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Occupation and chronic bronchitis among Chinese women

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Abstract

Objective—To examine the association between occupation and chronic bronchitis among a cross-section of Chinese women who participated in the Shanghai Women's Health Study (SWHS).

Methods—Cases were 4,873 women who self-reported a physician-diagnosed bronchitis during adulthood. Controls were 9,746 women randomly selected from SWHS participants and matched to the cases by year of birth and age at diagnosis. Lifetime occupational histories were obtained. Logistic regressions were used to evaluate the association between chronic bronchitis and occupation, adjusting for smoking, education, family income, and concurrent asthma.

Results—We observed excess prevalence of bronchitis for textile occupation (OR=1.09; 1.01–1.18) and industry (OR=1.11; 1.04–1.25), welders (OR=1.40; 1.01–1.92), packing and baling workers (OR=1.39; 1.15–1.68), and warehousing industry (OR=1.58; 1.08–2.30). We also identified several new associations that may warrant further exploration and confirmation, including employment in some metal fabrication industries, postal and telecommunication industry, and a few white collar occupations and industries.

Conclusions—Our study indicates that the risk of chronic bronchitis among women may be increased in some occupations and industries.

Keywords

chronic bronchitis; women; occupation; industry; China

INTRODUCTION

Chronic bronchitis is a common respiratory disease with prevalence ranging from 10 to 20% in adult general populations (1). According to the World Health Organization's study of the

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global burden of disease, chronic obstructive pulmonary disease (COPD), a disorder which includes chronic bronchitis and emphysema, was the sixth leading cause of death in 1999 (2). COPD is expected to rise in rank and be the third leading cause of death by 2020, largely due to increases in exposures to environmental and occupational pollutants (3,4).

Smoking and second hand tobacco smoke are the environmental factors most strongly associated with chronic bronchitis (5,6). Occupational exposures have also been implicated and are estimated to account for about 15% of the disease by the American Thoracic Society in 2003 (7). Studies of British coal miners (7,8,9,10) found associations between chronic bronchitis and respirable particle exposure. Other studies have reported increased risk of chronic bronchitis in wood and paper workers, textile and cotton workers, tailors, quarry workers, construction and transportation workers, and farmers and swine confinement workers (6,8,11). Specific exposures that may be involved include mineral dusts, welding fumes, oxides of nitrogen, sulphure dioxide, ammonia, and heavy metals (1,11,12).

Few studies on occupational exposures and chronic bronchitis (hereafter referred to as bronchitis) have been conducted among women, whose pattern of exposures may differ from that among men. In 1997, a large population-based cohort study was launched among women in Shanghai, China (13). Most of the participants were non-smokers (over 97%) and almost all had held employments outside their homes (99.6%). This cohort provides a unique opportunity to explore occupational risk factors for bronchitis among women that can be targeted for further etiologic studies and prevention programs.

MATERIALS AND METHODS

Subjects

The Shanghai Women's Health Study (SWHS) is a population-based prospective cohort study. A detailed description of the study design, study population and data collection has been published elsewhere (13). Briefly, between March 1997 and May 2000, all eligible women aged 40–70 years, permanently residing in seven communities in Shanghai, China, were invited to participate in the study (n=81,316). A total of 74,942 women were included in this analysis, after excluding women out of the study age range (0.4%), refusals (3.0%), and women absent during the enrollment period (2.6%) or not available for other reasons (1.6%). Cases for the current analysis were identified retrospectively based on a self report at baseline that they had been diagnosed with bronchitis by a physician and the initial diagnosis occurred after 16 years of age. Two controls were selected for each case from the cohort by matching the year of birth (same year as the case) and age of case at initial diagnosis (4-year period). If more than two controls met the criteria, two were randomly selected.

Data collection

For each subject, an in-person interview was conducted at baseline by trained interviewers using a structured questionnaire. We obtained a lifetime occupational history of every job held longer than one year, including the name of work place, job and industry title, main duties, products, year starting and year ending the job. The job and industry titles were coded according to the Chinese National Standard Occupation and Industry Codes Manual (1986). Information was also collected on a variety of other factors including demographic background, socioeconomic status, tobacco and alcohol use, dietary habits, physical activity, menstrual and reproductive history, residential and cooking fume use history, exposure to second-hand tobacco smoke, medical history, height and weight, and history of hormone use.

Statistical analysis

Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated by logistic regression analysis. All analyses were adjusted for confounding factors that occurred prior to bronchitis diagnosis for cases and the corresponding date for controls, including smoking (ever/never), education (elementary school or less, middle school, high school, and college or above), annual family income (<10,000, 10,000–20,000, 20,000–30,000, and 30,000+ Chinese yuans), and concurrent asthma, stratified by year of birth (same year) and age at diagnosis (4-year period). Additional adjustment for exposure to second-hand tobacco smoke (ever vs. never at home or at work) and exposure to coal and gas fumes used for cooking (ever vs. never) did not substantially change the risk estimates, therefore results were presented without adjustment for these variables. We included all jobs that were held up to the age of diagnosis for cases and the equivalent cut-off age (midpoint of 4-year interval) for controls. Association with chronic bronchitis was determined for each 3-digit occupation and industry (ever *vs*. never employed in the occupation or industry). Further analyses were based on broad groups of 3-digit occupation and industry created according to known or suspected exposure factors for chronic bronchitis. We present ORs for all broad groups and for each occupation and industry with at least 10 exposed cases and either a significant OR or a non-significantly elevated OR > 1.2 (or reduced OR < 0.8). In addition, we evaluated trends with duration of employment (never [referent], <10, and ≥10 years) by assigning ordinal category scores and treating the variable as continuous.

