

Passive Smoking: A summary of the evidence

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Principal health effects

Breathing other people's smoke is called passive, involuntary or second-hand smoking. The non-smoker breathes "sidestream" smoke from the burning tip of the cigarette and "mainstream" smoke that has been inhaled and then exhaled by the smoker. Environmental tobacco smoke (ETS) is a major source of indoor air pollution. Tobacco smoke contains over 4000 chemicals, some of which have marked irritant properties and some 60 are known or suspected carcinogens (cancer causing substances).^[1]

Evidence of the health impact of passive smoking has been building up over the past two decades. During the 1980s, a number of comprehensive reviews of the effects of passive smoking were published. These include reports by the US National Research Council, ⁱⁱ[2], the 1986 Report of the US Surgeon General, ⁱⁱⁱ[3], the National Health and Medical Research Council of Australia ^{iv}[4] and the UK Independent Scientific Committee on Smoking and Health ^v[5]. This culminated in a major review by the US Environmental Protection Agency ^{vi}[6] published in 1992 which classified ETS as a class A (known human carcinogen).

More recently, further major reviews on passive smoking have been published. These include studies by the UK Government-appointed Scientific Committee on Tobacco and Health ^{vii}[7] (SCOTH), a World Health Organization (WHO) consultation report on Environmental Tobacco Smoke and Child Health, ^{viii}[8] a report by the California Environmental Protection Agency ^{ix}[9] (EPA) and a review by the International Agency for Research on Cancer (IARC). ^x[10] The California EPA identified passive smoking as a risk factor for the following:

Childbirth and infancy

Low birthweight
Cot death (SIDS)

Illnesses in children

Middle ear infection
Asthma (induction & exacerbation)
Bronchitis (induction & exacerbation)
Pneumonia (induction & exacerbation)

Illnesses in adults

Heart disease
Stroke
Lung cancer
Nasal cancer

The California EPA report also identified a link between passive smoking and the following:

Spontaneous abortion (miscarriage)
Adverse impact on learning and behavioural development in children
Meningococcal infections in children
Cancers and leukaemia in children
Asthma exacerbation in adults
Exacerbation of cystic fibrosis
Decreased lung function
Cervical cancer

Passive smoking and lung cancer

More than 50 studies of passive smoking and lung cancer risk in never smokers have been published over the past 25 years. Most show an increased risk, especially among people with a high level of exposure. To evaluate this information, meta-analyses have been conducted whereby the relative risks from the individual studies are pooled together. These meta-analyses show that there is a statistically significant risk of lung cancer risk among non-smokers living with smokers. The risk is in the order of 20% for women and 30% for men. Furthermore, studies of non-smokers exposed to environmental tobacco smoke at work show an increased risk of lung cancer of the order of 16 to 19 per cent. The IARC review led the authors to conclude that *"This evidence is sufficient to conclude that involuntary smoking is a cause of lung cancer in never smokers."***Error! Bookmark not defined.**

Hackshaw et al [x/111](#) analysed 37 published epidemiological studies of the risk of lung cancer (4626 cases) in non-smokers. The review found that the excess risk of lung cancer in life-long non-smokers who lived with a smoker was 24 per cent (95% confidence interval: 13% to 36%). Adjustment for factors such as diet had little overall effect. Tobacco specific carcinogens in

the blood of the non-smokers provided clear evidence of the effect of passive smoking. In addition, the study found a dose-response relationship between a non-smoker's risk of lung cancer and the number of cigarettes and years of exposure to the smoker. The authors concluded that "*The epidemiological and biochemical evidence on exposure to environmental tobacco smoke, with the supporting evidence of tobacco specific carcinogens in the blood and urine of non-smokers exposed to environmental tobacco smoke, provides compelling confirmation that breathing other people's tobacco smoke is a cause of lung cancer.*"

A major European study of non-smokers' exposure to ETS also found a small increased risk of lung cancer in non-smokers who work in a smoky environment or live with a spouse who smokes. The study by Boffetta et al.^{xiii[12]} was conducted in 12 centres from seven European countries. A total of 650 patients with lung cancer and 1542 control subjects up to 74 years of age were asked about their exposure to ETS during childhood, adulthood, at home, in the workplace, in vehicles and in public places. The study found that exposure during childhood was not associated with an increased risk of lung cancer: odds ratio (OR) for ever exposure = 0.78 (95% confidence interval: 0.64 - 0.96). The OR for exposure to spousal ETS was 1.16 (95% CI: 0.93 - 1.44). No clear dose response relationship could be demonstrated for cumulative spousal ETS exposure. The OR for workplace exposure was 1.17 (95% CI: 0.94 - 1.45) with possible evidence of increasing risk of duration of exposure. Although the increased risk of lung cancer is small, the findings are within the range of a 10-30% increase in risk found in other major studies of lung cancer and ETS exposure.

