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EVIDENCE BASED PUBLIC HEALTH POLICY AND PRACTICE

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Objective: To identify and evaluate the options for population level government policies to increase the prevalence of homes free of secondhand smoke.

Methods: The literature was searched for population level policy options and evidence on them. Three criteria were used to evaluate the policy options: effectiveness, the reductions on inequalities in secondhand smoke exposure, and cost effectiveness. The setting was four developed, English speaking jurisdictions: Britain, USA, Australia, and New Zealand.

Results: Evidence from all four countries shows some association between relatively comprehensive tobacco control programmes and lower prevalence levels of smoking in homes. The evidence of the effect of such programmes on inequalities in smokefree home prevalence is limited. No published evidence was found of the cost effectiveness of the programmes in achieving changes in smokefree homes. Within comprehensive programmes, there is some indirect evidence that some mass media campaigns could increase the prevalence of smokefree homes. Structural options that have potential to support smokefree homes include smokefree places legislation, and laws for the protection of children.

Conclusion: The available evidence to date suggests that comprehensive tobacco control programmes (to reduce the prevalence of smoking in the total population) are likely to be the most effective and sustainable option for increasing the prevalence of smokefree homes.

Secondhand smoke (SHS) exposure is important as a cause of harm to human health and wellbeing. It is dangerous at very low levels, with immediate adverse effects in healthy adults.^{1–2} Large studies show that long term exposure increases the risk of cardiovascular disease and death for adult non-smokers.^{3–4} For infants and children, there are numerous adverse health effects from SHS, including the increased risk of death from sudden infant death syndrome.⁵ SHS is included as a significant cause of death in national mortality burdens.^{6–9}

Homes are crucial sites of SHS exposure, and are one of the last frontiers of tobacco control efforts to reduce SHS in interiors. The social consequences of home SHS exposure include increased school absence,^{10–12} which may have an impact on educational experience. In addition, smoking in homes results in health care spending, lost pay, lost and lower production, higher cleaning and maintenance costs, lower home resale prices, fire related costs and impacts, and higher insurance costs.¹³ Other indirect and intangible costs from children's sickness resulting from SHS include time off work for parents, transport, home care, support services, and the downstream financial and other costs of the psychological stress on parents.¹⁴

Smoking bans inside homes may also decrease smoking and smoking uptake. Such bans in the USA and New Zealand have been associated with decreased rates of children becoming smokers, leading to suggestions that the bans are protective for smoking uptake.^{15–18} In California, smokers in partly or totally smokefree homes were much more likely to be light smokers, and to be able to wait at least 30 minutes from waking for their first cigarette, relative to those in homes without restrictions on smoking.¹⁹ In the USA, smokers in smokefree houses were more likely to report a quit attempt and to stop for at least six months.²⁰ The results have led to suggestions that the bans may promote quitting.

In addition to the direct SHS exposure from burning cigarettes, further exposure occurs as the smoke particles

deposited on clothes or household surfaces are mobilised back into the air, or absorbed by hand to mouth contact.²¹ Thus smoking inside, while other household members are outside, can subsequently result in SHS exposure to them. The higher rates of smoking and home SHS exposure in socially disadvantaged populations, and the lower likelihood of smokers in those populations being able to quit,^{22–23} means that a pro-equity approach requires options that particularly benefit these populations.

Previous reviews and discussions of policies to increase the prevalence of smokefree homes (that is, where no one smokes inside) have largely focused on household and individual level interventions.^{24–33} In contrast, this review examines the options for population level government policies to increase the prevalence of smokefree homes. Our aim was to identify and evaluate the major options found in the literature, where evidence was available of direct effects, rather than to conduct a systematic review of all interventions.

The decisions of smokers and others in relation to SHS are influenced by environmental factors,³⁴ as well as the needs to end nicotine craving.³⁵ Smokers may use "self exempting" beliefs (varied forms of denial) to help reduce the contradictions between beliefs in SHS risks, and their behaviour.³⁶ Predictors of positive attitudes to SHS restrictions in the home include the presence of children, some or all the adults being non-smokers, and believing that SHS can harm people.³⁷ Much of the theory around behaviour change and SHS has been reviewed by Borland.³⁸

METHODS

To identify the range and importance of the policy options, and the evidence for them, a search was made through Medline, Ebsco (MasterFILE Premier), and Google Scholar electronic search engines, using selective combinations of the search words: policy, population, environmental, passive, secondhand, tobacco, smok*, cost*, home*, infant*, child*,

