Chronic obstructive pulmonary disease mortality and risk factors were studied in a nationally representative sample of 169,871 Chinese men and women aged 40 years or older. Baseline data were collected in 1991 by using a standard protocol, and a follow-up evaluation was conducted in 1999–2000, with a response rate of 93.4%. Age-standardized mortality (per 100,000 person-years) was 179.9 for men and 141.3 for women. After adjustment for important covariables, the respective relative risks of chronic obstructive pulmonary disease–related mortality for baseline risk factors in men and women were 2.80 (95% confidence interval (CI): 2.64, 2.98) and 2.71 (95% CI: 2.53, 2.89) for each 10-year increase in age, 0.84 (95% CI: 0.74, 0.95) and 1.44 (95% CI: 1.07, 1.95) for alcohol consumption, 1.18 (95% CI: 1.04, 1.35) and 1.77 (95% CI: 1.45, 2.15) for ≥20 pack-years of smoking, 2.37 (95% CI: 1.91, 2.94) and 2.47 (95% CI: 1.66, 3.67) for non-high-school graduation, 1.57 (95% CI: 1.38, 1.79) and 1.35 (95% CI: 1.17, 1.56) for physical inactivity, 2.66 (95% CI: 2.34, 3.02) and 2.60 (95% CI: 2.25, 3.00) for underweight, 1.39 (95% CI: 1.23, 1.57) and 1.73 (95% CI: 1.50, 2.00) for living in northern China, and 2.14 (95% CI: 1.86, 2.46) and 1.79 (95% CI: 1.55, 2.07) for living in rural China. This study indicated that cigarette smoking, low educational level, physical inactivity, and underweight are important modifiable risk factors for chronic obstructive pulmonary disease–related mortality in China.
Data are scarce on the burden of COPD and related risk factors in the Chinese population (7–10). Several small, regional studies indicated that the prevalence of COPD varied from 5.4 percent to 9.4 percent in Chinese adults (7–9). Recently, a multiregion, cross-sectional study of COPD prevalence was conducted among 20,245 Chinese men and women aged 40 years or older and reported that the overall prevalence of COPD was 8.2 percent (12.4 percent in men and 5.1 percent in women) (9). However, no COPD mortality data from the Chinese population were available. Furthermore, the previous studies on risk factors for COPD were cross-sectional in design. The current study analyzed data from a large prospective cohort in a nationally representative sample of the general adult population of China to assess COPD-related mortality and to examine the risk factors associated with death from COPD.

**MATERIALS AND METHODS**

**Study population**

In 1991, a representative sample of the general Chinese population aged 15 years or older from all 30 provinces was selected by using a multistage, random, cluster-sampling design for the China National Hypertension Survey (11). In 1999, investigators from each province were requested to participate in conducting the China National Hypertension Survey Epidemiology Follow-up Study. Of the 30 provinces, 13 were not included in the follow-up study because study participants’ contact information was not available. However, the sampling process was conducted independently within each province, and the 17 provinces included in the follow-up study were evenly distributed in different geographic regions representing various economic and demographic conditions in China. Overall, 83,533 men and 86,338 women aged 40 years or older at their baseline examination were eligible to participate in the follow-up study. From this population, 158,666 (93.4 percent) study participants (or their proxies) were identified and were interviewed as part of the follow-up study. Participants included in the final analysis were not different from the overall study population in 1991 regarding their baseline characteristics.

**Baseline data collection**

During a single clinic visit, baseline data were collected by physicians and nurses trained in the use of standard methods, with stringent quality control (11). Data on demographic characteristics (age, gender, education, region, and urbanization), medical history (hypertension, coronary heart disease, and stroke), and lifestyle-related risk factors (cigarette smoking, alcohol consumption, and physical activity) were collected by trained staff using a standard questionnaire. Work-related physical activity was assessed because leisure-time physical activity was uncommon at that time. Work-related physical activity was classified on the basis of occupation into three levels: low (primarily desk work, retired, or disabled), medium (service sector, students, housewives, etc.), and high (farmers, miners, logging industry workers, herdsmen, and fishermen). Cigarette smoking was defined as having smoked at least one cigarette per day for 1 year or more. For those who reported tobacco use, one gram of tobacco was considered equivalent to one cigarette. For participants who reported past or current cigarette smoking, information on number of cigarettes smoked per day along with duration of cigarette smoking was also collected. Lifetime pack-years of smoking were calculated as number of packs of cigarettes (20 cigarettes per pack) per day multiplied by number of years of smoking. Data were also collected on type and amount of alcohol consumed during the previous year. Alcohol consumption was defined as drinking alcohol at least 12 times during the last year.