RESULTS

We identified a total of 4,873 prevalent bronchitis cases and 9,746 controls at baseline interview during 1997–2000 (Table I). No significant differences were observed between cases and controls in mean age, family income, and exposure to second hand tobacco smoke. Cases had higher education level ($p < 0.0001$) and higher prevalence of smoking ($p < 0.0001$) than controls. Employment history was stable in both cases and controls (average numbers of jobs up to the time of case diagnosis or cut-off age for controls were 1.66 and 1.55, respectively), although cases changed their jobs more often ($p < 0.0001$).

For broad occupational groups (Table II), small but significant increases in risk of bronchitis was observed for textile workers (OR=1.09), science and technical personnel (OR=1.15), and teaching personnel (OR=1.13). While most 3-digit occupations in these broad groups contributed to the elevated risks, only the association with ever employment in spinning textile workers (OR=1.28) reached statistical significance, but showed no pattern of further increase in risk with duration of employment. In contrast, long-term employments as a researcher in engineering (OR=2.24) or as civil engineering technical personnel (OR=1.81) under the science and technical broad group of jobs were associated with significantly elevated risk. In addition, significantly elevated risks were observed for several 3-digit occupations even though their broad occupation groups were not implicated. These included animal husbandry workers (OR=3.19), service workers in theaters and exhibition halls (OR=3.52), welders (OR=1.40), workers in packing and baling (OR=1.39), performers (OR=1.83), editors (OR=1.89), and typists (OR=1.72). Significant trends with duration of employment were observed for theater service workers (p=0.0003) and welders (p=0.03). Increased risk with long-term employment in food preparing and processing (OR=1.21), wood working in other timber/finished products (OR=1.90), and forestry raising/planting (OR=1.94) were also suggested. A significant deficit in risk of bronchitis occurred for loading and unloading workers (OR=0.64).

Out of 16 broad industry groups (Table III), significant excess risks of chronic bronchitis were observed for textile and sewing (OR=1.11), postal and telecommunication (OR=1.57), and education, culture and science (OR=1.14). Risks for specific 3-digit occupations within

these broad industry groups were generally elevated, with significant ORs found for raw fiber material processing (OR=2.55), cotton textile industry (OR=1.15), and other textile industry (OR=1.91), postal and telecommunication services (OR=1.83), and jobs in the arts (OR=1.48). In addition, significant positive associations with bronchitis for other 3-digit industries were observed, even though their broad industry groups were not related to risk. These included tea production (OR=2.52), production of movie, camera and office equipment (OR=2.12), special instrument manufacturing (OR=1.81), internal trade (OR=1.13), warehousing (OR=1.58), and armed forces (OR=1.35). Of these 3-digit industries, risk increased with duration of employment for tea production (p for trend =0.01), production of movie, camera and office equipment (p=0.0002), telecommunication services (p=0.04), and armed forces (p=0.02). In addition, a significantly elevated risk was linked with long-term employment in household machinery fabrication industry (OR=1.48), and manufacturing of electronic and wireless measuring instruments (OR=2.15). Significant deficit in risk for bronchitis was observed for electronic component industry (OR=0.61). Other 3-digit industry categories with borderline significantly elevated risk included furniture manufacturing (OR=1.72) and cement and cement products (OR=1.51).

DISCUSSION

Our findings in this large population-based study of mostly nonsmoking women suggest that some occupational exposures could be an important risk factor for chronic bronchitis in this population. The excess risk we observed for several occupations have been reported previously, including textile occupations and industries, and welders. Many previous studies in various countries have reported an increased risk in textile workers, mostly related to exposures to cotton dust (14–28). In our study, we found excess prevalence of bronchitis not only in women who were employed in the cotton textile industry, but also in raw fiber material processing and other textile industry. In all textile occupations and industries, risks of bronchitis were elevated with the shorter employment duration (< 10 years). This is contrary to expectation since it is known that chronic bronchitis develops slowly (10). Latency analysis (<10, 10 – 19, and 20 and more years since initial employment on the job) did not show significant differences in risk (data not presented). We also evaluated whether textile workers who had held a larger number of jobs in the work history had higher prevalence of bronchitis, but found no difference in risk with the number of jobs in their history(data not presented). The general excess in prevalence of bronchitis even among women with relatively short latency period may be explained, in part, by the high exposure levels of dust in these industries in Shanghai. On the other hand, it is also possible that some cases of byssinosis are incorrectly diagnosed as chronic bronchitis. It is known that symptoms of chronic bronchitis can coexist with symptoms of byssinosis, a syndrome caused by endotoxins in the inhaled cotton dust that occur on Monday morning back at work (7,8,22,23,29). However, this is unlikely to explain the excess prevalence of bronchitis we observed also among women who held jobs in textile industry other than cotton.

Welders have been reported to have an elevated risk of bronchitis, but the evidence was based on studies among men (10–12,30–34). Our findings of an elevated risk and a significant trend with duration of employment suggest that women exposed to welding fumes are equally susceptible to bronchitis. Welding fumes are a mixture of gases, particles and metal oxide fumes, mostly of respirable size which significantly reduce pulmonary functions. It has been shown that use of local exhaust ventilation or personal protection minimizes the risk of bronchitis (33).

We also observed excess risks of bronchitis with borderline significance that increased with duration of employment for wood workers in other timber/finished products and employment in the furniture manufacturing industry, consistent with previous reports in

different populations (10,11,14–16). The high exposure to biological wood dusts and wood preservatives are believed to be the risk factor (16,19). Enhanced inflammatory responses following exposure to fine wood dusts have been shown in experimental studies (35,36).

