Obstructive Lung Disease Among the Urban Homeless*

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**Study objectives:** Homelessness is a growing problem in the United States that may significantly impair physical health. The homeless have a high prevalence of cigarette smoking, poor nutrition, and adverse environmental exposures, which could contribute to obstructive lung disease (OLD). Despite this risk, the prevalence of OLD among the homeless remains unknown. We aimed to systematically assess the prevalence of OLD among the urban homeless.

**Design, setting, and participants:** We conducted a cross-sectional study of the prevalence of OLD among homeless individuals in San Francisco. By random sampling, we recruited 68 adults living in one homeless shelter to participate in a structured interview survey and spirometry assessment. We used a multifaceted approach to assess OLD, including respiratory symptoms, self-reported physician diagnosis of asthma, chronic bronchitis, emphysema, or COPD, and spirometry (defined as FEV₁ < 80% predicted and FEV₁/FVC ratio < 0.70).

**Results:** Sixty-eight adults completed the survey, and 67 adults completed the spirometry. Homeless adults were likely to be homeless < 1 year and homeless for the first time. There was a high prevalence of cigarette smoking (75% ever smokers, 68% current smokers). The prevalence of symptoms suggestive of OLD was high, including cough (29%), wheezing (40%), chronic bronchitis symptoms (21%), and dyspnea on exertion (29%). A substantial proportion of homeless subjects indicated a prior diagnosis of asthma (24%), chronic bronchitis (19%), and COPD (4%). Based on spirometry, the prevalence of OLD was 15% (95% confidence interval, 8 to 26%), which was more than double the expected prevalence in the general US population.

**Conclusions:** As OLD is a leading cause of death in the United States, it is important to identify it early for treatment. Homeless individuals have a higher-than-expected prevalence of OLD. Public health interventions should target the homeless population for prevention and treatment of OLD.

*CHEST 2004; 125:1719–1725*

**Key words:** homeless persons; pulmonary disease, chronic obstructive

**Abbreviations:** CI = confidence interval; NHANES = National Health and Nutrition Examination Survey; OLD = obstructive lung disease

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Homeless individuals represent a growing proportion of the US population. The challenges of living on the street, in a shelter, or in a transitional housing facility are unique and may significantly impair health.1–4 Homeless have significant rates of smoking,2,5–7 substance abuse,2,4,8–10 and mental illness,9,10 all of which can negatively affect physical health and impede access to care. In fact, the homeless do appear to have poorer perceived health.2,7,10,11 The prevalence and severity of physical disease among the homeless may be caused by or exacerbated by poor environmental conditions, poor nutritional status, and barriers to health care.9,12–15

The homeless may be at higher risk of obstructive lung disease (OLD), which is a leading cause of death and disability in the United States.16 Self-reported OLD, including asthma, chronic bronchitis, and emphysema, is higher among the homeless compared to the housed population.3,7 Cigarette smoking, a major cause of OLD, also appears to be common among the homeless.2,5,6 Although respiratory infections are a common reason for the homeless to seek medical attention,3,6,7,17–21 the occurrence of symptoms specific to OLD, including cough, wheezing, and phlegm production, has not been well documented in this group. The actual prevalence of OLD among the homeless, based on pulmonary function measurement, remains un-
known. To examine this problem, we evaluated the prevalence of OLD in a random sample of homeless adults living in San Francisco.

Materials and Methods

Overview

We conducted a cross-sectional examination of the prevalence of OLD in a random sample of homeless individuals in San Francisco. This was a field study with direct personal interviews and spirometry conducted with homeless individuals.

Study Participants and Recruitment

We recruited a random sample of homeless adults aged ≥ 35 years to participate. We used the Stewart B. McKinney Homeless Assistance Act of 1987 definition to determine those who were currently homeless. As all subjects were current residents of one homeless shelter in San Francisco in October 2002, they were homeless by the McKinney definition. The shelter houses approximately 380 individuals in beds each night (42 women and 338 men). Because of the small number of female residents, all female subjects meeting the criteria were eligible to participate in the study. Male subjects were randomly selected by shelter bed number to participate in the survey. For both sexes, shelter residents were ineligible if they were receiving medical treatment for active tuberculosis or an active pulmonary infection (fevers, chills, new or changed productive cough), were unable to complete survey (due to language barrier or poor mental status), or had chest or abdominal surgery in last 3 weeks. Written or verbal consent was obtained from all participants. The study was approved by the University of California, San Francisco Committee on Human Research.