Table 1 Comprehensive programmes and the prevalence of home SHS

Study	Population	Setting	Measures	Data collection	Results
Rohrbach <i>et al</i> , 2002 ³⁹	Adults	Sample of 18 California counties	Nil days exposed in past week	Random telephone surveys 1996, 1998	Exposure to tobacco control programmes was statistically significantly related to higher smokefree home rate
Rohrbach <i>et al</i> , 2002 ⁴⁵	10th grade students	Sample of high schools in 18 California counties	Nil days exposed in past week in indoor areas and cars	Questionnaires given face to face to sample of classes	The proportion not exposed significantly increased: (1996: 34%; 1998: 42%)
Norman, 2002 ⁴⁴	Smokers age 25 plus	18 California counties	Home smoking ban	Cross sectional random telephone survey, 1998	Exposure to tobacco control programmes was significantly related to increased smokefree home prevalence
Levy <i>et al</i> , 2004 ⁴⁶	Aged 15 plus	United States	No smoking anywhere inside	Stratified sample, telephone and in-person surveys 1992/3, 1998/9	State tax, media and smokefree laws were significantly related to higher smokefree home prevalence
Borland <i>et al</i> , 1999 ⁴²	Adults	Victoria, Australia	Household smokers always smoke outside	Representative sample, in-person surveys 1995, 1997	Smoking outside significantly increased: (1995: 20%; 1997: 28%)
Thomson <i>et al</i> , 2005 ⁴⁴	Aged 15 plus	New Zealand	1996: Not regularly exposed, 2003: Nil days exposed in past week	Stratified sample telephone surveys	The proportion not exposed significantly increased (1996: 72%; 2003: 82%)
Thomson <i>et al</i> , 2005 ⁴³	Year 10 students in participating schools	New Zealand	1997–2002: No smoking inside 2003: No smoking inside in past week	Self administered questionnaires	The proportion exposed to “no smoking inside” significantly increased: 1997: 62% 1998: 65% 2001: 69% 2002: 72% 2003: 70%
Jarvis <i>et al</i> , 2000 ⁵³	Children aged 11–15	Britain	Mean of cotinine levels	Saliva cotinine in non-smoking children	Mean cotinine significantly decreased: 1988: 0.96 ng/ml 1998: 0.52 ng/ml

parent* and qualitative (for literature published to March 2005). The combinations were informed by results obtained. The references within the material found enabled further publications to be identified. We looked for evidence that would enable us to evaluate options by three criteria: effectiveness, the reduction of inequalities in SHS exposure in homes, and cost effectiveness. Effectiveness was judged by changes in smokefree home prevalence. The selection of studies was limited to those countries with sufficient comparable data over time on smokefree home prevalence (USA, Australia, New Zealand, and Britain).

Population level was taken as an approach (for instance, mass media campaigns) that has the potential to affect a population (whether it is defined by a jurisdiction, ethnic group, or region) rather than identified individuals. Jurisdictions included states, cities, and health authority districts. We did not include individual level interventions, where identified smokers or identified exposed non-smokers are provided with personalised assistance (for example, counselling to quit or to smoke outside).

A focus for this review was on interventions where there were potentially substantive reductions in SHS exposure (that is, completely smokefree homes) and so we discounted interventions that promoted minor behaviour change such as smoking by a window or smokefree rooms. The volatile nature of tobacco smoke constituents means that such tactics are of limited effectiveness in reducing SHS exposure to others.^{39–40} Similarly, ventilation may reduce, but not eliminate the risk from SHS in homes.⁴¹

RESULTS

Four population based policy options were identified from the search: comprehensive programmes, policies that change public knowledge and actions on SHS, mass cessation programmes, and structural options. The only population level policy option that we found for which there was some direct evidence of an association with the prevalence of smokefree homes, or evidence on the reduction of inequalities

in exposure to SHS in homes, was comprehensive tobacco control programmes. For this study, “comprehensive” programmes were defined as those that at minimum included all of: active tobacco price policies, effective education, smokefree places policies, and population level cessation support.^{42–43} There is indirect evidence for the effects of other population level interventions, such as media campaigns and mass cessation programmes. It should be noted that all the other elements of comprehensive programmes would need to be controlled for if such interventions were to be fully evaluated. In addition, some structural options that had such a potential to support smokefree homes were identified.

The measures found for defining smokefree homes varied slightly. Unless otherwise stated below, they were: (a) the survey interviewees being exposed to tobacco smoke for zero days in their homes in the past week; or (b) where no smoking was permitted anywhere in homes; or (c) where all household smokers always smoked outside.

Comprehensive tobacco control programmes

Relatively comprehensive tobacco control programmes, which include an emphasis on SHS, may meet the criteria of effectiveness in increasing the proportion of smokefree homes (table 1). No direct evidence was found for such programmes as a cost effective way of increasing the prevalence of smokefree homes.

In California, smoking adults exposed to components of the statewide tobacco control programme had a significantly higher chance than others of having home smoking bans.⁴⁴ For Californian adults, the more components they were exposed to, the stronger the chance of smokefree homes. Californian 10th grade students had significantly decreased exposure to SHS in indoor areas and cars between 1996 and 1998.⁴⁵

The association of a relatively comprehensive tobacco control programme and some evidence of increased smokefree home prevalence is repeated in comparisons of states in

Table 2 Comprehensive tobacco control programmes and inequalities in home SHS exposure

Study	Population	Setting	Measures	Data collection	Results
Thomson <i>et al</i> , 2005 ⁵⁰	Aged 15 plus	New Zealand	1996: Not regularly exposed, 2003: Nil days exposed in past week	Stratified sample telephone surveys	Significant reduction in inequalities during 1996–2003 ($p < 0.00001$)* Maori exposed: 48% to 30% All exposed: 28% to 18%
Gilpin <i>et al</i> , 2002 ⁵⁴	Children, youth	California	Smoking banned inside	Telephone random surveys	A non-significant relative increase in inequalities, with the difference between the two groups being significant in 1999 ($p < 0.0001$)* (1992: African American 32.6%, non-Hispanic white 37.4%; 1999: African American 75.6%, non-Hispanic white 80.4%)

*Calculated for this review using EpilInfo (CDC, Atlanta) and using extra data from Gilpin 2001.⁵⁵

the USA,⁴⁶ in Victoria, Australia,^{47–48} and in New Zealand.^{49–50} In the comparisons between states of the USA, generally the more elements in the programmes, and the greater their strength, the higher the prevalence of smokefree homes.^{46–51} In Britain, while it is arguable whether even recent government efforts on tobacco control could be described as “relatively comprehensive”,⁵² the exposure of children as measured by cotinine almost halved between 1988 and 1998.⁵³

