RISK FACTORS FOR CHRONIC RESPIRATORY DISEASES

9. Causes and Consequences of Chronic Respiratory Diseases

KEY MESSAGES

- **Many risk factors for chronic respiratory diseases have been identified and can be prevented.**
- **Major risk factors include:**

  tobacco smoke
  second hand tobacco smoke
  other indoor air pollutants
  outdoor air pollutants
  allergens
  occupational agents.

- **Possible risk factors include:**

  diet and nutrition
  post infectious chronic respiratory diseases.

Many risk factors of chronic respiratory diseases among those of chronic diseases have been identified (Table 14).

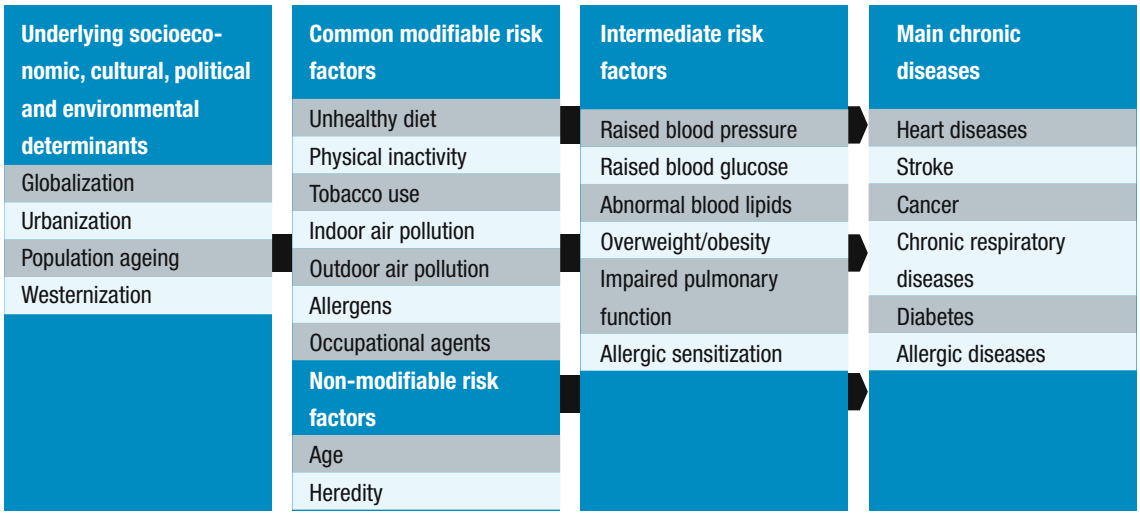
Table 14 Risk factors for chronic respiratory diseases among those of chronic diseases

Each year:
■ 7.1 million people die as a result of raised blood pressure
■ 4.9 million people die as a result of tobacco use
■ 4.4 million people die as a result of raised cholesterol levels
■ 2.7 million people die as a result of low fruit and vegetable consumption
■ 2.6 million people die as a result of being overweight or obese
■ 1.9 million people die as a result of physical inactivity
■ 1.6 million people die as a result of being exposed to solid fuels.[a]

[a] Includes acute respiratory infections and chronic respiratory diseases.
Source: references 1 and 270.

The causes of the chronic respiratory diseases are well known (Figure 16). The most important modifiable risk factors are: tobacco use, other exposures

Figure 16 Causes of chronic respiratory diseases



Source: reference *1*.

to indoor and outdoor air pollutants, allergens, occupational exposure, and to a lesser extent than for other chronic diseases, unhealthy diet, obesity and overweight intake and physical inactivity.

Preventable risk factors

In attempting to reduce risks to health, the first steps are to quantify the health risks and to assess their distribution. The risk factors for chronic respiratory diseases are presented in Tables 15 and 16.

Table 15 Disability-adjusted life years (DALYs) (in millions) attributable to various risk factors, by level of socioeconomic development and sex, 2000

	High mortality developing country		Low mortality developing country		Developed country	
	Males	Females	Males	Females	Males	Females
Total DALYs	421	412	223	185	118	97
	(% of total)	(% of total)	(% of total)	(% of total)	(% of total)	(% of total)
Tobacco	3.4	0.6	6.2	1.3	17.1	6.2
Indoor smoke from solid fuels	3.7	3.6	1.5	2.3	0.2	0.3
Urban air pollution	0.4	0.3	1.0	0.9	0.6	0.5
Occupational airborne particulates	0.1	<0.1	0.87	0.1	0.4	0.1

Source: reference *7*.

