

Chinese Water-Pipe Smoking and the Risk of COPD

Jun She, MD, PhD; Ping Yang, MD, PhD; Yuqi Wang, MD, PhD; Xinyu Qin, MD, PhD; Jia Fan, MD, PhD; Yi Wang, PhD; Guangsuo Gao, MD; Guangxiong Luo, MD; Kaixiang Ma, MD; Baoyan Li, MD; Caihua Li, MD; Xiangdong Wang, MD, PhD; Yuanlin Song, MD; and Chunxue Bai, MD, PhD, FCCP

BACKGROUND: Studies show that the incidence of COPD has remained high in southwest China despite the 1976 National Stove Improvement Program for indoor air quality. Chinese water-pipe tobacco smoking (commonly referred to as water-pipe smoking), which is thought to be less harmful under the assumption that no charcoal is used and water filters tobacco smoke, is popular in China. We investigated whether Chinese water-pipe use and exposure are associated with the risk of COPD.

METHODS: This multicenter, cross-sectional study enrolled 1,238 individuals from 10 towns in the Fuyuan area, Yunnan Province, China. A matched design was used to estimate the impact of active and passive exposure to Chinese water-pipe smoking on COPD risk; multivariate analyses adjusted for other risk factors. We also collected the water from Chinese water pipes to assess the mutagenicity of its major components and simulated Chinese water-pipe smoke exposure fine particulate 2.5 (PM_{2.5}) by using the High Volume Air Sampler and individuals' sera to search for the potential protein biomarkers of COPD.

RESULTS: The increased risk of COPD was profound for Chinese water-pipe smokers (adjusted OR, 10.61; 95% CI, 6.89-16.34), Chinese water-pipe passive smokers (adjusted OR, 5.50; 95% CI, 3.61-8.38), cigarette smokers (adjusted OR, 3.18; 95% CI, 2.06-4.91), and cigarette passive smokers (adjusted OR, 2.52; 95% CI, 1.62-3.91) compared with never-smoking control subjects. Chinese water-pipe use aggravates lungs with more PM_{2.5} compared with cigarettes. ChemR23 and tissue inhibitor of metalloproteinase-1 may be potential protein biomarkers of COPD.

CONCLUSIONS: Chinese water-pipe smoking significantly increases the risk of COPD, including the risk to women who are exposed to the water-pipe smoke.

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ABBREVIATIONS: CO = carbon monoxide; CPS = cigarette passive smoker; CS = cigarette smoker; CWPS = Chinese water-pipe passive smoker; CWS = Chinese water-pipe smoker; NPS = never passive smoker; NS = healthy control subjects never smoker; NSIP = National Stove Improvement Program; PAH = polycyclic aromatic hydrocarbon; PM_{2.5} = fine particulate 2.5; ppm = parts per million; TIMP-1 = tissue inhibitor of metalloproteinase-1

AFFILIATIONS: From the Department of Pulmonary Medicine (Drs She, Yuqi Wang, Qin, Fan, X. Wang, Song, and Bai), Zhongshan Hospital, Fudan University, Shanghai, China; the Department of Health Sciences Research (Drs Yang and Yi Wang), Mayo Clinic, Rochester, MN; Fuyuan County Hospital (Drs Gao, Luo, Ma, B. Li, and C. Li), Yunnan, China; And the Division of Preventive Medicine (Dr Yi Wang), Wenzhou Medical University, Zhejiang, China.

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CORRESPONDENCE TO: Chunxue Bai, MD, PhD, FCCP, Department of Pulmonary Medicine, Zhongshan Hospital, Fudan University, 180 Fenglin Rd, Shanghai, China, 200032; e-mail: bai.chunxue@zs-hospital.sh.cn

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COPD is a major global health problem with rising incidence and morbidity, and it is anticipated that it will become the fourth-leading cause of death worldwide before 2030. Its prevalence is 9% to 10% in adults older than 40 years of age.¹ Most studies in China have demonstrated that the high incidence of COPD is associated with indoor air pollution in southwest China (ie, burning of biomass fuels at home, such as coal and wood for cooking and heating).²⁻⁵ Since 1976, the National Stove Improvement Program (NSIP) in China has improved indoor air quality by introducing > 180 million stoves with chimneys (Fig 1),^{4,5} but the Fuyuan area of Yunnan Province in China is an example of an area that still has a high lung disease prevalence.⁶ Epidemiology studies indicate that the incidence of COPD is double the national mean^{7,8} and, in reality, the NSIP has not been as effective as expected in preventing lung diseases.^{9,10}