The published research evidence on the effect (or non-effect) of comprehensive tobacco control programmes on inequalities in home SHS exposure is limited, and seems context specific. In New Zealand, between 1996 and 2003 there was a statistically significant decrease in inequality (table 2). However, in 2003 Maori were still 1.6 times more likely to be exposed to SHS at home, compared with the total population.⁵⁰ In California, between 1992 and 1999 there was a small but non-significant increase in inequality between two ethnic groups, of youth SHS exposure at home (table 2).⁵⁴

Indirect evidence for separate interventions for supporting smokefree homes

There are indirect indications that within comprehensive programmes, policies that change public knowledge and actions on SHS may directly affect the prevalence of smokefree homes. Mass media campaigns are a likely means of changing behaviour on smoking in homes.^{56–57} There is some evidence that beliefs drive decisions on creating and maintaining smokefree homes. In California, even smokers were five times more likely to report living in a smokefree home if they believed in the harm of SHS.²⁰

There is “strong scientific evidence” by the criteria of a systematic review that mass media campaigns, combined with other interventions, are effective in reducing smoking prevalence.³¹ Such campaigns have also been found to be relatively cost effective forms of tobacco control.^{31–38} Some mass media campaigns that have included SHS themes have been effective in increasing knowledge about SHS harm.^{59–61} We found no evidence of the effect of such campaigns on inequalities in the prevalence of smokefree homes.

The published studies about mass media campaigns and smoking in homes use measures different from “smokefree homes”. A 1992 media campaign in Victoria, Australia, increased the proportion of non-smokers asking their visitors not to smoke.⁶² In Tasmania, Australia, national media campaigns and advice to pregnant mothers on avoiding sudden infant death syndrome during 1988–1993 were effective in reducing SHS exposure for infants. There was a significant increase in mothers reporting not smoking while holding or feeding the infant, or while in the same room or house as the infant. There was also a reported increase in others not smoking around infants.⁶³ In the USA, exposure to a media campaign on SHS resulted in increased intent to have smokefree homes.⁶¹

The contribution of smoking cessation to smokefree homes

No population level smoking cessation intervention studies were found that reported on the consequent prevalence of smokefree homes. However, quitting has the potential to contribute to an increase in smokefree homes. Telephone counselling for cessation is typically part of, or associated with, a mass media smoking cessation campaign.³⁸ There is strong evidence that, when combined with other interventions, Quitlines are effective in reducing smoking prevalence. There is also strong evidence for the effectiveness of Quitlines by themselves.^{64–65} One Quitline intervention, specifically for smoking mothers of children under the age of 6, resulted in 12.5% of those contacted after six months self reporting as not smoking for at least the past week.⁶⁶

Structural options to support smokefree homes

This review did not identify direct evidence for structural changes such as legislation affecting the prevalence of smokefree homes. Nevertheless, the changing of social norms across large populations may be an effective way to change attitudes and behaviours around SHS in homes, and thus increase the prevalence of smokefree homes. Such changes can be encouraged by protecting public and workspaces from SHS by legislation. For instance, banning smoking from public and work places changes the foundations for risk communication about SHS, and thus changes social norms more generally.^{56–57} There is evidence from New South Wales, Australia, that smokers and former smokers working in smokefree workplaces are significantly more likely to have smokefree homes.⁶⁷

Besides smokefree public and workplaces legislation, other aspects of a more supportive legal context for smokefree homes could be seen as population level interventions. At present, there is a limited legal base for increasing smokefree home prevalence. One avenue is the enforcement of international agreements. With the exceptions of the USA and Somalia, United Nation member nations are signatories to the Convention on the Rights of the Child. This convention legally binds governments to ensure those rights guaranteed by the convention. The rights relevant to SHS exposure include the right to life, and the use of the “best interests” of the child as the primary consideration in any relevant decision making by government or others.⁶⁸ The application of this law within the policy processes relevant to smokefree homes has the potential to ensure that the protection of children is prioritised over the interests of the tobacco industry (for instance in the industry’s ability to be deceptive on SHS harm). Such application could also help ensure that any government interventions reduce inequalities in SHS exposure in homes.

In a number of jurisdictions, there are instruments for legal interventions to protect children from SHS in their homes. These include legislation that enables child custody cases for

the protection of the child.^{69–70} Improving the legislative or common law base for such interventions could contribute to increased protection at a population level. In some jurisdictions, such as the USA, legislation or common law may provide some possible grounds for legal action to prevent SHS exposure, particularly if SHS invades those spaces from outside.^{71–72}

The options for improving structural support could include legislation to help protect homes from SHS penetration because of external sources, improving legal action to ensure that businesses do not dispense misleading information about SHS, and requirements to help protect children from SHS. Central and local governments could act directly to limit smoking in the common airspaces of housing controlled by public authorities. There could also be legislative requirements to set and monitor targets for hazard reduction that would include the SHS exposure of children and non-smoking adults.

Children have limited capacity to protect themselves from SHS, and their exposure is involuntary. A precautionary life course approach to health policy would also support the protection from SHS of pregnant women, infants, and children.⁷³ Requirements by governments to help protect children from SHS could start with monitoring obligations for health authorities (for instance, to establish the prevalence of SHS exposure at home for young children hospitalised with respiratory conditions). These requirements could be similar to existing requirements for monitoring communicable diseases, or could be built into government funding contracts with health sector agencies.

