4	27.9	20.2	22.5	36.6	38.5	< .001		
South	25.7	20.4	40.5	36.1	30.7	20.3	43.0	38.5	30.2	21.8	< .001		
West	23.6	23.8	24.9	19.2	23.7	25.6	11.1	15.0	17.6	18.1	.007		
Comorbidities (%)	67.5	62.6	56.7	66.5	71.0	75.4	69.1	59.8	70.3	65.8	< .001		
Hypertension	14.1	12.7	9.5	7.7	16.4	10.0	11.5	7.3	11.0	10.0	< .001		
Heart failure	4.9	9.7	2.4	8.8	3.0	5.6	11.2	6.2	3.8	1.3	< .001		
Diabetes mellitus	5.1	5.1	8.3	12.3	3.4	4.0	5.7	2.5	8.5	2.2	< .001		
Other respiratory disease‡	3.9	3.4	0.8	1.2	7.5	6.4	2.4	6.2	7.3	6.3	< .001		

\* COPD and related conditions means a primary diagnosis of ICD-9-CM 490 (unspecified bronchitis), ICD-9-CM 491 (chronic bronchitis), ICD-9-CM 492 (emphysema), and/or ICD-9-CM 496 (chronic airway obstruction).  
 † COPD only means a primary diagnosis of ICD-9-CM 491, 492, 496.  
 ‡ Other respiratory diseases means a primary diagnosis of ICD-9-CM 786 (symptoms involving respiratory system or other chest symptoms) and ICD-9-CM 460-466 (acute respiratory infections).  
 NA = not applicable  
 COPD = chronic obstructive pulmonary disease  
 ICD-9-CM = International Classification of Diseases, 9th Revision, Clinical Modification



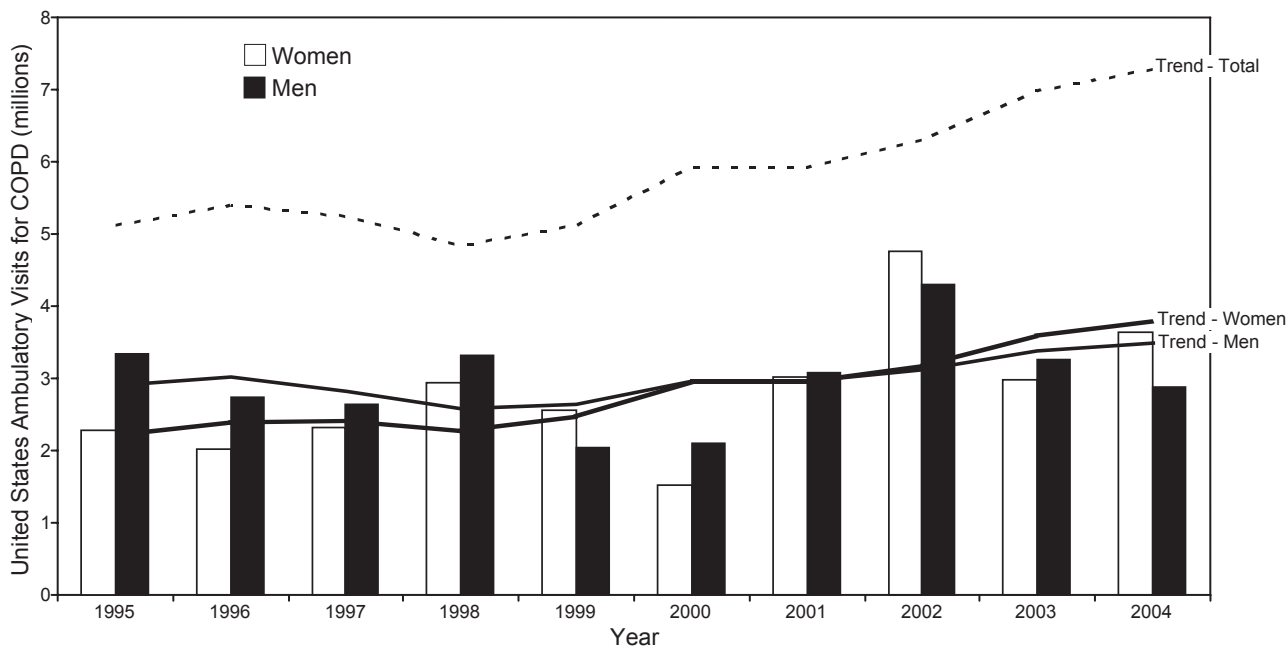


Fig. 2. Trends in ambulatory care visits for chronic obstructive pulmonary disease (COPD), by sex.