Three blood pressure readings were taken with a mercury sphygmomanometer according to standard protocol (12). The first and fifth Korotkoff sounds were recorded as systolic and diastolic blood pressures, respectively. Hypertension was defined as a mean systolic blood pressure greater than or equal to 140 mmHg, a mean diastolic blood pressure greater than or equal to 90 mmHg, or use of antihypertensive medication (13). Body weight and height were measured in light clothing without shoes according to standard protocol. Underweight was defined as a body mass index (weight in kilograms divided by the square of height in meters) of less than 18.5 (14).

**Follow-up data collection**

The follow-up examination, which was conducted between 1999 and 2000, included tracking study participants or their family members (if participants had died) to a current address, performing in-depth interviews in person to ascertain disease status and vital information, and obtaining hospital records and death certificates. All deaths identified during interviews with participants’ family members were verified by death certificates obtained from the local departments of public health or police. If a participant died while hospitalized, his or her hospital record, including medical history, findings on physical examination, laboratory findings, autopsy findings, and discharge diagnosis, was abstracted by trained staff using a standard form. Photocopies of selected sections of the participant’s inpatient record, discharge summary, electrocardiogram, spirometry, chest radiograph, and pathology reports were also obtained. If death occurred outside of the hospital, detailed information on medical history was obtained from a family member or health care provider. Participants’ previous hospital records were also obtained.

An endpoint assessment committee in each province used prespecified criteria to review all medical records as well as death certificates to determine the causes of each death. The COPD diagnostic criteria were consistent with World Health Organization/National Heart, Lung, and Blood Institute recommendations (15). A studywide endpoint assessment committee at the Chinese Academy of Medical Sciences in Beijing reviewed all death records and determined the final
underlying cause of death. Two committee members verified the cause of death independently of each other, and discrepancies were resolved by discussion with other committee members. COPD-related mortality was defined as an underlying cause of death listed as bronchitis (not specified or chronic, International Classification of Diseases, Ninth Revision (ICD-9) code 490 or 491); emphysema (ICD-9 code 492); asthma (ICD-9 code 493); chronic airway obstruction, not elsewhere classified (ICD-9 code 496); as well as cor pulmonale (ICD-9 code 416.9) with a documented history of COPD in medical records for this analysis.

This study was approved by the Tulane University Health Sciences Center Institutional Review Board and the Cardiovascular Institute and Fu Wai Hospital Ethics Committee. Written informed consent was obtained from all study participants at their follow-up visit.

**Statistical analysis**

Person-years of follow-up were calculated for each study participant from the date of the baseline examination to the date of the follow-up examination or date of death and were grouped according to gender and age in 10-year categories. Age-specific mortality was calculated for men and women in each age category. Age-standardized mortality was calculated by using the age-specific mortality and the age distribution of the Chinese population obtained from the 2000 census data. Age-standardized mortality was calculated separately for men and women, for residents of urban and rural areas, and for those living in northern and southern China.

Cox proportional hazards models were used to estimate the relative risk of death from COPD for possible baseline risk factors after adjusting for important covariates. To determine the effect of lifetime smoking on COPD-related mortality, we calculated the relative risk for those who had smoked for at least 20 pack-years compared with never smokers. Because COPD-related mortality was similar among participants who were normal weight, overweight, or obese but significantly increased among those who were underweight, the relative risk for being underweight was calculated.

Age, geographic region (north vs. south), and urbanization (urban vs. rural residence) were adjusted for in multivariate models. In the final multivariate model, age, alcohol consumption, smoking for at least 20 pack-years, hypertension, high school education, physical inactivity, underweight, geographic region, and urbanization were included simultaneously. A sensitivity analysis was conducted by excluding participants who died within the first 3 years of follow-up to reduce bias due to altering risk factors among patients with COPD at baseline. Methods to estimate variances that take into account sample clustering were used in Cox proportional hazards models (16). Statistical analyses were conducted with SAS software, version 9.1 (SAS Institute, Inc., Cary, North Carolina).