Risk accumulation with age

Populations are ageing in most low and middle income countries, against a background of many unsolved infrastructural problems. In the 1960s, people

Table 16 Mortality (in millions) attributable to various risk factors, by level of socioeconomic development and sex, 2000

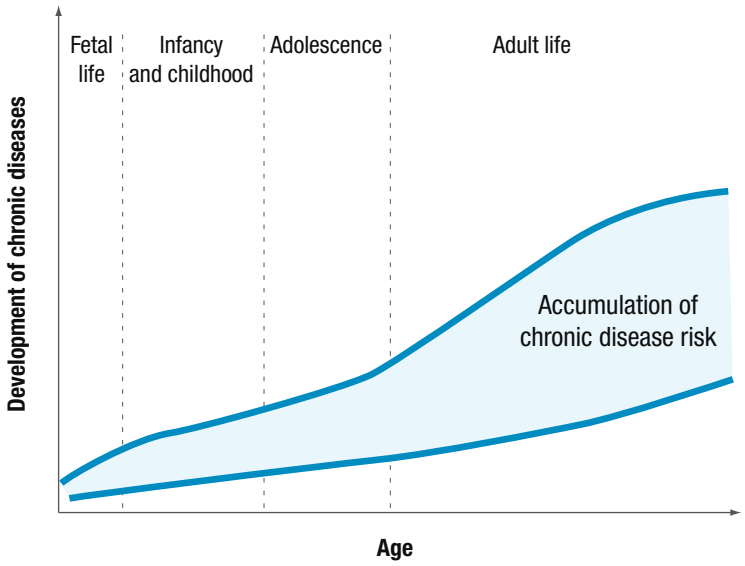
	High mortality developing country		Low mortality developing country		Developed country	
	Males	Females	Males	Females	Males	Females
Total deaths	13.8	12.7	8.6	7.4	6.9	6.6
	(% of total)	(% of total)	(% of total)	(% of total)	(% of total)	(% of total)
Tobacco	7.5	1.5	12.2	2.9	26.3	9.3
Indoor smoke from solid fuels	3.6	4.3	1.9	5.4	0.1	0.2
Urban air pollution	0.9	0.8	2.5	2.9	1.1	1.2
Occupational airborne particulate	0.3	<0.1	1.6	0.2	0.6	0.1

Source: reference *7*.

aged 60 years and over constituted only a small minority, but their number is increasing rapidly. Ageing is a process associated with chronic and disabling diseases (Figure 17). Chronic respiratory diseases are among the most frequent and severe of all, also in the elderly.

In low and middle income countries, those who spent a large part of their lives in an urban setting tended to have unhealthier lifestyles and therefore a higher risk of chronic diseases compared with their less urbanized counterparts. An exception to this rule may arise from exposure to indoor air pollution in rural areas where solid fuels are used for cooking and heating.

Figure 17 Risk accumulation: a life approach to chronic diseases



Source: reference *1*.

In general women live longer with chronic diseases than men, although they are in poor health (*271*). The costs associated with health care, including user fees, are a barrier to women's use of services. Women's income is lower than

that of men, and they have less control over household resources. Chronic respiratory diseases require regular use of medicines. Therefore they are no exception to this rule.

In low and middle income countries, the exposure of women and children to biomass fuels is of great concern. Improving the health of women in developing countries is one of the key Millennium Development Goals (*272*).

Several features related to gender constitute specific risk factors for chronic respiratory diseases. For example, in many low income countries women are more exposed to the smoke of biomass fuels used for cooking, whereas in some other regions men are more often smokers. These explain some of the differences in the prevalence of asthma, allergic diseases and chronic obstructive pulmonary disease.

