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Original Research

Chronic obstructive pulmonary disease deaths, disability-adjusted life years, and risk factors in Hubei province of mid-China, 1990–2015: the Global Burden of Disease Study 2015



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ABSTRACT

Objectives: The trends of chronic obstructive pulmonary disease (COPD) mortality and prevalence from 1990 to 2015 in Hubei province of mid-China remain unknown. We used findings from the Global Burden of Disease (GBD) 2015 study to estimate the COPD burden and attributable to risk factors in Hubei province of China from 1990 to 2015.

Study design: The GBD study uses various analytical tools and a diverse set of data sources to generate comparable estimates of deaths and mortality rates broken down by age, sex, cause, year, and geography.

Methods: Data were extracted from the GBD 2015 study. Statistical models were used to produce comprehensive results of COPD deaths, prevalence, disability-adjusted life years (DALYs), years of life lost, years lived with a disability, and attributable to risk factors in Hubei. The median of the percent change and 95% uncertainty intervals were determined for the period between 1990 and 2015.

Results: In 2015, there were 37,144 deaths from COPD in Hubei, accounting for 10.05% of the total deaths in Hubei. The age-standardized COPD death rate was reduced by 60.28% from 188.67 per 100,000 (in 1990) to 74.94 per 100,000 (in 2015). The age-standardized prevalence decreased from 4.30% (1990) to 2.85% (2015). By 2015, the leading risk factors for all ages COPD DALYs were smoking and ambient particulate matter pollution, accounting for 44.69% and 32.91%, respectively. The proportion of ambient ozone pollution was increasing steadily each year since 1990.

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Conclusion: Hubei has made substantial progress in reducing the mortality due to COPD since 1990, but the absolute number of COPD cases is increasing steadily, given the population growth and aging. The increasing contribution from smoking, ambient particulate matter pollution, and ambient ozone pollution should require growing attention.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a common inflammatory disease of the airways characterized by airflow limitation that is not fully reversible, which continues to be a major cause of morbidity, mortality, and healthcare costs worldwide.¹ In 2015, COPD caused 3,188,300 deaths globally with a mortality rate of 51.7 per 100,000 inhabitants.² Besides, COPD is also associated with cardiovascular disease, diabetes mellitus, renal insufficiency, osteoporosis, anxiety and depression, lung cancer, and infections.³ It is costly for both individuals and society, accounting for a long-lasting burden on the healthcare system. The rapidly aging Chinese population is expected to dramatically increase the burden of COPD over the coming decades. Because COPD is preventable, the prevention strategies include smoking cessation, adequate treatment of asthma, controlling risk factor exposure, and prevention of relevant complications.^{4,5}

The Global Burden of Disease 2015 (GBD 2015) study is the most comprehensive source of comparable summary population health measures. It includes country-level results, uncertainty quantification, and enabling comparisons across time and between locations.⁶ The GBD 2015 study used numerous metrics to measure the overall burden of health loss due to fatal and non-fatal diseases such as deaths and death rates, prevalence and prevalence rates, disability-adjusted life years (DALYs), years of life lost (YLLs) due to premature mortality, and years lived with disability (YLDs). DALYs are a standard index to measure overall disease burden, expressed as the sum of YLLs and YLDs.^{2,6}

Previous research has estimated the prevalence and mortality of COPD. Globally, the period from 2005 to 2015 has witnessed a 22.9% decrease in mortality and 22.1% decrease in DALYs caused by COPD.^{2,6} In China, the age-standardized death rate of COPD has fallen more sharply (50.3%) between 1990 and 2013.⁷ Hubei was roughly in line with the national trend with the death rate of COPD dropping from 136.2 per 100,000 (1990) to 77.9 per 100,000 (2013).⁸ Hubei province, located in the central part of China and the middle reaches of Yangtze River, has an area of 185,900 square kilometers and a population of nearly 60 million.

So far, data analysis for COPD in Hubei province of China focusing on yearly trend and subgroup analysis is unknown to the public. The data on COPD burden attributable to risk factors were also very limited.^{1,7,8} To support evidence-based policy development and targeted prevention and control of COPD, assessing its burden in Hubei province was necessary and urgent. Therefore, our aim was to summarize the key findings from the GBD 2015 study, with regard to its data on

mortality, prevalence, and DALYs lost because of COPD from 1990 to 2015 in Hubei province. We conducted subgroup analysis by age, gender, and year. We also analyzed the main preventable risk factors that lead to the burden of COPD.

Methods

Data sources

This study was based on publicly available anonymized aggregate data, which were accessed through the online visualization tool by the GBD 2015 study group including mortality, prevalence, DALYs, YLLs, and YLDs with 95% uncertainty intervals (UIs).⁹ We also acquired percent change in COPD between 1990 and 2015 from the GBD website. The main data sources included Disease Surveillance Points (DSPs), Maternal and Child Surveillance System, Chinese Center for Disease Control and Prevention Cause of Death Reporting System.⁷ Cases of COPD were identified based on the International Classification of Diseases and Injuries, version 10 (ICD-10) discharge diagnosis code (codes J40-J44.9 and J47-J47.9).¹⁰

Estimation of mortality and non-fatal health loss

The methods used in the GBD study to estimate all-cause mortality and cause-specific mortality have been published previously.^{11–14} To characterize the temporal trends, rates were age-standardized by the GBD 2015 global standard population.² The main method used to estimate fatal COPD death and YLL was Cause of Death Ensemble modeling.¹⁵ Results for each individual cause of death with uncertainty were combined into estimates that are consistent with the estimates of all-cause mortality for each province-age-sex-year group using a cause of death correction procedure called CoDCorrect algorithm.² Non-fatal COPD health loss (YLDs) was estimated using Bayesian meta-regression method DisMod-MR 2.0 that synthesizes diverse data sources to produce internally consistent estimates of prevalence.¹¹ DALYs were computed as the sum of YLLs and YLDs.

Prevalence estimates

The data sources used for prevalence estimates in China were described elsewhere.¹⁶ Overall COPD prevalence was estimated with DisMod-MR 2.0. Then, separate DisMod-MR 2.0 models were used to analyze data for the proportion of cases with different severity according to the Global Initiative for Chronic Obstructive Lung Disease guideline.¹⁷ The DisMod-MR 2.0 can also provide posterior distributions for prevalent

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