**RESULTS**

The baseline characteristics of the study participants are shown in table 1. Compared with women, men were more likely to be high school graduates, smoke, and drink alcohol. We documented 2,470 COPD-related deaths during an average follow-up period of 8.3 years (1,236,619 person-years), with a follow-up rate of 93.4 percent. The age-standardized mortality of COPD-related deaths was 161.8 per 100,000 person-years (179.9 for men and 141.3 for women). Age-specific mortality increased with age and was greater for men than for women in all age groups (table 2). Both men and women residents of rural areas compared with urban areas had higher age-standardized mortality (figure 1). On the other hand, men had higher COPD-related mortality in southern China, whereas women had higher mortality in northern China.

Table 3 presents the relative risks adjusted for age, urbanization, and geographic region for COPD-related mortality in China by gender. Alcohol consumption was associated with increased risk of COPD-related deaths for women but with decreased risk for men (p for interaction = 0.02). Smoking was also associated with a greater increased risk of COPD-related mortality for women compared with men (p for interaction < 0.0001), and those who smoked for more than 20 pack-years had a higher relative risk than those who smoked for 1–19 pack-years. Lack of a high school education, being underweight, and physical inactivity were all found to be significant risk factors for COPD-related mortality and were consistent between men and women. Hypertension was not found to be a significant risk factor for COPD-related mortality in either gender.

The final multivariate analysis, which included all risk factors examined simultaneously, is shown in table 4. Again, alcohol consumption was associated with an increased risk of COPD-related mortality for women and a decreased risk for men. Smoking for at least 20 pack-years was a stronger risk factor for COPD-related mortality in women than in men, but smoking for 1–19 pack-years, although significant...
for women, was not a significant risk factor for men. An increase in age, lack of a high school education, physical inactivity, being underweight, living in rural China, and living in northern China were all associated with increased risk of COPD-related mortality.

Sensitivity analysis

We conducted a sensitivity analysis excluding those participants who had died within the first 3 years of follow-up since those with COPD at baseline might have changed their risk factors because of disease. In the sensitivity analysis, alcohol consumption was significantly and inversely associated with COPD-related mortality in men (relative risk (RR) = 0.85, 95 percent confidence interval (CI): 0.73, 0.99; \( p = 0.04 \)) but was no longer significant for women (RR = 1.26, 95 percent CI: 0.85, 1.86; \( p = 0.26 \)). Hypertension remained not significantly associated with COPD-related mortality in women (RR = 1.08, 95 percent CI: 0.91, 1.28; \( p = 0.37 \)) but became significantly associated with COPD-related mortality in men (RR = 1.19, 95 percent CI: 1.03, 1.37; \( p = 0.02 \)). The relative risks of COPD-related mortality associated with other risk factors remained unchanged in the sensitivity analysis: smoking for 1–19 pack-years = 0.99 (95 percent CI: 0.80, 1.23) for men and 1.43 (95 percent CI: 1.11, 1.86) for women; smoking for at least 20 pack-years = 1.27 (95 percent CI: 1.09, 1.49) for men and 1.84 (95 percent CI: 1.44, 2.34) for women; lacking a high school education = 2.34 (95 percent CI: 1.39, 3.49) for men and 2.20 (95 percent CI: 1.39, 3.49) for women; physical inactivity = 1.55 (95 percent CI: 1.32, 1.82) for men and 1.41 (95 percent CI: 1.18, 1.68) for women; 10-year increase in age = 2.79 (95 percent CI: 2.59, 3.00) for men and 2.73 (95 percent CI: 2.51, 2.97) for women; living in north China = 1.45 (95 percent CI: 1.25, 1.68) for men and 1.61 (95 percent CI: 1.35, 1.93) for women, and living in a rural residence = 2.18 (95 percent CI: 1.84, 2.57) for men and 1.95 (95 percent CI: 1.63, 2.33) for women.