A review of the evidence to date on passive smoking and lung cancer risk, including the above studies, by the UK's Scientific Committee on Tobacco and Health (SCOTH) concluded: "*that long term exposure of non-smokers to ETS caused an increase risk of lung cancer which, in those living with smokers, is in the region of 20-30%*".

The report of the California EPA drew similar conclusions after reviewing evidence from major US studies. The reports states: "*Taken together, the recent studies provide additional evidence that ETS exposure is causally associated with lung cancer. The consistency of the findings in the five recent studies and the meta-analysis result of the US EPA indicate about a 20 per cent increase risk of lung cancer in non-smokers.*"

Passive smoking and heart disease

Evidence of a link between passive smoking and heart disease began to be established in the mid 1980's. The first qualitative reviews were included in the Report of the US Surgeon General, 1986 and the report of the US National Research Council, 1986. Both reviews concluded that an

association between ETS and coronary heart disease (CHD) was biologically plausible but the epidemiological evidence was inconclusive.

Studies by Glantz and Parmley^{xiii}[13] ^{xiv}[14] in the early 1990s estimated that heart disease caused by passive smoking was the third leading preventable cause of death in the United States, ranking behind active smoking and alcohol abuse, and that non-smokers living with smokers had an increased risk of heart disease of around 30%.

Analysis of a large sample in the United States also showed an elevated heart disease risk of around 20%^{xv}[15]. Given how widespread heart disease is in non-smokers, a 20% additional risk is very significant. The authors concluded:

If true, ETS might account for an estimated 35 000 to 40 000 heart disease deaths per year in the United States.

Since then, studies have shown conclusively that not only does exposure to ETS increase the risk of heart disease in non-smokers but that the risks are non-linear. It would appear that even a small exposure to tobacco has a large effect on heart disease, with further exposure having a relatively small additional effect. This may be explained by the fact that exposure to ETS causes the blood to thicken - a phenomenon known as platelet aggregation. New research has shown that even half an hour's exposure to environmental tobacco smoke by non-smokers is enough to adversely affect cells lining the coronary arteries. The dysfunction of these endothelial cells contributes towards the narrowing of arteries and a reduction in blood flow. ^{xvi}[16]

Unlike the risk for lung cancer, where the risk is roughly in proportion to smoke exposure, passive smokers' risk of heart disease may be as much as half that of someone smoking 20 cigarettes a day even though they only inhale about 1% of the smoke.

A review of 19 published studies of the risk of heart disease by Law et al^{xvii}[17] found that non-smokers have an overall 23 per cent increased risk of heart disease when living with a smoker, after adjusting for confounding factors such as diet. The authors also found that the immediate effect of a single environmental exposure was to increase risk by an estimated 34%. This compares with a risk of 39% from smoking one cigarette per day.

In a study by He et al^{xviii}[18] the authors reviewed 18 epidemiological studies and found that, overall, nonsmokers exposed to environmental tobacco smoke had a relative risk of coronary heart disease of 1.25 (ie a 25 per cent increased risk compared with nonsmokers not exposed). The relative risk for men was 1.22 and women 1.24. Non-smokers exposed to tobacco smoke at home had an overall risk of 1.17, while at work the risk was found to be 1.11.

While the risk of heart disease in non-smokers exposed to ETS is proportionally large, it would appear that some of the early damage to arteries caused by smoking may be reversible in healthy adults if further tobacco

smoke exposure is avoided for at least a year.^{[xix](#)[19]} The study by Raitakari et al in Australia found that most improvement in the former passive smokers was evident after 2 years of cessation of passive smoking.

Other circulatory diseases

Research in New Zealand by Bonita et al revealed that passive smoking as well as active smoking increases the risk of stroke.^{[xx](#)[20]} The study found passive smoking exposure increased the risk of stroke in non-smokers by 82% (odds ratio = 1.82; 95% confidence interval = 1.34-2.49). The risk was significant in men (OR = 2.10; 95% CI 1.33-3.32) and in women (OR = 1.66; 95% CI: 1.07-2.57). By comparison, active smokers had a fourfold risk of stroke compared with people who had never smoked or had stopped smoking more than 10 years earlier and who were not exposed to ETS (OR = 4.14; 95% CI 3.04-6.63.) Given that stroke is a common condition, this means that passive smoking is having a serious health impact on non-smokers.

