



Still dying from second-hand smoke at work: a brief review of the evidence for smoke-free workplaces in New Zealand

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Abstract

Aim To briefly review the evidence on the hazard from, and control of, second-hand smoke (SHS) in New Zealand workplace settings.

Methods Medline searches and searches of New Zealand health databases for unpublished reports.

Results The New Zealand evidence suggests that over 30% of workers continue to be exposed to SHS in workplace settings. The best available estimate is that SHS exposure in these settings causes around 100 avoidable deaths per year from lung cancer, coronary heart disease and stroke collectively. National survey data and studies in hospitality industry settings (measuring nicotine in hair and cotinine in saliva), strongly indicate that smoke-free workplaces result in reduced exposure to SHS. The data indicate that there is widespread concern regarding SHS and clear support for smoke-free workplaces.

Conclusions Available New Zealand data are fully consistent with the extensive international data indicating that smoke-free policies in workplaces can improve health protection for workers. New legislation is likely to enhance the control of SHS in New Zealand, but additional actions such as a mass media campaign on SHS are also desirable.

There is strong evidence that second-hand smoke (SHS) is a cause of lung cancer,¹⁻³ with the United States Surgeon General⁴ and the United States National Research Council⁵ also reaching this conclusion. Although this evidence is not specific to workplace SHS exposure, it is biologically plausible that such a risk would apply in any settings in which such exposure is significant.

A number of major reviews have reported that exposure to SHS is associated with heart disease in adults⁶ or is causal of heart disease in adults.^{7,8} A review of workplace studies on SHS and cardiovascular disease risk found that while five out of six studies were suggestive of increased risk, none were statistically significant.⁹ Nevertheless, the reviewers noted that there is no biologically plausible reason to believe that the hazards of SHS exposure that have been demonstrated in the home should not also apply to the workplace. A subsequent review has concurred with this assessment regarding workplace SHS exposure.¹⁰ There is also recent direct experimental evidence that passive smoking may cause endothelial dysfunction of the coronary circulation in healthy nonsmokers.¹¹

Major reviews have also reported that there is a causal association between SHS exposure and the risk of respiratory illness.^{7,8,12} A recent study has identified a dose-response relationship for SHS exposure among workers, and the occurrence for those workers of significant respiratory symptoms and physician consultation rates for

respiratory symptoms.¹³ A causal association between SHS exposure and increased severity of asthma episodes and symptoms has been reported by major reviews.^{4,8,12}

SHS in the workplace may also have an impact on child health. One review considered that the risk of SHS exposure in pregnant women for adverse pregnancy outcomes can be generalised to the work environment.¹⁴

While many developed countries regulate against exposure to SHS in workplace settings, substantial exposure can still occur. For example, in spite of regulations, SHS remains “the most common occupational exposure to chemical carcinogens in Finland”.¹⁵ In New Zealand, there is currently draft legislation before the Parliament to extend the scope of smoke-free workplaces. To encourage evidence-based policy making, this article briefly reviews the relevant New Zealand data and puts them into the international context.

Methods

Medline searches were conducted for the period 1966 to July 2002, with search terms covering “second-hand smoke”, “passive smoking”, “environmental tobacco smoke” and “involuntary smoking”. The search term “New Zealand” in relation to “smoking” or “tobacco” was also used. Unpublished reports relating to New Zealand data were identified by searches of New Zealand health databases (including medical library databases). Major international reviews on SHS in the workplace were identified to help put the New Zealand data into a broader context.

Results

Exposure to SHS in New Zealand and its effects The Smoke-free Environment Act (1990)¹⁶ effectively banned smoking in offices, but not in many other interior workplaces. A study that used 1992/93 data from workers in a nationwide multi-industry corporation, found that exposure of the workers to SHS averaged 47 minutes per week (for the total of work and home exposure).¹⁷ This group of workers reported more regular exposure to SHS than those in the community cohort who were also part of this study (52% versus 23%) – which indicated extra exposure at work.

A national survey in 1996 found 36% of indoor workers were exposed to SHS at lunch and tea breaks, and 19% were exposed to SHS during working hours.¹⁸ Maori and blue-collar workers were around 50% more likely to be exposed to SHS during working hours than others (28% and 29% respectively were exposed). Another national survey, in 1999, reported that 84% of respondents working in indoor workplaces stated that smoking restrictions were in place in these settings.¹⁹

A survey in 1999–2000 by Jones et al indicated that 59% of Wellington hospitality workers were exposed to SHS.²⁰ More than half of the exposed workers reported irritation to their throat or lungs from SHS.

