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Smoking in vehicles: An evidence review

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Summary

Second-hand smoke in Scotland

Second-hand smoke (SHS) is a recognised hazard to health. It causes heart disease, lung cancer, and a range of childhood illnesses and disorders including respiratory conditions, middle ear disease, and sudden infant death syndrome. Scotland's legislation prohibiting smoking in enclosed public places dramatically reduced exposure to this hazard. However in environments not covered by the legislation, including vehicles, exposure continues. On-going SHS exposure causes needless disease and disability, particularly among vulnerable groups such as children, who are especially susceptible to SHS's effects and often lack the ability to remove themselves from smoky environments.

How big a health issue is SHS exposure in vehicles?

Research teams in several different countries, including Scotland, have investigated the level of tobacco smoke that accumulates in vehicles. The findings are consistent: as vehicles are mostly enclosed, smoke can build to high levels. This is particularly the case when no ventilation is employed, however even under 'realistic' driving conditions (using mechanical ventilation, or with windows partly open) SHS exposure concentrations exceed healthy guidance limits during journeys.

In Scotland, there is little current data that allows accurate assessment of how many people, are affected by SHS in vehicles. From older data sources in Scotland and studies in other countries, around a quarter of adult non-smokers are often or sometimes exposed to SHS in vehicles - for children it is likely at least 5% experience SHS in vehicles, potentially higher depending on age and socioeconomic background. When asked, young people have a strong preference not to be exposed to the smoke of others in these environments.

Road safety

Smoking is classified as a distraction to be avoided in the Highway Code. Reporting systems in place for documenting the cause of road traffic accidents do not allow for an easy assessment of exactly how many accidents occur in which smoking could be a contributory factor. In-vehicle distractions, as a whole, contribute to a percentage of road traffic accidents in the low single figures - it is possible smoking contributes to some of these, but there is no straightforward way to verify this. Some studies have also found that smokers are more likely to be involved in road traffic accidents, but it remains an open question whether this risk is caused by the act of smoking itself, or if drivers who are predisposed to accidents for other reasons are more likely to smoke.

Do legislative interventions work to reduce SHS exposure?

One published study from Canada, where various provinces have implemented laws banning smoking in cars with children in a staggered fashion, found a positive impact on reducing child SHS exposure in the relatively short term after implementation. It did not find any displacement effects of smoking being shifted to the home. The UK implementation of legislative seatbelt and mobile phone interventions suggest that public awareness and acceptance of the risks of non-compliance with the law, and visibility of enforcement are factors in determining whether legislation on restricting smoking in cars has the intended results.

What do the public think about interventions to reduce exposure?

In Scotland, there is very strong support for legislation banning smoking in cars where children younger than 18 are travelling (over 80%). For other forms of legislative intervention (banning smoking in cars with any passenger, or all cars) support is less strong. More people support banning smoking in all cars than oppose it, however when looking just at smokers, opposition to banning smoking in cars with any passenger, or all cars, is moderate to strong.

Ethical considerations

There are numerous ethical issues to be navigated when considering intervening to restrict smoking in vehicles. Public health benefits need to be balanced against the burden of incursions into behaviours considered as private. These issues should be considered within an ethical framework which includes discussion of: whether the intervention to reduce exposure has clear goals, and if it is likely to achieve those goals; whether burdens - including infringements on individual liberties - can be minimised while achieving these goals; and ensuring that the intervention does not disadvantage particular population groups. Public health interventions must have genuine public trust that the intervention is being carried out in the public's best interest. A strong ethical case can be made for protecting individuals from exposure to health risks who are unable to take action to protect themselves.

Conclusions

ASH Scotland is supportive of approaches that minimise exposure to the health risks of second-hand smoke to the greatest extent possible - no individual should be exposed to second-hand smoke against their will. Smoking in vehicles is a source of high levels of smoke exposure, likely to harm the health of vehicle occupants. Increasing awareness and public acceptance of the hazards of SHS, and encouraging people in Scotland to make environments smoke-free for others on a voluntary basis is an important step. Legislative intervention to protect children from SHS in cars has popular backing and strong supporting ethical arguments. ASH Scotland supports a debate on legislative interventions to restrict smoking in vehicles carrying children, particularly if awareness-raising work alone does not show sufficient progress in reducing exposure among this vulnerable group. It is also important to note that SHS can cause harm to people of all ages, and there are groups other than children that are can be particularly vulnerable (for example, older adults or those with existing respiratory or cardiovascular conditions). Because of this, the debate about how best to protect people from other people's smoke - in vehicles and other settings - should focus on how best to protect all people in Scotland, young and old, from this health risk.

1. Introduction

What is second-hand smoke and why is it important?

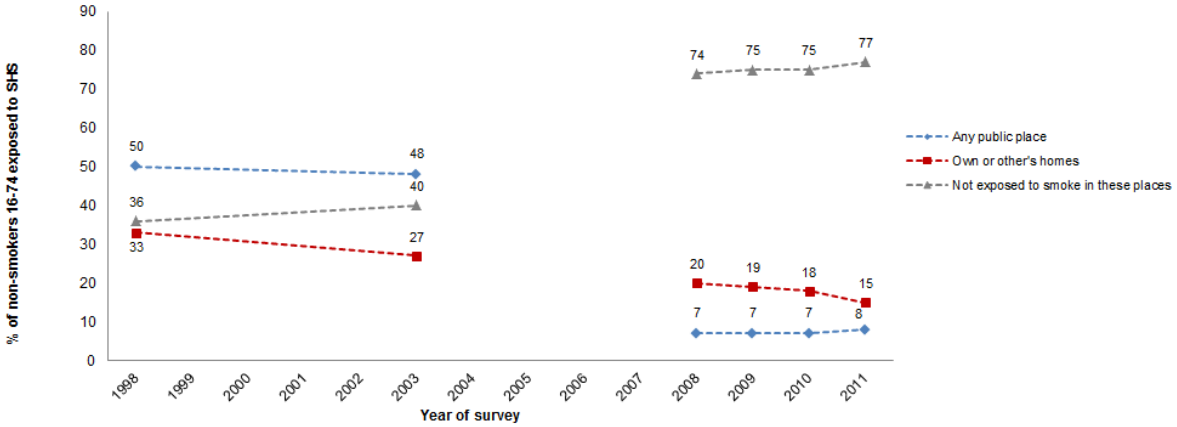
Second-hand smoke (SHS) is a by-product of tobacco combustion generated from both the smouldering tip of the cigarette (side-stream smoke) and that exhaled by the smoker (mainstream smoke). SHS is a recognised hazard to both adult[1] and child[2] health. Exposure to SHS from living with a smoker is associated with an elevated risk of both lung cancer and coronary heart disease in the region of 20-30%[1 3] in adults, and increases the risk of a range of child health problems that include lower respiratory infections, wheeze, asthma, middle ear disease, and sudden infant death syndrome[2]. Specifically, a recent review of the literature[2] has estimated that child exposure to SHS in the UK causes the following, annually:

- 20,000 cases of lower respiratory tract infection
- 120,000 cases of middle ear disease
- 22,000 new cases of wheeze and asthma
- 200 cases of bacterial meningitis
- 40 cases of sudden infant death
- 300,000 GP consultations and 9,500 hospital admissions.

Trends in second-hand smoke exposure in Scotland

In Scotland, most enclosed public places (including all workplaces, public transport, pubs and restaurants) are free from SHS as a result of a legislative Act[4] of the Scottish Parliament that came into force on 26 March 2006. The most recent data from national surveys reporting on trends in exposure to SHS smoke amongst non-smoking adults demonstrate self-reported regular exposure in any public place has fallen from 50% in 1998 to 8% in 2011, exposure in own or other's homes has fallen from 33% to 15%, and the proportion of those reporting no exposure to SHS in these places has risen from 36% to 77%[5] (*Figure 1*).

