

RESEARCH COMMUNICATION

Burden of Lung Cancer Deaths due to Smoking for Men and Women in the WHO Western Pacific and South East Asian Regions

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Abstract

Introduction: Eighty percent of all smokers live in low and middle-income countries of the Asia Pacific region but actual estimates of the burden of disease due to smoking in the region have yet to be quantified. **Methods:** The burden of lung cancer due to smoking for all countries in the WHO Western Pacific and South East Asian regions was calculated from the population attributable fractions (PAFs). Nationally representative sex-specific prevalences of smoking were obtained from the World Health Organization, MEDLINE and/or national government documents and hazard ratios (HR) for lung cancer due to smoking in Asian and non-Asian populations were obtained from published data. The HR and prevalence were then used to calculate PAFs for lung cancer deaths due to smoking, by gender and by country. **Results:** The national prevalence of smoking in the Asia Pacific region ranged from 18-65% in men and from 0-50% in women. The fraction of lung cancer deaths attributable to smoking ranged from 0-40% in Asian women and from 21-49% in Asian men. In ANZ, PAFs were as high as 80% for women and 68% for men. Future estimates of the burden of smoking-related lung cancer in Asia were obtained by assuming a continuation of current smoking habits in these populations. Extrapolating the higher HR from the ANZ region to Asia, resulted in an increase in the PAFs to 4-90% in women and from 62-85% in men. **Conclusion:** The current burden of lung-cancer due to smoking in the Asia-Pacific region is substantial accounting for up to 50% of deaths from the disease in men and up to 40% in women depending on the country. If current smoking habits in Asia remain unchanged then the number of people dying from smoking-related lung cancer over the next couple of decades is expected to double. It is known that the majority of lung cancer is due to smoking. This is the first paper to systematically compare current burdens of lung cancer deaths due to smoking in countries in the Western Pacific and South East Asia and by gender. Findings from this paper demonstrate the number of lung cancer deaths that could be prevented if the prevalence of smoking was eliminated.

Key Words: Smoking - lung cancer - population attributable fraction - Asia Pacific region

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Introduction

Smoking currently kills about 5 million people per year (Ezzati and Lopez, 2000; WHO, 2008) and will soon be the biggest cause of death worldwide, well surpassing the combined deaths from malaria (1 million deaths/year), maternal causes (half a million deaths/year), tuberculosis (1.46 million deaths/year) and HIV/AIDS (2.04 million deaths/year) (WHO Oct 2008). Whereas the burden of smoking is likely to decrease in developed countries due to widespread smoking cessation initiatives, it is increasing in developing countries where eight out of ten smokers now live (WPRO 2009). The association between smoking and lung cancer is certain; 90% of all lung cancer cases are directly attributed to smoking (Huxley et al, 2007). However, according to the World Bank, there is still a need for new research into the current and likely impact of smoking - especially in lower-and middle-income

countries (LMIC) and by gender.

Moreover, estimates of current, and future, burden of smoking-related illness by country are needed to assist policy-makers in planning for healthcare services, to emphasize the need for government intervention and to assess the likely impact of any smoking-related policies. This is true particularly in the Asia Pacific region, home to the majority of the world's population where one third of the world's 1.3 billion smokers live, 350 million in China alone (WPRO 2009).

Lung cancer remains a disease with a dismal prognosis, with an average five-year survival of 15% in "Western" countries (Crowell et al, 2007; Ou et al, 2009). In the developing countries such as those of the Asia Pacific region, the five-year survival for lung cancer is lower at approximately 9%; largely due to late diagnosis and less effective treatment options and supportive care (Parkin et al, 2002; Crowell et al, 2007; Chiang et al, 2008; Ou

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et al, 2009).

While smoking and lung cancer are undeniably linked, the World Bank Report on Smoking calls for more information on the burden of smoking-attributable disease (Gajalakshmi et al, 2000). In particular, this is needed by gender and for lower-and middle-income countries where the majority of smoking related burden is experienced (Thun et al, 2008). An epidemiological tool to measure the impact of a particular exposure, such as smoking, on health outcomes is the population attributable fraction (PAF). Here, the PAF estimates the proportion of lung cancer that could be avoided if smoking were eliminated from the population. Although this is an unlikely scenario, the PAF provides valuable information regarding the magnitude of the disease burden due to an exposure and enables predictions to be made if the prevalence of the exposure were to change. This paper aims to provide information on the burden of lung cancer due to smoking in the Asia Pacific region using PAFs for lung cancer for all countries in the WHO Western Pacific and South East Asian regions.

This paper also aims to predict future burden of lung cancer in Asia using hazard ratios from ANZ where the epidemic of smoking has been experienced for much longer. Current and future estimates of lung cancer due to smoking are given by gender and by country.

