



March 2014

Secondhand Smoke: the impact on children

research report **ash.**
action on smoking and health

Key Findings of this Report

- Breathing in other people's tobacco smoke is known as passive, involuntary or secondhand smoking (SHS). It may also be called environmental tobacco smoke exposure.
- Globally, an estimated 40% of children are reported to be exposed to SHS. In the UK around 2 million children are estimated to be regularly exposed to SHS in the home. The home is now the main source of exposure to SHS for children.
- There is no evidence that the introduction of the smoke free legislation across the UK in 2007 has had a negative impact on SHS exposure in children by displacing smoking back into the home.
- An overall reduction in SHS exposure in children has been reported since the introduction of the smoke free legislation, and an increasing proportion of parents are now making their homes smoke free. However there have been only modest reductions in exposure for children living in smoking households.
- Children are particularly vulnerable to the effects of SHS exposure, which has been linked to an increased risk of a range of illnesses including lower respiratory tract infections, asthma, wheezing, middle ear infections, sudden unexpected death in infancy and invasive meningococcal disease.
- These disorders generate over 300,000 UK GP consultations and about 9,500 hospital admissions every year, costing the NHS about £23.3 million.
- SHS exposure can have adverse effects on children's health even before birth through maternal smoking and exposure to secondhand smoke whilst pregnant.
- Smoking in cars is particularly hazardous as levels of SHS have been found to be dangerously high due to the enclosed space, even when the vehicle is well ventilated.
- In the UK, between 6.5% - 20% of children are reported to be exposed to SHS in cars, and up to 35% of children whose parents are smokers. There is increasing public support for restrictions to be placed on smoking in vehicles
- The only effective way to protect children from SHS exposure is to make homes and cars completely smoke free.

What is secondhand smoke?

Secondhand smoke (SHS) is inhalation of other people's tobacco smoke.¹ SHS is also commonly known as 'passive smoking', 'environmental tobacco smoke' and 'involuntary smoking'.¹ Inhaling SHS is an unavoidable consequence of being in a smoke-filled environment.¹

SHS is a mixture of air-diluted 'side stream' smoke from the burning tip of a cigarette, and the exhaled 'mainstream' smoke exhaled by the smoker.²

Mainstream smoke inhaled by a smoker contains over 4000 chemicals (both particles and gases), including chemical irritants and almost 70 carcinogens (cancer causing substances).³ Side stream is dangerous as whilst it has a similar composition to mainstream smoke, the concentrations of toxins and carcinogens are often much higher.⁴

Over 11,000 people in the United Kingdom (UK) were estimated to have died as a result of SHS exposure in 2003;⁵ SHS exposure is now widely recognised as a significant cause of both short-term and long-term harm to others, with particular concern being raised for the health of children.⁶

Extent of child exposure to SHS

40% of children globally are reported to be exposed to SHS (SHS).⁷ In the UK around 2 million children are estimated to be regularly exposed to SHS in the home.⁶ Passive smoking is therefore a major hazard to the health of millions of children both worldwide and in the UK.

In the UK, surveys in the 1980s and 1990s found that about half of all children lived in a house where at least one person smoked.⁸

Children from socio-economically disadvantaged backgrounds are generally more heavily exposed to SHS.⁶

Smokefree legislation

The smokefree legislation, which came into effect in 2006 in Scotland and in the rest of the UK in 2007, prohibited smoking in enclosed public places, work places and work vehicles. Private dwellings and private vehicles were not covered under the legislation.

Prior to the legislation's introduction, concerns were raised that children's health would be adversely affected as smoking may be displaced back into the home.¹¹ However, there is no published, peer-reviewed evidence to show that the smoke-free legislation has led to an increase in smoking in the home. Research conducted across the UK has observed that the overall level of SHS exposure among children has fallen substantially.^{6, 9, 10} There is further evidence that the smoking ban has led to an increasing proportion of parents making their homes smoke free; In England the proportion of smoking parents adopting smoke free home policies has risen from 16% in 1998 to 48% in 2008.¹¹

Whilst reductions in child SHS exposure have occurred across all sectors of society⁶ there is some evidence that for children who continue to live in smoking households there have been only modest reductions in SHS exposure since the introduction of the smokefree legislation.^{6 10}

Other countries with smokefree legislation also report no displacement of smoking into the home. Studies suggest that where smokefree work and public places are the norm, parents are more likely to make their own home a tobacco-free zone.^{12,13, 14, 15} Furthermore, smokefree workplaces encourage smokers to quit. The reduction in smoking among adults means that fewer children are likely to be exposed to smoke at home.

Sources of SHS for children

Since the introduction of the smoke free legislation, the major source of tobacco smoke exposure for young children is smoking in the home and in vehicles by parents and other household members.⁶ Maternal smoking is usually the largest source of SHS because of the cumulative effect of exposure during pregnancy and close proximity to the mother during early life.

Why opening a window won't help

Opening a window or restricting smoking to a specific room offers little protection against exposure to SHS.^{16, 17} Researchers have found that smoke from one cigarette can linger in a room for up to two and a half hours, even with a window open.¹⁸ Other measures commonly used by parents to reduce tobacco smoke exposure, such as smoking out of a window or smoking next to an extractor fan, are equally ineffective at keeping smoke out of the home.^{19, 20, 21} Research has shown that children's levels of exposure to SHS in homes where these harm reduction strategies are used by parents are not significantly lower than those of children who live in homes where no such restrictions on smoking are in place.^{19, 20}

This may be because pollution from SHS can linger on carpets, furnishings and walls. These materials absorb the toxins found in tobacco smoke and gradually release them back into the air, posing an additional risk of exposure.^{22, 23} This has been referred to as 'thirdhand smoke', and children are believed to be particularly susceptible to this kind of exposure. Children reportedly ingest twice the amount of dust particles compared to adults.²⁴ Younger infants may lick or put non-food objects in their mouths; have a breathing zone close to the floor; and as mobility increases are likely to generate and be exposed to increasing dust particles from carpets and upholstery.^{25, 26} Within enclosed spaces, this kind of tobacco pollution is not eradicated using common cleaning methods and ventilation.^{27, 28, 29}

Making homes completely smoke free is the only way to protect children from SHS exposure.