Figure 1: % of non-smokers (aged 16-74) in Scotland regularly exposed to second-hand smoke, by location 1998-2011



Data from the Scottish Health Survey 2011, no surveys conducted in 1999-2002 and 2004-2007, minimum unweighted base respondents in any single year: 4,130.

A programme of evaluation of the smoke-free legislation in Scotland[6] found it resulted in a number of benefits, including: reductions in heart attack admissions[7]; child asthma admissions[8]; improved pregnancy outcomes[9]; improvements in bar worker's self-reported health[10]; and an increased proportion of children reporting a ban on smoking in the home[11]. Moreover, these benefits were attained without any increase in smoking in the home post-legislation[12]. In fact, a recent evaluation of smoke-free laws in Ireland, France, Germany and the Netherlands found some evidence of an increase in home bans after public smoke-free laws were implemented[13].

Sources of continuing second-hand smoke exposure

While most enclosed public places in Scotland are smoke-free by law, SHS exposure continues in a variety of other settings, particularly in private homes and vehicles. Recently, health and medical organisations in the UK have called for a variety of further restrictions on smoking, including through the introduction of laws prohibiting smoking in private vehicles where children are present (as proposed by the British Lung Foundation[14] and the British Heart Foundation[15]), or prohibiting smoking in all vehicles (as proposed by the Royal College of Physicians[2] and the British Medical Association[16]).

Other countries have introduced laws to restrict smoking in vehicles under various circumstances of occupancy, these include various Canadian provinces and Australian and US states and territories. A list of jurisdictions that have previously introduced smoke-free car laws is available in a separate ASH Scotland briefing: www.ashscotland.org.uk/media/3796/Smokingincars.pdf

Airspace in vehicles is confined, which intuitively suggests SHS exposure could be more intense, and as vehicles are normally operated in public areas they are subject to numerous other forms of legislation in the interests of public safety (e.g. seatbelts, laws prohibiting intoxication while in control of a vehicle). Encouraging smokers to reduce the degree to which they expose others, particularly children, to SHS in the home is the focus of a range of other, non-legislative, interventions currently on-going in Scotland [e.g.17 18].

Scotland's current legislation that prohibits smoking in most enclosed public places[4] exempts all cars – whether used for private or business purposes – unless they are being used as a private taxi (company cars or leased vehicles are not covered by the existing laws). All other types of vehicles, such as work vans and heavy goods vehicles that are principally used for business**,** are covered by the law.

This review is intended to inform the continuing debate on the most appropriate means to reduce health harms caused by continuing exposure to SHS in vehicles.

2. Measuring exposure to second-hand smoke in vehicles and its health implications

To determine the scale of harm caused by exposure to SHS occurring in vehicles, a first step is to examine the magnitude of exposure within this particular micro-environment. It would be expected that the confined nature of vehicles could result in potentially high concentrations of SHS, compared to indoor environments with larger volumes of ambient air. However, particular factors of vehicles such as air exchange caused by mechanical ventilation and opening of windows also play a role in mediating passenger exposure to SHS. A range of international research has examined the magnitude of likely SHS exposure under these various conditions.

How is second-hand smoke exposure in vehicles measured?

Investigators typically examine concentrations of fine particulate matter ($PM_{2.5}$ - see box below) present in the passenger cabin of vehicles under a range of experimental driving conditions. Particular apparatus used varies from study to study, but broadly all involve the use of an air quality monitor logging air quality information by measuring levels of $PM_{2.5}$ present in the cabin (and in some occasions carbon monoxide or nicotine levels) across the journey duration. An example of type of apparatus used in a recent UK study[19] - where the sampling monitor input is affixed to a child size doll in a child safety seat, is in figure 2 below.

Figure 2: Air quality monitoring set-up as used in a recent UK investigation. Image used courtesy of the Scottish Centre for Indoor Air.

$PM_{2.5}$

Studies measuring exposure to SHS in vehicles discussed in this section use $PM_{2.5}$ - airborne fine particulate matter that measures less than 2.5 micrometres in diameter - as a measure of exposure. $PM_{2.5}$ can be readily monitored and reported on through the use of relatively compact measuring equipment and is a well-established technique for determining SHS (and other particle-generating forms of pollution) concentrations.

The type of monitoring equipment used is similar to that used to assess air quality in public places before and after implementation of smoke-free public places legislation[20], allowing some degree of comparison across these different environments. When assessing $PM_{2.5}$ levels it is important to bear in mind that air quality measurements based on $PM_{2.5}$ alone provide information on exposure to air pollution of a specific particle size only, and do not provide information on potential toxicity based on the chemical composition of the pollution. In tobacco smoke, the presence of many toxic constituents, including recognised human carcinogens[21], could result in any estimation of harm based on $PM_{2.5}$ alone being an under-estimation. This is likely to be the case when comparing $PM_{2.5}$ levels generated from tobacco smoking against established air quality guidance[22] (such as the U.S Environmental Protection Agency or World Health Organisation standards).

What level of tobacco smoke exposure occurs in vehicles?

The last five or so years have seen publication of several studies investigating particulate matter exposure as a result of cigarette smoke in vehicles. One early investigation from Greece[23] reported particulate matter many tens of times higher than that observed in UK and US smoking pubs and bars, however this was under unrealistic conditions of stationary vehicles and the cigarette source of particulate matter being left to smoulder till it extinguished (rather than being actively smoked).

A more realistic study carried out in the US city of Boston conducted forty-five driving trials in urban areas under both open window and closed window conditions[24] (no air conditioning or mechanical ventilation systems were used however) when one cigarette was actively smoked. In this case, ‘open windows’ meant all four car windows lowered halfway, while windows ‘closed’ meant only the smoker’s side window was lowered 5cm. During the approximate 5 minute

'smoking' phase of recording, concentrations of particulate matter were 272 µg/m^3 in the 'windows closed' condition and 51 µg/m^3 in the 'windows open' condition.

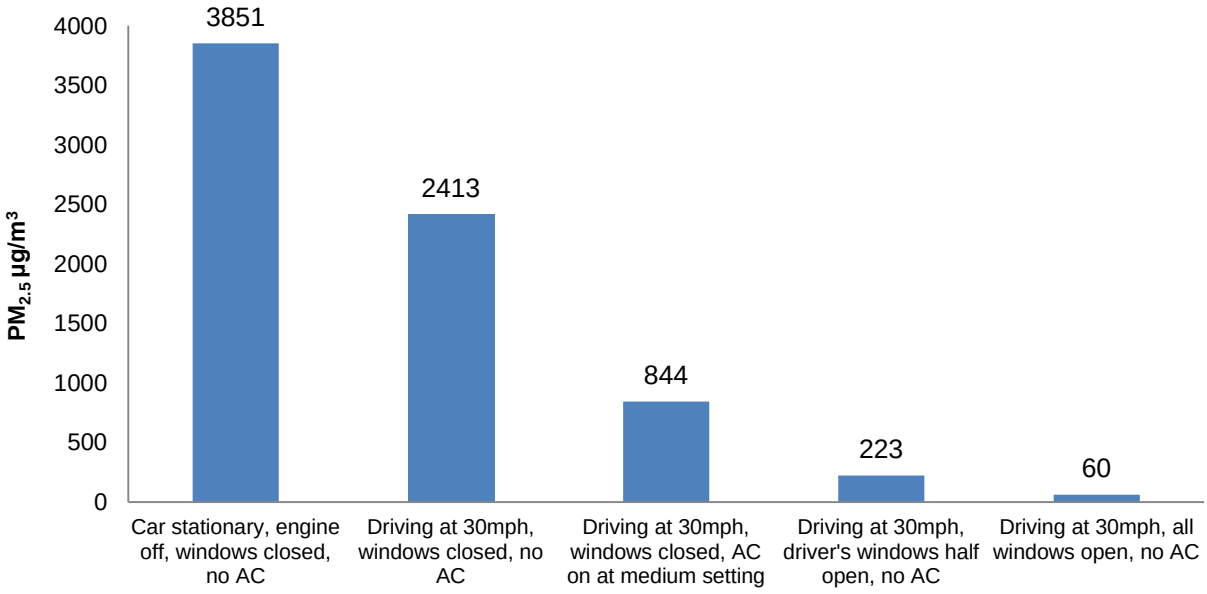
To provide a frame of reference for these figures, a 2007 study[25] of five outdoor sites (two rural, two roadside, and one suburban) in Scotland found annual average $PM_{2.5}$ concentrations to have a range between 8 and 12 µg/m^3 depending on location. Typical $PM_{2.5}$ levels in enclosed public places such as bars where smoking is now prohibited have concentrations around 5 to 10 µg/m^3 which is also around the level found in routine, non-smoking, car journeys[26].