Materials and Methods

Nationally representative prevalence of smoking, together with estimates of the hazard ratio (HR) and 95% confidence intervals (95% CI) for lung cancer deaths associated with smoking, was used to calculate PAFs. Region and sex-specific HRs (95%CI) were obtained from published data on the risk of lung cancer due to current smoking from the Asia Pacific Cohort Studies Collaboration (APCSC) (Woodward et al, 2006). These previously published HRs were based on analyses of individual participant data for those aged > 20 years, from 31 studies totaling 480,125 participants in the Asia Pacific region. HRs were: 2.48 (95% CI 1.99 - 3.11) for men in Asia and 9.87 (95% CI 6.04 - 16.12) in Australia and New Zealand (ANZ). For women, HR were 2.35 (95% CI 1.29 - 4.28) in Asia and 19.33 (95% CI 10.0 -37.3) in ANZ. For men and women, the p value for homogeneity between Asia and ANZ was < 0.0001 (Huxley et al, 2002). The population only become manifest up to two decades later. In Asia, many countries are only now, or are about to, experience the peak in the smoking habit and there are some indications that its popularity is actually on the increase among Asian women (Woodward et al, 2006).

Nationally representative data on the prevalence of smoking for adult men and women were obtained for countries in the WHO Western Pacific and South East Asian regions. Although the WHO does not recognize them as separate countries, Hong Kong, Macau and Taiwan were considered separately from China because these regions have unique health, political and administrative bodies that may influence the prevalence of smoking.

Prevalence data were compiled in 2009 from studies

indexed by the WHO and supplemented by data from national surveys, available either through Medline or through national government or non-governmental organization websites. Search terms used included: country name and smoking or tobacco and prevalence or nationally representative. These other surveys were used only if they contained more recent data or where the WHO did not have gender-specific data on smoking for a particular country. Only nationally representative surveys were used for the estimates of smoking prevalence.

Using the estimates of prevalence obtained from the literature and the HR from APCSC, current PAFs (%) for lung cancer deaths caused by smoking were calculated for each country, for both men and women, using the formula:

$$PAF = [100 \times \text{prevalence} \times (HR)] / [100 + \text{prevalence} \times (HR)]$$

where prevalence is in %.

Future estimates of the burden of lung cancer due to smoking in Asia were calculated using current smoking prevalence and by extrapolating the HR for lung cancer from ANZ to Asia.

Results

In the 31 countries for which there were eligible data, the prevalence of smoking ranged from 0.2% to 49.9% in women and from 18.3% to 64.8% in men (Figure 1). Several countries out of the 31 in the WHO Asia Pacific region do not yet have nationally representative data for smoking prevalence. Data on national smoking prevalence is lacking for Bhutan, Brunei Darassalam, the Marshall Islands, Micronesia, North Korea, Timor-Leste and Kiribati. Although some of these countries have data on smoking, they were not included in this report as the data is not nationally representative. Data on smoking prevalence from the Solomon Islands are not included in the figures but only in text here since the Solomon Islands do not have sex-specific data, reporting a 33% smoking prevalence in women only (Solomon Islands, 1990).

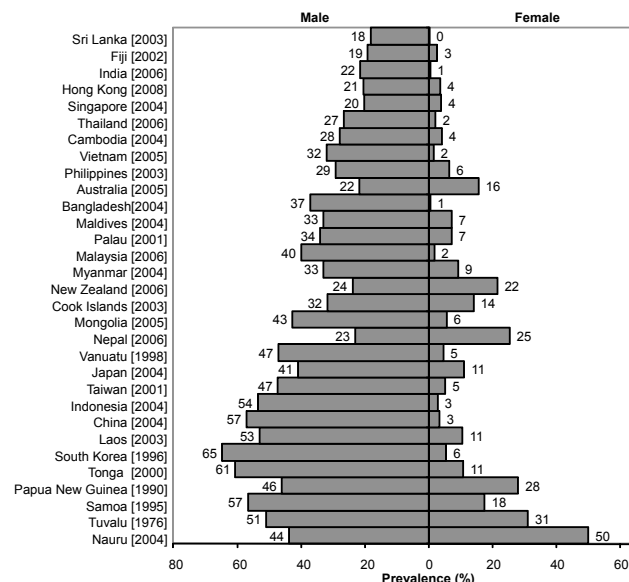


Figure 1. Prevalence of Smoking [National Data by Country]

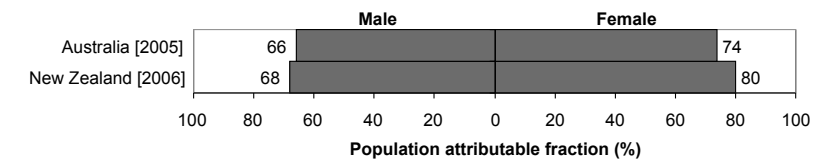


Figure 2. Population Attributable Fractions in Australia and New Zealand (ANZ)

Figure 2 shows the PAFs for lung cancer deaths in ANZ using HRs from Australia and New Zealand. In Australian women 74% of lung cancer deaths can be attributed to smoking, and 66% of lung cancer deaths in men. The PAFs are slightly greater in New Zealand where 80% of lung cancer deaths in women can be attributed to smoking and 68% of lung cancer deaths in men.