Of the female residents, 40 subjects were asked to participate over 2 nights of data collection. Of these, 3 subjects were ineligible, 11 subjects declined to participate, 25 subjects completed both the survey and the spirometry session, and 1 subject completed only the survey and declined the spirometry session. We randomly selected 130 male residents to participate in the study over 4 nights of data collection. Of these persons, 29 subjects were ineligible, 59 subjects declined to participate, and 42 subjects completed the survey and spirometry session. The participation rate was 65% for women and 42% for men.

Interview Content

Each participant underwent a structured in-person interview with a trained survey interviewer. The survey collected sociodemographic data, including circumstances of being homeless. Participants were asked how long they had been homeless, the number of times they had been homeless, and their proportion of nights in the previous month on the streets, in a shelter, in a single-room occupancy hotel, in an abandoned building, in a car, with friends, or with family. These questions were based on National Survey of Homeless Providers and Clients structured questions on homelessness. We defined the period of being homeless as the time since they last had a place of their own or shared with someone else in a house or apartment where they could stay for ≥ 30, a definition used by the RAND Course of Homelessness Study.

Self-reported general health status was assessed using a question developed for the National Health Interview Survey and used in the Medical Outcomes Study Short Form-36, the most widely used generic health status measure. Respiratory symptoms in the past 12 months were evaluated by questions used in the National Health and Nutrition Examination Survey (NHANES) III: do you usually cough on most days for 3 consecutive months or more during the year, do you bring up phlegm or sputum or mucus on most days for 3 consecutive months or more during the year, have you had wheezing or whistling in your chest, and have you had any times when you had to stop for breath when walking about 100 yards or a few minutes on level ground? Based on these responses, we defined chronic bronchitis as affirmative responses to the cough and phlegm items. They were also asked if they had been told by a health-care professional that they had emphysema, chronic bronchitis, asthma, COPD, or any other lung problem. Other items from NHANES III were used to ascertain ambulatory medical visits and medications received for wheezing and dyspnea during the past 12 months. Finally, past and current use of cigarettes, cigars, and tobacco pipes was evaluated using questions from the National Health Interview Survey.

Spirometry

The spirometry session was conducted with the primary investigator, who was blinded to the survey responses. The procedure for the spirometry followed the American Thoracic Society guidelines for spirometry assessment. Each subject’s age, gender, height, weight, and race were recorded. In a seated position with a nose clip in place, the subject performed a forced exhalation with a handheld spirometer (EasyOne model 2001 Frontline; ndd Medical Technologies; Chelmsford, MA). Up to six attempts were allowed to obtain an adequate measurement. The same spirometer was used for all participants. This spirometer is in compliance with the American Thoracic Society guidelines.

We used established prediction equations for predicted FEV1 and FVC developed from NHANES III data. We defined low FEV1 and FVC as < 80% predicted. We used the Global Initiative for Chronic Obstructive Lung Disease definition to classify subjects as having OLD: FEV1/FVC ratio < 70%.

Statistical Analysis

Data were analyzed using statistical software (SAS Version 8.1; SAS Institute; Cary, NC). We used a multifaceted approach to define the prevalence of OLD among homeless adults based on symptoms, diagnosis, and pulmonary function. We calculated the prevalence of chronic respiratory symptoms, self-reported physician-diagnosed OLD, and OLD based on the Global Initiative for Chronic Obstructive Lung Disease spirometric definition. The 95% confidence intervals (CIs) were calculated using the binomial distribution.

Because approximately half the sample was comprised of African-Americans, we used the χ2 test to evaluate the impact of African-American race on the prevalence of chronic respiratory symptoms, self-reported physician-diagnosed OLD, pulmonary function impairment, and OLD based on pulmonary function. In addition, we present the pulmonary function results, including the prevalence of OLD, stratified by African-American race and other race/ethnicity.

We compared the prevalence of OLD among homeless adults to the prevalence expected in members of the general population. Using NHANES III data restricted to the age range of our homeless sample, we developed a multivariate logistic regression model that estimated the expected prevalence of OLD, based on age, gender, race, smoking history, and history of asthma. We then substituted the mean values of these characteristics for
homeless adults into the regression equation to calculate the expected prevalence of OLD for a comparable general population sample. The observed prevalence of OLD among the homeless was then compared to the expected prevalence.