A pilot study in New Zealand using similar 'real life' conditions[27] found particulate matter levels of similar magnitude (mean $PM_{2.5}$ levels during smoking were 199 µg/m^3 and 162 µg/m^3 in two conditions where the smoker's window was fully or half down). During a third condition where all windows were closed, $PM_{2.5}$ levels during smoking were much higher at 2926 µg/m^3. Again, in this study, no ventilation was used.

A further US study[28], as part of a broader examination of the relationship between vehicle speed, ventilation and air exchange rates, also looked at the effect of these variables on SHS levels. The authors note their studies produced similar findings to that of the Boston study, with the additional observation that closing windows and operating air-conditioning and air recirculation can result in very high peaks of $PM_{2.5}$ concentration of above 2000 µg/m^3 during smoking.

A Canadian study[29] tested the levels of $PM_{2.5}$ generated by smoking a single cigarette in a car under five different ventilation conditions in each of eighteen vehicles. The mean $PM_{2.5}$ found by the investigative team during the time the cigarette was smoked (which normally took between 6 and 8 minutes) under the different ventilation conditions are shown in figure 3, below.

Figure 3: $PM_{2.5}$ levels measured in-car while one cigarette is smoked

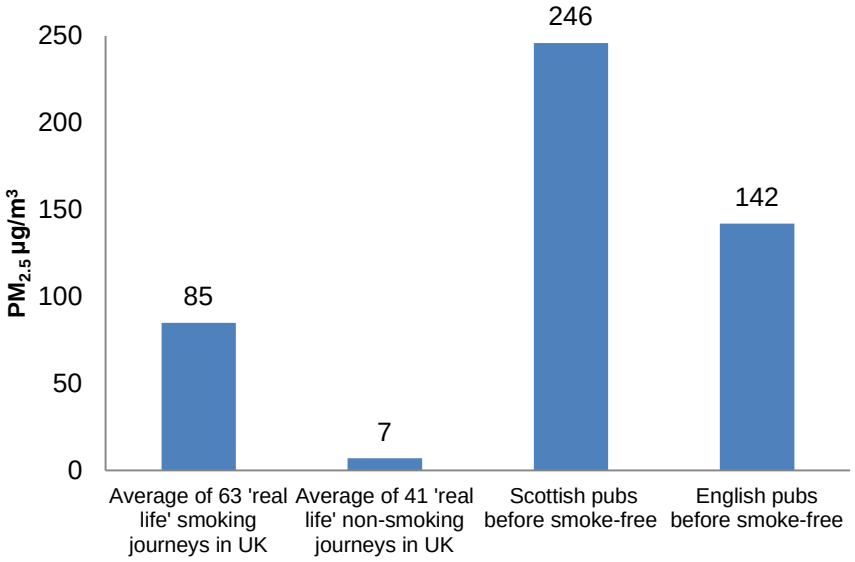


As previous studies have found, observed $PM_{2.5}$ levels varied significantly by ventilation condition, peaking at extremely high values when smoking occurs with no mechanical ventilation or windows open, and dropping significantly when ventilation occurs, though remaining elevated over baseline conditions where smoking is not present.

Most recently, a UK study conducted in Glasgow and the east of England[26] measured particulate matter concentrations under more natural driving circumstances (the studies described so far have focussed on externally imposed experimental smoking and ventilation conditions). Issuing research participants with recording equipment and instructing them to measuring exposure throughout everyday journeys gave the researchers exposure data from 104 'real life' journeys in the UK. Participants were instructed to drive and use ventilation as they would normally.

Data from the journeys, which were, on average, around half an hour in duration, provided the average $PM_{2.5}$ data in Figure 4 below. Reference values of particulate levels measured in bars and pubs in Scotland and England prior to smoke-free legislation are also provided, and both can be compared to the World Health Organisation (indoor) and US Environmental Protection Agency (outdoor) advised 24 hour exposure guidance for $PM_{2.5}$ - 25 µg/m^3 and 35 µg/m^3 respectively (these guidance figures indicate the level of particulate matter exposure health authorities consider it is unhealthy to exceed, when averaged over the course of a whole day).

Figure 4: $PM_{2.5}$ levels from 'real life' vehicle journeys compared with Scottish and English pubs prior to smoke-free public places legislation



Here the data shows the average concentration of particulate matter to be around one-third of that found in Scottish pubs prior to smoke free[30], and over half that found in English pubs and bars[26]. There is considerable variance around the average figures with a range of 16 µg/m^3 to 331 µg/m^3 among the 63 smoking journeys, compared with a range of 7 µg/m^3 to 902 µg/m^3 in Scottish pubs prior to smoke-free. Claims from previous reports that SHS exposure in vehicles is many times more concentrated than levels found in the home or in smoky pubs under realistic driving conditions are not supported by these data. However, as average concentrations in these studies mask wide variance in concentrations depending on ventilation conditions, $PM_{2.5}$ concentrations may exceed those found in smoky pubs and bars in 'worse case' scenarios'[22] where exposure is measured for a short duration (e.g. the time taken to smoke a single cigarette). Under naturalistic driving conditions and averaging exposure over a typical journey time, particulate concentration exceeds WHO and US EPA guidance for 24-hour exposure by several times.

How meaningful are guideline figures for 24-hour exposure?

Research findings from the previous section indicate that, under what are likely to be the most realistic vehicle conditions (i.e. in a moving vehicle with at least some form of ventilation), average particulate matter concentrations during typical journeys exceed both WHO (indoor) and EPA (outdoor) guidance for 24-hour exposure. In cases of poor or no ventilation, particle concentrations will be much higher (and even under ventilated conditions, concentrations can momentarily peak at high levels). However, these guidance limits are for exposure averaged over a 24-hour period, and it is reasonable to question what health impact exceeding them for the shorter duration of a vehicle journey is likely to have.

Under poor or no ventilation scenarios in a moving vehicle, it has been shown[28] that smoking two cigarettes in this manner results in a contribution to 24-hour average of 42 µg/m^3, exceeding the WHO air quality guidance figure of 25 µg/m^3 and the US EPA figure of 35 µg/m^3, assuming no other exposure to SHS other than that occurring in the vehicle. This assumption seems unlikely as it is plausible that exposure to SHS in a vehicles occurs due to smoking by individuals who

are probably also present and smoking in the home. Under conditions with greater ventilation such as with one passenger window fully open, the same study estimated that each cigarette smoked makes a more modest contribution towards 24-hour total exposure of around 2.2 µg/m^3 [28].