Another study by Al-Delaimy et al reported on hair nicotine levels amongst workers in the hospitality industry.²¹ It found that the exposure level was substantial, with hair nicotine levels among nonsmokers working in places with no restriction on smoking being similar to the hair nicotine levels of active smokers. The findings of this study highlight the importance of *workplace* exposure, as the results were unchanged when adjusted for other sources of SHS exposure.

The most recent study by Bates et al examined the concentrations of salivary cotinine (a marker for tobacco smoke exposure) found in hospitality workers.²² It reported that the levels of cotinine found in non-smoking workers exposed to SHS “have been

associated with substantial involuntary risks for cancer and heart disease”. Furthermore, workers in premises permitting customer smoking reported a higher prevalence of respiratory and irritation symptoms than workers in smoke-free workplaces.

SHS exposure in New Zealand workplace settings has been estimated to cause 101 avoidable deaths per year from lung cancer, coronary heart disease and stroke collectively.²³ This is 29% of the estimated total of all deaths attributable to SHS in New Zealand (estimated to be in the range of 174 to 490 deaths per year). However, these were conservative estimates that did not include the exposure of workers to SHS at lunch and tea breaks, or the effect of SHS on smokers. SHS exposure at work was also estimated to cause 190 hospital admissions for heart attacks annually, as well as contributing to illness from strokes and other causes.²⁴

There is also evidence from a New Zealand study that total SHS exposure (from work and home) contributes to the risk of stroke.²⁵

Impact of SHS control measures and education In New Zealand, legislation for smoke-free workplaces (Smoke-free Environments Act, 1990¹⁶) appears to have been highly effective in reducing exposure to tobacco smoke.²⁶ Further survey data have also shown that the proportion of workers exposed to tobacco smoke during working hours decreased from 31% in 1989, to 19% in 1996.¹⁸

The New Zealand study by Al-Delaimy et al²¹ found that non-smoking workers working in 100% smoke free restaurants had much lower hair nicotine levels than staff working in bars with no restrictions on smoking (with levels being intermediate for staff working in places with a partial smoking ban) ($p < 0.0001$).

Similarly, the study by Bates et al²² found that hospitality workers in premises allowing smoking by customers had significantly greater increases in salivary cotinine than workers in smoke-free premises. Workers in premises with no restrictions on customer smoking were more highly exposed to SHS than were workers in premises permitting smoking only in designated areas ($p < 0.03$).

Attitudes to SHS and control measures Three quarters of the hospitality sector interviewees surveyed by Jones et al wanted some sort of smoking restriction in bars.²⁰ Even so, knowledge of the hazard posed by SHS was limited, with less than one third of these workers and owners being aware that SHS increases the risk of stroke. In a 1996/97 national population survey of adults, just under half of the nonsmokers reported that they were “bothered a lot” by cigarette smoke and nearly a further third were “bothered a little”.²⁷ Of this group, women were significantly more likely than men to report to being “bothered a lot” by cigarette smoke.

A national survey in 1999 reported that 72% of all respondents were bothered by SHS to some degree, with this figure being even higher for nonsmokers, at 85%.¹⁹ A majority of Maori (62%) and Pacific respondents (76%) also reported that SHS was bothersome. This survey also found that 78% of respondents agreed that “smoking should not be allowed in any workplace where nonsmokers have to work”. Similarly, 97% of respondents favoured some form of smoking restrictions in restaurants, cafés and foodhalls; and 79% some form of restriction in bars.

A national survey in 2001 reported that 83% of Maori surveyed and 85% of all respondents agreed that people have a right to smoke-free workplaces. Only 7% of Maori and 8% of all respondents disagreed with this.²⁸

Discussion

The international literature provides strong evidence that SHS is a carcinogen and increases the risk of cardiovascular disease and respiratory illnesses. Although the specific data on workplace SHS exposure and adverse health outcomes are limited, it is biologically plausible that SHS poses a similar hazard in indoor workplaces to that in settings in which the impact is better established (ie, for spouses of smokers exposed in home environments).

Despite the evidence detailed in major reviews and from toxicological work highlighting the relative hazard of SHS,²⁹ some authors still dispute aspects of the hazard posed by SHS. For example, Bailar³⁰ and others have found it hard to understand that low levels of SHS impact on cardiovascular health (despite the available data indicating direct physiological effects of such exposure³¹). Some of the criticism of the evidence for the hazards of SHS has come from within particular disciplinary groups that lack a public health context (eg, mathematics and experimental toxicology^{32,33}). Policy makers should consider such critiques in the light of the overall weight of evidence, and the assessments made by international health authorities such as the International Agency for Research on Cancer (which considers SHS a proven carcinogen¹).