**Results**

Sociodemographic variables were different for the homeless subjects compared to the general population of San Francisco (Table 1). Subjects ranged in age from 35 to 73 years, with mean age of 46.5 years and a slight male predominance (62%). Compared to the San Francisco general population, minorities were overrepresented. African-Americans represented 50% of the total, white represented 16%, and Latino represented 12%. Use of cigarettes, tobacco pipes, and cigars was common among the homeless group. The majority (75%) of homeless adults reported ever smoking cigarettes (at least 100 cigarettes in their lifetime) with 68% percent (46 subjects) indicating current cigarette smoking. This is in contrast to the general population, with 23.3% current smokers in 2000. The mean duration of smoking was 16 years, with an average of 12 cigarettes per day.

The duration of the current period of homelessness was a mean of 42 months (SD 82) with 47% homeless < 1 year, 35% homeless 1 to 5 years, and 18% homeless > 5 years (Table 2). Almost one half had never been homeless before (28 subjects; 42%), one fourth had been homeless once before (18 subjects; 26%), one fourth had been homeless two to five times before (15 subjects; 22%), and the minority had been homeless more than five times before (6 subjects; 9%). Not considering the current night, the majority had spent some part of the last 30 days in a shelter (86%), followed by staying outside on the streets, in a car, or an abandoned business (40%), and in a single-occupancy hotel (22%).

Self-reported general health was often impaired among the homeless adults. A high proportion of homeless participants reported “fair” or “poor” general health (23 subjects; 33%). More women indicated “fair” or “poor” health compared to men (66% vs 17%).

The prevalence of chronic respiratory symptoms, as one indicator of OLD, was high among the homeless subjects (Table 3). A substantial proportion indicated symptoms of cough (20 subjects; 29%) and chronic bronchitis (14 subjects, 21%). Nearly half of the subjects reported wheezing during the past 12 months (27 subjects; 40%). Approximately one third of subjects reported dyspnea on exertion (20 subjects; 29%). There was no impact of African-American race on the prevalence of chronic respiratory symptoms, compared to homeless adults of other race/ethnicity (p > 0.20 in all cases).

Homeless adults had a high prevalence of a self-

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**Table 1—Sociodemographic Characteristics of 68 Homeless Adults**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Homeless</th>
<th>San Francisco</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yr</td>
<td></td>
<td>(n = 776,733)</td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>46.5 (7.87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>35–73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male gender</td>
<td>42 (62)</td>
<td>394,828 (51)</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American</td>
<td>34 (50)</td>
<td>60,515 (7.8)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>11 (16)</td>
<td>395,728 (50)</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>8 (12)</td>
<td>109,504 (14)</td>
<td></td>
</tr>
<tr>
<td>Native American</td>
<td>4 (6)</td>
<td>3,458 (0.4)</td>
<td></td>
</tr>
<tr>
<td>African-American and Latino</td>
<td>3 (4)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>3 (4)</td>
<td>243,409 (31)</td>
<td></td>
</tr>
<tr>
<td>Caribbean</td>
<td>2 (3)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>3 (4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking history</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigarettes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever smokedfx</td>
<td>51 (75)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>46 (68)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Former smoker</td>
<td>5 (7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pipes, tobacco</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever smokedy</td>
<td>9 (13)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cigars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ever smokedz</td>
<td>21 (32)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Data are presented as No. (%) unless otherwise indicated. NA = not applicable.
†Based on 2000 census.
‡Considered a cigarette smoker if smoked at least 100 cigarettes in their life, considered tobacco pipe smoker if smoked at least 20 pipes in their life, and considered a cigar smoker if smoked at least 20 cigars in their life.

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**Table 2—Recent Homeless History Among 68 Homeless Adults**

<table>
<thead>
<tr>
<th>Homeless Characteristics</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently homeless</td>
<td></td>
</tr>
<tr>
<td>&lt; 12 mo</td>
<td>32 (47)</td>
</tr>
<tr>
<td>1–5 yr</td>
<td>24 (35)</td>
</tr>
<tr>
<td>&gt; 5 yr</td>
<td>12 (18)</td>
</tr>
<tr>
<td>No. of times previously homeless in last 5 yr*</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>28 (41)</td>
</tr>
<tr>
<td>1</td>
<td>18 (26)</td>
</tr>
<tr>
<td>2–5</td>
<td>15 (22)</td>
</tr>
<tr>
<td>&gt; 5</td>
<td>6 (9)</td>
</tr>
<tr>
<td>In previous 30 d, subjects reporting any nights spent in:</td>
<td></td>
</tr>
<tr>
<td>A shelter (besides current night of interview)</td>
<td>59 (89)</td>
</tr>
<tr>
<td>On the street, in a car, or at an abandoned place of business</td>
<td>27 (40)</td>
</tr>
<tr>
<td>A single-occupancy hotel</td>
<td>15 (22)</td>
</tr>
<tr>
<td>With family or friends</td>
<td>4 (5.9)</td>
</tr>
<tr>
<td>Prison</td>
<td>1 (1.5)</td>
</tr>
<tr>
<td>At their own place</td>
<td>2 (2.9)</td>
</tr>
<tr>
<td>A hospital or drug treatment program</td>
<td>2 (2.9)</td>
</tr>
</tbody>
</table>

