Epidemiology shows that lung cancer is a serious disease, associated with a significant health burden in the UK and in much of the Western world. It is also likely to have a major impact in the developing world, particularly in countries like China where smoking, the number one risk factor for lung cancer, remains unaffected by changes in legislation such as those seen in the USA and Europe (Figure 1.1).

Epidemiological trends

The UK perspective

In the UK, lung cancer accounts for 6% of all deaths and roughly one in five of all cancer deaths. Around 38,000 cases are diagnosed, and approximately 33,500 people will die each year. That is more than the number of deaths from breast and bowel cancer combined. Indeed, more women die from lung cancer than breast cancer. Furthermore, only 25% of patients survive the first year following diagnosis, and the five-year survival rate has remained virtually unchanged for 30 years at approximately 7%.

However, with changing perceptions of smoking in the UK there has been a large reduction in smoking amongst men in the last 50 years, from a peak national consumption of about 12 cigarettes per male per day in 1945 to 4.6 per day by 1992. The incidence of lung cancer in men has declined correspondingly; from 80–120 per 100,000 in 1962 to 70–100 per 100,000 by 2002 (Figures 1.2 and 1.3).

In men at least, the UK incidence rates are comparable to many other European countries. By contrast, lung cancer death rates in women are not yet falling universally across all age cohorts, as their peak tobacco consumption occurred in 1974. Consumption has now fallen by about 50%, but as corresponding lung cancer mortality rates lag behind changes in smoking habits the mortality rate amongst women continues to rise (Figure 1.3). In fact, the UK has one of the highest incidence rates of any country in Europe (Box 1.1).

As well as a change in trends amongst men and women, lung cancer is now rare in individuals below the age of 40. The average age at presentation is currently approximately 75 years.

Lung cancer is 2–3 times more common in deprived areas compared to affluent regions of the country. As such, there is considerable regional variation in lung cancer mortality rates in the UK. The highest rates are found in Scotland and northern England, and reflect regional smoking patterns. This has major implications for prevention strategies.

An international perspective

Many of the epidemiological trends seen in the UK are seen in other Western countries, particularly in Europe. There are around 243,000 deaths from lung cancer each year in European Union (EU)
countries (188,000 in men and 55,000 in women). For men there has been a small decrease in the number of deaths from lung cancer since a peak in the early 1980s. However, lung cancer remains the biggest cancer killer, accounting for around 50 deaths per 100,000 men in 1995. However, in women lung cancer continues its gradual rise, resulting in about 22 deaths per 100,000 inhabitants in 1996. The highest male lung cancer incidence and mortality rates are found in Hungary, Poland and Belgium, with the lowest rates in Sweden and Portugal. Amongst females the highest lung cancer incidence and mortality rates are found in Denmark, Hungary and the UK, whilst the lowest are in Spain, Portugal and Malta (Figure 1.4).

In the USA lung cancer is the primary cancer killer in both men and women; during 2006 there were an estimated 174,470 new cases diagnosed. In the USA men have higher rates of lung cancer than females. In 2003, 78.5 per 100,000 men compared to 51.3 per 100,000 women were diagnosed with the disease. However, lung cancer incidence rates have been decreasing significantly among men whilst the rate has been stable since 1998 in women, after a long period of increases. In 1987, it surpassed breast cancer to become the leading cause of cancer deaths in women. The age-adjusted death rate in the black population was 12% greater than the rate in the white population. Similar regional variations among affluent and deprived areas are seen in the USA.

Beyond the West, in countries of the developing world and the ‘boom’ economies of the Far East and the Indian sub-continent, lung cancer rates remain low compared to those seen in the USA and Europe. However, the epidemiology of lung cancer is likely to change dramatically in the next 30 years in these countries unless curbs are placed on smoking.

The geographical differences seen represent the different stages of the worldwide tobacco epidemic. Although lung cancer incidence and mortality is declining slowly in most countries in Western Europe, in the USA and Australasia, and particularly in Asia, the increase in smoking habits means that sadly world lung cancer mortality is certain to rise from its current level of approximately one million deaths per annum in the 21st century.

### Smoking

The classic early epidemiological study by Doll and Hill in 1950 was followed by the ‘doctors’ study in which the smoking patterns and health outcome of 20,000 British doctors were followed for 50 years – a unique achievement (Figure 1.5). This study and others have demonstrated unequivocally that smoking causes lung cancer; the risks are proportional to the dose; quitting reduces that risk; but that even after quitting additional risks remain for more than 40 years (Figure 1.6).

The lifetime risk of a continuing smoker developing lung cancer is approximately 1 in 15, whereas for a lifelong non-smoker it is 1 in 200–300. If people quit at 50 years of age they reduce their lifetime risk to approximately 1 in 30. One consequence of this is that the proportion of lung cancer occurring in ex rather than current smokers in the UK is increasing, and is now at about 50%.

There is no such thing as a ‘safe cigarette’. Smokers become very proficient at controlling their preferred nicotine dose. For example, they can achieve a quick increase in levels by taking several deep inhalations when anxious or can opt for lower sustained levels when bored. The increasing use of low-tar cigarettes and filters may be responsible for the rise in frequency of adenocarcinoma, as the smoke is inhaled further out into the lung as the smoker tends to inhale more deeply. As a proportion of all cancers, this particular form has increased from about 15 to 30% in the last 20 years. The risk of lung cancer for long-term pipe smokers and the habitual cigar smoker is lower, but these forms of smoking do also cause cancer.
Risk factors additional to active tobacco smoking

The rates of spontaneous lung cancer increase with age and account for about 10% of all forms. Some lung cancers never seem to be associated with tobacco. An example is bronchoalveolar-cell carcinoma (BAC), which mimics a chronic unresolving pneumonia. These tumours spread within the lung segment or lobe and the majority do not metastasise (Table 1.1).