Why are children vulnerable?

Children are especially vulnerable to SHS as they breathe more rapidly, inhaling more pollutants per pound of body weight (a higher relative ventilation rate) than adults.³⁰ Children also ingest higher quantities of tobacco smoke pollutants due to more hand-to-mouth behaviours.²² Research has found that after exposure to similar levels of tobacco smoke, cotinine levels (a metabolite of nicotine used to measure SHS exposure) in children are about 70% higher than in adults.³¹

SHS in the home is a major source of exposure because children spend most of their time at home and indoors. Unlike adults who can choose whether or not to be in a smoky environment, children have little choice or control over their SHS exposure. They are far less likely to be able to leave a smoke-filled room if they want to: babies cannot ask, some children may not feel confident about raising the subject, and others may not be allowed to leave even if they do ask.

Health effects

In 2010 The Royal College of Physicians (RCP) published a landmark report entitled “Passive Smoking and Children”. The report acknowledges the importance of smokefree legislation in reducing exposure to SHS in the workplace but points out that the principle source of exposure for non-smokers is in the home and that children are especially at risk.⁶

The authors state that *“passive smoking in the home is a major hazard to the health of the millions of children in the UK who live with smokers, and the extent of this health problem has not, to date, been accurately quantified.”*(preface ix) They conclude that *“passive smoking is a significant cause of morbidity and mortality in babies and children.”*(p197)⁶

The RCP report concurs with the findings of a review published by the World Health Organization in 1999,³² with both reports identifying that SHS is linked to increased risks of a wide range of poor health outcomes for children.

The poor health outcomes are discussed below.

Lower respiratory tract infections

Lower respiratory tract infections affect the airways and lungs, and include flu, bronchitis and pneumonia. A review of 60 research studies found that SHS exposure in the home increased young infants’ risks of developing lower respiratory tract infections by 20% to 50%.³³

Asthma and wheezing

Asthma is the most common chronic disease of childhood. SHS exposure has been found to trigger the development of asthma and exacerbate symptoms.³⁴ A review of 79 studies reported that exposure to pre or post-natal SHS was associated with between 30-70% increased risk of incidents of wheeze, and 21-85% increase risk in asthma in children.³⁵ The review concluded that the effects of SHS exposure on incident wheeze and asthma are substantially higher than previous estimates, and the authors argued that SHS exposure is an important risk factor for both conditions throughout childhood.³⁵

A further review of 20 studies found that exposure to SHS was associated with a 30% increased risk of physician-diagnosed asthma in childhood.³⁶

Research suggests that an effective means of preventing asthma is to reduce exposure to SHS.^{34, 37}

Middle ear infections

There is evidence that exposure to SHS increases the risks of middle ear disease in children. A review of 61 studies found that exposure to maternal smoking increased a child's risk of middle ear infection by over 60%.³⁸ The review concluded that 7.5% of episodes of middle ear infections in children in the UK could be attributed to exposure to SHS in the home.³⁸

Sudden unexpected death in infancy

Sudden unexpected death in infancy, also known as cot death, is the sudden and unexpected death of an apparently well baby, and affects at least 300 babies in the UK each year.³⁹ A review of the research presented in the Passive Smoking and Children report using data from 75 studies concluded that maternal smoking after birth was associated with a three-fold increased risk of sudden unexpected death in infancy.⁶ The report also found that having one or more smokers living in the household more than doubled the risk of sudden unexpected death in infancy.⁶

Invasive meningococcal disease

Invasive Meningococcal disease is a serious cause of disability and death in children, with just under 5% of cases being fatal and around 16% of those having the disease being left with serious physical or mental disability.⁴⁰ A review of 18 studies found that exposure to SHS in the home more than doubled a child's risk of invasive meningococcal disease, with the greatest risks found for children under five years of age and those whose mothers smoked in the postnatal period.⁴¹

Other ill health

Exposure to SHS has also been found to be linked to increased risks of a range of other health conditions, including some types of childhood cancer,⁴² emphysema in adulthood,⁴³ impaired olfactory (sense of smell) function,⁴⁴ and may exacerbate chronic conditions such as sickle cell disease.⁴⁵

Economic cost of these ill health effects

These disorders generate over 300,000 UK GP consultations and about 9,500 hospital admissions every year, costing the NHS about £23.3 million.⁶

Social/mental development, school absenteeism

Exposure to SHS in childhood may also affect children's mental development. One study found that children exposed to SHS at home were at an increased risk of neurobehavioural health problems, including learning disabilities and attention deficit hyperactivity disorder.⁴⁶ A United States (US) study found deficits in reading and reasoning skills among children even when exposed to very low levels of SHS.⁴⁷

There is also some evidence to suggest a link with poor mental health, with some research from the US⁴⁸ and UK⁴⁹ suggesting that children and adolescents exposed to SHS in the home are more likely to have symptoms of depression and anxiety.