*Time since last had a place of their own or shared with someone else in a house or apartment where they could stay for ≥ 30 days.
The prevalence of impairment among 67 homeless adults revealed a high prevalence of impairment (Table 3). A substantial proportion of homeless subjects indicated a prior diagnosis of asthma (16 subjects; 24%). Fewer subjects reported chronic bronchitis (19%; 13 subjects) and chronic obstructive lung disease (4%; 3 subjects). One subject reported a past diagnosis of emphysema. Compared to homeless of other race/ethnicity, there was no impact of African-American race on the risk of any reported OLD diagnosis (p > 0.10 in all cases).

Pulmonary function measurement among 67 homeless adults revealed a high prevalence of impairment (Table 4). The mean FEV$_1$ was 2.80 L/s (SD 0.79), which was 85% predicted for the sample. However, the FEV$_1$ range included some very low values (0.87 to 4.41 L/s), and 37% of the homeless subjects had a low FEV$_1$ (< 80% predicted). The mean FVC was 3.74 L (SD 1.05), which was 91% predicted. The range of FVC also included some very low values (1.51 to 5.82 L), with 30% of homeless subjects having an FVC < 80% predicted. Mean FEV$_1$/FVC ratio was 0.76 (SD 0.10), with 24% of subjects having a ratio < 0.70.

We defined OLD as FEV$_1$ < 80% predicted and an FEV$_1$/FVC < 0.7. In our sample, the prevalence of OLD by spirometry was 15% (95% CI, 8 to 26%). Based on our predictive regression model, the expected OLD prevalence in a comparable general population sample was 7.2%. Consequently, the prevalence of OLD among homeless adults is more than double that expected in the general population. The prevalence of OLD was similar among male and female homeless adults (17% vs 12%; p = 0.61) [Table 5]. Cigarette smoking was associated with threefold increase in the prevalence of OLD (18% vs 6%).

In additional analyses, we examined the impact of African-American race on the risk of pulmonary function impairment among homeless adults (Table 4). Compared to subjects of other race/ethnicity, there was no statistical difference in the prevalence of impaired FEV$_1$ (32% vs 42%, p = 0.39), FVC (26% vs 33%, p = 0.54), or FEV$_1$/FVC ratio (24% vs 18%, p = 0.22) among the African-American homeless. There was also no statistical difference in the prevalence of OLD among African-American homeless vs those of other backgrounds (9% vs 21%, p = 0.15). Although the risk of OLD appeared lower among African-American homeless, the CI was wide and did not exclude no difference (odds ratio, 0.4; 95% CI, 0.08 to 1.5).

Table 3—Prevalence of OLD Among 68 Homeless Adults: Respiratory Symptoms and Respiratory Conditions

<table>
<thead>
<tr>
<th>Respiratory Symptom or Diagnosis</th>
<th>No. (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic respiratory symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic cough</td>
<td>20 (29)</td>
<td>19–42</td>
</tr>
<tr>
<td>Chronic bronchitis symptoms*</td>
<td>14 (21)</td>
<td>12–32</td>
</tr>
<tr>
<td>Wheezing</td>
<td>27 (40)</td>
<td>28–52</td>
</tr>
<tr>
<td>Current dyspnea</td>
<td>20 (29)</td>
<td>19–42</td>
</tr>
<tr>
<td>Respiratory conditions†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asthma</td>
<td>16 (24)</td>
<td>14–35</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>13 (19)</td>
<td>11–30</td>
</tr>
<tr>
<td>COPD</td>
<td>3 (4)</td>
<td>0.92–12</td>
</tr>
<tr>
<td>Emphysema</td>
<td>1 (1)</td>
<td>0–7.9</td>
</tr>
</tbody>
</table>

*Cough and phlegm for 3 consecutive months.
†Self-reported physician diagnosis of the condition.