We found a significant excess of bronchitis among packing and baling workers, as well as warehouse workers, particularly among those who held these jobs for less than ten years. In a population-based administrative database of a sample of the labor force in Canada, increased risk for obstructive respiratory disease was observed among material handling workers, who performed similar tasks as packing and baling in our population (37). Data from the population-based Third National Health and Nutrition Examination Survey in the US indicated that freight, stock, and material handlers had higher risks for chronic obstructive pulmonary disease (17). A Dutch study revealed a non-significantly increased incidence of bronchitis in male warehouse workers (14). Observations from these studies, along with our findings, suggest that further assessment of bronchitis risk in workers who handle and store industrial materials may be warranted.

In this study we also identified a few associations that have not been linked to bronchitis previously, including metal fabrication industries (production of movie, camera and office equipment, and special instrument manufacturing), postal and telecommunication, and a variety of mostly administrative occupations and industries. These findings may provide leads for further investigation in future studies, but caution should be exercised in interpreting these results. Some of the associations could be due to chance, as we have evaluated a large number of occupations and industries. As this is a population-based study, women were not enrolled at the beginning of their employment. It is possible that some women may have changed jobs after their bronchitis diagnosis, but still they should have the same chance to be included. The occurrence of positive and negative associations with duration of employment in some industries is difficult to interpret. It is also important to remember that duration may not be a reliable indicator of level of exposure in some situations.

There are very little data on the possible associations of metal fabrication industries. We found that for certain metal fabrication industries, elevated risks of bronchitis were restricted to long-term employment (≥ 10 years), such as fabrication of household machinery and manufacturing of electronic and wireless measuring instruments. If these findings are confirmed in future studies, further investigation into the role of metal dust and fumes may be warranted.

Some limitations in our study should be considered. Bronchitis was based on self-reports of a physician diagnosed illness that could be a source of recall and information bias. Use of self-reports of physician diagnosed bronchitis depends on proper recognition and diagnosis of bronchitis by both study participants and physicians, thus underreporting of this condition is possible (38,39). Bias in bronchitis diagnosis due to differential access to health care is unlikely, since health care was uniformly provided for workers and retirees under the communist system until recently. Furthermore, the prevalence of adult chronic bronchitis in our population (6.6%) was comparable to the prevalence of COPD (6.5%) estimated for Chinese adult men and women by an expert regional working group in Asia (40).

Self-reports of bronchitis have been widely used in other epidemiological studies and have been shown to be a simple, reliable, and specific method for identifying bronchitis in a population (41–43). However, no data on validation process of self-report of bronchitis were found for a Chinese population. We believe that any information and recall biases, if existed, would be nonselective, as the study was primarily conducted in a general population to follow cancer incidence, with no emphasis on bronchitis.

Employment history in our study was based on the self-reported occupation and industry titles. Since employment in China has been stable until recently, and work history was collected systematically and temporal gaps in employment were reviewed with the participants, we believe that the data on employment were accurate. However, since no personal exposure data were available, we cannot directly relate specific exposures to bronchitis occurrence. Our results therefore should be considered as exploratory and hypothesis generating, which provide leads on potential exposures that can be assessed in future studies with more refined exposure assessment.

Our study is among the first that provides data on occupational risk for bronchitis in a general population of women, who were almost all employed at some time during their lives. We were able to carefully adjust for potential confounding factors because detailed information on lifestyle, medical and other factors was collected. The large study size and high response rate enable us to more precisely estimate risk of bronchitis for different occupations and industries than has been possible in some other studies. A major advantage of the study is that almost all women were non-smokers (around 97%), so that the influence of active smoking was diminished. Still, smokers had a significantly higher risk of bronchitis (OR=1.68; 95% CI 1.43–1.97), but we were able to control for smoking in logistic regression analysis.

In summary, we confirmed previously reported high-risk occupations and industries for chronic bronchitis among women, including textile occupations and industry, warehousing industry, and occupations in packing/baling and welding. The association between bronchitis and welding has been reported only among men previously. We also identified a few associations that were not usually related to bronchitis, such as production of movie, camera and office equipment, and special instruments within the metal fabrication industries, postal and telecommunication, and a few administrative occupations and industries that need further exploration and confirmation.

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References

1. Marek, K.; Zejda, JE. Chronic obstructive pulmonary disease. In: Stelman, JM., editor. Encyclopaedia of Occupational Health and Safety. 4. Vol. 1. Geneva: International Labour Office; 1998. p. 10.1-10.97.(Printed version)
2. Murray CJL, Lopez AD. Evidence-based health policy – lessons from the global burden of disease study. Science. 1996; 274:740–743. [PubMed: 8966556]
3. WHO. WHO strategy for prevention and control of chronic respiratory diseases. Geneva: World Health Organization; 2002.
4. WHO Fact Sheet N^{o}. 2000. Available at: http://www.who.int/inf-fs/en/fact206.html
5. Parker, WR.; Turner-Warwick, M. Occupational Lung Disorders. London: Butterworths; 1982. p. 17-22.
6. Antó, JM.; Vermiere, P.; Sunyer, J. Chronic obstructive pulmonary disease. In: Annesi-Maesano, I.; Gulsvik, A.; Viegi, G., editors. Respiratory Epidemiology in Europe. Sheffield: European Respiratory Monograph; 2000. p. 1-22.
7. American Thoracic Society Statement. Occupational contribution to the burden of airway disease. Am J Respir Crit Care Med. 2003; 167:787–797. [PubMed: 12598220]