10. Tobacco Smoking: The Major Threat in High Income Countries, As Well As in Low And Middle Income Countries

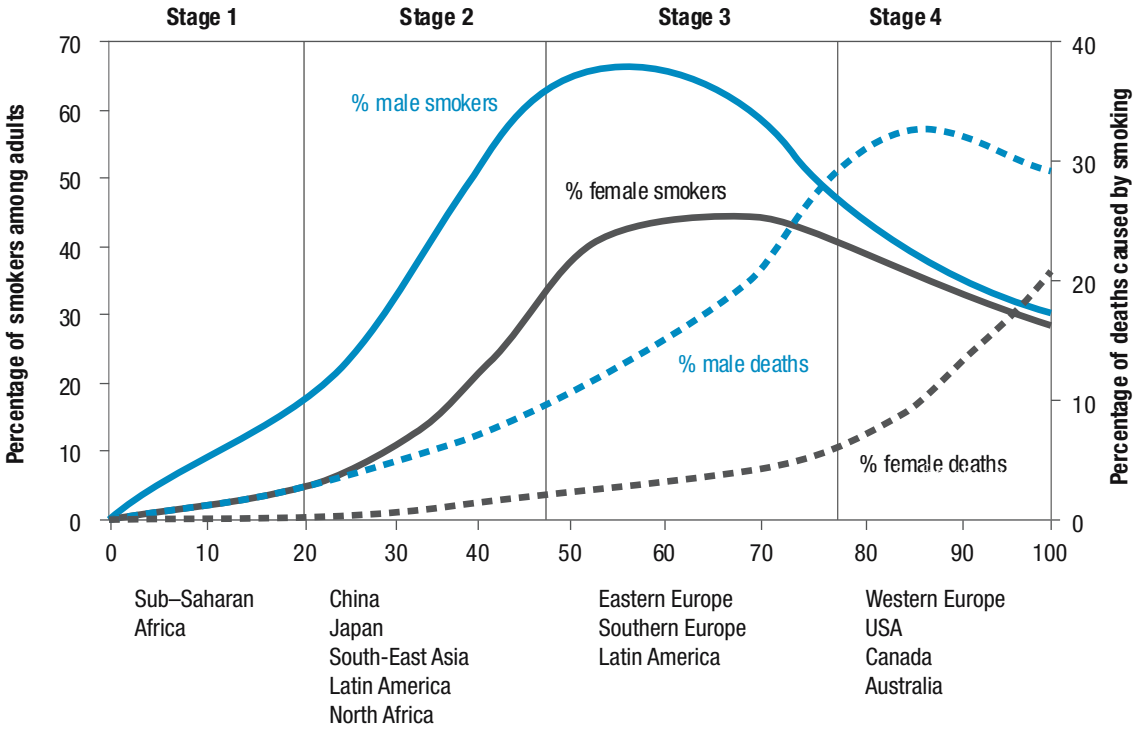
KEY MESSAGES

- **Exposure to tobacco smoke, both the active and second hand, is a major threat to people in high income countries, as well as in low and middle income countries, because of its close link with noncommunicable and communicable diseases.**
- **The cumulative effect of tobacco smoke and other air pollutants increases the risk for chronic respiratory diseases.**

The spread of the tobacco epidemic is facilitated through a variety of complex factors with cross-border effects, including trade liberalization and direct foreign investment. Other factors such as global marketing, transnational tobacco advertising, promotion, lobbying and sponsorship, as well as international smuggling and counterfeit cigarettes, also contribute to the explosive increase in tobacco use.

Rates of tobacco use among 13–15 year old school children are high. The Global Tobacco Surveillance System collaborative group has recently analysed a sample of 747 603 adolescents from different countries and continents. They report the frequency of current tobacco use to vary from 11.4% in the Western Pacific Region, to 22.2% in the Americas, for a global average of 17.3%. While in general girls smoke less than boys, both in the Americas and in Europe, in the leading regions in smoking youngsters, the frequency is almost the same between genders (*273*).

Figure 18 The four stages of the tobacco epidemic



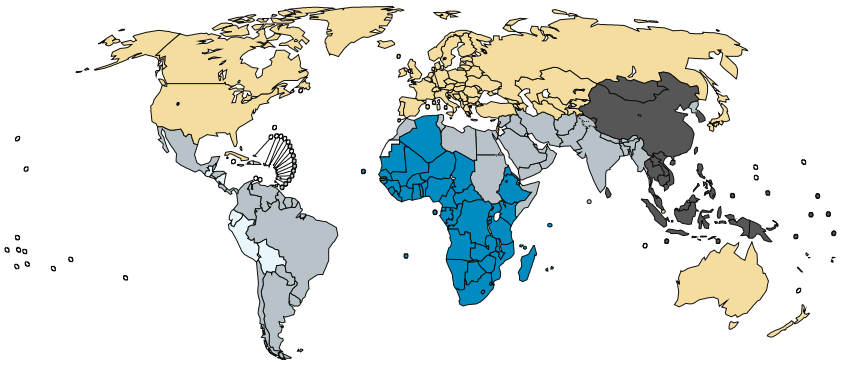
Source: reference *274* and *277*.

Smoking: the well-known killer

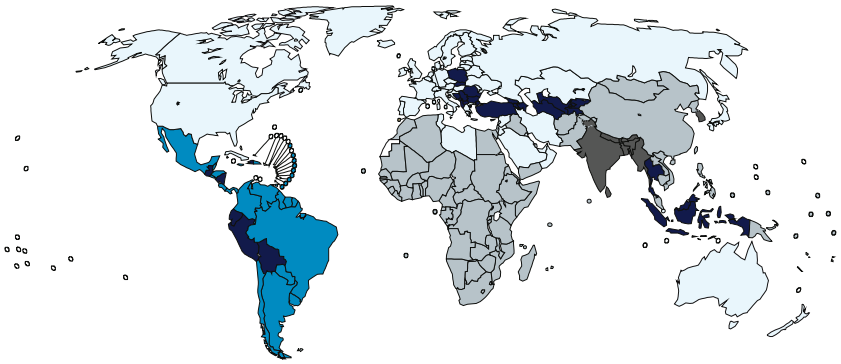
The report on *The Millennium Development Goals and tobacco control: an opportunity for global partnership* (*274*) summarizes the health effects of smoking. Tobacco is the second risk factor causing death after high blood pressure. The annual number of deaths from tobacco, estimated at nearly