Children who live with a smoker have also been found to have increased school absenteeism.^{50, 51, 52}

Increased likelihood of smoking uptake

A review of the research has found that children exposed to smoking are significantly more likely to take up smoking themselves.⁵³ Children whose parents both smoked were at a three-fold increased risk of smoking uptake. Children were further found to be over 70% more likely to start smoking if just one parent smoked, and over twice as likely if that parent was the mother. The authors estimated around 23,000 adolescents in the UK were smoking as a result of exposure to household smoking.

Health effects of prenatal exposure to SHS

Maternal smoking in pregnancy is associated with a wide range of adverse health outcomes such as miscarriage, stillbirth, prematurity, low birth weight, perinatal morbidity and mortality, neo-natal or sudden infant death.^{54, 6}

A report by the Public Health Research Consortium estimated costs to the National Health Services [NHS] related to poor infant health outcomes associated with smoking in pregnancy to be around £23.5 million per year.⁵⁵

Health effects of exposure of pregnant women to SHS

Research has highlighted significant risks associated with SHS exposure in pregnant women. A review of 58 studies published in 2008 found that infants of women exposed to SHS during pregnancy were on average between 33g– 40g lighter than infants whose mothers were not exposed.⁵⁶ Babies born to mothers exposed to SHS during pregnancy were further found to be at between 20-30% increased risk of being born at low birth weight (less than 2500g), and some evidence was found for a further link with babies being small for their gestational age.⁵⁶

Similarly, a review of 76 studies published in 2010 found that the infants of SHS exposed women were at increased risk of low birth weight, congenital anomalies and smaller head circumferences.⁵⁷

A further review of 19 studies that examined SHS exposure during pregnancy specifically among non-smoking women found significantly increased risks of stillbirth and congenital malformation.⁵⁸

Smoking in cars

Smoking in vehicles and cars is an important source of SHS exposure for children. Levels of SHS in cars can be extremely high because of the restricted area in which the smoke is circulated,¹⁸ which allow high levels of tobacco smoke to accumulate.

Research conducted since this review consistently reports that smoking in vehicles can cause SHS concentrations to build up to dangerously high levels.^{59, 60, 61} Several studies measuring tobacco smoke pollutants in vehicles have further found high levels even in ventilated conditions.^{62, 63}

A recent study carried out in Scotland examined secondhand smoke in cars in a realistic setting.⁶⁴ Fine air particulate matter (a commonly used measure of secondhand smoke exposure), was examined in 104 journeys, during which participants were asked to carry out their normal driving and smoking behaviours. Fine particulate matter concentrations in cars where smoking took place were found to be high, and exceeded the World Health Organisation's indoor air quality guidance values. Even when ventilation methods were used, such as opening windows or using electronic ventilation, these indoor air quality guidelines were still exceeded.

Research into smoking in cars is likely to underestimate the risks involved as fine particulate matter measurements do not give detailed toxicity information. The

research suggests that as with smoking in the home, the only effective way to prevent SHS exposure in vehicles is to make them entirely smoke free.

Prevalence of smoking in cars

Internationally, in 2007 it was reported that smoking in the presence of non-smokers in cars ranged from 29% in the UK and Australia, 34% in Canada and 44% in the US.⁶⁵

There is some information about the prevalence of children's exposure to SHS in vehicles.

- In England, a 2009 survey carried out on behalf of the Department of Health found that 35% of children aged 8-13 whose parents smoked reported being exposed to SHS while travelling in a vehicle with them.⁶⁶
- 2012 data from a survey carried out in England by the Health and Social Care Information Centre found 30% of 11-15 year olds report being exposed to SHS in someone else's car, and 26% report being exposed in their own family's car.⁶⁷
- In Scotland, 6.5% of 11-12 year olds reported exposure to smoking in cars in 2007.⁶⁸
- In Wales, 20% of 11-16 year olds reported being exposed to SHS the last time they travelled in a car.⁶⁹
- In Ireland, 14% of 13-14 year olds were reported to be exposed to SHS in vehicles.⁷⁰

These figures suggest that a significant number of children in the UK are exposed to SHS in cars and vehicles.

Smoking in cars, public opinion

Public support for a smoking ban in vehicles, particularly in the presence of children, is growing. In 2011 the British Medical Association called for legislation to ban smoking in all vehicles.⁷¹ Following an amendment to the Children and Families Bill, in March 2014 Parliament passed legislation enabling the government to bring forward regulations requiring a ban on smoking in vehicles when children are present.⁷²

Proposals for restrictions are generally well supported.

- An international review of surveys from North America, the UK and Australasia found a majority (76%) of the public supported the introduction of smoke free car laws. In four of the jurisdictions examined (Victoria, California, New Zealand, and South Australia) levels of public support were in excess of 90%.⁷³
- Data from the 2007 wave of the International Tobacco Control Four Country Survey found high levels of support for banning smoking in cars and vehicles carrying children. In the UK, 75% of smokers were found to

support such a ban; support was also high among respondents from Australia (83%), Canada (74%) and the USA (60%).⁷⁴

- A YouGov poll in 2012 found 60% of adults in the UK support a smoking ban in cars carrying passengers, however only 37% support a ban on smoking in all private vehicles.⁷⁵
- A YouGov poll published by the Faculty of Public Health in August 2010 found 74% support for a ban on smoking in cars with children.⁷⁶
- Polls publicised by Road Safety GB around the time that that smokefree laws were implemented in 2007 showed that 70% of respondents supported a complete ban on smoking in cars in the UK.⁷⁷

International laws

Laws banning smoking in cars carrying children have been introduced in a number of jurisdictions in Canada, the United States and Australia. Other countries that have moved to ban smoking in cars carrying children include South Africa, Bahrain, Cyprus and the United Arab Emirates.