A recent study from California[31] measured $PM_{2.5}$ in a stationary vehicle setting, where windows were partially open, and estimated that a child spending ten minutes in a car with a smoker under these conditions would cause a 30% increase to the child's daily average $PM_{2.5}$ exposure. As has already been established, stationary vehicles are where exposures are highest, so this will be an estimate tending towards the worst-case. Also, when calculating the increase to the child's daily average exposure, researchers used the baseline exposure from a child in a non-smoking homes. As it is likely that most children who are exposes to SHS in cars are also exposed in homes to some degree, the 30% increase will be an overestimate for children who are in smoky home environments.

There are further issues with only evaluating whether exposure to SHS in cars meets or exceeds established values for indoor or outdoor air quality such as WHO or EPA guidance. These guideline figures are intended to set quality standards for the totality of exposure in all environments over the course of a whole day, not to adjudicate on temporary exposures in different microenvironments[32]. While they are not irrelevant in considering if vehicle SHS exposure is likely to be harmful to health, particularly child health, they should be considered within the context of other factors, below.

Implications of second-hand smoke toxicity

As discussed previously, using particulate matter concentration to report on exposure to SHS - as is the case for the majority of the literature on vehicle SHS exposure, is likely to underestimate true health hazard from SHS as it does not account for toxicity in detail. Tobacco smoke contains many toxic constituents, including human carcinogens, and, as described by the World Health Organisation[33], strictly has no threshold level identified as 'safe'.

General and acute health effects of second-hand smoke

Tobacco smoke is a mix of many different chemical compounds, with several of the major classes of chemicals that result from combustion being toxic or carcinogenic (though there is scientific uncertainty over which specific constituents are responsible for particular health outcomes)[34]. Exposure to SHS is recognised as a cause of disease in non-smokers, with the evidence most strongly supporting an increased risk of lung cancer and heart disease[1 3] and, more recently, an increased risk of stroke[35]. This evidence is generated from studies that have found increased in risk of disease non-smokers who live with smokers, typically over many years of exposure to SHS.

For some diseases caused by tobacco smoke, particularly cardiovascular disease, there is a sharp increase in risk of disease at low levels of exposure (such as infrequent active smoking or frequent exposure to SHS), with the increase in risk levelling off at higher levels of exposure[34]. There are a range of chemicals believed to be responsible for this relationship, including carbon monoxide, oxides of nitrogen, and particulate matter. Exposure to tobacco smoke contributes to several mechanisms such as inflammation, endothelial dysfunction (the inner lining of blood vessels functioning abnormally) and lipid abnormalities which are potential contributors to atherosclerosis[34]. Some of these effects are measurable from relatively short durations of exposure, one study[36] finding 30 minutes of exposure to SHS significantly reduced 'coronary flow velocity reserve', one measure of endothelial dysfunction.

Increased risks for children

There are several reasons why children and infants may face elevated risks from SHS exposure as passengers in vehicles when compared to adults. They have smaller airways, faster rates of respiration and immature immune systems. Because of differences in respiration, infants inhale increased quantities of particulates[37], and through greater hand to mouth contact can absorb quantities through ingestion[38]. There are also issues of agency, adults are typically more able to take action to remove themselves from smoky environments, or alter the environment (for example, by increasing ventilation) than children.

Epidemiological studies on second-hand smoke in vehicles and child health

While there is a large and robust body of epidemiological evidence supporting associations between SHS exposure and adverse child health outcomes in general[2], there are relatively few studies directly examining the independent effect of exposure that occurs in vehicles, as opposed to other locations. Because children exposed to SHS in vehicles are highly likely to be exposed in the home and other environments, it is difficult to analyse the discrete effect of SHS in vehicles. One Irish study attempted to do this[39] using a cross-sectional survey of around 3,000 13 and 14 year olds. After accounting for active smoking by the young person and SHS exposure at home, the odds of wheeze amongst those who report exposed to SHS in vehicles during their journey to school in a car were 35% higher (95% confidence interval: 8% to 70%), and the odds of hay fever symptoms were 30% higher (95% CI: 1% to 67%).

More broadly, considering child exposure to SHS in all settings, a recent meta-analysis and summary by the Royal College of Physicians[2] concluded SHS exposure is associated with increased risk of:

- child lower respiratory infections by 50% for household smoking and 60% for maternal smoking
- wheeze between 65-77% dependent on child age and with the strongest effect for maternal smoking
- asthma in school-age children by approximately 50% for household smoking
- middle ear disease by 35% for household smoking and 46% for maternal smoking
- meningitis by around two times
- sudden infant death by around two times.

Influence on smoking uptake

In addition to the health effects of exposure to SHS described above, there is a large body of evidence that shows children growing up with parental or household smoking results in increased likelihood of smoking uptake for the child (a recent review suggested that children growing up with parents or siblings who smoke are around twice as likely to become smokers themselves[2]).

A further New Zealand study[40] investigated the association between exposure to smoking in cars and early stage smoking activity in pre-adolescent children. The study sampled 3607 students aged between 10 and 13 years, using self-administered questionnaires the students were asked if they had ever smoked; how often they smoked; and whether anyone had smoked around them in a car during the past seven days. After modelling for the effect of other known predictors of smoking (including parental smoking status, smoke exposure inside the home, and other demographic factors), reported exposure to smoking in cars was significantly associated with an increased risk of both current and initiated smoking (the increased risk of initiated smoking being increased by around two times, the increased risk of current smoking around three times).

Summary

Authors of experimental and observational studies measuring SHS concentration described in this section have concluded that, even under realistic ventilation conditions, tobacco smoke pollution occurs in vehicles at a level that is likely to be harmful to health[19 29]. Under extreme worst-case scenarios, it may contribute enough exposure to significantly exceed 24-hour exposure guidelines on its own, even assuming no other sources of exposure. Under less extreme conditions exposure exceeded guidance levels by several times, although due to the short duration of exposure events it is likely to contribute only modestly to 24-hour exposure averages.

When considering the likely health impact, other factors must also be weighted in coming to judgement: WHO and EPA guidelines are not designed with this kind of micro-environment in mind, and sharp ‘peaks’ in exposure could be harmful in themselves for some conditions; $PM_{2.5}$ measurement alone may underestimate harm due to SHS toxicity; and vulnerable passengers such as children are likely to be at increased risk.

It is also important to consider that, for many diseases that are associated with SHS and child illness, the available evidence can only provide limited guidance on what magnitude and duration of exposure are causative of any particular adverse health outcome for any individual, and what, if any, level can be considered free of risk (or only confer an 'acceptable' excess risk). For example, in asthma exacerbations triggered by SHS exposure it may be the case that it is the peak exposure that is important, rather than averaged cumulative exposure through any single day, week or year. It is also possible that the dose-response relationship between SHS and disease is differs across health outcomes. For example, irritation effects such as eye irritation may be subject to a threshold where a specific level of exposure, if exceeded, triggers the outcome. By contrast, lung cancer risk increases with increasing SHS exposure in an apparently linear fashion[41] in a similar way, though at lesser magnitude, as increasing intensity of active smoking linearly risk of lung cancer[42].

While there are difficulties in specifying excess health risk caused specifically by smoking in cars, experimental and epidemiological evidence combined with a plausible theoretical model indicate that health risks are likely to occur as a result of exposure, particularly for vulnerable groups such as children.

3. Prevalence of smoking in vehicles

In addition to an understanding of the magnitude of exposure to SHS that occurs in vehicles and the likelihood of adverse health outcomes as discussed in the previous section, to determine the magnitude of public health risk posed by smoking in vehicles, the prevalence of the activity is also important to consider, specifically:

- how widespread smoking in vehicles is; and
- what the predictors and preventative factors are.