Figure 19 Burden of disease attributable to selected environmental risk factors (percentage of DALYs in each subregion): (a) tobacco; (b) indoor smoke from solid fuels; (c) urban air pollution

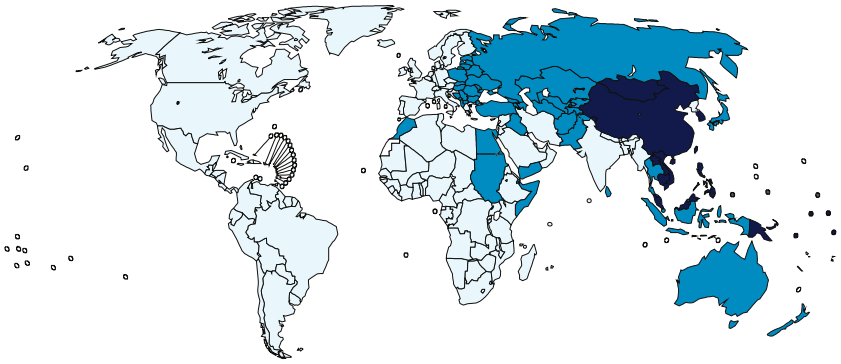
(a) Tobacco



(b) Indoor smoke from solid fuels



(c) Urban air pollution



Proportion of DALYs attributable to selected risk factor

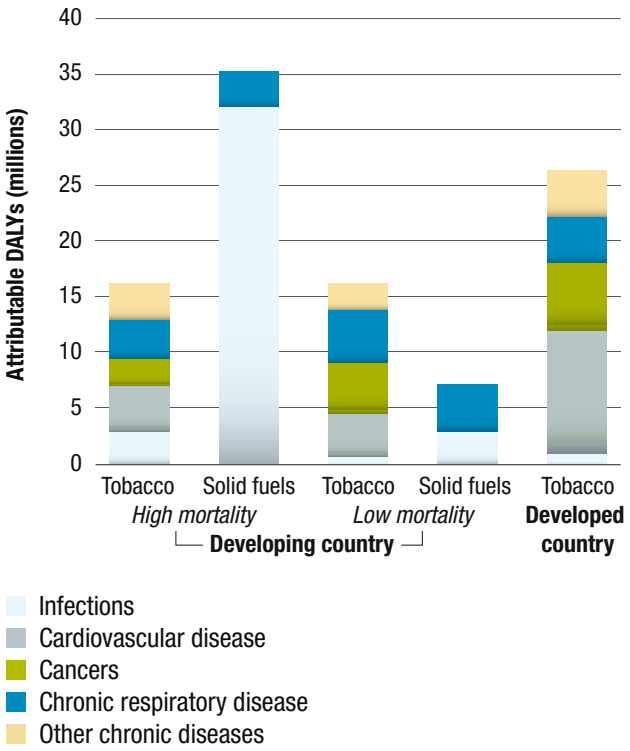
>0.5%	2–3.9%	16%+
0.5–0.9%	4–7.9%	
1–1.9%	8–15.9%	

Source: reference *7*.

5 million in 2000, was divided almost equally between high income and low and middle income countries (*275*). On current trends, mortality will increase to 8.3 million a year by 2030, and 80% of these deaths will occur in low and middle income countries (*276*) (Figures 18 and 19).

The leading causes of death from smoking are cardiovascular diseases (1.7 million deaths annually), chronic obstructive pulmonary disease (1 million deaths annually) and lung cancer (0.85 million deaths annually) (*275*). Patterns of death and disease from tobacco vary depending on the country's level of development (Figure 20).

Figure 20 Burden of disease attributable to tobacco and indoor smoke from solid fuel



Source: reference *198*.

In the United States, vascular disease and lung cancer predominate. In China, chronic obstructive pulmonary disease causes more tobacco-related deaths than lung cancer. In India, with almost half the world's tuberculosis deaths, smoking exacerbates the effects of tuberculosis, and causes a greater risk of death. Tobacco is also responsible for a large portion of the disease burden in low and middle income countries and is the largest contributor to DALYs lost in high income countries (*278*).