Options that aim to increase the prevalence of smokefree homes need to recognise the large sex differences for some contexts, in the effect of some tobacco control interventions.⁷⁴ While the smoking of fathers is important,⁷⁵ the importance of maternal smoking for the SHS exposure of infants^{11–76} means that tobacco control options that benefit women who smoke need special consideration. These options could include organisational links between maternity and well-child services and smoking cessation services, and the thematic content of mass media campaigns. In some countries, maternity and well-child services have the potential to offer cessation access to the large majority of smoking parents.^{77–78}

DISCUSSION

The limitations of this analysis

The breadth of the evidence base examined is limited by the restricted focus on data from just four developed English speaking countries, and the general paucity of studies that specifically investigate links between population level interventions and the prevalence of home SHS exposure. Outside of California and New Zealand, the evidence depends on one type of survey per jurisdiction. For New Zealand, the different measures and sampling for the 1996 and 2003 adult surveys may weaken the comparison. However, the less specific 1996 measure means that the indicated change over time is probably an underestimate.

Besides the policy options covered, there are further avenues that could affect the upstream determinants for smokefree home prevalence. These include improving educational achievement, and thus improving the confidence and ability of people to negotiate smokefree places. Other factors for smokefree homes at a population level are the determinants of smoking cessation and uptake—including tobacco prices,^{31–51} the effectiveness of smoking cessation services,³¹ and the impact of socioeconomic deprivation. Further possible options for increasing the prevalence of smokefree homes include the modification of tobacco products, the ongoing substitution of smokeless nicotine sources for

cigarettes, and legal requirements to prevent tobacco industry deception about SHS harm.

Finally, this analysis used a limited set of evaluation criteria, and excluded other criteria that might illuminate important aspects of programmes (for example, sustainability and community acceptability). Further criteria could be used to judge, for particular contexts, how likely the policies were to being adopted by governments. For instance, studies could explore whether governments find it necessary to accept responsibility for a policy objective, if they accept that coercion or incentives are required to meet this responsibility, and if governments have the power to exert such coercion or provide incentives.⁷⁹

How robust is the evidence for the effect of comprehensive programmes?

The range of potential influences on smokefree home prevalence is wide, and the causal links between official comprehensive programmes and smokefree homes are uncertain. The evaluation of such programmes is complex.⁸⁰ Decreasing smoking prevalence may be both a cause and an effect of smokefree homes.^{46–51} Other potential influences include “free” media coverage of the information on adverse SHS effects, particularly for children,⁸¹ since 1986 or before.^{82–83}

While there is little research evidence (outside the USA) for direct links between relatively comprehensive tobacco control programmes and increases in the prevalence of smokefree homes, there is extensive evidence from systematic reviews for the effectiveness of interventions that decrease smoking prevalence and increase awareness of SHS harm.³¹ The grouping of these interventions in comprehensive programmes may not only decrease smoking prevalence but also increase the prevalence of smokefree homes. For instance, in Britain the reduced SHS exposure of children during 1988–98 could be partly linked to the general decline in adult smoking prevalence from 32% to 27%,⁸⁴ as well as to the reduction in smoking by parents.³³

While no direct evidence was found for comprehensive tobacco control programmes as a cost effective way of increasing the prevalence of smokefree homes, there is some evidence that such programmes have reduced some tobacco related costs to governments and society in Canada and Australia.^{85–87} The potential for cost savings has been well argued,^{88–89} and some of those costs arise from SHS exposure in homes. The net cost to governments, of comprehensive tobacco control programmes that entail the use of the revenue gain from tobacco taxes, is likely to be low or nil. At least partial dedication of tobacco taxes to tobacco control increases the likelihood of effective tobacco control, and

What this paper adds

- Previous reviews of policies to reduce SHS in homes have largely focused on interventions at the individual and household level.
- This review found some association between relatively comprehensive tobacco control programmes and lower prevalence levels of smoking in homes, in the four English speaking countries examined. Such programmes are likely to be the most effective and sustainable option for increasing the prevalence of smokefree homes. Other population level options include campaigns to change social norms around secondhand smoke.

Policy implications

Vigorously conducted comprehensive tobacco control programmes should be strongly considered by policymakers as a means to increase the prevalence of smokefree homes.

helps tackle the ethical issues of using a dangerous addictive product to raise general revenue.⁹⁰

The generalisability of the evidence for policy options

While much of the evidence presented comes from jurisdictions that have considerable restrictions on smoking in public places and workplaces, the general types of policy options will be applicable to a much wider group of countries. Because of the need to change attitudes about SHS across large populations, some jurisdictions where the smoking epidemic is at an earlier stage may decide to first focus on legislation to ban smoking in public and work places. However, many of the options that have been considered here would be complementary to such an aim, insofar as they increase knowledge about SHS, and positively change the political and social context for adopting and implementing such legislation.

Policy options will always be partly contingent on the sociopolitical context, with this limiting or facilitating interventions that seek to affect behaviour in private settings. In particular, national perceptions of individual rights in relation to SHS risks will vary widely. Local housing styles and climatic factors will also affect the success of particular policies. The capacity and cultures of official and other organisations will limit or enable the types of policies considered, as well as their implementation.