Figure 3 demonstrates the current and future PAFs for lung cancer deaths in the Asia Pacific region using HR from this region for current PAFs and using HR from ANZ to estimate future PAFs. These PAFs are estimates of the increase in lung cancer, solely due to taking into account the lag time between smoking and lung cancer (Figure 4) (Lopez et al, 1994).

Future PAFs could be greater if the prevalence of smoking increases concomitantly as predictions suggest. Current PAF ranged from 0.3% for women in Sri Lanka to 40.3% for women in Nauru. For men, PAFs ranged from 22% in Fiji to 49% of lung cancer deaths being attributable to smoking in South Korea. If these countries go on to have smoking epidemics similar to Australia and New Zealand future projections show PAFs ranging from 4% to 90% of lung cancer deaths being attributable to smoking in women and 61% to 83% of deaths in men.

Discussion

This is the first study which provides estimates for the current and future burden of lung cancer deaths caused by smoking for men and women in countries of the Asia-Pacific region. Hazard ratios for lung cancer due to smoking differ between the Asia Pacific and ANZ because of the long lag time between exposure to smoking and lung

cancer. Individuals in most countries of the Asia Pacific region have not been smoking as long, or as much (pack/years) as individuals in ANZ and hence current HRs are smaller for this region. Even if the prevalence of smoking were to stay the same in most countries of the Asia Pacific region, higher HRs will be observed as travel along this lag time is experienced. Hence, Australia and New Zealand currently have higher PAFs for lung cancer deaths due to smoking however this is likely to change in future as the PAFs for Asian countries grow.

Most countries in the Asia Pacific region have been experiencing a rise of their own epidemics of smoking, though some countries are observing dropping rates such as Australia, Fiji, Hong Kong, Japan, Laos, Malaysia, New Zealand and Singapore (Corrao et al, 2000). Bangladesh, India and the Maldives had rates drop between 1980 and 1990 but now appear to have increasing smoking rates once again (Corrao et al, 2000).

This study indicates that currently up to 80% of lung cancer deaths are attributable to smoking in these regions. Much of this excess mortality can be prevented if smokers quit now, though quitting is rare in low and middle-income countries (Jha et al, 2002). Importantly, while smoking prevalence is increasing in many countries in the Asia Pacific region, it is increasing even more so for women. This is particularly worrying given the greater risk of death from lung cancer due to smoking in women compared to men (Huxley et al, 2007).

This study also provides information on the predicted burden of lung cancer deaths caused by smoking for both women and men by country. For instance, South Korea is expected to experience an increase in lung cancer deaths due to smoking from 50% to 85% if they continue to smoke at the current rate. Information from this study may help inform country-specific health policies regarding lung cancer and tobacco control in the Western Pacific and South East Asian regions. This study also highlights that data on national smoking prevalence for about 27

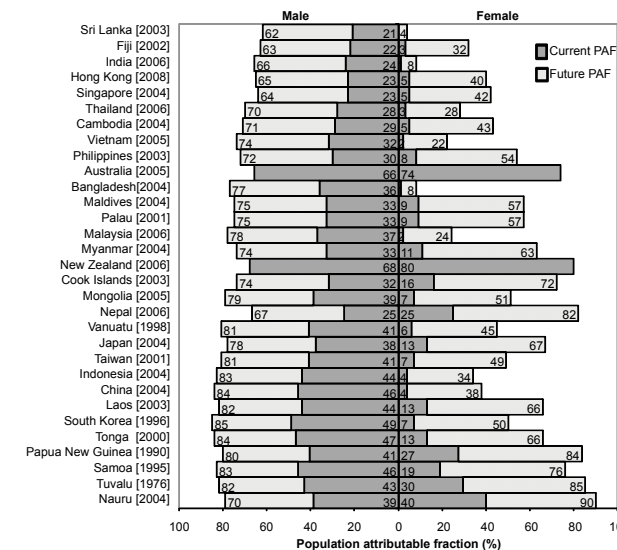


Figure 3. Current and Future Population Attributable Fractions in the Asia Pacific