The most important additional risk factors are passive smoking and asbestos. There is strong epidemiological evidence that the relative risk to long-term passive smokers is 20–30% above baseline for a spouse or partner, and higher for workplace exposure, and that this causes about 600 lung cancer deaths yearly in the UK. This underpins the banning and restriction of smoking in the workplace and enclosed public places, which is already in force in several American states, some European countries, Scotland and, more recently, England.

People with symptomatic pulmonary asbestosis secondary to occupational exposure, have a 500% increase in their risk of lung cancer. There is a debate as to whether this risk is confined to persons with asbestosis, or whether asbestos itself is a carcinogen. Although unresolved it is likely that asbestos does increase the risk on its own and in proportion to the intensity and duration of exposure.

Radon is a naturally occurring radioactive gas that leaches out of granite. Therefore, people living in houses built upon granite are at an increased risk. This is of considerable importance in countries
such as Sweden, and to a lesser extent in the south-west of the UK and in Wales.

Women are more susceptible to lung disease, including both chronic obstructive pulmonary disease (COPD) and lung cancer, as a result of smoking than men; the reason for this is unknown. This fact makes it even more important for us to develop primary prevention strategies that are effective in young women. Lung cancer is currently the fastest increasing cause of cancer death in women, yet in the UK 38% of females aged between 20 and 24 years are regular smokers.

People with COPD are at an increased risk of developing lung cancer compared to others with an equivalent smoking history but normal spirometry, and the risk is roughly proportional to COPD severity. The reason for this is unknown. It has been hypothesised that it may be due to the additional effects of a separate tobacco-induced airway inflammation or, less plausibly, to the effects of altered airflow rates on carcinogen deposition in peripheral lung tissue.

### Prevention

Prevention is by far the most effective way by which we could reduce lung cancer mortality (Box 1.2). However, primary prevention is weak in the UK: by the age of 15, one in every four children is a regular smoker and it is estimated that 450 children start smoking every day. It is at this time that nicotine addiction develops.

Altering this pattern of behaviour will be difficult. It will probably need a combination of social and pricing policies and social pressures. Government action taken in Europe and the USA includes cigarette and tobacco packet health warnings, banning tobacco advertisements in all media, health education and, most recently, a ban on smoking in all public places. Parental habits and peer pressure appear to be the two driving factors in most cases and are far less susceptible to alteration.

Nicotine is highly addictive. Mark Twain famously said ‘quitting smoking is the easiest thing in the world to do; I have done it several times.’ Thus, although more than 70% of smokers would like to quit, long-term quit rates remain low. Simple unequivocal advice by a doctor produces a quit rate of 1–3%. If nicotine replacement therapy and support are added, the quit rate rises to about 6–8%. However, this action tends to be concentrated on adults over the age of 50. Because young people consult their physicians less often, the impact on younger smokers is less. Quit programmes (Box 1.3) cost £800 per life-year saved (1998 data); lung cancer chemotherapy is about 25 times as expensive.

International agencies both in the EU and worldwide, such as the World Health Organisation (WHO), are attempting to combat the menace of the active promotion of cigarette smoking by the large multinational tobacco companies. The WHO Framework Convention on Tobacco Control (FCTC) is an example of this action (Box 1.4). It remains to be seen whether concerted regulatory action by the world’s governments will be powerful enough to halt the trend of increased smoking in developing countries, which threatens to engulf fledgling health services and result in a huge burden of tobacco-related diseases in the second half of the 21st century and beyond.

### Table 1.1 Lung cancer risk factors other than cigarette smoking.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Relative risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental tobacco smoke</td>
<td>1.2</td>
</tr>
<tr>
<td>Asbestos (risk proportional to dose)</td>
<td>1.0–5.0</td>
</tr>
<tr>
<td>Radon gas (granite rock)</td>
<td>1.2</td>
</tr>
<tr>
<td>Diesel fumes (occupational)</td>
<td>1.3</td>
</tr>
<tr>
<td>Silicosis</td>
<td>2.5–3.2</td>
</tr>
<tr>
<td>Family history (especially women) &lt;50 yr</td>
<td>2–4 (unconfirmed)</td>
</tr>
<tr>
<td>Gender (women at greater risk)</td>
<td>1.2–1.7</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>2.7–5.0</td>
</tr>
</tbody>
</table>

### Box 1.2 Methods for reducing lung cancer mortality

- Primary prevention: stopping children starting
- Secondary prevention: ‘quit’ programmes
- Chemo prevention: no evidence of benefit yet
- Screening: trials in progress
- Reducing interval between first symptom and treatment: cancer standards
- Better treatments: ongoing clinical research

### Box 1.3 Recommendations for smoking cessation programmes in primary care

- Ask about smoking at every opportunity
- Advise all smokers to stop
- Assist the smoker to stop
- Arrange follow-up
- Assistance:
  - set quit date
  - review past attempts
  - warn about symptoms
  - tell family and friends
  - discuss alcohol consumption
  - provide nicotine replacement therapy

Adapted with permission from Raw et al. 1998.

### Box 1.4 Key provisions in the Framework Convention on Tobacco Control (FCTC)

- Enact comprehensive bans on tobacco advertising, promotion and sponsorship.
- Obligate the placement of rotating health warnings on tobacco packaging to cover at least 30% of the principal display areas.
- Ban the use of misleading terms such as ‘light’ and ‘mild’.
- Protect citizens from exposure to tobacco smoke in workplaces, on public transport and in indoor public areas.
- Combat smuggling.
- Increase tobacco taxes.
Further reading