Research needs

Evaluations of comprehensive programmes would be improved by the inclusion of the effects on smokefree home prevalence in the assessment of resulting changes in health inequalities, and in the assessment of the programmes' cost effectiveness. Campaigns around SHS knowledge and actions clearly need evaluations of their effects on smokefree home prevalence.

Policymakers generally do not have good information from national samples of the quality of public knowledge about SHS health effects. Discrepancies between knowledge of SHS harm, and consequent actions,^{27,91} suggest that quality of knowledge may be important. Policymakers also need to know how the public perceptions of SHS harm compare with other health hazards, the perceived immediacy or distance of the harm, the frequency of any prompts about SHS harm, and the effectiveness of those prompts. Because different questions about attitudes to SHS policies produce very different results,⁹² there seems to be a need for a much better understanding of the way that support for "rights" to smokefree places is balanced with preferences for permitted smoking. Research into the effectiveness of major interventions for smokefree homes, such as mass media campaigns, is required to ensure these are particularly effective for disadvantaged populations.

Research to inform public health advocacy on SHS in homes is also needed, to establish the level of knowledge of policymakers about SHS, their attitudes to the various options for increasing the prevalence of smokefree homes, and public support for a range of policy changes. Apart from some exceptions, (for instance, Hill *et al.*,⁹³ Howden-Chapman *et al.*,⁹⁴ Wakefield *et al.*,⁹⁵ and Dunn *et al.*⁹⁶) the literature available on policies for increasing the prevalence of smokefree homes also seems to be relatively weak in terms of

qualitative studies. These may provide a richer account of the household or societal context, and an added understanding of the complexities for policy formation and implementation.

Implications for policymakers

The available evidence suggests that policymakers should particularly consider using comprehensive population level tobacco control programmes as a means of increasing the prevalence of smokefree homes. This seems to be an obvious conclusion. Nevertheless, it is important to highlight it, given the overwhelming research focus to date on individualised approaches, and the risk that some health professionals and policymakers may tend to favour such approaches, rather than population level ones.

The evidence of some association between the strength of the programmes and the higher prevalence of smokefree homes suggests that programmes funded to best practice standards,⁹⁷ and conducted aggressively, have multiple benefits.⁹⁸⁻¹⁰⁰ Because of the dangers from small amounts of SHS, the most effective and sustainable solution to SHS exposure in homes is likely to be the reduction of the prevalence of smoking in the total population.

Merely reducing SHS within individual homes, in contrast with aiming to have no smoking inside, has disadvantages as a policy objective. Besides the limited effectiveness in reducing harm of such tactics as smoking in different rooms, "reducing SHS" suffers from a lack of clarity and simplicity as an objective, compared with the unambiguous division of inside/outside given by "no smoking inside".

In summary, there are substantial proportions of the populations of even the jurisdictions most advanced in tobacco control, who are still at risk from SHS in their homes, with the most disadvantaged tending to be the most affected. Fortunately, there is evidence for a range of policies that can be used to directly and indirectly increase the prevalence of smokefree homes.

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REFERENCES

- 1 Nelson E. The miseries of passive smoking. *Hum Exp Toxicol* 2001;**20**:61-83.
- 2 Otsuka R, Watanabe H, Hirata K, *et al.* Acute effects of passive smoking on the coronary circulation in healthy young adults. *JAMA* 2001;**286**:436-41.
- 3 Whincup PH, Gilg JA, Emberson JR, *et al.* Passive smoking and risk of coronary heart disease and stroke: prospective study with cotinine measurement. *BMJ* 2004;**329**:200-5.
- 4 Hill S, Blakely T, Kawachi I, *et al.* Mortality among "never smokers" living with smokers: two cohort studies, 1981-4 and 1996-9. *BMJ* 2004;**328**:988-9.
- 5 DiFranza J, Aligne C, Weitzman M. Prenatal and postnatal environmental tobacco smoke exposure and children's health. *Pediatrics* 2004;**113**:1007-15.
- 6 Mokdad A, Marks J, Stroup D, *et al.* Actual causes of death in the United States 2000. *JAMA* 2004;**291**:1238-45.
- 7 Ministry of Health. *Looking upstream: causes of death cross-classified by risk and condition, New Zealand 1997*. Wellington: Ministry of Health, 2004.
- 8 Tobias M, Turley M. Causes of death classified by risk and condition, New Zealand 1997. *Aust N Z J Public Health* 2005;**29**:5-12.