fact of smoking on lung function in women than in men,<sup>42,43</sup> and/or the fact that in the United States women live longer, on average, than men do. COPD-related deaths among women increased so that, by 2000, COPD deaths among women surpassed those among men, and women with severe COPD using long-term oxygen therapy have a greater risk of death than men do.<sup>13,44</sup>

Our study results may indicate changes in the traditional view that primary-care physicians, who are the principal providers for many patients with COPD, may harbor a lingering bias that COPD is a “male disease.”<sup>10,45</sup> However, underdiagnosis of COPD in women may also be partly due to physicians’ reluctance to use spirometry.<sup>10,12,46</sup>

Bronchodilators are currently recommended as essential therapy for COPD symptom management.<sup>23,47</sup> Bronchodilators commonly used for COPD include short-acting and long-acting  $\beta$  agonists, anticholinergics, and methylxanthines. In general, our study found that oral corticosteroids and short-acting  $\beta$  agonists were the most commonly prescribed COPD medications in out-patient visits. According to current guidelines, short-acting  $\beta$  agonists are generally prescribed for as-needed relief of acute symptoms. The greater prescription of short-acting  $\beta$  agonists in our study may indicate a preference for a drug that gives symptom-relief rather than for long-acting  $\beta$  agonists and anticholinergics, which are associated with more treatment benefits, including reduced symptoms, better health status, fewer exacerbations, and less use of rescue medications (eg, short-acting  $\beta$  agonist).<sup>23</sup>

Use of oral steroids in recent years decreased in men but stayed constant in women. As both oral steroids and an-

tibiotics are usually used for COPD exacerbation, that usage pattern may reflect patients seeking treatment for exacerbations. One study found that women with COPD had more exacerbations and worse quality of life than did men, although the women in that study were younger, had smoked less, and had fewer comorbidities.<sup>48</sup> It may be that women perceive COPD symptoms and a given degree of obstruction differently.

Although NAMCS and NHAMCS use sophisticated sampling techniques and collect detailed information to create nationally representative data, our study has several limitations associated with the data. We could not follow individual patients over time, because NAMCS and NHAMCS do not capture longitudinal data on individual patients; rather, both NAMCS and NHAMCS capture visit data in a way that may overrepresent frequent users of care. The number of physicians who participated in the surveys varied year to year, which could result in selection bias and contribute to sampling error. Moreover, random variations in the relatively small sample size could cause large perceived differences. To reduce this risk of sampling error we combined study years into 2-year periods. The NAMCS and NHAMCS survey prescription-writing, but patient adherence to therapy cannot be assumed, and patient and pharmacy records were not audited to confirm that prescriptions were filled. In addition, by relying solely on the physicians’ reported diagnosis of COPD, this study may overlook patients with mild COPD, because objective lung-function measurements to diagnose COPD might be performed infrequently.<sup>5</sup> To our knowledge, our study is the first on sex differences in COPD visits, and the sen-

Table 2. Prescriptions for COPD Medications at COPD Visits

	Ambulatory Visits												<i>P</i> (1995-1996 vs 2003-2004)
	1995-1996		1997-1998		1999-2000		2001-2002		2003-2004		<i>P</i>		
	Women ( <i>n</i> = 2,154,000)	Men ( <i>n</i> = 3,046,000)	Women ( <i>n</i> = 2,636,000)	Men ( <i>n</i> = 2,983,000)	Women ( <i>n</i> = 2,037,000)	Men ( <i>n</i> = 2,077,000)	Women ( <i>n</i> = 3,890,000)	Men ( <i>n</i> = 3,686,000)	Women ( <i>n</i> = 3,316,000)	Men ( <i>n</i> = 3,069,000)			
Visits without COPD prescriptions (%)	26.8	36.0	28.4	33.0	33.7	42.1	32.3	30.7	33.3	36.8	< .001		
Visits with COPD prescriptions (%)	73.2	64.0	71.6	67.0	66.3	57.9	67.8	69.3	66.7	63.2	< .001		
Number of COPD prescriptions (mean ± SD)	1.8 ± 1.5	1.6 ± 1.7	1.7 ± 1.6	1.2 ± 1.5	1.5 ± 1.6	1.2 ± 1.3	1.4 ± 1.4	1.5 ± 1.5	1.3 ± 1.2	1.4 ± 1.4	.21		
<i>P</i> (number of medications prescribed to women vs men)		.015		.028		.038		.006		.010			
Number of Medications (%)													
1	23.0	19.0	20.8	24.7	28.6	20.0	19.8	20.1	24.4	20.93	.38		
2	15.9	14.7	15.7	16.7	13.8	20.6	20.9	21.8	22.4	21.27	< .001		
3	18.4	12.9	19.8	12.8	10.7	9.4	14.7	11.0	16.5	9.87	< .001		
≥ 4	16.0	17.5	15.4	12.9	13.2	8.1	12.4	16.4	3.5	11.18	.002		