8. Garshick E, Schenker MB, Dosman JD. Occupationally induced airways obstruction. Med Clin North Am. 1996; 80(4):851–78. [PubMed: 8676617]
9. Strachan, D. Early British studies of chronic respiratory disease and their current relevance. In: Annesi-Maesano, I.; Gulsvik, A.; Viegi, G., editors. Respiratory Epidemiology in Europe. European Respiratory Monograph. 2000. p. 23-36.
10. Meldrum M, Rawbone R, Curran AD, Fishwick D. The role of occupation in the development of chronic obstructive pulmonary disease (COPD). Occup Environ Med. 2005; 62:212–214. [PubMed: 15778251]
11. Viegi G, Di Pede C. Chronic obstructive lung diseases and occupational exposure. Curr Opin Allergy Clin Immunol. 2002; 2:115–121. [PubMed: 11964759]
12. Viegi G. Epidemiology of chronic obstructive pulmonary disease (COPD). Respiration. 2001; 68:4–19. [PubMed: 11223724]
13. Zheng W, Chow WH, Yang G, et al. The Shanghai Women's Health Study: Rational, Study Design, and Baseline Characteristics. Am J Epidemiol. 2005; 162:1123–1131. [PubMed: 16236996]
14. Heederik D, Kromhout H, Burema J, Biersteker K, Kromhout D. Occupational exposure and 25-year incidence rate of non-specific lung disease: The Zutphen Study. Int J Epidem. 1990; 19(4): 946–952.
15. Sunyer J, Kogevinas M, Kromhout H, et al. Pulmonary ventilatory defects and occupational exposures in a population-based study in Spain. Am J Respir Crit Care Med. 1998; 157:512–517. [PubMed: 9476866]
16. Zock J-P, Sunyer J, Kogevinas M, Kromhout H, Burney P, Antó JM. Occupation, chronic bronchitis, and lung function in young adults. Am J Respir Crit Care Med. 2001; 163:1572–1577. [PubMed: 11401876]
17. Hnidzo E, Sullivan PA, Bang KM, Wagner G. Association between chronic obstructive pulmonary disease and employment by industry and occupation in the US population: A study of data from the Third National Health and Nutrition Examination Survey. Am J Epidemiol. 2002; 156:738–746. [PubMed: 12370162]
18. Jaén A, Zock JP, Kogevinas M, Ferrer A, Marin A. Occupation, smoking and chronic obstructive respiratory disorders: a cross sectional study in an industrial area of Catalonia, Spain. Environ Health. 2006 Feb 14.5:2. [PubMed: 16476167]
19. LeVan TD, Koh WP, Lee HP, Koh D, Yu MC, London SJ. Vapor, dust and smoke exposure in relation to adult-onset asthma and chronic respiratory symptoms. Am J Ind Med. 2006; 163:1118–1128.
20. Beckett WS, Pope CA, Xu X-P, Christiani DC. Women's respiratory health in the cotton textile industry: an analysis of respiratory symptoms in 973 non-smoking female workers. Occup Envrion Med. 1994; 51:14–18.
21. Christiani DC, Eisen EA, Wegman DH, et al. Respiratory disease in cotton textile workers in the People's Republic of China. Scand J Work Environ Health. 1986; 12:40–45. [PubMed: 3961440]
22. Christiani DC, Wang Z-R, Pan L-D, et al. Longitudinal changes in pulmonary function and respiratory symptoms in cotton textile workers. A 15-yr follow-up study. Am J Respir Crit Care Med. 2001; 163:847–853. [PubMed: 11282755]
23. Wang X-R, Eisen EA, Zhang H-X, et al. Respiratory symptoms and cotton dust exposure; results of a 15 year follow up observation. Occup Environ Med. 2003; 60:935–941. [PubMed: 14634185]
24. Kennedy SM, Christiani DC, Eisen EA, et al. Cotton dust and endotoxin exposure-response relationship in cotton textile workers. Am Rev Respir Dis. 1987; 135(1):194–200. [PubMed: 3800146]
25. Fishwick D, Fletcher AM, Pickering CA, Niven RM, Faragher EB. Respiratory symptoms and dust exposure in Lancashire cotton and man-made fiber mill operatives. Am Respir Crit Care Med. 1994; 150(2):441–447.
26. Fishwick D, Fletcher AM, Pickering CA, Niven R, Faragher EB. Lung function in Lancashire cotton and man made fiber spinning mill operators. Occup Environ Med. 1996; 53(1):46–50. [PubMed: 8563857]