**TABLE 2.** Age-specific and age-standardized mortality from chronic obstructive pulmonary disease among the 169,871 study participants, China, 1991–2000

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Total</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of person-years</td>
<td>No. of deaths</td>
<td>Mortality per 100,000 person-years</td>
<td>No. of person-years</td>
<td>No. of deaths</td>
<td>Mortality per 100,000 person-years</td>
<td>No. of person-years</td>
</tr>
<tr>
<td>40–49</td>
<td>460,086</td>
<td>81</td>
<td>17.6</td>
<td>232,524</td>
<td>48</td>
<td>20.6</td>
<td>227,562</td>
</tr>
<tr>
<td>50–59</td>
<td>400,600</td>
<td>330</td>
<td>82.4</td>
<td>196,185</td>
<td>191</td>
<td>97.4</td>
<td>204,415</td>
</tr>
<tr>
<td>60–69</td>
<td>260,621</td>
<td>847</td>
<td>325.0</td>
<td>126,562</td>
<td>512</td>
<td>404.5</td>
<td>134,059</td>
</tr>
<tr>
<td>≥70</td>
<td>115,311</td>
<td>1,212</td>
<td>1,051.1</td>
<td>50,853</td>
<td>662</td>
<td>1,301.8</td>
<td>64,458</td>
</tr>
<tr>
<td>Total*</td>
<td>1,236,619</td>
<td>2,470</td>
<td>161.8</td>
<td>606,124</td>
<td>1,413</td>
<td>179.9</td>
<td>630,494</td>
</tr>
</tbody>
</table>

* Mortality (per 100,000 person-years) was standardized according to the 2000 census data for China’s population.

**DISCUSSION**

This large, prospective cohort study conducted in a nationally representative sample documented that COPD-related mortality (per 100,000 person-years) was 179.9 for men and 141.3 for women in the general population aged 40 years or older in China. These results indicated that COPD-related mortality was the second leading cause of death after stroke (310.5/100,000 for men and 242.3/100,000 for women) in the Chinese adult population (17). COPD-related mortality in our study population was also higher than that in other populations (4, 19, 20). For example, Tovar Guzman et al. (4) reported that COPD mortality was 61/100,000 for men and 43/100,000 for women among Mexicans aged 35–94 years. Fuhrman et al. (18) found that COPD mortality was 97.7/100,000 for men and 34.9/100,000 for women among...
Several studies have indicated that COPD mortality might underestimate the burden of disease because patients with COPD most likely die from other causes (18–20). In addition, among those for whom a diagnosis of COPD was listed on their death certificates, COPD was listed as the underlying cause of death for less than half (18, 19). Cor pulmonale is the most common cause of death among COPD patients in China (21). In our study, cor pulmonale deaths with a documented history of COPD were included as COPD-related mortality. Our study better captured COPD deaths than studies that included only those deaths with COPD as the underlying cause.

### TABLE 3. Relative risks, adjusted for age, geographic region, and urbanization, for death from chronic obstructive pulmonary disease among the 169,871 study participants, China, 1991–2000

<table>
<thead>
<tr>
<th>Baseline risk factor</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. RR 95% CI p value</td>
<td>No. RR 95% CI p value</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>71,176 0.87 0.77, 0.99 0.03</td>
<td>72,912 1.76 1.31, 2.36 0.0002</td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td>68,545 1.00‡</td>
<td>72,746</td>
</tr>
<tr>
<td>Never smoker</td>
<td>1.00‡</td>
<td></td>
</tr>
<tr>
<td>1–19 pack-years</td>
<td>1.03 0.87, 1.23 0.73</td>
<td>1.55 1.26, 1.91 &lt;0.0001</td>
</tr>
<tr>
<td>≥20 pack-years</td>
<td>1.29 1.14, 1.47 &lt;0.0001</td>
<td>2.18 1.80, 2.63 &lt;0.0001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>78,358 0.97 0.87, 1.09 0.65</td>
<td>80,058 0.96 0.85, 1.09 0.55</td>
</tr>
<tr>
<td>No high school education</td>
<td>70,617 2.29 1.85, 2.83 &lt;0.0001</td>
<td>72,570 2.51 1.69, 3.71 &lt;0.0001</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>71,985 1.62 1.42, 1.84 &lt;0.0001</td>
<td>73,601 1.33 1.16, 1.54 &lt;0.0001</td>
</tr>
<tr>
<td>Underweight</td>
<td>78,365 2.27 2.01, 2.55 &lt;0.0001</td>
<td>80,061 2.39 2.09, 2.73 &lt;0.0001</td>
</tr>
</tbody>
</table>