- 9 Makomaski Illing E, Kaiserman M. Mortality attributable to tobacco use in Canada and its regions, 1998. *Can J Public Health* 2004;**95**:38–44.
- 10 Mannino D, Siegel M, Husten C, et al. Environmental tobacco smoke exposure and health effects in children: results from the 1991 national health interview survey. *Tob Control* 1996;**5**:13–18.
- 11 Cook D, Strachan D. Health effects of passive smoking: summary of effects of parental smoking on the respiratory health of children and implications for research. *Thorax* 1999;**54**:357–66.
- 12 Gilliland F, Berhane K, Islam T, et al. Environmental tobacco smoke and absenteeism related to respiratory illness in schoolchildren. *Am J Epidemiol* 2003;**157**:861–9.
- 13 Adams E, Melvin C, Merritt R, et al. The costs of environmental tobacco smoke (ETS): an international review. Geneva: World Health Organisation, 1999.
- 14 Leung G, Ho L, Lam T. The economic burden of environmental tobacco smoke in the first year of life. *Arch Dis Child* 2003;**88**:767–71.
- 15 Wakefield M, Chaloupka F, Kaufman N, et al. Effect of restrictions on smoking at home, at school, and in public places on teenage smoking: cross sectional study. *BMJ* 2000;**321**:333–7.
- 16 Scragg R, Laugesen M, Robinson E. Parental smoking and related behaviours influence adolescent tobacco smoking: results from the 2001 New Zealand national survey of 4th form students. *N Z Med J* 2003;**116**:U707.
- 17 Darling H, Reeder A. Is exposure to secondhand tobacco smoke in the home related to daily smoking among youth? *Aust N Z J Public Health* 2003;**27**:655–6.
- 18 Proescholdbell RJ, Chassin L, MacKinnon DP. Home smoking restrictions and adolescent smoking. *Nicotine Tob Res* 2000;**2**:159–67.
- 19 Gilpin E, White M, Farkas A, Pierce J. Home smoking restrictions: which smokers have them and how they are associated with smoking behavior. *Nicotine Tob Res* 1999;**1**:153–62.
- 20 Farkas A, Gilpin E, Distefan J, et al. The effects of household and workplace smoking restrictions on quitting behaviours. *Tob Control* 1999;**8**:261–5.
- 21 Matt G, Quintana P, Hovell M, et al. Households contaminated by environmental tobacco smoke: sources of infant exposures. *Tob Control* 2004;**13**:29–37.
- 22 Crampton P, Salmond C, Woodward A, et al. Socioeconomic deprivation and ethnicity: Both are important for anti-tobacco health promotion. *Health Educ Behav* 2000;**27**:317–27.
- 23 Centers for Disease Control and Prevention. Cigarette smoking among adults—United States, 2000. *Morb Mortal Wkly Rep* 2002;**51**:642–5.
- 24 Arborelius E, Hallberg AC, Hakansson A. How to prevent exposure to tobacco smoke among small children: a literature review. *Acta Paediatr Suppl* 2000;**89**:65–70.
- 25 Ashley M, Ferrence R. Reducing children's exposure to environmental tobacco smoke in homes: issues and strategies. *Tob Control* 1998;**7**:61–5.
- 26 Roseby R, Waters E, Polnay A, et al. Family and carer smoking control programmes for reducing children's exposure to environmental tobacco smoke. *Cochrane Library*. Issue 3. Oxford: Update Software, 2002.
- 27 Green E, Courage C, Rushton L. Reducing domestic exposure to environmental tobacco smoke: a review of attitudes and behaviours. *J R Soc Health* 2003;**123**:46–51.
- 28 Wewers M, Uno M. Clinical interventions and smoking ban methods to reduce infants' and children's exposure to environmental tobacco smoke. *J Obstet Gynecol Neonatal Nurs* 2002;**31**:592–8.
- 29 Klerman L. Protecting children: reducing their environmental tobacco smoke exposure. *Nicotine Tob Res* 2004;**6S2**:S239–53.
- 30 Hovell M. Reducing children's exposure to environmental tobacco smoke: the empirical evidence and directions for future research. *Tob Control* 2000;**9**:1140–7.
- 31 Hopkins D, Briss P, Ricard C, et al. Reviews of evidence regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. *Am J Prev Med* 2001;**20**:16–66.
- 32 Gerhman C, Hovell M. Protecting children from environmental tobacco smoke (ETS) exposure: a critical review. *Nicotine Tob Res* 2003;**5**:289–301.
- 33 Emmons KM, Wong M, Hammond SK, et al. Intervention and policy issues related to children's exposure to environmental tobacco smoke. *Prev Med* 2001;**32**:321–31.
- 34 Logan S, Spencer N. Smoking and other health related behaviour in the social and environmental context. *Arch Dis Child* 1996;**74**:176–9.
- 35 Borland R. *Theories of behavior change in relation to environmental tobacco smoke control to protect children*. Geneva: World Health Organisation, 1999. <http://www.who.int/tobacco/media/en/borland.pdf> (accessed 30 Mar 2005).
- 36 Green E, Courage C, Rushton L. Reducing domestic exposure to environmental tobacco smoke: a review of attitudes and behaviours. *J R Soc Health* 2003;**123**:46–51.
- 37 Borland R, Mullins R, Trotter L, et al. Trends in environmental tobacco smoke restrictions in the home in Victoria, Australia. *Tob Control* 1999;**8**:266–71.
- 38 Wakefield M, Borland R. Saved by the bell: the role of telephone helpline services in the context of mass-media anti-smoking campaigns. *Tob Control* 2000;**9**:117–19.
- 39 Wakefield M, Banham D, Martin J, et al. Restrictions on smoking at home and urinary cotinine levels among children with asthma. *Am J Prev Med* 2000;**19**:188–92.
- 40 Blackburn C, Spencer N, Bonas S, et al. Effect of strategies to reduce exposure of infants to environmental tobacco smoke in the home: cross sectional survey. *BMJ* 2003;**327**:257–61.
- 41 Repace J, Kawachi I, Glantz S. *Fact sheet on secondhand smoke*. Geneva: International Union Against Cancer, 1999:16. <http://www.repace.com/SHSFactsheet.pdf> (accessed 7 Apr 2005).