In Mauritius smoking is prohibited in any vehicle carrying passengers. There are also a growing number of countries which ban smoking in vehicles used for work purposes, while in Kuwait it is against the law to smoke while driving in any vehicle.⁷⁵

In England and Wales, there is currently only a law prohibiting smoking in vehicles used for work purposes by more than one person (until the new law banning smoking in cars when children are present is implemented). In Scotland it is illegal to smoke in any vehicle used for work purposes, except cars.

Government action to protect children from SHS

In March 2011, the Department of Health published a Tobacco Control Plan for England as part of its Public Health White Paper: 'Healthy Lives, Healthy People'.⁷⁸ Among the measures proposed, the Government pledged to:

- work with national media to raise awareness of the risks of exposing children to SHS
- support local areas to encourage smokers to change their behaviour so that they do not smoke in their homes or family cars

There is strong recognition by the Government that children are entitled to be protected from exposure to SHS.

Educating parents and carers about SHS

Parents who smoke should be aware that their children may become ill as a result of breathing in secondhand smoke.

Since the introduction of the smokefree legislation there has been a marked shift towards making homes smokefree. This suggests that the law prohibiting smoking in public places is having an impact in terms of changing beliefs and norms about SHS. However, passive smoking among children remains substantial and measures are still needed to persuade parents and carers not to smoke in the home.

In 2003, the Department of Health launched a mass media campaign to raise awareness about the hazards of SHS exposure and to reduce the number of people smoking around children. Similar mass media campaigns were launched in March 2012 and June 2013. An evaluation of the 2003 campaign revealed that the number of respondents reporting that SHS was a hazard to children's health increased from 28% to 50% after the campaign.⁶ Research has found evidence that public knowledge about SHS-related illnesses increase with mass media campaigns.⁷⁹ Health warnings on cigarette packs can also help to reinforce the message about the harm from SHS.

Other approaches aimed at raising awareness include intervention strategies targeted at individuals or households. A review of 36 studies concluded that there is insufficient evidence to recommend any particular approach.⁸⁰ A similar review of 12 intervention studies⁸¹ aiming to reduce SHS exposure in neonatal infants was also inconclusive; interventions in this area provided mixed findings, with no one intervention type or setting found to be more effective at reducing child SHS exposure.

Awareness of health risks to exposure to SHS

Since the introduction of the smokefree legislation and mass media campaigns, recognition that SHS exposure is harmful is becoming more widespread and the majority of smokers report that they try not to smoke in the presence of children.

According to the 2009 Smoking-Related Behaviour and Attitudes survey,⁸² 77% of smokers report that they would not smoke at all when they are in a room with children, with a further 14% saying they would limit their smoking in the presence of children. The same survey found a high level of knowledge about the impact of secondhand smoke: 92% of adults were aware that exposure to SHS increases a child's risk of chest infections and 86% were aware of an increased risk of asthma. However, fewer respondents (58%) were aware of the risks associated with cot deaths while only 35% were aware of the association between SHS and ear infections.⁸²

The results of a Populus survey of 1,009 children in England reported in the 2010 Passive Smoking and Children report⁶ found high awareness among children about the dangers of SHS exposure: 83% of 8 year olds, and 90% of 13 year olds believed that people smoking around them was damaging for their health. In addition, 92% believed that parents' smoking in cars was harmful to children.

Legal rights

Children are protected under the smokefree legislation from exposure to SHS at school; whilst this only applies to enclosed spaces, NICE guidelines recommend school-wide smoking bans, which is also encouraged under the Healthy Schools initiative.⁸³ The Department for Education's statutory framework for learning, development and care for children from birth to five years requires premises to have a no smoking policy, and to prevent smoking indoors and in outside play areas when children are present or about to be present.⁸⁴

While there is no explicit protection against exposure to SHS in the home, the need to protect the health of children does have some legal recognition:

The UN Convention on the Rights of the Child

The Convention was adopted by the UN General Assembly on 20 November 1989 and came into force in September 1990. The Convention consists of legally binding international obligations. Article 3 of the Convention states that:

“In all actions concerning children, whether undertaken by public or private social welfare institutions, courts of law, administrative authorities or legislative bodies, the best interests of the child shall be a primary consideration.”

Although the Convention does not include any explicit right to protection from the harm caused by tobacco, official interpretation of the articles of the Convention demonstrates that tobacco is a human rights issue. According to the World Health Organization:

“Because of the enormous potential harm to children from tobacco use and exposure, States have a duty to take all necessary legislative and regulatory measures to protect children from tobacco and ensure that the interest of children take precedence over those of the tobacco industry.”⁸⁵

The 1997 Declaration of the Environment Leaders of the Eight (G8) on Children's Environmental Health.⁸⁶

“We affirm that environmental tobacco smoke is a significant public health risk to young children and that parents need to know about the risks of smoking in the home around their young children. We agree to co-operate on education and public awareness efforts aimed at reducing children's exposure to environmental tobacco smoke.”

Smoking and children in care

The British Association for Adoption and Fostering (BAAF) and the Fostering Network have produced policy papers giving guidance on reducing the risks from environmental tobacco smoke for fostered children.^{87, 88} Both organisations recommend that children aged under five should not be placed with carers who smoke and that children with significant health problems should not be placed with carers who are ex-smokers until at least 12 months after cessation (because of the

risk of relapse to smoking within one year). However, implementation of these recommendations varies depending on local authority. Smoke free policies in foster homes may be difficult to enforce and could potentially limit the number of foster homes available for vulnerable children.⁶

Conclusions

The health impacts of passive smoking on children are now well documented, and public awareness of the risks is high. Despite this, a substantial proportion of UK children continue to be exposed to SHS. Whilst the smoke free legislation has been effective in reducing exposure to tobacco smoke, the majority of children's exposure now occurs in private homes and vehicles that are not covered under the legislation. The only effective way of reducing exposure is to make homes and vehicles completely smokefree, as ventilation or limiting smoking to certain areas do not provide sufficient protection.