Passive smoking and respiratory diseases

Passive smoking has subtle but significant effects on the respiratory health of non-smoking adults, including increased coughing, phlegm production, chest discomfort and reduced lung function. For people with asthma, ETS can cause serious problems as cigarette smoke is a common trigger for asthma attacks. There are 3.5 million people with asthma in the UK and ETS causes difficulties for up to 80% of them.^{[xxi](#)[21]}

Adults exposed to ETS at home or in the workplace have a 40-60% increase in the risk of asthma compared with adults who are not exposed in these places. Passive smoking as a cause of chronic obstructive pulmonary disease (COPD) in non-smokers has been demonstrated in a number of studies, although the magnitude of the association is small. This may be a reflection of the lack of data and complexity of designing studies to measure the effects of non-malignant respiratory diseases.^{[xxii](#)[22]} The review by the California EPA notes that recent studies suggest that ETS may make a significant contribution to the development of chronic respiratory symptoms in non-smoking adults.

The impact of passive smoking on children

According to the World Health Organization, almost half the world's children (700 million) are exposed to tobacco smoke by the 1.2 billion adults who smoke. A consultation document issued by the WHO concluded that passive smoking is a cause of bronchitis, pneumonia, coughing and wheezing, asthma attacks, middle ear infection, cot death, and possibly cardiovascular and neurobiological impairment in children.**Error! Bookmark not defined.**

Approximately half of all children in the UK are exposed to tobacco smoke in the home. Young children are particularly vulnerable to the health impact of passive smoking. In its 1992 report, "Smoking and the Young", the Royal College of Physicians estimated that 17,000 children under the age of five are admitted to hospital every year in the UK as a result of illnesses resulting from passive smoking.^{[xxiii](#)[23]}

For young children, the major source of tobacco smoke is smoking by parents and other household members. Maternal smoking is usually the largest source of ETS because of the cumulative effect of exposure during pregnancy and close proximity to the mother during early life. Results from more than 40 studies of the impact of parental smoking on lower respiratory tract illnesses in children have shown that children whose mothers smoke are estimated to have a 1.7-fold (95% CI = 1.6 – 1.9) higher risk of respiratory illnesses than children of non-smoking mothers. Paternal smoking alone causes a 1.3-fold (95% CI = 1.2 - 1.4) increase in risk.

Maternal smoking during pregnancy is a major cause of sudden infant death syndrome (SIDS) as well as other health effects including low birth weight and reduced lung function. In addition, the WHO consultation document notes that ETS exposure among non-smoking pregnant women can cause a decrease in birth weight and that infant exposure to ETS may contribute to the risk of SIDS.

Asthma is the most common chronic disease of childhood. Both asthma and respiratory symptoms (wheeze, breathlessness and phlegm) are increased among children whose parents smoke.

The California EPA report shows that there is now compelling evidence that ETS is a risk factor for induction of new cases of asthma as well as for increasing the severity of disease among children with established asthma. In the UK, this means that between 1,600 and 5,400 new cases of asthma occur every year in children as a result of parental smoking.

Childhood exposure to ETS is also causally associated with acute and chronic middle ear disease. Over 40 studies investigating the effects of parental smoking on ear disease in their children have revealed relative risks ranging from 1.2 to 1.4, and are statistically significant.

For further evidence of the health effects of passive smoking on children, see ASH briefing: [Passive smoking: The impact on children](#)

Other effects of passive smoking

The California EPA report has identified consistent associations between passive smoking and nasal sinus cancer, presenting strong evidence that ETS exposure increases the risk of nasal sinus cancer in non-smoking adults.

Existing studies have demonstrated a risk ranging from 1.7 to 3.0 although further study is needed to determine the magnitude of the risk across wider populations.

Other diseases associated with passive smoking for which further study is

required include: spontaneous abortion, adverse impact on learning and behavioural development in children, meningococcal infections in children, cancers and leukaemia in children, asthma exacerbation in adults, exacerbation of cystic fibrosis, decreased lung function and cervical cancer. (See table at the end of this document.)

Many people exposed to ETS experience relatively minor discomfort such as eye irritation, headache, cough, sore throat, dizziness and nausea. While not life-threatening, discomfort caused by persistent exposure to ETS can affect productivity levels in the workplace and lead to tension between smokers and non-smokers.

Policy Implications

Public Places

As part of its tobacco control policy, as set out in the White Paper, "Smoking Kills", the UK Government launched a Public Places Charter in conjunction with the hospitality industry. This is designed to increase the provision of smoke-free areas in pubs, restaurants, etc. by voluntary means rather than through legislation.^{xxiv}^[24] However, progress in this area has been slow and there is now increasing pressure for legislation to ban smoking in public places. At the forefront is the British Medical Association whose new report, "Towards Smoke-free Public Places" recommends legislation be introduced as soon as possible.^{xxv}^[25] The report notes that there is no safe level of exposure to second-hand smoke. (For further information on smoking in public places see: [ASH briefings on smoking in public places](#))

Workplace

A survey^{xxvi}^[26] by ASH in April 1999 revealed that approximately 3 million people in the UK are regularly exposed to ETS at work. In July 1999, the Health and Safety Commission issued a draft Approved Code of Practice (AcoP) to clarify the implementation of the Health and Safety at Work Act as it applies to passive smoking in the workplace. However, this was not adopted by the government. ASH and other health organisation are now campaigning for legislation that will outlaw smoking in the workplace.