In the absence of changes in legislation, or substantial changes in smoking prevalence, enforcement or education since 1996, the national survey data suggest that at least 30% of workers are currently exposed to SHS at lunch and tea breaks. Also, at least 15% are exposed to SHS during working hours. However, the lack of more recent national survey data makes these estimates tentative. It is plausible that other tobacco control efforts have had some impact on SHS workplace exposure since the mid 1990s, given the ongoing annual decline in per capita tobacco consumption (down by about 22% between 1996 and 2001³⁴). This trend to lower per capita consumption (while smoking prevalence has stayed at 25–26% of the adult population since 1991) would probably decrease the daily *level* of exposure to SHS, rather than the *proportion* of the working population exposed to SHS.

The New Zealand national survey data and data from studies of the hospitality sector, strongly suggest that the expansion of smoke-free workplaces can reduce the exposure of workers to SHS. This picture is consistent with the substantial international evidence for the effectiveness of interventions to reduce smoking in workplaces and public places.^{35–38} One of these reviews³⁷ concluded that in addition to smoking bans and restrictions reducing exposure to SHS in the workplace, such interventions appear to reduce tobacco consumption and increase smoking cessation.

The impact of further workplace controls in New Zealand is likely to be beneficial for businesses as well as for workers. New Zealand surveys indicate that bars and restaurants would receive more patronage.^{39,40} One review of studies in the United States³⁷ reported that smoking restrictions do not have an adverse economic effect on businesses (including bars and restaurants) or on tourism. Indeed, the impact on businesses of smoke-free bar and restaurant laws can be positive.^{41–43} The business

benefits include decreases in worker sickness and accidents, labour turnover, productivity losses, legal risks and insurance, cleaning, ventilation and legal compliance costs.⁴⁴⁻⁴⁹ Compliance with smoke-free regulations has been reported to be high in various United States and Australian settings.⁵⁰⁻⁵²

The main options to protect workers from SHS are the voluntary limitation of smoking in workplaces by either management or workers, and legislation to limit such smoking. There is evidence that voluntary limitation is much less effective than legislation in reducing SHS exposure.⁵³⁻⁵⁵ Also, one review reported that totally smoke-free workplaces had about twice the effect on tobacco consumption and smoking prevalence as policies that allowed smoking in some areas.³⁸

Improving ventilation has been suggested as an option for reducing the hazard posed by SHS in workplaces. However, experimental work has revealed that ventilation to control SHS is not feasible,⁵⁶ and that eye and nasal irritations are observed at very low levels of SHS (ie, corresponding to a fresh air dilution volume of >3000 m³ per cigarette).⁵⁷

There is currently draft legislation before the New Zealand Parliament to extend the scope of smoke-free workplaces (and possibly to make all bars and restaurants smoke free). The evidence detailed in this review would support such legislation on public health and economic grounds. Yet to maximise the impact of any new legislation, the government and health authorities should consider various supplementary options:

- 1) Funding mass media campaigns in the near future to further educate workers and the public about the hazards of SHS in the workplace. Such campaigns should be particularly aimed to the audiences of low-income workers, and Maori and Pacific peoples, due to their greater likelihood of being at risk from SHS. Use of campaigns would facilitate both self enforcement and easier enforcement of new legislation. In particular, they could help inform members of the New Zealand hospitality industry. Many in this industry, especially those managing clubs and bars, have indicated concerns about the effects of any legislation to ban smoking in licensed premises.⁵⁸
- 2) Supporting employers with smoking cessation interventions for their staff (eg, encouraging use of the Quitline and providing financial support for smoking cessation, using the proven methods described in new smoking cessation guidelines for New Zealand⁵⁹).
- 3) Actively exposing and countering tobacco industry misinformation concerning the risks associated with SHS (as documented in a recent New Zealand review⁶⁰).
- 4) Improving tobacco control in general, particularly with greater use of mass media campaigns, publicity for the Quitline, and the further use of quit and win contests.
- 5) Regular monitoring of the exposure of workers to SHS, of workers' attitudes to and knowledge of the effects of SHS, and of the economic impact of policy interventions. Additional research in the New Zealand setting could address the impact of SHS on both workers and non-workers for health conditions that are particularly relevant to this country. These conditions include asthma and meningococcal disease.

In summary, the international literature provides strong evidence that SHS is a carcinogen, and that it increases the risk of cardiovascular disease and respiratory illnesses. Furthermore, the available data on workplace exposure to SHS are strongly suggestive that this hazard is a significant threat to the health of exposed workers.

The New Zealand data are consistent with the extensive international evidence, that smoke-free policies in workplaces can improve health protection for workers. However, in this country there are many workers still exposed to significant levels of SHS. The exposure is estimated to cause around 100 deaths annually. This workplace health risk may soon be addressed by new and stronger smoke-free environments legislation. Nevertheless, there are a range of feasible additional actions that the health sector can take to enhance the impact of such important legislation – including running a mass media campaign on the hazard posed by SHS.