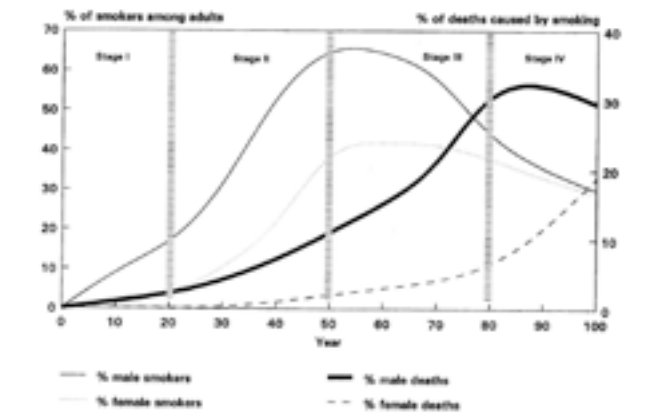


Figure 4. Stages of the Smoking Epidemic (Lopez et al, 1994)

million men and women in the Asia Pacific region are lacking [Bhutan (697,000), Brunei Darassalem (400,000), Kiribati (98,000), Marshall Islands (62,000), Micronesia (111,000), North Korea (24,051,706), the Solomon Islands (523,000) and Timor-Leste (1,134,000)] (UN, 2009).

A strength of this study is its use of PAFs using HRs from the largest-ever study of cancer in the Asia-Pacific, and one of the largest studies anywhere in the world. The hazards of smoking are more precise, and are available by gender and region because of the large size of the APCSC.

There are also limitations to estimating the burden of lung cancer due to smoking. First, prevalence data as well as estimates of the hazard ratio often use only the simple self-reported variable for smoking (yes/no) and as such, differences in prevalence and also estimates of risk do not take into account duration of smoking, amount smoked, method of smoking, or passive smoking. Second, the previously published hazard ratios were not able to take into account the influence of potential confounding or intervening variables such as income, air pollution (Du et al., 1996; Liu et al., 1998; Hesketh et al., 2007; Gu et al., 2009). A third limitation is that, although the estimates of risk were adjusted for age, data on the prevalence of smoking were not. Fourth, and last, the individual studies in the APCSC used different methods to verify causes of death. Studies did not have information on the proportion of lung cancer cases that were confirmed by histology, thus misclassification (of lung cancer as a non-cancer or vice versa) could have occurred and would result in an underestimation of the risks associated with smoking. Methods to confirm the cause of death will have varied over time and this lack of standardization could have had an unknown effect on the results. In summary, all the limitations in this study likely resulted in conservative estimates of the PAFs, thus only further underscoring the impact of smoking upon lung cancer now and in the future in the Asia Pacific region.

In conclusion, this study uses HR from the largest study of its kind in the region (APCSC) and provides PAFs using the most up to date national prevalence for smoking by country for two large WHO regions. This paper provides information on the burden of lung cancer due to smoking and also highlights countries in the region for which no national smoking prevalence exists, indicating countries where essential information should be collected in order to assess the current burden of smoking and also to be able to assess the impact of tobacco control policies (if any) over time.

It is certain that reducing smoking prevalence would prevent millions of deaths from lung cancer (and other smoking-related diseases) over the next few decades. Given that early detection and treatment of lung cancer is far beyond the reach of the health-care systems for many LMIC, the implementation of cost-effective programs and policies to reduce smoking prevalence is crucially important in these countries. There are existing tobacco control policies that have been shown to be effective and thankfully in September 2009 plans to operationalise the Framework Convention on Tobacco Control (FCTC) in the Western Pacific region was agreed upon (Cheng, 2009). Yet, there are still countries in the Asia Pacific region that

lag behind and which continue to experience increasing smoking rates.

Papers, such as this one, on the current and growing burden of smoking-related illness should help emphasize to policy makers the urgency required to take action. Adopting the Framework Convention on Tobacco Control and following through with its guidelines would be an ideal first step for countries aiming to curb their local epidemics of smoking.

What this paper adds relates to the fact that the prevalence of smoking is high and growing in low and middle-income countries including the WHO Western Pacific and South East Asian regions. More men than women currently smoke. There is less information on the prevalence of smoking in women and there is little information on the burden of disease caused by smoking in these regions. This study provides estimates for the population attributable fraction of lung cancer deaths caused by smoking for men and women by country. This study indicates that up to 80% of lung cancer deaths are attributable to smoking in these regions. It provides information on the predicted burden of lung cancer deaths caused by smoking for both men and women by country. For instance South Korea is expected to experience an increase in lung cancer deaths due to smoking from 50% to 85%. This is the first study to present information on current and predicted tobacco-attributable lung cancer deaths in two large WHO regions and by gender. Information from this study may help inform country-specific health policies regarding lung cancer and tobacco control in the Western Pacific and South East Asian regions.

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