- 42 Weintraub J, Hamilton W. Trends in prevalence of current smoking, Massachusetts and states without tobacco control programmes, 1990 to 1999. *Tob Control* 2002;**11**:118–13.
- 43 Stephens T, Pederson L, Koval J, et al. Comprehensive tobacco control policies and the smoking behaviour of Canadian adults. *Tob Control* 2001;**10**:317–22.
- 44 Norman G, Ribisl K, Howard-Pitney B, et al. The relationship between home smoking bans and exposure to state tobacco control efforts and smoking behaviors. *Am J Health Promot* 2000;**15**:81–8.
- 45 Rohrbach L, Howard-Pitney B, Unger J, et al. Independent evaluation of the California Tobacco Control Program: relationships between program exposure and outcomes, 1996–1998. *Am J Public Health* 2002;**92**:975–83.
- 46 Levy DT, Romano E, Mumford EA. Recent trends in home and work smoking bans. *Tob Control* 2004;**13**:258–63.
- 47 White V, Hill D, Siahpush M, et al. How has the prevalence of cigarette smoking changed among Australian adults? Trends in smoking prevalence between 1980 and 2001. *Tob Control* 2003;**12**:67–74.
- 48 Borland R, Mullins R, Trotter L, et al. Trends in environmental tobacco smoke restrictions in the home in Victoria, Australia. *Tob Control* 1999;**8**:266–71.
- 49 Laugesen M, Swinburn B. New Zealand's tobacco control programme 1985–1998. *Tob Control* 2000;**9**:155–62.
- 50 Thomson G, Wilson N, Howden-Chapman P. Smoky homes: A review of the exposure and effects of secondhand smoke in New Zealand homes. *N Z Med J* 2005;**118**:U1404.
- 51 Gilpin EA, Stillman FA, Hartman AM, et al. Index for US state tobacco control initial outcomes. *Am J Epidemiol* 2000;**152**:727–38.
- 52 Jamrozik K, Weller DP, Heller RF. The UK smoking time-warp: roll on 1989! Targets for the prevalence of smoking in 2010 are embarrassingly modest. *Med J Aust* 2004;**180**:266–7.
- 53 Jarvis M, Goddard E, Higgins V, et al. Children's exposure to passive smoking in England since the 1980s: cotinine evidence from population surveys. *BMJ* 2000;**321**:343–5.
- 54 Gilpin E, Farkas A, Emery S, et al. Clean indoor air: advances in California, 1990–1999. *Am J Public Health* 2002;**92**:785–91.
- 55 Gilpin EA, Emery SL, Berry C. *Technical report on analytic methods and approaches used in the 1999 California tobacco survey analysis*. Vol 3. *Methods used for final report. The California Tobacco Control Program: a decade of progress, 1989–1999*. La Jolla, CA: University of California, San Diego, 2001.
- 56 Leiss W. *Risk perception and communication: environmental tobacco smoke and child health*. Geneva: World Health Organisation, 1999. <http://www.who.int/tobacco/resources/publications/en/leiss.pdf> (accessed 5 Apr 2005).
- 57 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. *Am J Public Health* 2004;**94**:314–20.
- 58 Secker-Walker R, Worden J, Holland R, et al. A mass media programme to prevent smoking among adolescents: costs and cost effectiveness. *Tob Control* 1997;**6**:207–12.
- 59 Campion P, Owen L. Evaluation of a mass media campaign on smoking and pregnancy. *Addiction* 1994;**89**:1245–55.
- 60 Goldman L, Glantz S. Evaluation of antismoking advertising campaigns. *JAMA* 1998;**279**:772–7.
- 61 King K, Vidourek R, Creighton S, et al. Smokers' willingness to protect children from secondhand smoke. *Am J Health Behav* 2003;**27**:554–63.
- 62 Mullins R, Scallo M, Borland R. Evaluation of a campaign on the effects of passive smoking on children. In: Mullins R, ed. *Quit Evaluation Studies*. Vol 7. Melbourne: Quit Victoria (Victorian Smoking and Health Program), 1995.
- 63 Ponsonby A, Couper D, Dwyer T. Features of infant exposure to tobacco smoke in a cohort study in Tasmania. *J Epidemiol Community Health* 1996;**50**:40–6.
- 64 Hopkins D, Briss P, Ricard C, et al. Reviews of evidence regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. *Am J Prev Med* 2001;**20**:16–66.
- 65 Grigg M, Glasgow H. Subsidised nicotine replacement therapy. *Tob Control* 2003;**12**:238–9.
- 66 Davis S, Cummings K, Rimer B, et al. The impact of tailored self-help smoking cessation guides on young mothers. *Health Educ Q* 1992;**19**:495–504.
- 67 Merom D, Rissel C. Factors associated with smoke-free homes in NSW: results from the 1998 NSW Health Survey. *Aust N Z J Public Health* 2001;**25**:339–45.
- 68 World Health Organisation. *Tobacco and the rights of the child*. Geneva: World Health Organisation, 2001.
- 69 Sweda EL Jr. Lawsuits and secondhand smoke. *Tob Control* 2004;**13**(suppl 1):i61–6.
- 70 Sweda EL Jr, Gottlieb MA, Porfiri RC. Protecting children from exposure to environmental tobacco smoke. *Tob Control* 1998;**7**:1–2.
- 71 Kline RL. Smoke knows no boundaries: legal strategies for environmental tobacco smoke incursions into the home within multi-unit residential dwellings. *Tob Control* 2000;**9**:201–5.
- 72 Sweda EL. Litigation on behalf of victims of exposure to environmental tobacco smoke. The experience from the USA. *Eur J Public Health* 2001;**11**:201–5.
- 73 Kriebel D, Tickner J. Reenergizing public health through precaution. *Am J Public Health* 2001;**91**:1351–5.
- 74 Dedobbeleer N, Beland F, Contandriopoulos A, et al. Gender and the social context of smoking behaviour. *Soc Sci Med* 2004;**58**:1–12.
- 75 Blackburn CM, Bonas S, Spencer NJ, et al. Parental smoking and passive smoking in infants: fathers matter too. *Health Educ Res* 2005;**20**:185–94.
- 76 Al-Delaimy W, Crane J, Woodward A. Passive smoking in children: effect of avoidance strategies, at home as measured by hair nicotine levels. *Arch Environ Health* 2001;**56**:117–22.