While legislation to regulate smoking in the home may currently be inappropriate, there is growing recognition of the rights of children to be protected from exposure to SHS. There is strong support for legislation to prohibit smoking in cars where children are present and laws have been successfully introduced in other countries. The Government should continue with its programme of hard hitting educational campaigns which remind adult smokers of their responsibility to protect children from exposure to secondhand smoke.

References

- ¹ U.S. Department of Health and Human Services. The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006. [View report](#)
- ² Fielding JE, Phenow KJ. Health effects of involuntary smoking. *New England Journal of Medicine*. 1988;319(22):1452-60.
- ³ United States Environmental Protection Agency. Respiratory health effects of passive smoking; lung cancer and other disorders. EPA/600/6-90/006F 1992. [View report](#)
- ⁴ Hoffmann D, Hoffmann I. Significance of exposure to sidestream tobacco smoke. *IARC scientific publications*. 1987(81):3-10. [View abstract](#)
- ⁵ Jamrozik, K. Estimate of deaths attributable to passive smoking among UK adults: database analysis. *British Medical Journal*, 2005. 330:812-17. [View report](#)
- ⁶ Royal College of Physicians. *Passive smoking and children. A report of the Tobacco Advisory Group of the Royal College of Physicians*. London: Royal College of Physicians; 2010. [View report](#)
- ⁷ Oberg M, Jaakkola M, Woodward A, Peruga A, Pruss-Ustun A. Worldwide burden of disease from exposure to second-hand smoke: a retrospective analysis of data from 192 countries. *Lancet*. 2011;377(9760):139-46. [View abstract](#)
- ⁸ Jarvis MJ, Goddard E, Higgins V, Feyerabend C, Bryant A, Cook DG. Children's exposure to passive smoking in England since the 1980s: cotinine evidence from population surveys. *British Medical Journal*. 2000;321(7257):343-5. [View abstract](#)
- ⁹ Holliday JC, Moore GF, Moore LAR. Changes in child exposure to secondhand smoke after implementation of smoke-free legislation in Wales: a repeated cross-sectional study. *Bmc Public Health*. 2009;9. 430. [View abstract](#)
- ¹⁰ Health Promotion Agency. Childhood exposure to tobacco smoke (CHETS) in Northern Ireland. HPA; 2009. [View report](#)
- ¹¹ Jarvis M, Sims M, Gilmore A, Mindell J. Impact of smoke-free legislation on children's exposure to secondhand smoke: cotinine data from the Health Survey for England. *Tobacco Control*. 2012;21(1):18-23. [View abstract](#)
- ¹² Soliman S, Pollack H, Warner K. Decrease in the prevalence of environmental tobacco smoke exposure in the home during the 1990s in families with children. *American Journal of Public Health*. 2004;94(2):314-20. [View abstract](#)
- ¹³ Hyland A, Higbee C, Hassan L, Fong GT, Borland R, Cummings KM, et al. Does smoke-free Ireland have more smoking inside the home and less in pubs than the United Kingdom? Findings from the international tobacco control policy evaluation project. *European Journal of Public Health*. 2008;18(1):63-5. [View abstract](#)

- ¹⁴ O'Dowd A. Smoking ban in public places also cuts smoking at home. *BMJ (Clinical research ed)*. 2005;331(7509):129. [View abstract](#)
- ¹⁵ Borland R, Mullins R, Trotter L, White V. Trends in environmental tobacco smoke restrictions in the home in Victoria, Australia. *Tobacco Control*. 1999;8(3):266-71. [View abstract](#)
- ¹⁶ Carrington J, Watson AF, Gee IL. The effects of smoking status and ventilation on environmental tobacco smoke concentrations in public areas of UK pubs and bars. *Atmospheric Environment*. 2003;37(23):3255-66. [View abstract](#)
- ¹⁷ Centre for Community Child Health. Preventing passive smoking effects on children. Royal Children's Hospital, Australia, 2006. [View report](#)
- ¹⁸ Ott WR, Klepeis NE, Switzer P. Analytical solutions to compartmental indoor air quality models with application to environmental tobacco smoke concentrations measured in a house. *Journal of the Air & Waste Management Association*. 2003;53(8):918-36. [View abstract](#)
- ¹⁹ Spencer N, Blackburn C, Bonas S, Coe C, Dolan A. Parent reported home smoking bans and toddler (18-30 month) smoke exposure: a cross-sectional survey. *Archives of Disease in Childhood*. 2005;90(7):670-4. [View abstract](#)
- ²⁰ Blackburn C, Spencer N, Bonas S, Coe C, Dolan A, Moy R. Effect of strategies to reduce exposure of infants to environmental tobacco smoke in the home: cross sectional survey. *BMJ*. 2003;327(7409):257. [View abstract](#)
- ²¹ Johansson A, Hermansson G, Ludvigsson J. How should parents protect their children from environmental tobacco-smoke exposure in the home? *Pediatrics*. 2004;113(4):E291-E5. [View abstract](#)
- ²² Matt GE, Quintana PJE, Hovell MF, Bernert JT, Song S, Novianti N, et al. Households contaminated by environmental tobacco smoke: sources of infant exposures. *Tobacco Control*. 2004;13(1):29-37. [View abstract](#)
- ²³ Becquemin MH, Bertholon JF, Bentayeb M, Attoui M, Ledur D, Roy F, et al. Third-hand smoking: indoor measurements of concentration and sizes of cigarette smoke particles after resuspension. *Tobacco Control*. 2010;19(4):347-8. [View abstract](#)
- ²⁴ Roberts JW, Dickey P. Exposure of Children to Pollutants in House Dust and Indoor Air. *Reviews of Environmental Contamination and Toxicology* <D>. 1995;143:59-78. [View abstract](#)
- ²⁵ Moya J, Bearer CF, Etzel RA. Children's behavior and physiology and how it affects exposure to environmental contaminants. *Pediatrics*. 2004;113(4):996-1006. [View abstract](#)
- ²⁶ Winickoff JP, Friebely J, Tanski SE, Sherrod C, Matt GE, Hovell MF, et al. Beliefs About the Health Effects of "Thirdhand" Smoke and Home Smoking Bans. *Pediatrics*. 2009;123(1):E74-E9. [View abstract](#)
- ²⁷ Fortmann AL, Romero RA, Sklar M, Pham V, Zakarian J, Quintana PJE, et al. Residual Tobacco Smoke in Used Cars: Futile Efforts and Persistent Pollutants. *Nicotine & Tobacco Research*. 2010;12(10):1029-36. [View abstract](#)