27. Fishwick D, Bradshaw LM, D'Souza W, et al. Chronic bronchitis, shortness of breath, and airway obstruction by occupation in New Zealand. Am J Respir Crit Care Med. 1997; 156:1440–1446. [PubMed: 9372658]
28. Niven RM, Fletcher AM, Pickering CA, et al. Chronic bronchitis in textile workers. Thorax. 1997; 52:22–27. [PubMed: 9039235]
29. Hendrick DJ. Occupation and chronic obstructive pulmonary disease (COPD). Thorax. 1996; 51(0):947–955. [PubMed: 8984710]
30. Bakke PS, Baste V, Hanoa R, Gulsvik A. Prevalence of obstructive lung disease in a general population: relation to occupational title and exposure to some airborne agents. Thorax. 1991; 46(12):863–70. [PubMed: 1792631]
31. Ozdemir O, Numanoglu N, Gonullu U, Savas I, Alper D, Gurses H. Chronic effects of welding exposure on pulmonary function tests and respiratory symptoms. Occup Environ Med. 1995; 52(12):800–803. [PubMed: 8563842]
32. Sobaszek A, Edme JL, Boulanguez C, et al. Respiratory symptoms and pulmonary function among stainless steel welders. J Occup Envrion Med. 1998; 40(3):223–229.
33. Erkintuntti-Pekkanen R, Slater T, Chenh S, et al. Two year follow up pulmonary function values among welders in New Zealand. Occup Environ Med. 1999; 56:328–333. [PubMed: 10472307]
34. Fidan F, Unlu M, Koken T, et al. Oxidant-antioxidant status and pulmonary function in welding workers. J Occup Health. 2005; 47(4):286–92. [PubMed: 16096352]
35. Maatta J, Luukkonen R, Husgafvel-Pursiainen K, Alenius H, Savolainen K. Comparison of hardwood and softwood dust-induced expression of cytokines and chemokines in mouse macrophage RAW 264.7 cells. Toxicology. 2006; 218(1):13–21. [PubMed: 16202497]
36. Maatta J, Lehto M, Leino M, et al. Mechanisms of particle-induced pulmonary inflammation in mouse model: exposure to wood dust. Toxicol Sci. 2006; 93(1):96–104. [PubMed: 16740616]
37. Kraut A, Walld R, Mustard C. Prevalence of physician-diagnosed asthma by occupational grouping in Manitoba, Canada. Am J Ind Med. 1997; 32:275–282. [PubMed: 9219658]
38. Bobadilla A, Guerra S, Sherrill D, Barbee R. How accurate is the self-reported diagnosis of chronic bronchitis? CHEST. 2002; 122:1234–1239. [PubMed: 12377847]
39. Mannino DM. Chronic obstructive pulmonary disease: definition and epidemiology. Respir Care. 2003; 48(12):1185–1191. [PubMed: 14651759]
40. Regional COPD Working Group. COPD prevalence in 12 Asia-Pacific countries and regions: Projections based in the COPD prevalence estimation model. Respirology. 2003; 8:192–198. [PubMed: 12753535]
41. Trupin L, Earnest G, San Pedro M, et al. The occupational burden of chronic obstructive pulmonary disease. Eur Respir J. 2003; 22:462–469. [PubMed: 14516136]
42. Barr GR, Herbstman J, Speiaer FE, Camargo CA. Validation of self-reported chronic obstructive pulmonary disease in a cohort study of nurses. Am J Epidemiol. 2002; 155:965–971. [PubMed: 11994237]
43. Straus SS, McAlister F, Sackett DL, Jonathan DJ. Accuracy of history, wheezing, and forced expiratory time in the diagnosis of chronic obstructive pulmonary disease. J Gen Intern Med. 2002; 17:684–688. [PubMed: 12220364]

Table I

Descriptive characteristics of bronchitis cases and controls

	Bronchitis Cases (N=4 873)	Controls (N =9 746)	p value
Mean age in years*	40.2	40.8	0.94
Range	16 – 69	17 – 69	
Educational Level			< 0.0001
Elementary/Less	1 479 (30.4%)	3 248 (33.3%)	
Middle School	1 374 (28.2%)	2 859 (29.3%)	
High School	1 265 (26.0%)	2 290 (23.5%)	
College and more	745 (15.5%)	1 351 (13.9%)	
Total Family Income in Last Year (yuans)			0.87
<10,000	936 (19.2%)	1 787 (18.3%)	
10,000 – 19,999	1 809 (37.1%)	3 741 (38.4%)	
20,000 – 29,999	1 257 (25.8%)	2 552 (26.2%)	
>30,000	870 (18.9%)	1 665 (17.1%)	
Ever smoking	174 (3.6%)	197 (2.02%)	< 0.0001
Ever exposed to second hand tobacco smoke	3 405 (69.9%)	6 635 (68.1%)	0.43
Mean Number of Jobs	1.66	1.55	< 0.0001
Range	0.0 – 6.0	0.0 – 6.0	

*Age at diagnosis for cases and cutoff year for controls

Table II

Risk for chronic bronchitis by occupational groups and occupations; ever employment and duration of employment