Manufactured cigarettes, as well as all other products of "smoked tobacco" (e.g. cigars, or other "traditional" products like waterpipes, kreteks and bidis) are not the only form of tobacco that carries significant risk (*279*). All tobacco products are harmful and addictive and all can cause disease and death (*280*, *281*).

Smokeless tobacco products (i.e. chewing tobacco, snuff, Swedish snus gutkha and other oral smokeless tobacco) used by many poor people – and especially

by women – contain addictive levels of nicotine, many carcinogens, heavy metals, and other toxins and therefore carry a substantial mortality risk (*282*).

In low and middle income countries, tobacco smoking is linked with poverty and poor education (*283*). At the individual and household level, a lot of money is spent on tobacco. For poor people, money spent on tobacco is money not spent on basic necessities, such as food, shelter, education and health care. Tobacco users are at much higher risk of falling ill and dying prematurely of tobacco-related diseases, thus depriving families of much-needed income and imposing additional health-care costs. Those who grow tobacco suffer as well. Many tobacco farmers, rather than becoming rich from their crop, often find themselves in debt to tobacco companies (*283*).

Second-hand tobacco smoke

Second-hand tobacco smoke is the combination of smoke emitted from the burning end of a cigarette or other tobacco products and smoke exhaled by the smoker. Second-hand tobacco smoke contains thousands of known chemicals, at least 250 of which are known to be carcinogenic or otherwise toxic (*284*). Second-hand tobacco smoke is a major constituent of air pollution in indoor environments, including the home. Scientific evidence has firmly established that there is no safe level of exposure to second-hand tobacco smoke, a pollutant that causes serious illnesses in adults and children. In light of the accumulated evidence, local and national governments worldwide are increasingly implementing smoke-free policies in workplaces and public places to protect people from the dangers of second-hand tobacco smoke. Jurisdictions that have implemented smoke-free workplaces and public places have observed an immediate drop in levels of second-hand tobacco smoke, a decline in levels of second- hand tobacco smoke components in the population as well as significant and immediate health improvements in workers previously exposed to second-hand tobacco smoke.

In some countries, regulation on smoking in the workplace and public places has made the home the dominant unregulated source of environmental tobacco smoke. However, in most countries, the consequence of workplace exposure seems to be more serious than domestic exposure (*285*).Evidence on the adverse health effects of exposure to second-hand tobacco smoke has been accumulating for nearly 50 years. In children, environmental tobacco smoke increases the risk of sudden infant death syndrome, middle ear disease, lower respiratory tract illness, and prevalence of wheeze and cough. It also exacerbates asthma. In adults, environmental tobacco smoke is associated with an increased risk of chronic respiratory diseases, lung cancer and cancers of other sites (*286*), as well as cardiovascular disease (*287*). Intrauterine and environmental exposure to parental tobacco smoking is related to more respiratory symptoms and poorer lung function in adulthood.

There is no safe level of exposure to second-hand tobacco smoke (*284*, *288–289*). Therefore, the elimination of smoking from indoor environments is the only science-based measure that adequately protects a population's

health from the dangerous effects of second-hand tobacco smoke. Smoke-free policies protect health; where they are introduced, exposure to second-hand tobacco smoke falls and health improves. They are also extremely cost-effective, especially compared with the ineffective "alternatives" promoted by the tobacco industry, generally through third parties, namely (*284*):

- Separation of smokers and non-smokers within the same airspace.

- Increased ventilation and air filtration combined with "designated smoking areas."

11. Indoor Air Pollutants: The Unrecognized Killers In Low and Middle Income Countries

KEY MESSAGES

- **Solid fuels represent a major danger for health in low and middle income countries.**
- **Children under 5 years of age and women are the most vulnerable population because they are most likely to be exposed to indoor air pollution every day.**

Solid fuels represent a major danger in low and middle income countries. However, more than 3 billion people, almost all in low and middle income countries, rely on solid fuels, in the form of wood, dung and crop residues, for domestic energy (*272, 291, 292*). These materials are typically burnt in simple stoves with incomplete combustion. Consequently, women and young children are exposed to high levels of indoor air pollution every day resulting in an estimated 1.5–1.8 million premature deaths a year (*7, 270*). In Africa, approximately 1 million of these deaths occur in children aged under 5 years as a result of acute respiratory infections, 700 000 occur as a result of chronic obstructive pulmonary disease and 120 000 are attributable to cancer in adults, particularly in women (*292–301*). The global estimates may be up to 5 times higher. In a population survey in India, traditional solid fuels such as wood were found to have adverse effects on pulmonary function, in particular in women (*302*). It has been estimated, based on a model, that household indoor air pollution will cause a cumulative total of 9.8 million premature deaths by the year 2030 (*303*). In high income countries such as Spain, a strong association has been found between exposure to wood or charcoal smoke and chronic obstructive pulmonary disease (*304*), suggesting that the risks associated with the use of solid fuels may not be restricted to low and middle income countries.