The global increase in tobacco smoking with a water pipe (ie, hookah, narghile, or shisha) has contributed to the health consequences of COPD and its related diseases.¹¹ The Chinese water pipe (Fig 1A) is popular in Asia, including, but not limited to, China, Burma, Laos, and Vietnam.¹² However, little information is known by

the public about a regional endemic related to the Chinese water pipe, which is different from the Arabic water pipe. Traditionally, the Chinese water pipe has been misconceived as less harmful for three reasons: (1) no charcoal is used, in contrast to the Arabic water pipe; (2) tobacco smoke passes through the water, unlike

FOR EDITORIAL COMMENT SEE PAGE 875

in cigarette smoking (ie, Chinese water-pipe smoke is filtered by the water); and (3) smoking through a large-volume water pipe may “improve lung function” (assuming breath strength and vital capacity increase after long-term smoking of the water pipe; this is disproven in our current study).^{6,13}

We postulated that active and passive Chinese water-pipe exposure may be a culprit that could impair pulmonary function via large volumes of smoke containing toxic constituents. Additionally, we simulated Chinese water-pipe smoke exposure fine particulate 2.5 (PM_{2.5}) by using the High Volume Air Sampler (G701, Thermo Andersen), and collected subjects’ sera to search for potential protein biomarkers for the high rates of COPD.

Materials and Methods

Individuals and Study Design

This multicenter, population-based, cross-sectional study (October 15, 2011 to January 12, 2013) enrolled 1,238 individuals from 10 towns (Dahe, Dongshan, Housuo, Fuchun, Zhongan, Yingshang, Zhuyuan, Laochang, Shibaliashan, and Huangnihe) covering a wide geographic area in Fuyuan County, Yunnan Province, China, and representing a total population of > 780,000.

We targeted all residents ≥ 40 years of age¹⁴ and used a random-digit phone sampling at 12 local hospitals and clinics (see e-Appendix 1). In these areas, nearly all people who smoke Chinese water pipes are men; female water-pipe smokers are extremely rare. Therefore, a Chinese water pipe is commonly smoked in the household by the man and the wife would be exposed to passive smoking.

Passive smoke refers to the smoke that nonsmokers breathe in from active smokers. People who spend time around smokers are breathing

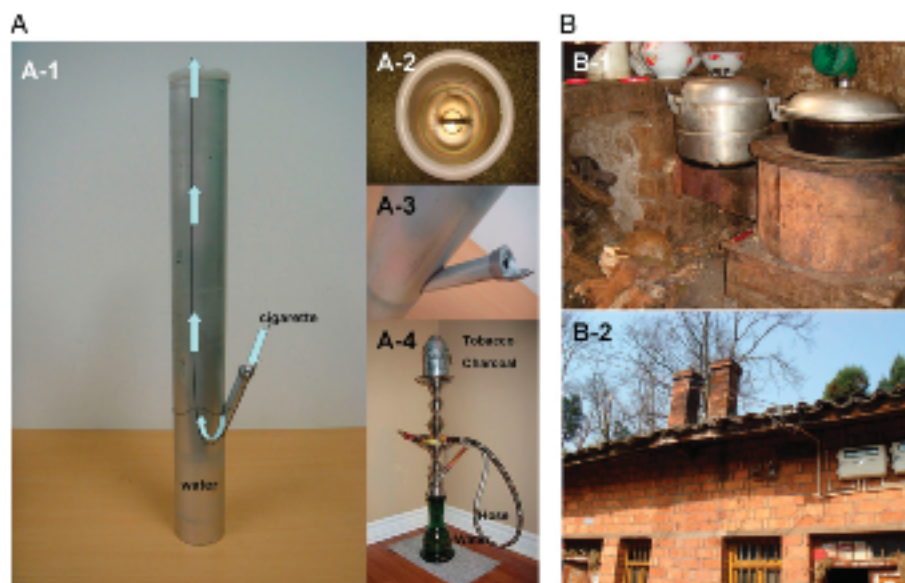


Figure 1 – A, Chinese water pipe (A-1), inside of Chinese water pipe (A-2), Chinese water-pipe holder (A-3), and Arabic water pipe (A-4). B, The National Stove Improvement Program to improve indoor air quality in China. Improved stove (B-1) with chimney (B-2).

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