Occupational Groups and Occupations	Ever employment		Duration of employment				
			< 10 years		≥ 10 years		Trend P
	Cases	OR (95% CI)*	No	OR (95% CI)*	No	OR (95% CI)*	
CONSTRUCTION WORKERS	48	0.97 (0.72–1.30)	31	0.96 (0.66–1.37)	17	1.00 (0.61–1.63)	0.88
TRANSPORTATION WORKERS	72	0.84 (0.66–1.07)	28	0.70 (0.48–1.02)	44	0.97 (0.71–1.31)	0.35
TEXTILE WORKERS	***833***	***1.09 (1.00–1.18)***	***295***	***1.14 (1.01–1.30)***	538	1.06 (0.96–1.17)	0.11
Spinning/Filature/Plying/Twisting	***245***	***1.28 (1.12–1.47)***	***94***	***1.44 (1.16–1.79)***	***151***	***1.20 (1.01–1.42)***	***0.003***
Instal/Maint Mach Weaving/Knitting	21	1.33 (0.85–2.07)	10	1.37 (0.72–2.61)	11	1.29 (0.70–2.39)	0.25
Textile Printing & Dyeing Workers	30	1.33 (0.92–1.93)	12	1.50 (0.83–2.70)	18	1.24 (0.77–2.00)	0.20
PAPER WORKERS	38	1.20 (0.87–1.67)	18	1.35 (0.84–2.17)	20	1.09 (0.70–1.71)	0.40
Paper-Making Workers	14	1.47 (0.86–2.53)	5	1.66 (0.66–4.14)	9	1.39 (0.71–2.72)	0.21
WOOD WORKERS	18	1.39 (0.87–2.24)	12	1.53 (0.85–2.75)	6	1.18 (0.52–2.68)	0.27
Other Timber/Finished Prods	10	1.61 (0.85–3.06)	5	1.40 (0.57–3.45)	5	1.90 (0.76–4.74)	0.11
AGRICULTURE AND FARMERS	526	0.95 (0.85–1.05)	393	0.96 (0.85–1.08)	133	0.91 (0.76–1.09)	0.24
Tea plantation/Orchard Farmers	11	1.23 (0.67–2.26)	10	1.14 (0.60–2.16)	1/0	96.91 (0.00–∝)	0.37
Other farm workers	12	1.31 (0.73–2.34)	6	2.16 (0.93–5.02)	6	0.95 (0.42–2.14)	0.65
Forest Raising/Planting Personnel	14	1.46 (0.83–2.55)	9	1.31 (0.67–2.56)	5	1.94 (0.70–5.41)	0.14
Animal Husbandry Workers	***5***	***3.19 (1.21– 8.45)***	***4***	***3.94 (1.25–12.46)***	1	1.92 (0.25–14.60)	***0.04***
CHEMICAL & RUBBER WORKERS	172	1.01 (0.86–1.18)	68	0.99 (0.77–1.26)	104	1.02 (0.84–1.25)	0.87
Rubber Process Machine Operators	31	1.22 (0.85–1.76)	11	1.28 (0.70–2.36)	20	1.19 (0.76–1.87)	0.33
FOOD PREPARING & PROCESSING	210	1.05 (0.91–1.21)	84	0.88 (0.70–1.09)	***126***	***1.21 (1.00–1.45)***	0.19
Pickling/Canning/Preservation Food	11	1.38 (0.75–2.53)	2	0.81 (0.20–3.28)	9	1.64 (0.83–3.24)	0.20
METAL WORKERS	436	0.99 (0.89–1.10)	194	1.07 (0.92–1.24)	242	0.93 (0.82–1.07)	0.55
SERVICE OCCUPATIONS	839	1.05 (0.97–1.14)	414	1.07 (0.97–1.19)	425	1.03 (0.93–1.15)	0.32

Occupational Groups and Occupations	Ever employment		Duration of employment				Trend P
			< 10 years		≥ 10 years		
	Cases	OR (95% CI)*	No	OR (95% CI)*	No	OR (95% CI)*	
Postal Service Workers	10	1.65 (0.86–3.16)	5	2.06 (0.80–5.28)	5	1.39 (0.56–3.43)	0.21
Purchasing Agents	20	1.48 (0.94–2.33)	12	1.79 (0.97–3.23)	8	1.19 (0.59–2.42)	0.19
Service in Theaters and Exhibition Halls	***8***	***3.52 (1.63–7.61)***	4	2.73 (0.95–7.82)	***4***	***5.13 (1.58–16.69)***	***0.0003***
Cleaning/Waste Disposal	16	1.37 (0.81–2.30)	***11***	***2.42 (1.25–4.70)***	5	0.73 (0.30–1.79)	0.70
Other Service Personnel	22	1.34 (0.87–2.07)	15	1.35 (0.80–2.27)	7	1.33 (0.62–2.84)	0.21
OTHER PRODUCTION WORKERS	1121	1.06 (0.99–1.14)	441	1.05 (0.95–1.17)	680	1.07 (0.98–1.16)	0.11
Binders	12	1.55 (0.87–2.78)	3	1.90 (0.58–6.18)	9	1.47 (0.75–2.87)	0.18
Welders	***40***	***1.40 (1.01–1.92)***	15	1.23 (0.73–2.08)	***25***	***1.52 (1.01–2.28)***	***0.03***
Glass Workers	27	1.24 (0.85–1.83)	12	1.26 (0.71–2.25)	15	1.23 (0.73–2.07)	0.30
Painters	67	1.22 (0.95–1.57)	33	1.22 (0.86–1.73)	34	1.23 (0.87–1.74)	0.13
Prod Cultural/Educ/Sports Articles	14	1.22 (0.71–2.08)	10	1.54 (0.81–2.92)	4	0.80 (0.30–2.16)	0.78
Other Power Generation Equipment	13	1.20 (0.69–2.11)	9	1.75 (0.88–3.48)	4	0.71 (0.26–1.93)	0.92
Workers in Packing/Baling	***121***	***1.39 (1.15–1.68)***	***59***	***1.65 (1.26–2.16)***	62	1.21 (0.94–1.57)	***0.006***
Loading/Unloading Workers	***26***	***0.64 (0.43–0.95)***	14	0.79 (0.46–1.34)	***12***	***0.53 (0.30–0.94)***	***0.02***
HEALTH CARE WORKERS	254	0.97 (0.85–1.10)	82	1.06 (0.85–1.33)	172	0.93 (0.79–1.09)	0.46
Urban Health Technology Personnel	31	1.23 (0.85–1.76)	20	1.22 (0.78–1.92)	11	1.24 (0.68–2.28)	0.29
SCIENCE AND TECHNICAL	***298***	***1.15 (1.01–1.30)***	113	1.13 (0.93–1.38)	185	1.16 (0.99–1.36)	***0.04***
Researchers in Engineering	17	1.42 (0.86–2.34)	4	0.65 (0.24–1.77)	***13***	***2.24 (1.26–4.01)***	***0.03***
Civil Engineering Tech Personnel	19	1.35 (0.85–2.16)	5	0.79 (0.33–1.94)	***14***	***1.81 (1.04–3.16)***	0.08
Electrical/Electronic Engineering	40	1.21 (0.87–1.67)	20	1.37 (0.87–2.18)	20	1.08 (0.69–1.69)	0.40
Mechanical Engineering Personnel	41	1.29 (0.93–1.78)	14	1.74 (0.99–3.04)	27	1.14 (0.77–1.68)	0.25
Industry Management Tech Personnel	33	1.21 (0.85–1.73)	16	1.28 (0.77–2.13)	17	1.15 (0.71–1.88)	0.36
TEACHING PERSONNEL	***475***	***1.13 (1.02–1.26)***	***184***	***1.24 (1.06–1.45)***	291	1.06 (0.93–1.21)	0.11
Other Teachers	45	1.30 (0.96–1.76)	29	1.35 (0.92–1.97)	16	1.22 (0.74–2.03)	0.14
ADMIN & POLIT & ART & LITER	966	1.03 (0.96–1.12)	364	1.04 (0.93–1.17)	602	1.03 (0.93–1.13)	0.50