Several indoor air pollutants are associated with asthma and chronic obstructive pulmonary disease (*292*). The main health pollutants in dwellings are second-hand tobacco smoke, indoor allergens, nitrogen oxide, formaldehyde, volatile organic compounds, indoor-generated particulate matter and carbon monoxide. These pollutants can affect the respiratory system and can cause or exacerbate asthma, acute respiratory diseases or chronic obstructive pulmonary disease. Some pollutants, such as radon, second-hand tobacco smoke and volatile organic compounds, pose a significant cancer risk. Among all indoor air pollutants, tobacco smoke is the major cause of indoor air pollution, morbidity and mortality in high, middle and low income countries (*305*).

12. Outdoor Air Pollutants

KEY MESSAGES

- **Urban air pollution poses a health risk worldwide, especially in low- and middle-income countries.**
- **Outdoor air pollutants have been associated with increased morbidity and mortality due to cardiovascular and respiratory diseases.**

Impact of air pollution on mortality and morbidity increases with the exposure levels but there are no thresholds below which the adverse effects of the pollution do not occur. Therefore the morbidity and mortality is increased by the pollution in all parts of the world, but at least half of the disease burden is borne by the populations of developing countries. People with existing heart or lung disease are at increased risk of acute symptoms or mortality (*306*).

Adverse respiratory health effects of air pollution are:

- Increased mortality.
- Increased incidence of cancer.
- Increased frequency of symptomatic asthma attacks.
- Increased incidence of lower respiratory infections.
- Increased exacerbations of disease in people with cardiopulmonary diseases, which could result in:
  - decreased ability to cope with daily activities (e.g. shortness of breath);
  - increased hospitalization, both in frequency and duration;
  - increased number of visits to emergency ward or physician;
  - increased need for pulmonary medication;
  - decreased pulmonary function.
- Reduction in FEV_1 or FVC associated with clinical symptoms:
  - in the short term (during acute exposure);
  - in the long term, marked by an increased rate of decline in pulmonary function.
- Increased prevalence of wheezing in the chest apart from colds, or of wheezing most days or nights.
- Increased prevalence or incidence of chest tightness.

- Increased prevalence or incidence of cough or phlegm production requiring medical attention.

- Increased incidence of acute upper respiratory infections that may interfere with normal activity.

- Eye, nose and throat irritation that may interfere with normal activity.

Long-term exposure to traffic-related air pollution may shorten life expectancy. Long-term exposure to combustion-related fine particulate air pollution is an important environmental risk factor for cardiac, pulmonary and lung cancer mortality (*307*). Even relatively low levels of air pollution observed in California, United States of America, have chronic, adverse effects on lung development in children from the age of 10 to 18 years, leading to clinically significant deficits in attained FEV_1 as children reach adulthood (*308, 309*).

The role of outdoor air pollution in causing chronic obstructive pulmonary disease or asthma needs to be studied further in order to separate out the effects of single pollutants from the combined effects of the complex mixture of air pollutants in urban atmospheres (*310*). The impact of outdoor air pollution appears to be smaller than that of cigarette smoke and indoor pollution (in respect of chronic obstructive pulmonary disease) and that of allergens (in respect of asthma) (*107, 311–314*). Outdoor air pollutants are of particular concern in low and middle income countries (*315*).

13. Allergens

KEY MESSAGES

- **Indoor and outdoor allergens are common in all countries.**
- **Exposure to allergens is one of the major triggers in sensitized individuals with asthma.**

Allergic diseases result from a complex interaction between genes, allergens (*316*) and co-factors which vary between regions (*317*). Allergens are antigens reacting with specific IgE antibodies. Allergens originate from a wide range of mites, animals, insects, plants, fungi or are small molecular weight chemicals. They are usually classified as indoor allergens (mites, some moulds, animal danders, insects) or outdoor allergens (pollens and some moulds). The role of allergens in the development of asthma is well established (*314*), although some uncertainties remain (*37*). Exposure to allergens is a trigger for symptoms in sensitized individuals with asthma. This is especially true for

Table 17 Prevalence of asthma and specific IgE in the 36 centres of the European Community Respiratory Health Survey (ECRHS I)