- ²⁸ Matt GE, Quintana PJE, Zakarian JM, Fortmann AL, Chatfield DA, Hoh E, et al. When smokers move out and non-smokers move in: residential thirdhand smoke pollution and exposure. *Tobacco Control*. 2011;20(1). [View abstract](#)
- ²⁹ Schick SF, Farraro KF, Perrino C, Sleiman M, van de VossenberG G, Trinh MP, et al. Thirdhand cigarette smoke in an experimental chamber: evidence of surface deposition of nicotine, nitrosamines and polycyclic aromatic hydrocarbons and de novo formation of NNK. *Tobacco Control*. 2013. [View abstract](#)
- ³⁰ Canadian Institute of Child Health. Environmental hazards: Protecting children. Canada1997. [View report](#)
- ³¹ Willers S, Skarping G, Dalene M, Skerfving S. Urinary cotinine in children and adults during and after semiexperimental exposure to environmental tobacco smoke. *Archives of Environmental Health*. 1995. 50(2): 130-138. [View abstract](#)
- ³² World Health Organisation. International Consultation on Environmental Tobacco Smoke (ETS) and Child Health. Consultation report. 1999. [View report](#)
- ³³ Jones LL, Hashim A, McKeever T, Cook DG, Britton J, Leonardi-Bee J. Parental and household smoking and the increased risk of bronchitis, bronchiolitis and other lower respiratory infections in infancy: systematic review and meta-analysis. *Respiratory Research*. 2011;12:5. [View report](#)
- ³⁴ Cabana MD, Birk NA, Shish KK, Yoon EY, Pace K, Nan B, et al. Exposure to tobacco smoke and chronic asthma symptoms. *Pediatric Asthma Allergy & Immunology*. 2005;18(4):180-8. [View abstract](#)
- ³⁵ Burke H, Leonardi-Bee J, Hashim A, Pine-Abata H, Chen Y, Cook DG, et al. Prenatal and Passive Smoke Exposure and Incidence of Asthma and Wheeze: Systematic Review and Meta-analysis. *Pediatrics*. 2012;129(4):735-44. [View abstract](#)
- ³⁶ Tinuoye, O., J.P. Pell, and D.F. Mackay, *Meta-analysis of the Association Between Secondhand Smoke Exposure and Physician-Diagnosed Childhood Asthma*. *Nicotine & Tobacco Research*, 2013. [View abstract](#)
- ³⁷ Lewis SA, Antoniak M, Venn AJ, Davies L, Goodwin A, Salfield N, et al. Secondhand smoke, dietary fruit intake, road traffic exposures, and the prevalence of asthma: A cross-sectional study in young children. *American Journal of Epidemiology*. 2005;161(5):406-11. [View abstract](#)
- ³⁸ Jones LL, Hassanien A, Cook DG, Britton J, Leonardi-Bee J. Parental Smoking and the Risk of Middle Ear Disease in Children A Systematic Review and Meta-analysis. *Archives of Pediatrics & Adolescent Medicine*. 2012;166(1):18-27. [View abstract](#)
- ³⁹ NHS. Sudden infant death syndrome. 2012. <http://www.nhs.uk/Conditions/Sudden-infant-death-syndrome/Pages/Introduction.aspx> (Accessed 6 August 2013)
- ⁴⁰ Baraff LJ, Lee SI, Schriger DL. Outcomes of bacterial-meningitis in children – a Meta analysis. *Pediatric Infectious Disease Journal*. 1993;12(5):389-94. [View abstract](#)