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Occupational Groups and Occupations	Ever employment		Duration of employment				
			< 10 years		≥ 10 years		Trend P
	Cases	OR (95% CI)*	No	OR (95% CI)*	No	OR (95% CI)*	
Personnel Workers	38	1.33 (0.96–1.85)	***24***	***1.61 (1.06–2.45)***	14	1.03 (0.60–1.76)	0.25
Performers	***30***	***1.83 (1.25–2.67)***	***13***	***2.60 (1.43–4.73)***	17	1.50 (0.91–2.46)	***0.01***
Editors	***19***	***1.89 (1.17–3.04)***	9	1.90 (0.95–3.79)	10	1.88 (0.98–3.61)	***0.01***
Typist, Mimeographers	***31***	***1.72 (1.19–2.49)***	***20***	***2.13 (1.33–3.40)***	11	1.29 (0.70–2.37)	***0.03***
Armymen	22	1.22 (0.79–1.89)	16	1.10 (0.66–1.83)	6	1.72 (0.74–4.02)	0.25
Political Workers	75	1.22 (0.96–1.55)	42	1.18 (0.86–1.62)	33	1.28 (0.90–1.84)	0.09
Other Political & Security Workers	21	1.25 (0.80–1.94)	8	0.93 (0.46–1.89)	13	1.58 (0.89–2.78)	0.18

*Adjusted for smoking, education, family income, and asthma

Table III

Risk for chronic bronchitis by industry groups and industries; ever employment and duration of employment

Industrial groups	Ever employment		Duration of employment				Trend P
			1 – 9 years		≥ 10 years		
	Cases	OR (95% CI)*	Cases	OR (95% CI)*	Cases	OR (95% CI)*	
AGRICULTURE AND FARMING	602	0.96 (087–1.06)	443	0.96 (0.86–1.08)	159	0.95 (0.80–1.12)	0.39
Raising & Herding Livestock	14	1.24 (0.73–2.13)	9	1.33 (0.68)	5	1.10 (0.45–2.71)	0.53
FOOD PRODUCTION	137	1.08 (0.91–1.29)	59	1.01 (0.78–1.31)	78	1.15 (0.91–1.44)	0.28
Other Food Production	24	1.46 (0.96–2.23)	12	1.60 (0.88–2.93)	12	1.35 (0.75–2.43)	0.12
Tea Production	***8***	***2.52 (1.20–5.30)***	5	2.37 (0.94–5.99)	3	2.84 (0.81–9.91)	***0.01***
TEXTILE & SEWING	***1073***	***1.11 (1.03–1.19)***	***348***	***1.21 (1.08–1.36)***	725	1.06 (0.98–1.16)	***0.03***
Raw Fiber Materials Processing	***9***	***2.55 (1.27–5.10)***	***8***	***3.66 (1.70–7.86)***	1	0.78 (0.11–5.66)	0.07
Cotton Textile Industry	***660***	***1.15 (1.05–1.25)***	***204***	***1.24 (1.07–1.44)***	***456***	***1.11 (1.00–1.23)***	***0.01***
Other Textile Industry	***15***	***1.91 (1.12–3.25)***	***8***	***4.35 (1.91–9.90)***	7	1.20 (0.56–2.57)	0.11
LUMBERING & WOOD	28	1.10 (0.75–1.60)	10	0.87 (0.46–1.63)	18	1.28 (0.80–2.06)	0.45
Furniture Manufacturing	10	1.72 (0.90–3.27)	2	1.11 (0.27–4.60)	8	1.99 (0.96–4.12)	0.06
PULP/PAPER PRODUCTION	55	1.11 (0.85–1.46)	21	1.11 (0.72–1.73)	34	1.11 (0.79–1.56)	0.48
Paper Processing/Product Manufacturing	32	1.38 (0.96–1.97)	16	1.65 (0.99–2.74)	16	1.19 (0.72–1.96)	0.17
CHEMICALS	199	0.97 (0.84–1.12)	72	0.97 (0.77–1.23)	127	0.96 (0.80–1.15)	0.63
RUBBER/PLASTIC	131	1.03 (0.86–1.23)	36	0.74 (0.53–1.03)	95	1.21 (0.98–1.49)	0.32
NON-METALLIC	85	1.17 (0.94–1.46)	44	1.33 (0.98–1.81)	41	1.04 (0.76–1.42)	0.34
Cement & Cement Products	15	1.51 (0.89–2.55)	7	1.29 (0.60–2.78)	8	1.76 (0.86–3.62)	0.09
Glass & Glass Products	43	1.30 (0.95–1.77)	***20***	***1.58 (1.00–2.52)***	23	1.13 (0.74–1.71)	0.21
METAL FABRICATION	1273	0.97 (0.90–1.03)	405	0.96 (0.86–1.07)	868	0.97 (0.90–1.05)	0.36
Surface/Heat/Treatment Metal	27	1.26 (0.86–1.86)	14	1.52 (0.89–2.63)	13	1.07 (0.61–1.86)	0.41
Household Machinery Fabrication	40	1.29 (0.94–1.78)	13	1.03 (0.59–1.79)	***27***	***1.48 (1.00–2.18)***	0.06
Aircraft Manufacturing	17	1.28 (0.78–2.08)	8	1.22 (0.60–2.49)	9	1.33 (0.68–2.61)	0.33