- 77 **Coppel D**, Watts K, White J, *et al*. Contracting for smoking and pregnancy interventions: current practice across England. *Public Health* 2001;**115**:222–8.
- 78 **Pullon S**, Webster M, McLeod D, *et al*. Smoking cessation and nicotine replacement therapy in current primary maternity care. *Aust Fam Physician* 2004;**33**:94–6.
- 79 **Gostin L**. *Public health law: power, duty, restraint*. Berkeley: University of California Press, 2000:5.
- 80 **Unnamed authors**. Evaluating comprehensive tobacco control interventions: challenges and recommendations for future action. Report of a workshop convened by the Institute for Global Tobacco Control, Johns Hopkins Bloomberg School of Public Health. *Tob Control* 2002;**11**:140–5.
- 81 **US Environmental Protection Agency**. *Respiratory health effects of passive smoking: lung cancer and other disorders*. *Smoking and tobacco control monograph no 4*. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health, 1993.
- 82 **US Department of Health and Human Services**. *The health consequences of involuntary smoking: a report of the surgeon general*. Rockville, MD: Office on Smoking and Health, 1986.
- 83 **Steenland K**. Passive smoking and the risk of heart disease. *JAMA* 1992;**267**:94–9.
- 84 **Walker A**, Maher J, Coulthard M, *et al*. *Living in Britain*. London: The Stationery Office, 2001. <http://www.statistics.gov.uk/lib2000/resources/fileAttachments/GHS2000.pdf> (accessed 12 Aug 2005).
- 85 **Health Canada**. *Canadian tobacco use monitoring survey (CTUMS): trends in the prevalence of current smokers*. Ottawa: Health Canada. <http://www.hc-sc.gc.ca/hecs-sesc/tobacco/research/ctums/index.html> (accessed 2 Apr 2005).
- 86 **Group d'analyse**. *Impact of an anti-tobacco campaign on direct health care costs in Canada*. Montreal: Group d'analyse, 2002. <http://www.smokefreeottawa.com/pdf/impact.pdf> (accessed 31 Mar 2005).
- 87 **VicHealth Centre for Tobacco Control**. *Tobacco control: a blue chip investment in public health*. Melbourne: VicHealth Centre for Tobacco Control, 2003.
- 88 **Jha P**, Musgrove P, Chaloupka FJ, *et al*. The economic rationale for intervention in the tobacco market. In: Jha P, Chaloupka F, eds. *Tobacco control in developing countries*. Oxford: Oxford University Press, 2000.
- 89 **Hurley SF**, Scollo MM, Younie SJ, *et al*. The potential for tobacco control to reduce PBS costs for smoking-related cardiovascular disease. *Med J Aust* 2004;**181**:252–5.
- 90 **Wilson N**, Thomson G. Tobacco taxation and public health: ethical problems, policy responses. *Soc Sci Med* 2005;**61**:649–59.
- 91 **Thomson G**, Wilson N, Howden-Chapman P. Attitudes to and knowledge of secondhand smoke in New Zealand homes and cars. *N Z Med J* 2005;**118**:U1407.
- 92 **Thomson G**, Wilson N. Public attitudes about tobacco smoke in workplaces - the importance of workers' rights in survey questions. *Tob Control* 2004;**14**:206–7.
- 93 **Hill L**, Farquharson K, Borland R. Blowing smoke: Strategies smokers use to protect non-smokers from environmental tobacco smoke in the home. *Health Promot J Austr* 2003;**14**:196–201.
- 94 **Howden-Chapman P**, Pene G, Crane J, *et al*. Open houses and closed rooms: Tokelau housing in New Zealand. *Health Educ Behav* 2000;**27**:351–62.
- 95 **Wakefield M**, Reid Y, Roberts L, *et al*. Smoking and smoking cessation among men whose partners are pregnant: a qualitative study. *Soc Sci Med* 1998;**47**:657–64.
- 96 **Dunn C**, Pirie P, Lando H. Attitudes and perceptions related to smoking among pregnant and postpartum women in a low-income, multiethnic setting. *Am J Health Promot* 1998;**12**:267–74.
- 97 **Centers for Disease Control and Prevention**. *Best practices for comprehensive tobacco control programs—August 1999*. Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. <http://www.cdc.gov/tobacco/bestprac.htm>.
- 98 **Siegel M**, Mowery PD, Pechacek TP, *et al*. Trends in adult cigarette smoking in California compared with the rest of the United States, 1978–1994. *Am J Public Health* 2000;**90**:372–9.
- 99 **Fichtenberg C**, Glantz S. Association of the California tobacco control program with declines in cigarette consumption and mortality from heart disease. *N Engl J Med* 2000;**343**:1772–7.
- 100 **Bal DG**, Lyman DO, Veneziano DF. Tobacco control in Australia: what aren't you doing and why aren't you doing it? *Med J Aust* 2003;**178**:313–14.