Unfortunately, there are no existing regular sources of data for this information in Scotland, though a partial picture can be obtained from a range of other sources.

In the United Kingdom as a whole, it has previously been reported that around 30% of adult smokers permit smoking in their vehicle when non-smokers are present[43]. 26% of adult non-smokers are often or sometimes exposed to SHS in vehicles as reported in a 2010 Royal College of Physicians publication[2].

An international study using data from the International Tobacco Control Four Country Survey (Australia, the UK, Canada and the US) gathered in 2007 found that, within a total sample of 6,786 adult smokers reports of smoking in cars in the presence of non-smokers varied from 29% in the UK and Australia, to 34% in Canada, to 44% in the US[44].

How widespread is smoking in vehicles with children?

In Scotland, a study carried out as part of the evaluation of the smoke-free public places legislation found that, from a sample of 2,389 of 11-12 year olds in 2007, 6.5% reported exposure to SHS in a car the previous day[12]. This type of survey has not been repeated in Scotland more recently, however as exposure to SHS in the home and public places among adults has remained relatively steady in national surveys[5] since the smoking ban, it seems likely the figure will remain broadly accurate. No Scottish-specific data is available on the prevalence of SHS exposure amongst younger children or infants. Elsewhere, in one Irish study, around 14% of 13 to 14 year olds reported being exposed to tobacco smoke in cars[39] whilst in Wales 5% to 9% (depending on socioeconomic status) of 10-11 year olds reported being exposed to smoke in a car when surveyed in 2007/8[45]. Amongst a wider age group in Wales (11 to 16 year olds), 20% of respondents reported they were exposed to smoking the last time they travelled in a car[46]. The difference between the latter figures from Wales when compared to the former is likely a result of the former asking whether respondents were exposed to smoke in a car *yesterday* whereas the latter asked if the respondent had been exposed *the last time they travelled in a car*.

In Canada, the Youth Smoking Study conducted in 2006 that collected nationally-representative data from 71,003 youth in grades 5-12 (ages 10 – 18 years)[47] found that 28.1% of Canadian youths in grades 5-12 were exposed to smoking in the car at least once in the previous week and 4.6% were exposed to SHS in the car on a daily basis.

Current and accurate data on child smoke exposure in vehicles in Scotland is lacking. It seems likely that what might be judged 'regular' (broadly defined as self-reported 'regularly' or weekly to daily) child exposure to smoke in vehicles appears to lie in the 5% - 20% range depending on age and socioeconomic status. Unfortunately these surveys are often unable to provide information to judge frequency of exposure in detail (e.g. how many times a day or week a young person is exposed to SHS in this manner), but from the fact that two of the studies estimated prevalence based on a question that asked for exposure to SHS in vehicles by the respondent on the day prior to completion of the survey[12 45], it is likely the exposure occurs with some frequency. Relatively little information is available on the frequency of exposure in other, younger or older age groups, but a recent survey of a thousand 8 to 15 year olds carried out by the British

Lung Foundation (BLF) found that 51% reported exposure to cigarette smoke when a passenger in a vehicle[48] (however this does not provide information about frequency of exposure).

Socio-economic status as a predictor of SHS exposure in cars

As would be expected from higher smoking rates among less affluent groups in society[49], there is a higher prevalence of exposure to smoking in cars for children from lower socioeconomic status (SES) groups. In a recent cross-sectional study[45] just over 3,000 10-11 year old Welsh primary school children were surveyed, one group before smoke-free legislation and a further group 1 year later. Saliva cotinine testing was carried out on 2,787 children. Following legislation, exposure to SHS as measured by saliva cotinine remained unchanged in children from low SES while children from high and medium SES were significantly more likely to have undetectable levels of cotinine. Car-based exposure was highest among children from low SES households at 8.8% compared to 6.5% and 5.4% from medium and high SES households respectively.

In 2006, utilising observational roadside methods, New Zealand researchers established a method to estimate the point prevalence of smoking and SHS exposure in cars, and compared this between two areas of contrasting socioeconomic status[50]. Using two teams of observers, researchers observed 16,055 cars in Wellington, New Zealand in five different sites. Two of the observation sites were in high and low areas of deprivation and three were in the city centre. The researchers observed a 4.1% point prevalence of smoking in cars with, the prevalence in the highest deprivation areas three times that of the low deprivation area. A more recent roadside survey of nearly 150,000 vehicles in New Zealand[51] reported that 3.2% of vehicles had smoking, and, of those, 4.2% had children inside (meaning the prevalence of smoking in vehicles with children was around 0.13%). A further similar New Zealand study, with a sample of vehicles from lower socioeconomic areas, found a prevalence of children in cars where adults were smoking was higher, at 2%[52].

When considering point prevalence estimates from these observational studies, it is important to remember that these estimates reflect the proportion of people smoking in vehicles at any given point in time. The ‘journey prevalence’ (the proportion of journeys in which an adult smokes in a car with a child) will be likely to be higher, as the time taken to smoke a cigarette is in most cases shorter than the average journey time.

Summary

Determining accurately the prevalence of smoking in cars is difficult, particularly when addressing the issue of how frequently young people and other passengers are exposed. We can infer from surveys that it is likely at least 5% of young people in their early teenage years in Scotland are in vehicles where smoking occurs, and that around a quarter of adult non-smokers are often or sometimes exposed. Because socio-economic status is a predictor of exposure, people from poorer backgrounds are more likely to be exposed more frequently. Evidence on younger children and infants is particularly lacking.

4. Road safety

While the majority of concern over smoking in vehicles stems from exposure to SHS, other arguments relating to the impact of smoking on road safety have been raised. Smoking, along with other behaviours such as trying to read maps, tuning a radio, and eating and drinking, are classified as distractions to be avoided under section 148 of the Highway Code[53]. If smoking or lighting a cigarette at the wheel is deemed to cause careless driving, this could be viewed as an offence.

Smoking behaviours are believed to have an adverse impact on road safety as it creates a form of driver distraction where the driver's attention is focused away from control of the vehicle. A 2003 literature review of driver distraction and crashes conducted in the US[54] cites smoking as a contributory factor in about 1% of distraction-related crashes in Pennsylvania, and concludes that smoking while driving is a potential trigger for distraction.

A UK analysis of police fatal accident reports from 1985 to 1995[55] found that in-vehicle distraction (of all kinds) is reported as a contributory factor in about 2% of fatal road accidents (though the authors believed the estimate to be conservative). Over the period, 5,740 coded police reports were analysed with distraction being reported as a contributory factor in 101 of the reports. Within the 101 cases, the most common cause of distraction was 'interaction with passengers' (reported in 26 cases), followed by distractions caused by 'car radio/cassette player' (reported in 19 cases) followed by 'food, drink and cigarettes' (in 17 cases).

The database used for the analysis did not contain information from police forces in Scotland and the fatal accident reports presented in this study are now old, and are unlikely to accurately represent modern risks (smoking is less prevalent now than during 1985 to 1995 and other factors like mobile telephone use are more prevalent.)

More modern systems of contributory factor accident reporting in Britain use a list of 77 contributory factors, falling into nine wider categories, including 'impairment or distraction'. This reporting system is largely subjective and reflects the attending police officer's opinion at the time of reporting. Smoking itself is not detailed as a separate contributory factor: 'distraction in the vehicle' more generally was reported as a contributory factor in 3,132 accidents of all types in Great Britain in 2011 (3% of all accidents), and 75 fatal accidents (5% of all fatal accidents)[56].