Countries[a]	Number of centres	Prevalence (%)		Odds ratio (95% CI)			
		Asthma	Atopy[b]	HDM[c]	Cat	Timothy grass	Atopy[b]
Estonia	1	7	18	1.82	8.74	3.12	1.25
Iceland	1	3	23	8.91	7.02	4.59	4.21
Spain	5	4–11	17–42	1.48–4.54	2.78–8.90	1.62–4.02	1.33–5.44
Norway	1	7	26	3.17	5.46	2.76	5.16
Italy	3	6–15	24–30	2.53–5.30	1.10–9.51	2.76–4.52	2.94–4.85
Sweden	3	8–10	30–32	1.88–2.36	2.60–5.54	2.02–3.58	1.92–5.17
France	4	6–13	29–43	1.79–4.64	3.43–6.48	1.37–3.98	1.53–4.60
Belgium	2	5–9	35–36	3.65–3.65	2.78–5.03	4.17–5.10	4.24–5.28
Germany	2	3–7	35–40	0.23–2.55	2.60–4.47	1.35–2.55	1.36–3.31
United Kingdom	4	9–14	34–44	2.01–5.07	2.33–5.17	1.62–2.86	2.03–5.74
Netherlands	3	5–7	36–41	2.06–6.14	3.75–5.52	2.44–5.49	2.03–5.74
Ireland	1	12	41	3.15	3.62	5.51	2.07
New Zealand	3	11–14	40–46	1.74–6.14	0.83–8.34	2.19–3.14	1.57–4.58
USA	1	12	43	1.01	2.13	2.48	2.52
Switzerland	1	10	45	1.86	1.31	1.75	1.53
Australia	1	12	45	2.89	3.24	2.41	3.22
All (95% CI)	36	9 (8–10)	34 (31–37)	2.78 (2.41–3.20)	4.18 (3.54–4.93)	2.63 (2.30–4.93)	2.82 (2.44–3.28)

[a] Countries listed in order of percentage of atopy.
[b] Atopy: any of house dust mite, cat, timothy grass, C. *herbarum*, and birch, Parietaria or ragweed IgE.
[c] House dust mite.
Source: reference *320*.

allergens primarily found indoors but can also be true for outdoor allergens with sufficiently high exposure (*319*) (Table 17).

Allergic sensitization is common in low and middle income countries, although some allergens may be specific to tropical environments (*321*). In Africa, allergic diseases are more common in urban than rural areas (*322, 323*), possibly because parasites protect people from atopic diseases (*324*). In deprived populations within the United States, cockroaches are common allergens (*325*).

14. Occupational Exposure

KEY MESSAGES

- **The workplace environment contributes significantly to the burden of chronic respiratory diseases.**
- **Because of the variation in latency periods, chronic respiratory diseases may occur immediately or only after many years.**

Workplace fatalities, injuries and illnesses remain at unacceptably high levels. They involve an enormous and unnecessary health burden, they cause great suffering, and they represent economic losses amounting to 4%–5% of GDP. According to ILO estimates for 2000, there are 2 million work-related deaths per year. WHO estimates that only 10%–15% of workers have access to a basic standard of occupational health services (*326*).

In 2000, WHO estimated that risk factors at the workplace were responsible worldwide for 37% of back pain, 16% of hearing loss, 13% of chronic obstructive pulmonary disease, 11% of asthma, 8% of injuries, 9% of lung cancer, and 2% of leukaemia. These risks at work caused 850 000 deaths worldwide and resulted in the loss of about 24 million years of healthy life (*327*).

Work-related respiratory conditions can have long latency periods. Once the disease process has begun, the worker continues to be at risk for many years, even after exposure ceases. In addition, once these conditions have developed, they are usually chronic and may worsen, even after avoidance of the risk factors.

Occupational respiratory diseases include a spectrum of conditions caused by the inhalation of both organic and inorganic materials (*328*). The population attributable risk of asthma and chronic obstructive pulmonary disease arising from work exposure is estimated to be up to 15% (*328*). Worldwide, asthma is the principal disease caused by the inhalation of organic agents. Fibrosis and cancers are the principal ailments resulting from inorganic agents: fibrosis in relation to silica dust (*329*) and asbestos, and fibrosis of the pleura and malignant mesothelioma in relation to asbestos fibers (*330–332*). Mesothelioma and lung cancers are now more frequent causes of death than asbestosis. Mortality attributable to asbestosis decreased over the last few decades of the 20th century because of the progressive implementation of workplace controls (*333*). Mesothelioma, in particular, is often related to a history of exposure to asbestos over a short period of time, often many years earlier. Smoking and tuberculosis are major co-factors in the development of occupational chronic respiratory diseases and cancers (*38, 334, 335*).