Table 4—Pulmonary Function Measurement Among 67 Homeless Adults

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean (SD)</th>
<th>Range</th>
<th>Percentage Predicted</th>
<th>Prevalence of Impairment*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mean</td>
<td>Range</td>
</tr>
<tr>
<td>Entire group (n = 67)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV$_1$</td>
<td>2.80 (0.79)</td>
<td>0.87–4.41</td>
<td>85 (19)</td>
<td>34–146</td>
</tr>
<tr>
<td>FVC</td>
<td>3.74 (1.05)</td>
<td>1.51–5.82</td>
<td>91 (20)</td>
<td>48–147</td>
</tr>
<tr>
<td>FEV$_1$/FVC</td>
<td>0.76 (0.10)</td>
<td>0.35–1.0</td>
<td>94 (13)</td>
<td>44–126</td>
</tr>
<tr>
<td>OLD†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African-American subjects (n = 34)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV$_1$</td>
<td>2.68 (0.68)</td>
<td>1.35–4.41</td>
<td>90 (18)</td>
<td>63–146</td>
</tr>
<tr>
<td>FVC</td>
<td>3.33 (0.97)</td>
<td>1.51–5.27</td>
<td>96 (22)</td>
<td>58–147</td>
</tr>
<tr>
<td>FEV$_1$/FVC</td>
<td>0.77 (0.09)</td>
<td>0.59–1.0</td>
<td>95 (12)</td>
<td>73–126</td>
</tr>
<tr>
<td>OLD†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other race/ethnicity (n = 33)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEV$_1$</td>
<td>2.92 (0.88)</td>
<td>0.87–4.23</td>
<td>81 (19)</td>
<td>34–118</td>
</tr>
<tr>
<td>FVC</td>
<td>3.96 (1.11)</td>
<td>2.01–5.82</td>
<td>87 (18)</td>
<td>48–119</td>
</tr>
<tr>
<td>FEV$_1$/FVC</td>
<td>0.74 (0.11)</td>
<td>0.35–0.99</td>
<td>93 (13)</td>
<td>44–126</td>
</tr>
<tr>
<td>OLD†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Impaired value of FEV$_1$ and FVC defined as < 80% predicted; impaired value of FEV$_1$/FVC is a ratio < 0.70.
†Defined as FEV$_1$ < 80% predicted and FEV$_1$/FVC ratio < 0.70.
Despite the high prevalence of OLD among the homeless, few subjects received regular medical care for their respiratory condition. Among the 22 subjects who reported a physician diagnosis of asthma, chronic bronchitis, emphysema, or COPD, only 11 subjects (50%) indicated that they had at least one ambulatory medical visit for wheezing or dyspnea during the past 12 months. Similarly, a small proportion of homeless adults with OLD, as defined by spirometry, had an outpatient medical visit for respiratory symptoms (n = 10; 30%). Perhaps reflecting the low utilization of ambulatory medical care, the majority (60%) of homeless persons with OLD did not report a physician diagnosis of an airway disease (ie, asthma, chronic bronchitis, emphysema, or COPD). Moreover, only a small proportion of homeless with a self-reported diagnosis of airway disease or OLD (by spirometry) reported treatment with a respiratory medication during the past year (50% and 20%, respectively).

**Discussion**

The burden of OLD in the United States is substantial, including disability, mortality, and economic costs. As one of the leading causes of death in the United States, OLD has been underreported and undertreated. Previous studies established that patients with OLD have a higher incidence of morbidity with respiratory infections, leading to higher health-care utilization. In a study of medical conditions in the homeless, pulmonary disease, primarily OLD, conferred a higher risk of death. There has not, to our knowledge, been any previous objective assessment of OLD among the urban homeless using pulmonary function measurement. We found that the prevalence of OLD among homeless adults was more than double that expected in the general population.

The high prevalence of OLD among homeless adults could translate into a substantial burden of disease. In San Francisco, there are a large number of homeless persons, with estimates ranging from 6,000 to 18,000. A physical count by the mayor’s office in October 2002 documented 6,921 adults on the streets and in shelters (58% men, 23% women, 1.2% transgender, and 18% not identified). Because the local homeless population has a high proportion of African-American and Native-American minorities compared to the general San Francisco population, the burden of OLD appears to disproportionately affect minorities.

Respiratory symptoms suggestive of OLD in our homeless sample were common. While respiratory symptoms related to infections have been well documented in the homeless, few studies evaluated symptoms possibly related to OLD. One study compared to similar urban-housed male subjects found a higher rate of breathlessness in the homeless compared to the housed sample. Moreover, we found a high prevalence of self-reported OLD among the homeless, which was greater than that found in the general population of San Francisco County and the United States.