Epidemiological studies[57] [58] have reported smokers being at increased risk of being involved in accidents when compared to non-smokers. However, it is not possible to infer with certainty a casual linkage between the act of smoking itself and increased likelihood of accidents from these studies. While most studies in this area have attempted to adjust for a variety of other predictors of crashes (e.g. age, driving experience, driving frequency), it is likely smoking clusters with other risk-taking behaviours that themselves contribute to increased risk of accidents. One study[58] however, has attempted to account for the effect of a large range of other variables (including a range of measures of risk taking and sensation seeking behaviours) and found an increased two-fold risk of accidents from being a current smoker persisted after adjustment.

Summary

Smoking as a distraction could be a cause or contributory factor to some road accidents in Scotland - however routine contributory factor reporting systems do not record it in enough detail to be certain. There are indications that smokers are at greater risk of a road traffic accident than non-smokers, however it not clear if this excess risk is caused by the act of smoking itself, or the fact that drivers who are more predisposed to accidents for other reasons are more likely to smoke.

5. Impact of legislative interventions

Evaluation of SHS-reducing legislative interventions

Only one study has been identified that specifically addresses the question of whether legislative interventions are effective in changing behaviour and reducing exposure to second-hand smoke in vehicles[59]. The author used Canadian survey data from children aged 10 and over to evaluate whether legislation reduces child second-hand smoke in cars, and whether it had any adverse effect of displacing smoking into the home. Canadian data is useful for this purpose, as various Canadian provinces have adopted legislation to restrict smoking in cars with children from 2008 onwards, and have implemented the law at different times hence providing a useful natural experiment. The analysis used a variety of different methodologies to investigate the data from two different health surveys involving many tens of thousands of young people in Canada.

Conservative estimates from the study were that legislation reduced the proportion of children exposed to SHS by around 10% relative to the period before the law was implemented and in provinces that did not adopt such laws (in absolute terms, this represents a 4 percentage point reduction from pre-policy SHS child exposure of 43%). More optimistic alternative analysis from the study suggested legislation reduced SHS child exposure by over a quarter (a 7 percentage point reduction from a pre-policy SHS exposure level of 27%). The differences between these estimates is attributable to the fact the study used different surveys each with different age-groups, number of years of pre- and post-ban data, and different question phrasing used to ascertain SHS exposure. The study did not find evidence of substitution to home smoking following legislation to ban smoking in cars.

Comparable legislative interventions in vehicles

As there is currently only one study examining the effectiveness of legislative interventions to reduce SHS in vehicles, it is useful to consider how successful analogous interventions have been in changing behaviour to achieve a public health benefit.

Seatbelts

Laws to introduce the compulsory use of seatbelts for drivers and front seat passengers was introduced in the UK in 1983, with rear seatbelt use being made compulsory with cars with belts for children in 1989, and for adults in 1991. High profile media campaigns to raise awareness preceded and accompanied the introduction of legislation. Compliance is measured routinely through an observational survey, carried out at 21 sites in Scotland in 2009[60]. In Scotland, seatbelt rates were 95% and 97% for the driver and passengers in the front seat respectively, and 88% for rear seat passengers.

Compliance with seatbelt legislation is high. A literature review on understanding public attitudes to road safety[61] analysed several different public opinion survey sources. The reviewers report that the majority of drivers (90%) agree that they ‘want to’ wear a seat belt. The review also reports that approval of seat belts across the EU is high, and highest in countries where enforcement is greatest. Also reported in the review was a further piece of research with drivers who only occasionally wear seat-belts which suggested that such drivers only wear seat-belts in perceived high-risk situations such as high speeds, or unfamiliar roads, with a variety of distancing and mediating psychological processes justifying these behaviours (e.g. thinking ‘I feel completely in control [of the car]’ or ‘I know my [driving] capabilities’).

Mobile phone use

In 2003 it became illegal to drive while using a hand-held mobile phone, and further penalties were introduced in 2007. A 2009 Department for Transport report[62] based on observational surveys in England found that hand-held mobile phone use had risen from 1.1% to 1.4% between 2008 and 2009 amongst car drivers, and 2.2% and 2.6% amongst van and lorry drivers (both statistically significant increases). The report describes the longer term trend in use of

hand-held mobile phone use by drivers as responsive in the short term to changes in legislation (reducing after the introduction of the legislation in 2003, then increasing, then reducing after the increase in penalty in 2007, then increasing again). This observation is consistent with UK research published in the scientific literature[63] [64], however these studies may not take full account of changes in mobile phone market penetration, or changing demographics in UK mobile phone use. A longer-term US study[65] concluded that bans had long term effects on reducing prevalence of hand-held mobile phone use, but that it could not determine whether reductions are driven by a switch to hands-free devices.

The British Social Attitudes Survey reports on public attitudes towards issues such as mobile phone use while driving. The 2010 report[66] found that, while few respondents agreed that it is safe to talk on a hand-held phone while driving, there are indications of a softening in attitudes towards the use of phones since 2009. The survey reported that 69% of respondents agreed that the law on banning mobile phones while driving is not properly enforced.

Summary

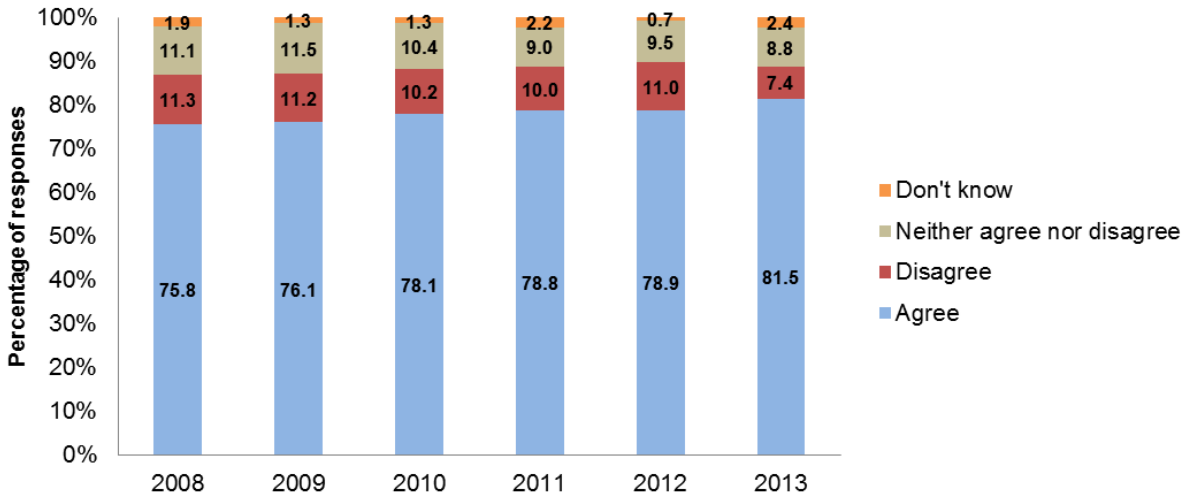
There is some evidence from Canada that legislative interventions can be effective in reducing child exposure to second-hand smoke in vehicles. The experiences with legislative intervention in the case of seatbelt and mobile phone use are useful in considering why an intervention does, or does not work. Viability of enforcement is likely to be important, but also salient public understanding of the risks of the behaviour and its possible consequences. Public awareness of the risks of behaviour may diminish soon after unsupported legislative intervention and individuals may forget, downplay, or find other coping strategies to deal with the execution of an identified ‘risky’ behaviour.