* Alcohol consumption was defined as drinking alcohol at least 12 times during the last year. Hypertension was defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg and/or use of antihypertensive medications. Physical activity was assessed by classifying the physical labor involved in a participant’s work at the time of the study. Underweight was defined as a body mass index of <18.5 kg/m².
† RR, relative risk; CI, confidence interval.
‡ Referent.

### TABLE 4. Multivariate-adjusted relative risks* for chronic obstructive pulmonary disease–related death among the 169,871 study participants, China, 1991-2000

<table>
<thead>
<tr>
<th>Baseline risk factor</th>
<th>Men RR 95% CI p value</th>
<th>Women RR 95% CI p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, 10 years</td>
<td>2.80 2.64, 2.98 &lt;0.0001</td>
<td>2.71 2.53, 2.89 &lt;0.0001</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>0.84 0.74, 0.95 0.007</td>
<td>1.44 1.07, 1.95 0.02</td>
</tr>
<tr>
<td>Cigarette smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–19 pack-years</td>
<td>0.94 0.79, 1.13 0.52</td>
<td>1.35 1.09, 1.67 0.005</td>
</tr>
<tr>
<td>≥20 pack-years</td>
<td>1.18 1.04, 1.35 0.01</td>
<td>1.77 1.45, 2.15 &lt;0.0001</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.05 0.93, 1.19 0.41</td>
<td>1.06 0.93, 1.22 0.39</td>
</tr>
<tr>
<td>No high school education</td>
<td>2.37 1.91, 2.94 &lt;0.0001</td>
<td>2.47 1.66, 3.67 &lt;0.0001</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>1.57 1.38, 1.79 &lt;0.0001</td>
<td>1.35 1.17, 1.56 &lt;0.0001</td>
</tr>
<tr>
<td>Underweight</td>
<td>2.66 2.34, 3.02 &lt;0.0001</td>
<td>2.60 2.25, 3.00 &lt;0.0001</td>
</tr>
<tr>
<td>Living in northern China</td>
<td>1.39 1.23, 1.57 &lt;0.0001</td>
<td>1.73 1.50, 2.00 &lt;0.0001</td>
</tr>
<tr>
<td>Living in rural China</td>
<td>2.14 1.86, 2.46 &lt;0.0001</td>
<td>1.79 1.55, 2.07 &lt;0.0001</td>
</tr>
</tbody>
</table>

* All variables listed were adjusted simultaneously in the same model.
† Alcohol consumption was defined as drinking alcohol at least 12 times during the last year. Hypertension was defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg and/or use of antihypertensive medications. Physical activity was assessed by categorizing the physical labor involved in a participant’s work at the time of the study. Underweight was defined as a body mass index of <18.5 kg/m².
‡ Included in this analysis were 68,000 men and 72,024 women.
§ RR, relative risk; CI, confidence interval.
COPD-related mortality was higher among rural residents compared with their counterparts living in urban settings. A higher prevalence of underweight and lower educational levels among rural residents, both important risk factors for COPD-related mortality in China, were observed in our study. However, even after adjustment for these risk factors, residents of rural China still had higher COPD-related mortality compared with their urban counterparts. Poor access to health care and exposure to indoor pollution or occupational dusts might also play an important role in the excess COPD-related mortality among rural residents. Previous studies found that exposures to indoor biomass fuels and occupational dust were significant risk factors for COPD in rural China (9, 22). Our study indicated that residents of northern China had increased COPD-related mortality after we adjusted for measured risk factors. Future studies should examine the effect of outdoor air pollution and cold climate on excess COPD-related mortality in northern China.

