

## Emerging tobacco hazards in China: 2. Early mortality results from a prospective study

Shi-Ru Niu, Gong-Huang Yang, Zheng-Ming Chen, Jun-Ling Wang, Gong-Hao Wang, Xing-Zhou He, Helen Schoepff, Jillian Boreham, Hong-Chao Pan, Richard Peto

### Abstract

**Objective** To monitor the evolving epidemic of mortality from tobacco in China following the large increase in male cigarette use in recent decades.

**Design** Prospective study of smoking and mortality starting with 224 500 interviewees who should eventually be followed for some decades.

**Setting** 45 nationally representative small urban or rural areas distributed across China.

**Subjects** Male population aged 40 or over in 1991, of whom about 80% were interviewed about smoking, drinking, and medical history.

**Main outcome measure** Cause specific mortality, initially to 1995 but later to continue, with smoker versus non-smoker risk ratios standardised for area, age, and use of alcohol.

**Results** 74% were smokers (73% current, only 1% former), but few of this generation would have smoked substantial numbers of cigarettes since early adult life. Overall mortality is increased among smokers (risk ratio 1.19; 95% confidence interval 1.13 to 1.25,  $P < 0.0001$ ). Almost all the increased mortality involved neoplastic, respiratory, or vascular disease. The overall risk ratios currently associated with smoking are less extreme in rural areas (1.26, 1.12, or 1.02 respectively for smokers who started before age 20, at 20-24, or at older ages) than in urban areas (1.73, 1.40, or 1.16 respectively).

**Conclusion** This prospective study and the accompanying retrospective study show that by 1990 smoking was already causing about 12% of Chinese male mortality in middle age. This proportion is predicted to rise to about 33% by 2030. Long term continuation of the prospective study (with periodic resurveys) can monitor the evolution of this epidemic.

### Introduction

The recent substantial increase in cigarette consumption by Chinese men will eventually cause a substantial increase in mortality.<sup>1</sup> To monitor the long term evolution of this epidemic, a large, nationally representative, prospective study will continue for some decades. We describe here its early (1992-5) mortality results.

### Methods

In 1987 the Chinese Academy of Preventive Medicine established 145 nationally representative "disease surveillance points," each involving about 100 000 registered residents in 5-8 units (urban street committees or rural villages).<sup>2</sup> All men aged  $\geq 40$  in two or three units in 45 representative disease surveillance points were sought in 1990-1 for this prospective study, and about 80% (224 500) were interviewed on smoking, drinking, and medical history. In all, 30% of interview-

ees were urban (the same proportion as in China as a whole). Mortality was prospectively monitored through local residential records. Causes from official death certificates were supplemented by medical notes and were coded (according to the international classification of diseases, ninth revision) by trained staff, blinded to baseline information. By January 1996, 3608 (2%) were untraced and 13 412 (6%) had died, with neoplastic, respiratory, vascular, and other causes equally common.

### Results

In 1990, 73% of the men (68% urban, 75% rural) smoked; just 1% were former smokers (many having stopped because they were ill). Of the smokers, 55% used only cigarettes in 1990 (87% urban, 43% rural; 67% at ages 40-49, 37% at  $\geq 65$ ) and 30% had begun before age 20 (26% urban, 32% rural). The overall mortality of smokers was significantly higher than that of never smokers (relative risk 1.19; 95% confidence interval 1.13 to 1.25;  $P < 0.00001$ ) and was highest among men who had begun smoking before age 20, particularly in urban areas (figure). The excess mortality among smokers chiefly involved neoplastic (1.26;  $P < 0.0001$ ), respiratory (1.38;  $P < 0.00001$ ), and vascular (1.13;  $P = 0.01$ ) disease. If these associations with smoking are largely causal, then tobacco is a cause of about 12% of all male adult deaths in China (table).

### Discussion

This nationally representative, prospective study shows that smoking is already an important cause of neoplastic, respiratory, and vascular death in Chinese men. This is consistent with smaller prospective studies in particular parts of China<sup>3</sup> and with a retrospective study of one million deaths.<sup>4</sup> For many conditions that can be caused by tobacco, the smoker/non-smoker mortality ratio is less extreme in China than in countries where cigarettes have been used widely for several decades. However, the background mortality (except for ischaemic heart disease) among non-smokers is particularly high in China, so the mortality from tobacco is already substantial. By about 1990 smoking was already responsible for about 12% of Chinese adult male deaths, which corresponds to 0.7 million male deaths in the year 2000 from tobacco (or somewhat more as the percentage increases).<sup>4</sup>

The current health effects, however, chiefly reflect the consequences of past smoking patterns, and the future health effects of current smoking patterns will be much larger. In countries such as the United Kingdom or the United States, where most smokers start before age 20, about half of all persistent cigarette smokers are eventually killed by tobacco.<sup>5</sup> Yet it is only recently that the full size of the US hazard became

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Chinese Academy of Preventive Medicine (CAPM), 29 Nan Wei Lu, Beijing 100050, People's Republic of China

Shi-Ru Niu, professor

Gong-Huang Yang, professor

Jun-Ling Wang, programmer

Gong-Hao Wang, professor

Xing-Zhou He, professor

Clinical Trial Service Unit and Epidemiological Studies Unit, Nuffield Department of Clinical Medicine, Radcliffe Infirmary, Oxford OX2 6HE