6. Public opinion

Data from Scotland

A representative annual opinion poll of around one thousand Scottish adults (aged 18+) by YouGov Plc asking respondent's opinions on interventions to reduce smoking in vehicles has been carried out in each year between 2008 and 2013[67]. Respondents were asked their views on a range of tobacco control interventions, including those focusing on reducing exposure to smoke in cars. The option that is most strongly supported by the polling data is banning smoking in cars carrying children younger than 18 years of age. Figure 5 below displays the data from the -survey over the past six years.

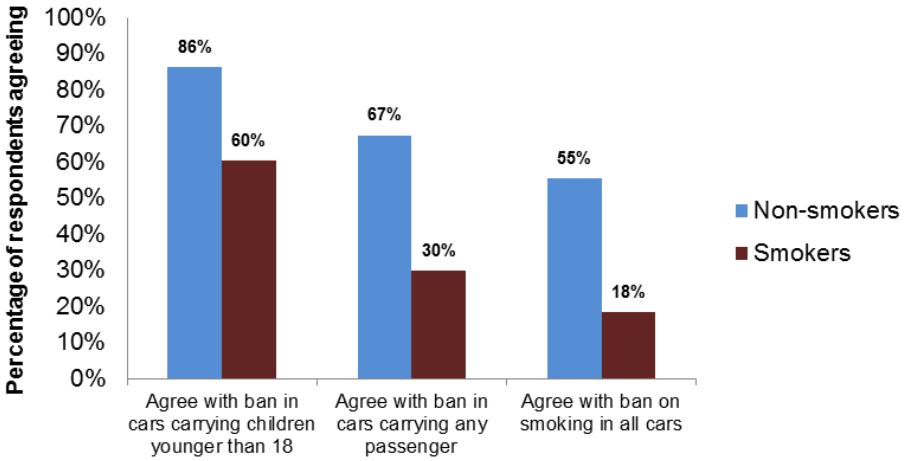
Figure 5: Agreement/disagreement with the statement that 'Smoking should be banned in cars that are carrying children younger than 18 years of age'



Support for banning smoking in cars containing children younger than 18 has been strong in all years of the survey with more than three-quarters of all respondents agreeing with the proposal. There is an apparent trend for an increase in agreement as time goes on, from 75.8% in 2008 to 81.5% in 2013.

Public support for other interventions to reduce smoking in cars (banning smoking in cars with any passenger, and banning smoking in any car) were also investigated. Results from the 2013 survey are in Figure 6.

Figure 6: Support for three interventions to reduce second-hand smoke exposure in cars, Scotland 2013



A large majority of non-smoking adults and the majority of all smokers support a ban on smoking in cars carrying children younger than 18. Support drops amongst both smokers and all adults (but more sharply among smokers) when considering the next intervention of banning smoking in cars with any passenger, with around two-thirds of non-smoking adults and a third of all smokers supporting. Support for a ban on smoking in all cars drops again, with around half of non-smoking adults supporting, and less than a fifth of smokers supporting. A greater proportion of all adults support (48%, not shown in graph) than oppose (34%, not shown) a ban on smoking in all cars, however opposition among smokers to both a ban in cars carrying any passenger (47%, not shown) and all cars (65%, not shown) is moderate to strong.

Public support for smoke-free public place laws

It is useful to compare levels of support for legislative intervention on smoking in cars with public support for the March 2006 smoke-free public places legislation, now widely regarded as having strong popular support. Between August 2005 and May 2006, prior to and just after implementation, support for the law was consistently around 60%[68 69], but by October 2006 - several months after implementation - support for the legislation was at 70%[69]. The most recent figures from 2013 show support for the law to make enclosed public places and workplaces smoke-free to be 84%[70].

Public support in other countries

A range of studies from other countries provide some comparison to the Scottish data described above. An American study that looked at public attitudes to smoking in car bans was carried out in the state of Indiana with 529 state residents aged 18 and above[71]. The respondents were asked two questions: 'would you favour or oppose an ordinance that prohibits people from smoking while driving a car?' and 'would you favour or oppose an ordinance that prohibits passengers in cars from smoking?' A smoking ban in cars was favoured by less than a third of all respondents (34% for drivers and 28% for passengers). Respondents who opposed a ban expressed concerns about infringement of privacy and the feasibility of enforcing a ban. Smoking status, heavy smoking, employment status and religiosity were all significantly associated with attitudes toward the bans. However in this study respondents were not asked questions to measure attitudes to smoking in cars in different scenarios e.g. whether the vehicle was carrying a child or non-smoker and a relatively low response rate may have led to response bias.

An international review[72] of public attitudes to smoke-free private vehicle laws in North America, the UK and Australasia suggested there was majority public support for laws that ensured cars carrying children are smoke-free. A number of limitations with this review make it difficult to generalise to other countries as a wide range of study methods were used across the studies included.

More recent research using data from the large International Tobacco Control (ITC) Four Country Survey conducted a study across four countries (USA, Canada, UK and Australia) which also ascertained support for banning smoking in cars with children[73]. Controlling for routine demographic differences, smoking frequency, smoking health knowledge/beliefs and intention to quit, the team compared support across the four countries. The respondents were asked 'would you support a law that banned smoking in cars when children are in them?' Support for a ban was highest in Australia (83%) followed by smokers in the UK (75%), Canada (74% and USA (60%). It was hypothesised that support was higher in Australia as there has been a longer history of advocacy campaigns and media coverage for bans compared to the other countries. In South Australia where a ban was already in place at the time of the ITC survey, smokers were more than 3 times more likely to support a ban than smokers from all other states. Further predictors of support for car smoking bans were lighter smokers, smokers who had stronger quit intentions, had lower education, had no children in the home, who believed smoking is dangerous to non-smokers, that it could cause asthma in children and those who were concerned about modelling smoking behaviour to children.

What children think about smoking in cars

There is very little research that explores the opinions of children themselves in this area. A recent survey[74] of 1000 children by the British Lung Foundation showed that 86 per cent of the UK children (8 to 15 year olds) surveyed wanted people to stop smoking when they were present in the vehicle.

Research from Canada explored data from the 2004 Canadian Youth Smoking Survey (YSS) in order to examine the beliefs of 29,243 Canadian youths in grades 5-9 (ages 10-15 years) about smoking in the home and car[75]. Statistical analysis was conducted to examine whether exposure to SHS at home or in the car was associated with beliefs about children's exposure to SHS in the home or car. Over 90% of youths reported that they did not believe smoking should be allowed around children in cars. Although the prevalence was highest among non-smoking youths (91.8%), the majority of smoking youths (72.9%) also reported that smoking should not be allowed around children in cars. Youths who were exposed to SHS in the home and/or car in the last seven days were more likely than those who were not exposed to report that smoking should not be allowed around children in cars. The survey was repeated in 2006 and collected data from 71,003 youth in grades 5-12 (ages 10-18 years) [76]. The majority of young people surveyed (88.4%) reported that they did not think smoking should be allowed around children in cars.

Summary

In Scotland, support for banning smoking in cars where under-18s are passengers is strong. Support falls and opposition rises (particularly among smokers) to a complete ban on smoking in cars, or a ban on smoking with passengers of any age. This is consistent with the international evidence which, subject to differences in survey methodology or particular phrasing of questions, finds considerable support for banning smoking in cars with children. Children themselves strongly believe that smoking should not be allowed in cars when they are present.

7. Ethical arguments

The focus of tobacco control policy is the prevention of harm. Smoked tobacco products are harmful both in terms of their direct effects on the health of smokers and the harm tobacco smoke causes to non-smokers, with these harms being perpetuated by the addictive nature of tobacco. Because of the widespread nature of tobacco consumption, interventions to reduce tobacco use frequently provoke debate and disagreement on the legitimate role of authorities to intervene in private behaviour. These arguments are brought into particular focus when discussing interventions to reduce smoke exposure in vehicles.