- ⁴¹ Murray RL, Britton J, Leonardi-Bee J. Second hand smoke exposure and the risk of invasive meningococcal disease in children: systematic review and meta-analysis. BMC public health. 2012;12(1):1-11. [View abstract](#)
- ⁴² Hemminki K, Chen B. Parental lung cancer as predictor of cancer risks in offspring: Clues about multiple routes of harmful influence? International journal of cancer. 2006;118(3):744-8. [View abstract](#)
- ⁴³ Lovasi GS, Roux AVD, Hoffman EA, Kawut SM, Jacobs DR, Jr., Barr RG. Association of Environmental Tobacco Smoke Exposure in Childhood With Early Emphysema in Adulthood Among Nonsmokers. American Journal of Epidemiology. 2010;171(1):54-62. [View abstract](#)
- ⁴⁴ Nageris B, Braverman I, Hadar T, Hansen MC, Frenkiel S. Effects of passive smoking on odour identification in children. Journal of Otolaryngology. 2001;30(5):263-5. [View abstract](#)
- ⁴⁵ Best D, Comm Environm H, Comm Native Amer Child H, Comm A. Technical Report- Secondhand and Prenatal Tobacco Smoke Exposure. Pediatrics. 2009;124(5):E1017-E44. [View abstract](#)
- ⁴⁶ Kabir Z, Connolly GN, Alpert HR. Secondhand Smoke Exposure and Neurobehavioral Disorders Among Children in the United States. Pediatrics. 2011;128(2):263-70. [View abstract](#)
- ⁴⁷ Yolton K, Lanphear BP, Dietrich KN, Auinger P. Exposure to environmental tobacco smoke and cognitive ability among US children. Pediatric Research. 2002;51(4):440A-A. [View report](#)
- ⁴⁸ Bandiera FC, Richardson AK, Lee DJ, He J-P, Merikangas KR. Secondhand Smoke Exposure and Mental Health Among Children and Adolescents. Archives of Pediatrics & Adolescent Medicine. 2011;165(4):332-8. [View abstract](#)
- ⁴⁹ Hamer M, Ford T, Stamatakis E, Dockray S, Batty D. Objectively Measured Secondhand Smoke Exposure and Mental Health in Children Evidence From the Scottish Health Survey. Archives of Pediatrics & Adolescent Medicine. 2011;165(4):326-31. [View abstract](#)
- ⁵⁰ Levy DE, Winickoff JP, Rigotti NA. School Absenteeism Among Children Living With Smokers. Pediatrics. 2011;128(4):650-6. [View abstract](#)
- ⁵¹ Mannino DM, Moorman JE, Kingsley B, Rose D, Repace J. Health effects related to environmental tobacco smoke exposure in children in the United States - Data from the Third National Health and Nutrition Examination Survey. Archives of Pediatrics & Adolescent Medicine. 2001;155(1):36-41. [View abstract](#)
- ⁵² Gilliland FD, Berhane K, Islam T, Wenten M, Rappaport E, Avol E, et al. Environmental tobacco smoke and absenteeism related to respiratory illness in schoolchildren. American Journal of Epidemiology. 2003;157(10):861-9. [View abstract](#)

- ⁵³ Leonardi-Bee J, Jere ML, Britton J. Exposure to parental and sibling smoking and the risk of smoking uptake in childhood and adolescence: a systematic review and meta-analysis. *Thorax*. 2011;66(10):847-55. [View abstract](#)
- ⁵⁴ Royal College of Physicians. Smoking and the young. A report of a working party of the Royal College of Physicians. In: Physicians Royal College of Physicians. London 1992. [View report](#)
- ⁵⁵ Godfrey, C., Pickett, K., Parrott, S., MDege, N. & Eapen, D. Estimating the costs to the NHS of smoking in pregnancy for pregnant women and infants. 2010. Public Health Research Consortium: University of York. [View summary](#)
- ⁵⁶ Leonardi-Bee J, Smyth A, Britton J, Coleman T. Effects of Environmental Tobacco Smoke (ETS) on Fetal Health: Systematic Review and Meta-analysis. 2007. [View abstract](#)
- ⁵⁷ Salmasi G, Grady R, Jones J, McDonald SD, Knowledge Synth G. Environmental tobacco smoke exposure and perinatal outcomes: a systematic review and meta-analyses. *Acta Obstetrica Et Gynecologica Scandinavica*. 2010;89(4):423-41. [View abstract](#)
- ⁵⁸ Leonardi-Bee J, Britton J, Venn A. Secondhand Smoke and Adverse Fetal Outcomes in Nonsmoking Pregnant Women: A Meta-analysis. *Pediatrics*. 2011;127(4):734-41. [View abstract](#)
- ⁵⁹ Edwards R, Wilson N, Pierse N. Highly hazardous air quality associated with smoking in cars: New Zealand pilot study. *The New Zealand medical journal*. 2006;119(1244):U2294-U. [View report](#)
- ⁶⁰ Ott W, Klepeis N, Switzer P. Air change rates of motor vehicles and in-vehicle pollutant concentrations from secondhand smoke. *Journal of Exposure Science and Environmental Epidemiology*. 2008;18(3):312-25. [View abstract](#)
- ⁶¹ Sendzik T, Fong GT, Travers MJ, Hyland A. An experimental investigation of tobacco smoke pollution in cars. *Nicotine & Tobacco Research*. 2009;11(6):627-34. [View abstract](#)
- ⁶² Jones MR, Navas-Acien A, Yuan J, Breyse PN. Secondhand tobacco smoke concentrations in motor vehicles: a pilot study. *Tobacco Control*. 2009;18(5):399-404. [View abstract](#)
- ⁶³ Liu S, Zhu Y. A case study of exposure to ultrafine particles from secondhand tobacco smoke in an automobile. *Indoor Air*. 2010;20(5):412-23. [View abstract](#)
- ⁶⁴ Semple S, Apsley A, Galea KS, MacCalman L, Friel B, Snelgrove V. Secondhand smoke in cars: assessing children's potential exposure during typical journey conditions. *Tobacco Control*. 2012;21(6):578-83. [View abstract](#)
- ⁶⁵ Hitchman SC, Fong GT, Borland R, Hyland A. Predictors of smoking in cars with nonsmokers: Findings from the 2007 Wave of the International Tobacco Control Four Country Survey. *Nicotine & Tobacco Research*. 2010;12(4):374-80. [View abstract](#)
- ⁶⁶ Populus. Survey of 8-13 year olds: executive summary. In: Department of Health, editor. 2009. http://www.populus.co.uk/uploads/download_pdf-281009-Blue-Rubicon-Poll-of-8-13-year-olds-on-smoking.pdf (accessed 5 August 2013)
- ⁶⁷ Health and Social Care Information Centre. Smoking, drinking and drug use among young people in England in 2012. 2013. <https://catalogue.ic.nhs.uk/publications/public-health/surveys/smok-drin-drug-youn-peop-eng-2012/smok-drin-drug-youn-peop-eng-2012-repo.pdf> [accessed 15 Aug 2013].