Zheng-Ming Chen, reader

Helen Schoepff, programmer

Jillian Boreham, senior research fellow

Hong-Chao Pan, programmer

Richard Peto, professor

Correspondence to: Professor Niu, Professor Peto or Dr Chen

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Numbers of deaths at age 40-79 during 1992-95, mortality, mortality risk ratios (95% confidence intervals), and percentages of mortality attributed to smoking

Cause of death <sup>4</sup>	No of deaths*	Annual mortality/1000†		Risk ratio for ever smokers v non-smokers‡	% of deaths attributed to smoking
		Smoker	Non-smoker		
Neoplastic	2018	3.13	2.49	1.26 (1.13 to 1.55)¶	16
Respiratory§	2530	3.78	2.73	1.38 (1.25 to 1.55)¶	22
Vascular	2543	3.82	3.39	1.13 (1.07 to 1.20)**	9
Other	2142	2.94	2.88	1.02 (0.92 to 1.13)	0
All deaths	9233	13.67	11.49	1.19 (1.13 to 1.25)¶	12

\*6997 deaths in smokers and 2236 deaths in never smokers.

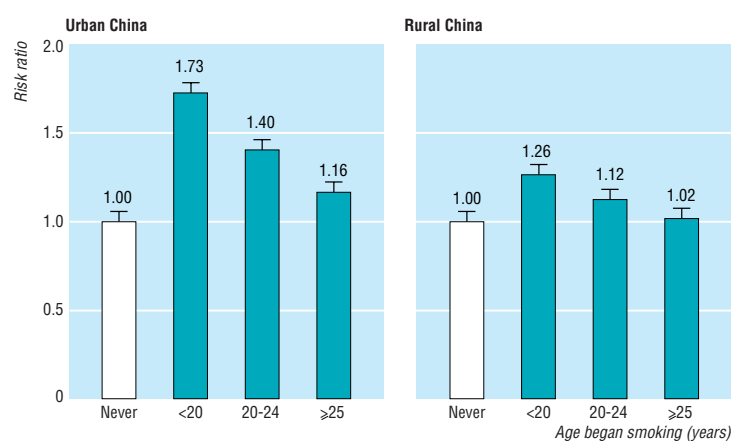
†Standardised to the non-smoker distribution (so the rate in smokers is the risk ratio times the rate in non-smokers).

‡Estimated using maximum likelihood, stratified for area, age, and alcohol. Such stratified analyses of this nationally representative study allow for the heterogeneity between urban and rural, and between particular areas.

§Including tuberculosis and respiratory heart disease.<sup>4</sup>

¶P<0.0001 compared with never smokers.

\*\*P=0.01 compared with never smokers.



Age when subjects began smoking v all cause mortality for men aged 40-79 in 1992-5: risk ratios and their floated standard errors.<sup>3</sup> The proportions starting at ages <20, 20-4, and ≥25 were respectively: urban 26%, 39%, and 35%; and rural 32%, 42%, and 26%. Hence, for the whole study (and hence for all China) the corresponding risk ratios were 1.34, 1.18, and 1.05

clear. For although the main increase in US cigarette use took place before 1950 (in 1910, 1930, and 1950 the mean consumption among US adults aged over 15 was 1, 4, and 10 cigarettes a day respectively), the main increase in US tobacco mortality took place after 1950, when those who had started smoking substantial numbers of cigarettes in early adult life reached middle and old age. Of all US deaths at ages 35-69, the proportion attributable to tobacco in 1950 was only 12%, rising to 33% in 1990, when the increase in US male tobacco deaths had been completed.<sup>6</sup> Recent prospective studies of US and UK male smokers correctly indicate that about half are killed by tobacco, but similar studies in those countries in the 1960s, before the main mortality increase was completed, misleadingly indicated that “only” a quarter would be.<sup>7</sup> In China as a whole, the all cause mortality ratio for smokers starting before age 20 is already 1.34, indicating that even at current death rates about 1 smoker in 4 (0.34/1.34) would be killed by tobacco. This low risk ratio reflects the fact that older men may in the past not have smoked persistently,<sup>3</sup> or may have smoked forms of tobacco with a lower risk than cigarettes. However, in urban areas (where a greater proportion of tobacco use involves cigarettes), the risk ratio for those who began before age 20 is

### Key messages

- In recent years most young men in China have become persistent cigarette smokers, starting at about age 20; this will cause high mortality in middle age and old age
- Currently, however, most middle aged and older smokers (particularly in rural areas) have not persistently used substantial daily numbers of cigarettes ever since they were young adults, so their current tobacco attributed mortality is more limited
- Nationally representative retrospective and prospective studies now show that in about 1990 “only” about 12% of adult male deaths in middle age were caused by smoking
- Continuation of the present prospective study will monitor the growth of the epidemic of tobacco related deaths in China over the next few decades

already approaching 2, suggesting that about half will be killed by tobacco.

The main increase in cigarette consumption in China took place only recently (in 1952, 1972, and 1992 the mean consumption among Chinese men was 1, 4, and 10 cigarettes a day respectively), so on present day smoking patterns Chinese tobacco mortality will increase substantially. Of all male deaths at ages 35-69 the proportion attributed to tobacco will rise between 1990 and 2030, from 12% to about 33% (as happened previously in the United States<sup>6</sup>) because both in urban and in rural China two thirds of young men (but currently few young women) become cigarette smokers, and cessation is rare. Long term continuation of this prospective study, with periodic resurveys of all middle aged adults living in the study areas, will monitor the evolution of the epidemic.

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