An adult choice

A frequent argument against interventions to reduce smoking, and one that has historically been championed by the tobacco manufacturers themselves, is to present the issue of smoking solely in terms of personal choice and freedoms. Within this framing, fully informed competent adults have sufficient knowledge of future risks, choose to smoke in the face of these risks, and should be free from interference in the pursuit of this decision.

However this viewpoint is contestable in several ways. While there are current smokers who are of this view, a large body of research summarising the experiences and opinions of many other smokers and ex-smokers conflicts with it. The addictive nature of smoking combined with the high levels of regret many smokers feel about commencing tobacco use[77] and the desire most smokers have to give up smoking completely[78] indicates that arguments based purely on voluntary decision-making have limits when it comes to understanding tobacco consumption.

This position also does not take account of the fact that uptake of smoking frequently does not occur amongst competent adults, but is instead initiated by an addiction began in childhood (most smokers start before the age of 18[79]) when knowledge of the harms smoking causes are incomplete and understanding of the likelihood of future health hazards are likely to be poor.

Lastly, and most relevant to the issue of smoking in vehicles, the assumption that the smoker is in full consent and control over their smoking does not extend to those around them who are involuntarily exposed to SHS. This can be particularly the case for children and other vulnerable groups who lack agency to move away from or otherwise change smoky environments.

The car as a private space

A civil liberties argument raised in opposition to the prohibition or further restrictions on smoking in vehicles is that the vehicle is principally a private space, akin to the home, and hence not an appropriate area for this kind of intervention. This point of view is one that can be intuitively understood as many vehicles are privately owned, their use invokes a sense of personal freedom, and most users of cars are physically separated from the outside world.

However, there are also many senses in which the use of vehicles crosses from the private into the public sphere. Vehicles are mostly used for travel in public spaces, and it is recognised that the risk they can pose to the public is such that regulations governing many aspects of motoring are already in place (e.g. requirements to possess a license for legal use, mandatory seatbelts, minimum tyre tread, speed and drink-driving limits, and so on).

As with restricting smoking in vehicles, existing regulation of motoring exists largely to protect the health and wellbeing of both the user of the vehicle, their passengers, and the wider public. The arguments for the car as a private space in the same category as the home are weaker when seen in the light of the range of existing regulations that are already accepted on the grounds of protecting the public from harm.

Balancing benefits and burdens

A proposed framework[80] for making ethical decisions in public health makes it clear that, before any public health intervention is adopted, it should be carefully scrutinised and associated ethical issues evaluated in several areas, including whether:

- it has well-defined goals
- the programme is likely to be effective in achieving these goals
- the programme has any known burdens, including infringements on individual liberties
- the burdens can be minimised or an alternative less burdensome approach can be adopted that achieves the same goals
- the intervention can be implemented fairly without disadvantaging population groups
- the benefits and burdens can be fairly balanced.

When considering the intervention of limiting by legislation smoking in cars to protect others in the context of this framework, it seems clear such interventions have well-defined goals to reduce the morbidity and mortality caused by tobacco smoke. There is some evidence that legislative intervention will be effective in achieving these goals, however experience with other interventions like seatbelt and mobile phone use suggest success depend on variables such as practicability and visibility of enforcement, accompanying information/media campaigns, the enthusiasm with which the public engages with and adopts the underlying health behaviour message behind the intervention (that SHS is harmful and exposing others to it should be avoided), and the support of multiple agencies in promoting the message.

There are clear burdens in terms of the extent of infringement on individual behaviours that can be identified in this case, however other interventions that carry similar burdens of invasion into privacy have already been adopted and many have been well-accepted. When considering legislative intervention, there are multiple options, some with more obvious burdens on individual liberty than others. Each should be carefully evaluated to determine whether it brings an acceptable level of additional benefit for the additional burdens more intrusive interventions bring.

As the pattern of tobacco use is unequally distributed throughout the population, interventions that restrict tobacco use through universal legislation will disproportionally effect poorer groups in society that have higher levels of tobacco use. However as the group most at risk of health harms, they also stand to benefit most from such interventions, provided they are effective. Defining the boundaries where public health intervenes unacceptably with individual liberties is a continuing debate in ethics. It has already been strongly argued[2] that the ethical grounds for protecting young people from exposure to smoke are extremely strong, and enough to justify a balancing point of benefits and burdens that include legislatively intervening to prohibit smoking in vehicles where children are present.

Citizens and groups in society can be expected to disagree on what the appropriate balance is in issues like smoking in vehicles. This is to be expected and unanimity of public opinion is not normally required before proceeding providing sufficient thought and care has been taken to maximise benefits and minimise burdens (e.g. there will always be individuals who do not want to wear seatbelts but this has not prevented it being appropriate to take legislative action on this issue.) Most important, is that public health interventions must have genuine public trust that an intervention is being done on behalf of the best interests of the public. In the context of smoking in vehicles, this means public health organisations must clearly communicate the ethical arguments surrounding the area, and why any intervention that imposes a costs on individuals is justified by wider benefits accrued by the public.

8. Conclusions

This review has summarised recent research on smoking in vehicles. The evidence and arguments reviewed describe that:

- Scotland has made significant progress in tackling the health issue of second-hand smoke in recent years, however exposure to second-hand smoke continues outside of enclosed public places covered by the smoking ban
- concentration of second-hand smoke in vehicles can reach very high levels, and even under 'realistic' driving conditions using ventilation, exceeds established guidance for exposure to airborne particulates
- these exposures are likely to harm health, particularly among vulnerable groups
- there is limited evidence on current prevalence of smoking in cars in Scotland, older studies from Scotland and internationally indicates it does occur, and is very likely to be patterned by deprivation
- there is not sufficient evidence to quantify the contribution of smoking as a risk factor in road traffic accidents
- there is supportive evidence from Canada that legislative interventions can have an impact on reducing the prevalence of SHS exposure among children
- experience with other legislative interventions in vehicles - seatbelts and mobile phone use - indicate that public awareness and acceptance of harms, visibility and practicability of enforcement are important components of effective interventions
- public support for legislative interventions to prohibit smoking in vehicles with children in Scotland is strong, and appears to be growing
- interventions to limit smoke exposure in cars need to navigate ethical arguments surrounding the intervention in spaces perceived to be private - there are strong ethical arguments to intervene to protect vulnerable groups like children

As a health charity, ASH Scotland is in favour of measures that minimise the health risks of second-hand smoke - our work involves finding the best ways of protecting people from this harm. A major gap in knowledge is that there is poor data on current levels of second-hand smoke exposure in vehicles in either adults or children in Scotland: to accurately assess the scale of the health issue and the effectiveness of interventions to reduce harm, this should be rectified.

Evidence summarised in this review indicates that awareness and acceptance of the health risks of second-hand smoke exposure, particularly for vulnerable groups, is an important component of an effective tobacco control strategy. Widespread awareness raising work on the health impact of second-hand smoke in vehicles - along with other environments such as the home - is required.

There is evidence that legislative interventions can be effective in reducing child exposure to second-hand smoke in vehicles. ASH Scotland is supportive of these measures, particularly if awareness-raising work does not show sufficient progress in reducing exposure. Much of the public debate on these issues has focused on protecting children. This is understandable - children are particularly susceptible to the health effects of second-hand smoke and often are not in a position to remove themselves from smoky environments.

However, it is important to remember that second-hand smoke impacts people of all ages - and there are groups particularly vulnerable to its health effects other than children (for example, those with pre-existing health conditions). The intention to reduce the harm caused by second-hand smoke to any bystander should be reflected in the debate.

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