**Table 5—Prevalence of Impaired Pulmonary Function and OLD by Gender and Smoking Subgroups**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Male</th>
<th>Female</th>
<th>Never Smoked</th>
<th>Ever Smoked</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1 &lt; 80% predicted</td>
<td>14 (33)</td>
<td>11 (44)</td>
<td>7 (44)</td>
<td>18 (35)</td>
</tr>
<tr>
<td>FVC &lt; 80% predicted</td>
<td>10 (24)</td>
<td>10 (40)</td>
<td>7 (44)</td>
<td>13 (25)</td>
</tr>
<tr>
<td>FEV1/FVC ratio &lt; 0.70</td>
<td>12 (29)</td>
<td>4 (16)</td>
<td>3 (19)</td>
<td>13 (25)</td>
</tr>
<tr>
<td>OLD†</td>
<td>7 (17)</td>
<td>3 (12)</td>
<td>1 (6)</td>
<td>9 (18)</td>
</tr>
</tbody>
</table>

*Data are presented as No. (%).
†Defined as FEV1 < 80% predicted and FEV1/FVC ratio < 0.70.
is that homelessness may exacerbate and cause re-
crudescence of preexisting OLD. This could be due
to smoking, infections, general health, nutrition,
environmental stress, drug and alcohol abuse, or
poor access to care. Future prospective studies will
be necessary to further evaluate the causal relation
between homelessness and OLD.

This study has several limitations. First, homeles-
ness encompasses a broad range of people and
conditions; the characteristics of persons who live on
the streets are different from shelter residents or
those living with family or friends. Therefore, health
indicators, such as the prevalence of OLD, may vary
by specific homeless group. This study focuses on
one segment of the homeless population that may
not be applicable to all homeless individuals, espe-
cially in that shelter residents may have better health
or at least different degree of disease. However,
a large proportion, if not the majority, of
homeless people in the United States are staying in a
shelter at least part of the time. Shelter residents are
more likely to be homeless for the first time and
homeless for \( \leq 6 \) months. This has important health-
care consequences, as long-term homeless (\( > 5 \)
years) are less likely to report a site of care, and
unsheltered homeless are more likely to abuse alco-
hol or drugs. Our finding of higher OLD in the
shelter population raises the concern that the street
population may have even a higher prevalence of
OLD.

In addition, the high prevalence of African-American
homeless in our sample raises the possibility of con-
founding by race/ethnicity. For example, African-
American persons have, on average, smaller FEV<sub>1</sub>
and FVC values for a given height; they have a
smaller average trunk to leg ratio. Could this high
proportion of African-American subjects account for
the greater prevalence of OLD in our sample? Sev-
eral lines of evidence indicate that this is not the
case. First, we estimated the prevalence of impaired
lung function, including FEV<sub>1</sub>, using predicted val-
ues that take race/ethnicity, including African-American
race, into account. Second, we found that
African-American homeless had a similar prevalence
of chronic respiratory symptoms, self-reported phy-
sician diagnosis of chronic airway diseases, and pul-
monary function impairment compared to homeless
adults of other race/ethnicity. Third, we compared
the prevalence of OLD among homeless adults to
the expected prevalence in the general population,
taking race into account. Taken together, these
results indicate that the high prevalence of OLD
among the homeless was not explained by the over-
representation of African-American persons.

Other limitations of the study are related to the
sample selection. This study focused on one shelter
in San Francisco, and the findings may not be
applicable to rural homeless, or even other urban
areas in the United States. We relied on self-report
for sociodemographics, general health, respiratory
symptoms, respiratory diagnosis, and health-care uti-
лизation. A notable study strength is the use of
objective pulmonary function measurement to de-
fine OLD.

Health care is perceived as an important unmet
need for many homeless. Our study focused on one
important and possible unmet need among this
vulnerable segment of the population. In this study,
OLD symptoms, self-reported OLD diagnosis, and
spirometry confirm that OLD is a common health
problem among the urban homeless. Public health
interventions are needed that target the prevention
and treatment of OLD in this susceptible subpopu-
lation.

ACKNOWLEDGMENT: We thank Dr. Jacqueline Tulsky, Dr.
Sharad Jain, Douglas Jenny, the staff and residents at Multi-
Service Center South in San Francisco, and the project inter-
viewers: Marina Goldovsky, Jen Johnson, Sarah Kemble, Jong-
ing Lu, Michele Montandon, and Scott Young.

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