Previous studies have found that cigarette smoking is an important risk factor for COPD mortality and that smoking cessation reduces the risk of COPD mortality (1, 7–9, 23, 24). Our study found that those who smoked for at least 20 pack-years had a moderately increased risk of COPD-related death compared with those who never smoked. Additionally, the association between cigarette smoking and COPD-related mortality was stronger for women compared with men. Other studies in China also reported that female smokers were at higher risk than male smokers of developing COPD (7, 8). The reason that female smokers are at a higher risk is still unknown and warrants further research.

When the multivariate model was adjusted to examine the risk for former smokers and current smokers separately, former smokers had a considerably higher relative risk (RR = 2.20, 95 percent CI: 1.82, 2.68 for men and RR = 3.78, 95 percent CI: 2.72, 5.25 for women) compared with current smokers (RR = 0.98, 95 percent CI: 0.86, 1.11 for men and RR = 1.38, 95 percent CI: 1.17, 1.63 for women). A recent study in China also found that COPD is more prevalent in former smokers than current smokers (10), possibly because former smokers quit because of increased severity of their COPD.

Furthermore, our study found that alcohol consumption was a significant risk factor for COPD-related mortality in women but was slightly protective for men. However, after we excluded those who died within the first 3 years of follow-up, alcohol consumption was no longer a significant risk factor for COPD-related mortality in women, but it remained significantly protective for men. A cross-sectional study of men in three European countries found that moderate drinkers had lower COPD mortality compared with nondrinkers and heavy drinkers, but that study did not examine the effects of alcohol consumption on COPD mortality in women (25).

Lack of a high school education was found to be a significant and independent risk factor for COPD-related mortality in our study. Lower educational levels were also reported to be associated with higher prevalence of COPD in two cross-sectional studies in China (9, 10). Education is a socioeconomic status indicator associated with social class, occupation, health knowledge, lifestyle, and access to health care. A Norwegian study found education to be a significant risk factor for prevalent COPD after adjusting for occupational exposure and cigarette smoking (26). Information on access to health care was not collected in our study.

Our study indicated that being underweight was an independent risk factor for COPD-related mortality. Previous studies in the Chinese population also reported that low body weight was associated with an increased prevalence of COPD (9, 10). In addition, Guerra et al. (27) reported that a body mass index of less than 18.5 was associated with an increased risk of emphysema (odds ratio = 2.97, 95 percent CI: 1.33, 6.68) in the longitudinal cohort of the Tucson Epidemiologic Study of Airways Obstructive Diseases. Meyer et al. (28) found that patients dying of COPD were more likely than those dying of other causes to be underweight (odds ratio = 4.5, 95 percent CI: 2.8, 7.2) after controlling for age group and sex in the US National Mortality Follow-back Survey. Malnutrition in COPD patients has been associated with respiratory muscle weakness and impaired immunity (29–31). Underweight was associated with increased mortality among patients with COPD in the Copenhagen City Heart Study (32). Future studies should examine the association between underweight and incidence of COPD.

Physical activity was associated with less decline in lung function and risk of COPD among smokers in previous studies (33). Physical activity was also associated with a lower risk of hospital admissions and mortality among patients with COPD (34). Patients with COPD often experience a reduction in exercise capacity due to physiologic dysfunction (35). Consistent with these findings, our study indicated that physical inactivity was associated with an increased risk of COPD-related mortality in Chinese adults.

Our study has a few limitations. We did not test lung function at the baseline examination; therefore, we could not adjust for it in our analysis. We also did not collect data on some risk factors, such as levels of indoor and outdoor air pollution, occupational exposure to pollutants, and passive smoking. We were not able to examine the association between these risk factors and COPD-related mortality. However, our study has some unique strengths. It was conducted in a large, nationally representative cohort with a high follow-up rate of 93.4 percent. The data on risk factors and covariates were collected carefully, with stringent quality control. All COPD-related deaths were confirmed by both death certificate and hospital records.

Our findings have important clinical and public health implications. This study indicates that COPD has become a leading cause of death in China. Cigarette smoking, low educational level, physical inactivity, and underweight are important modifiable risk factors for COPD-related deaths. Future intervention studies should be conducted to examine the effect of reducing these risk factors on incidence of and mortality from COPD.

ACKNOWLEDGMENTS

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Conflict of interest: none declared.

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