Industrial groups	Ever employment		Duration of employment				Trend P
			1 – 9 years		≥ 10 years		
	Cases	OR (95% CI)*	Cases	OR (95% CI)*	Cases	OR (95% CI)*	
Medical Devices	23	1.31 (0.85–2.00)	10	1.89 (0.98–3.63)	13	1.05 (0.60–1.85)	0.44
Production Movie/Camera/Office Equipment	***24***	***2.12 (1.39–3.25)***	10	1.69 (0.88–3.25)	***14***	***2.59 (1.47–4.55)***	***0.0002***
Electronic/Wireless Measuring Instruments	10	1.50 (0.79–2.86)	2	0.69 (0.17–2.82)	***8***	***2.15 (1.03–4.52)***	0.09
Special Instrument Manufacturing	***22***	***1.81 (1.17–2.81)***	***12***	***1.95 (1.07–3.56)***	10	1.67 (0.88–3.19)	***0.02***
Weapon Manufacturing	10	1.33 (0.70–2.52)	3	0.79 (0.25–2.48)	7	1.90 (0.88–4.15)	0.20
Electronic Components	***20***	***0.61 (0.39–0.95)***	6	0.40 (0.18–0.90)	14	0.78 (0.46–1.33)	0.08
CONSTRUCTION	100	1.07 (0.87–1.31)	54	1.11 (0.84–1.47)	46	1.03 (0.76–1.38)	0.63
OTHER INDUSTRIES	224	0.98 (0.85–1.12)	120	1.04 (0.87–1.26)	104	0.91 (0.75–1.11)	0.52
TRANSPORTATION	85	0.84 (0.67–1.04)	35	0.79 (0.57–1.12)	50	0.87 (0.66–1.16)	0.17
Transportation via Airways	13	1.44 (0.82–2.54)	6	1.21 (0.53–2.77)	7	1.72 (0.79–3.74)	0.15
Traffic-Transport Support Industry	10	1.28 (0.68–2.42)	5	1.30 (0.53–3.21)	5	1.26 (0.51–3.09)	0.48
POSTAL/TELECOMMUNICATION	***41***	***1.57 (1.14–2.17)***	12	1.45 (0.80–2.62)	***29***	***1.63 (1.11–2.39)***	***0.005***
Telecommunication Services	22	1.52 (0.98–2.35)	4	1.08 (0.40–2.98)	***18***	***1.66 (1.02–2.70)***	***0.04***
Postal & Telecommunication Service	***12***	***1.83 (1.00–3.32)***	6	2.16 (0.91–5.17)	6	1.59 (0.69–3.66)	0.09
HEALTH/PHARMACEUTICAL	292	0.98 (0.87–1.11)	103	1.01 (0.83–1.24)	***189***	***0.96 (0.83–1.12)***	***0.68***
EDUCATION/CULTURE/SCIENCE	***798***	***1.14 (1.05–1.25)***	***275***	***1.14 (1.00–1.30)***	***523***	***1.14 (1.03–1.27)***	***0.005***
Education Program Workers & Farmers	19	1.36 (0.85–2.17)	13	1.40 (0.80–2.46)	6	1.29 (0.56–2.94)	0.24
The Arts	***30***	***1.48 (1.02–2.15)***	11	1.80 (0.97–3.37)	19	1.34 (0.84–2.14)	0.08
Publication	22	1.43 (0.93–2.21)	10	1.40 (0.73–2.66)	12	1.46 (0.81–2.62)	0.12
COMMERCE/FINANCE/STATE BODIES/HOUSING/SERVICES	973	1.06 (0.99–1.14)	452	1.07 (0.97–1.19)	521	1.05 (0.95–1.15)	0.19
Internal Trade	***353***	***1.13 (1.01–1.27)***	155	1.14 (0.96–1.34)	198	1.13 (0.97–1.31)	***0.04***
Warehousing	***30***	***1.58 (1.08–2.30)***	***11***	***1.95 (1.05–3.64)***	19	1.41 (0.88–2.28)	***0.04***
Real Estate Management	47	1.29 (0.96–1.74)	26	1.38 (0.93–2.06)	21	1.19 (0.76–1.86)	0.16
Sanitation Services	27	1.22 (0.83–1.79)	9	1.29 (0.66–2.53)	18	1.18 (0.74–1.90)	0.37
Finance	37	1.39 (0.99–1.94)	14	1.50 (0.87–2.59)	23	1.33 (0.87–2.03)	0.08

Industrial groups	Ever employment		Duration of employment				Trend P
	Cases	OR (95% CI)*	1 – 9 years		≥ 10 years		
			Cases	OR (95% CI)*	Cases	OR (95% CI)*	
Armed Forces	***60***	***1.35 (1.04–1.77)***	45	1.29 (0.95–1.75)	15	1.59 (0.93–2.70)	***0.02***

*Adjusted for smoking, education, family income, and asthma