The workplace environment contributes significantly to the general burden of asthma (*336–338*) and COPD (*339*), but information on prevalence is difficult to obtain in many low and middle income countries. The worldwide mortality and morbidity from asthma, COPD, and pneumoconiosis arising from occupational airborne exposure were estimated for the year 2000 (*340*). There were an estimated 386 000 deaths (asthma, 38 000; COPD, 318 000; pneumoconiosis, 30 000) and nearly 6.6 million DALYs (asthma, 1 621 000; COPD, 3 733 000; pneumoconiosis, 1 288 000) attributable to exposure to occupational airborne

particulates. Work-related asthma is the United Kingdom's fastest growing occupational disease and all health-care professionals should be aware of this possible diagnosis in patients with symptoms of asthma Patients with occupational asthma have higher rates of hospitalization and mortality than healthy workers (*341*).

In all countries, occupational chronic respiratory diseases represent a public health problem with economic implications (*13*). Technologies which are obsolete or banned in industrialized countries are still largely used in the world's poorest countries (*342*). In low and middle income countries, occupational illnesses are generally less visible and are not adequately recognized as a problem. Moreover, in those countries, most patients are not compensated and usually continue to work until the disease is severe and debilitating.

15. Diet and Nutrition

KEY MESSAGES

- **Dietary factors may be harmful or protective for chronic respiratory diseases.**
- **A dietary approach for the prevention and control of major chronic diseases could be beneficial for chronic respiratory diseases.**

For a long time, nutritional intake has been related to disease. WHO has adopted a broad-ranging approach under the Global Strategy on Diet, Physical Activity and Health, endorsed by the World Health Assembly in May 2004 (resolution WHA57.17). Dietary factors which increase or decrease the risk of other chronic diseases may be harmful or beneficial for chronic respiratory diseases (*343, 344*).

- Based on currently available evidence, it is not possible to conclude on the effect of dietary salt reduction in the management of asthma. However, there is an improvement in pulmonary function with a low salt diet. Further large-scale trials are required before any firm conclusions can be reached (*345*).

- Epidemiological studies suggest that a diet high in marine fatty acids (fish oil) may have beneficial effects on inflammatory conditions such as asthma (*346*). Fish oil supplementation has shown inconsistent effects in asthma outcomes (*347*).

- A beneficial effect of fresh fruit consumption on symptoms or lung function has been observed in asthma by several epidemiologic studies (*343, 348–350*). The role of vitamin C supplementation in the management of asthma is not clear yet (*351*).

- Obesity is a major risk factor of diabetes, cardiovascular diseases and other chronic diseases. It appears to be associated with the increased prevalence of asthma in high income (*16, 352–355*) and low and middle income countries as well as in deprived populations (*356*, *357*). Moreover, for people with asthma, obesity is a risk factor for dyspnea (*358*) and poor control of the disease (*359, 360*). Properly controlled studies are needed to confirm the benefits of weight-loss programmes for people with asthma (*361*). For people with COPD, obesity is thought to be a risk factor for dyspnea and may increase the severity of the disease (*201*).

  WHO dietary guidelines recommend exclusively breast-feeding for six month, in general. Studies suggest that exclusively breast-feeding, avoiding solid foods, seems to be effective for allergy prevention (*362*).

- A high proportion of COPD patients experience a significant weight loss, and low BMI is a marker of a poor prognosis (*363, 364*). Progressive weight loss in these patients is characterized by disease-specific elevated energy requirements that are unbalanced by dietary intake (*365*).

- Increases in the BMI of rural children in subsistence economies may lead to an increased prevalence of atopic disease (*366*).

Although diet and nutrition are not major direct risk factors for chronic respiratory diseases, obesity can be associated with dyspnoea and further increment the symptoms of chronic respiratory diseases.

16. Post-infectious Chronic Respiratory Diseases

Respiratory infections are common in low and middle income countries, but their consequences of are not often reported (*367*) and no true prevalence can be obtained since there is a lack of accurate data. Bronchiectasis is common after viral infections in children (*368*). Severe sequelae resulting from tuberculosis include bronchiectasis, pachypleuritis, aspergillosis or fibrothorax (*369–371*). It seems that a high proportion of tuberculosis deaths are attributable to post-tuberculosis chronic respiratory disease, but data are lacking to support this assertion. In high income countries also, respiratory tract infections in children and adolescents can cause chronic respiratory diseases in adult life (*372*). The interactions with smoking or HIV/AIDS have a major deleterious effect.

There is now extensive evidence from many countries that conditions before birth and in early childhood influence health in adult life (*373*). Children are unable to choose the environment in which they live, their diet, living situation, and exposure to tobacco smoke and other air pollutants. They also have a very limited ability to understand the long-term consequences of their behaviour. Yet it is precisely during this crucial phase that many health behaviours are shaped. Young tobacco smokers, for example, may acquire the habit and become dependent well before reaching adulthood.