COPD = chronic obstructive pulmonary disease

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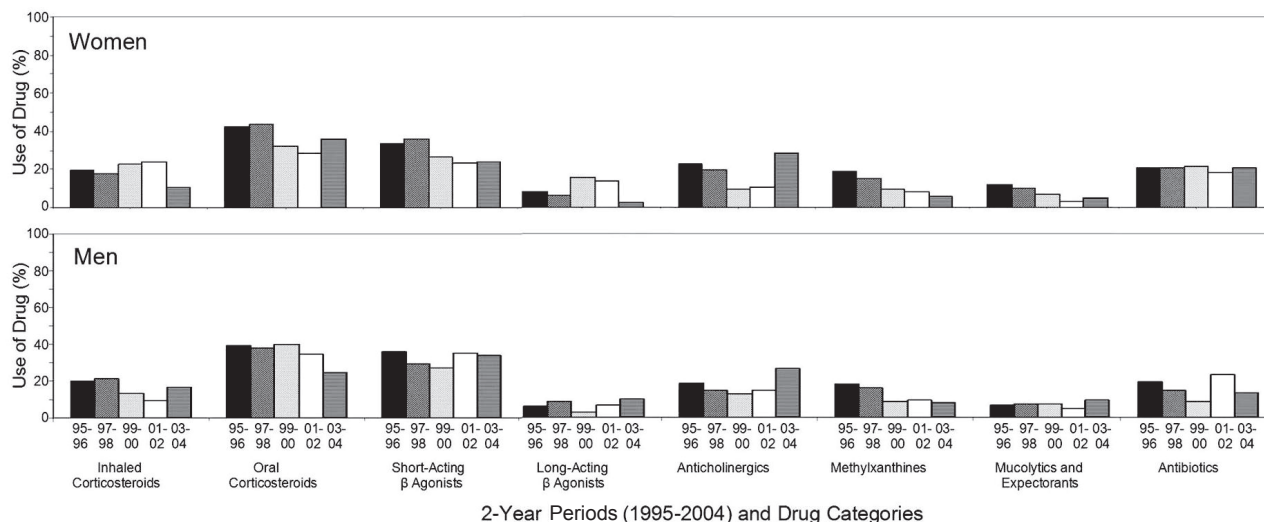


Fig. 3. Medications prescribed for treatment of chronic obstructive pulmonary disease (COPD), by drug category, 2-year period, and sex.

sitivity of the data for detecting COPD visits has not been established.

Nonetheless, our findings indicate that it is important to draw the attention of providers and policy makers to the increasing frequency of COPD among women in the outpatient setting and to highlight 2 questions: Are women being diagnosed accurately? Are women being managed well with respect to the changing demographics of COPD presentation?

Increased awareness among providers that women are presenting more commonly with COPD-type symptoms will help ameliorate the negative consequences of COPD in women.<sup>49</sup> It remains uncertain if biological or behavioral influences were responsible for the recent shift in demographics and COPD management, so a multidisciplinary team approach is recommended to improve the awareness and management of COPD.<sup>46</sup>

### Conclusions

COPD visits have increased in both women and men, and women are now more likely than men to make outpatient visits for COPD. There are sex-related differences in susceptibility to and severity of COPD, and in response to its management.<sup>11</sup> Providers should be aware that COPD in women is an increasing health problem that requires adequate diagnosis and treatment to avoid additional complications. The impact of COPD in women is understudied and warrants further examination.

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