Children

The severity of the health impact of ETS exposure on children has led the WHO to call for the right of every child to grow up in an environment free of tobacco smoke. To achieve this goal, greater efforts will be needed to encourage pregnant women and their partners to stop smoking; and by reducing overall consumption of tobacco products. In a review of the impact of parental smoking on child health, Cook and Strachan argued that "*substantial benefits to children would arise if parents stopped smoking after birth, even if the mother smoked during pregnancy*".^{xxvii}^[27] They too argue

that policies need to be developed which reduce smoking among parents and protect children from exposure to ETS.

Estimate of UK impact of passive smoking

Whilst the relative health risks from passive smoking are small in comparison with those from active smoking, because the diseases are common, the overall health impact is large. The British Medical Association has conservatively estimated that secondhand smoke causes at least 1,000 deaths a year in the UK. However, the true figure is likely to be much higher. Professor Konrad Jamrozik of Imperial College London estimates that domestic exposure to secondhand smoke causes at least 3,600 deaths annually from lung cancer, heart disease and stroke combined, while exposure at work leads to approximately 700 deaths from these causes. Jamrozik also estimates 49 deaths – or about 1 a week – from exposure at work in the hospitality trades. In the population aged 65 or older, passive smoking is estimated to account for 16,900 deaths annually. 9,700 are due to stroke, where current evidence of health effects is weakest. [xxviii\[28\]](#)

Tobacco Industry Approach

The tobacco industry has consistently denied that non-smokers' exposure to environmental tobacco smoke is harmful to health. Despite the strength of the evidence outlined above, the tobacco companies have steadfastly refused to acknowledge the dangers. This is because, to do so, would undermine what they perceive to be a "right" to smoke. The industry approach has been to try to spread doubt and confusion about the health effects of passive smoking and to recruit supportive scientists to promote their point of view. One tobacco industry executive stated: *"Doubt is our product since it is the best means of competing with the 'body of fact' that exists in the mind of the general public. It is also the means of establishing a controversy. If we are successful at establishing a controversy at the public level then there is an opportunity to put forward the real facts about smoking and health."* [xxix\[29\]](#) According to the Tobacco Manufacturers' Association, *"the health risk claims are all too often based on a selective view of the evidence"*. [xxx\[30\]](#)

There have been several notable attempts by the tobacco industry to challenge sound research on the effects of passive smoking. See also ASH's document, ["Tobacco Explained"](#) and ["TRUST US – WE ARE THE TOBACCO INDUSTRY"](#) for examples of what the tobacco industry has said and how it has responded to the issue of passive smoking.

A series of press advertisements by Philip Morris in 1996 compared the risk of lung cancer from passive smoking with a variety of other everyday activities, including eating biscuits or drinking milk. The implication was that the increased risk of lung cancer among those exposed to other people's smoke of around 20% is tiny in comparison with the risks of eating foods high in saturated fat. The advertisements were eventually withdrawn after the Advertising Standards Authority ruled that they were misleading but by that time the campaign had

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- ii2** Environmental tobacco smoke: Measuring exposures and assessing health effects. US National Research Council, 1986
- iii3** The health consequences of involuntary smoking. A report of the US Surgeon General, USDHHS, 1986
- iv4** Effects of passive smoking on health National Health and Medical Research Council. Australian Government Publishing Service, 1987.
- v5** Fourth report of the Independent Scientific Committee on Smoking and Health, DHSS, 1988
- vi6** Respiratory health effects of passive smoking: Lung cancer and other disorders. The report of the US Environmental Protection Agency, 1993 . [\[View document\]](#)
- vii7** Report of the Scientific Committee on Tobacco and Health. The Stationery Office, 1998 [\[View document\]](#)
- viii8** International Consultation on Environmental Tobacco Smoke (ETS) and Child Health. WHO Tobacco Free Initiative, WHO/NCD/TFI/99.10. 1999 [\[View text\]](#)
- ix9** Health effects of exposure to environmental tobacco smoke. The report of the California Environmental Protection Agency. Smoking and Tobacco Control Monograph 10, National Cancer Institute, 1999 [\[View document\]](#)
- x10** Involuntary Smoking. (Summary) IARC, 2002. [View summary](#) (Full Monograph due to be published late 2002)
- xi11** Hackshaw AK, Law MR and Wald NJ. The accumulated evidence on lung cancer and environmental tobacco smoke. BMJ, 1997; 315: 980-88 [\[View text\]](#)
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- xviii18** He J et al. Passive Smoking and the Risk of Coronary Heart Disease - A Meta-Analysis of Epidemiologic Studies. NEJM 1999; 340: 920-6 [\[View abstract\]](#)
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