- ⁶⁸ Akhtar PC, Currie DB, Currie CE, et al. Changes in child exposure to environmental tobacco smoke (CHETS) study after implementation of smoke-free legislation in Scotland: national cross sectional survey. *BMJ* 2007;**335**(7619):545 [View abstract](#)
- ⁶⁹ Welsh Assembly Government Social Research. Health behaviour in school-aged children: initial findings from the 2009/10 survey in Wales. 2011. <http://wales.gov.uk/about/aboutresearch/social/latestresearch/healthbehaviours/?lang=en> [accessed 02 August 2013].
- ⁷⁰ Kabir Z, Manning PJ, Holohan J, Keogan S, Goodman PG, Clancy L. Second-hand smoke exposure in cars and respiratory health effects in children. *European Respiratory Journal*. 2009;34(3):629-33. [View abstract](#)
- ⁷¹ British Medical Association. Smoking in vehicles: a briefing from the Board of Medicine. 2011. http://www.bma.org.uk/health_promotion_ethics/tobacco/November (Accessed 5 August 2013).
- ⁷² House of Commons. Children and Families Bill. Debate. Hansard, Column 10 Feb 2014 : Column 622. <http://www.publications.parliament.uk/pa/cm201314/cmhansrd/cm140210/debtext/140210-0003.htm>
- ⁷³ Thomson G, Wilson H. Public attitudes to laws for smokefree private vehicles: a brief review. *Tobacco Control*. 2009;18:256-61. [View abstract](#)
- ⁷⁴ Hitchman, S.C., et al., *Predictors of smoking in cars with nonsmokers: Findings from the 2007 Wave of the International Tobacco Control Four Country Survey*. *Nicotine & Tobacco Research*, 2010. **12**(4): p. 374-380. [View Abstract](#)
- ⁷⁵ YouGov. Sunday Times Survey Results. 2012. http://cdn.yougov.com/cumulus_uploads/document/tojh8h1oek/YG-Archives-Pol-ST-results-02-040212.pdf (accessed 5 August 2013).
- ⁷⁶ Maryon-Davis A, Jolley R. Healthy Nudges: When the public wants change and politicians don't know it. Faculty of Public Health: August 2010. [View report](#)
- ⁷⁷ Road safety GB. Support grows for a ban on smoking at the wheel. 2007 http://www.larsoa.org.uk/larsoa/media/25.06.07_support.php June [Accessed 5 August 2013].
- ⁷⁸ Department of Health. Healthy lives, healthy people: A tobacco control plan for England. London: 2011. [View report](#)
- ⁷⁹ Evans KA, Sims M, Judge K, Gilmore A. Assessing the knowledge of the potential harm to others caused by second-hand smoke and its impact on protective behaviours at home. *Journal of Public Health*. 2012;34(2):183-94. [View abstract](#)
- ⁸⁰ Priest N et al. Family and carer smoking control programmes for reducing children's exposure to environmental tobacco smoke. *Cochrane Database of Systematic Reviews* 2008 (4): CD001746. [View abstract](#)

⁸¹ Baxter S, Blank L, Everson-Hock ES, Burrows J, Messina J, GuillaUme L, et al. The effectiveness of interventions to establish smoke-free homes in pregnancy and in the neonatal period: a systematic review. *Health Education Research*. 2011;26(2):265-82. [View abstract](#)

⁸² Office for National Statistics. Opinions Survey Report No. 40. Smoking-related behaviour and attitudes. The Information Centre; 2009. [View report](#)

⁸³ National Institute for Clinical Excellence. School-based interventions to prevent smoking. NICE, February 2010. [View report](#)

⁸⁴ Department for education. Statutory Framework for the Early Years Foundation Stage; Setting the standards for learning, development and care for children from birth to five. 2012. webarchive.nationalarchives.gov.uk/20130401151715/https://www.education.gov.uk/publications/eOrderingDownload/EYFS%20Statutory%20Framework.pdf (accessed 5 August 2013).

⁸⁵ World Health Organisation. Tobacco and Rights of the Child. 2001. whqlibdoc.who.int/hq/2001/WHO_NMH_TFI_01.3_Rev.1.pdf (accessed 5 August 2013).

⁸⁶ G8 Information Centre. Environment Leaders' Summit of the Eight Miami, Florida, May 5-6, 1997; 1997 Declaration of the Environment Leaders of the Eight on Children's Environmental Health. 1997. www.g7.utoronto.ca/environment/1997miami/children.html (accessed 5 August, 2013).

⁸⁷ British Association of Adoption and Fostering. Reducing the risks of environmental tobacco smoke for looked after children and their carers. 2007. www.fostering.com/assets/pdf_downloads/pn51_tobaccosmoke_000.pdf (Accessed 5 August 2013).

⁸⁸ The Fostering Network. Foster care and smoking. 2009. www.fostering.net/sites/www.fostering.net/files/resources/fostering-networks-position/foster-care-and-smoking.pdf (Accessed 5 August 2013).