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References:

1. International Agency for Research on Cancer. Involuntary Smoking (Group 1). 5. Summary of Data Reported and Evaluation. 2002; 83. Available online. URL: <http://monographs.iarc.fr/htdocs/monographs/vol83/02-involuntary.html>
2. Hackshaw AK, Law MR, Wald NJ. The accumulated evidence on lung cancer and environmental tobacco smoke. *BMJ* 1997;315:980–8.
3. Taylor R, Cumming R, Woodward A, Black M. Passive smoking and lung cancer: a cumulative meta-analysis. *Aust NZ J Public Health* 2001;25:203–11.
4. United States Department of Health and Human Services. The health consequences of involuntary smoking: a report of the Surgeon General (DHHS Publication No. CDC 87-8398). Washington, DC: Government Printing Office; 1986.
5. National Research Council, Committee on Passive Smoking. Environmental tobacco smoke: measuring exposures and assessing health effects. Washington, DC: National Academy Press; 1986.
6. World Health Organization. International consultation on environmental tobacco smoke (ETS) and child health. (Consultation report.) Geneva: World Health Organization; 1999.
7. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment. Health effects of exposure to environmental tobacco smoke. Sacramento, California: EPA; 1997.
8. Scientific Committee on Tobacco and Health. Report of the Scientific Committee on Tobacco and Health (Publication No. 011322124x). London: Her Majesty's Stationery Office; 1998.
9. Kawachi I, Colditz GA. Workplace exposure to passive smoking and risk of cardiovascular disease: summary of epidemiologic studies. *Environ Health Perspect* 1999;107(Suppl 6):847–51.
10. Jousilahti P, Patja K, Salomaa V. Environmental tobacco smoke and the risk of cardiovascular disease. *Scand J Work Environ Health* 2002;28(Suppl 2):41–51.
11. 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.
12. United States Environmental Protection Agency. Respiratory health effects of passive smoking: lung cancer and other disorders (Publication No. EPA 600/006F). Washington, DC: Government Printing Office; 1992.

13. Lam TH, Ho LM, Hedley AJ, et al. Environmental tobacco smoke exposure among police officers in Hong Kong. *JAMA* 2000;284:756–63.
14. Misra DP, Nguyen RH. Environmental tobacco smoke and low birth weight: a hazard in the workplace? *Environ Health Perspect* 1999;107(Suppl 6):897–904.
15. Kauppinen TP, Virtanen SV. Exposure to environmental tobacco smoke in Finland in 2000. *Scand J Work Environ Health* 2002;28(Suppl 2):7–15.
16. New Zealand Government. *Smoke-free Environments Act 1990*. Wellington: New Zealand Government; 1990.
17. Whitlock G, MacMahon S, Vander Hoorn S, et al. Association of environmental tobacco smoke exposure with socioeconomic status in a population of 7725 New Zealanders. *Tob Control* 1998;7:276–80. Available online. URL: <http://tc.bmjournals.com/cgi/content/full/7/3/276>
18. National Research Bureau. *Environmental tobacco smoke study 1996*. Wellington: National Research Bureau Ltd; 1996.
19. ASH. *Attitudes toward environmental tobacco smoke (Report for the Ministry of Health)*. Auckland: ASH; 1999. Available online. URL:<http://www.ash.org.NZ/doc/doc/0000527.html>
20. Jones S, Love C, Thomson G, et al. Second-hand smoke at work: the exposure, perceptions and attitudes of bar and restaurant workers to environmental tobacco smoke. *Aust NZ J Public Health* 2001;25:90–3.
21. Al-Delaimy WK, Fraser T, Woodward A. Nicotine in hair of bar and restaurant workers. *NZ Med J* 2001;114:80–3.
22. Bates MN, Fawcett J, Dickson S, et al. Exposure of hospitality workers to environmental tobacco smoke. *Tob Control* 2002;11:125–9.
23. Woodward A, Laugesen M. How many deaths are caused by second hand cigarette smoke? *Tob Control* 2001;10:383–8.
24. Woodward A, Laugesen M. *Morbidity attributable to second hand cigarette smoke in New Zealand*. Wellington: Ministry of Health; 2001.
25. Bonita R, Duncan J, Truelsen T, et al. Passive smoking as well as active smoking increases the risk of acute stroke. *Tob Control* 1999;8:156–60.
26. Brander P. *Evaluation of the Smoke-free Environments legislation affecting workplaces*. Wellington: Department of Health; 1992.
27. Ministry of Health. *Taking the Pulse: the 1996/97 New Zealand Health Survey*. Wellington: Ministry of Health; 1999.
28. CM Research NZ Ltd. *Auahi Kore/Smokefree Research Report*. Wellington: Health Sponsorship Council; 2001. p. 44.
29. Nelson E. The miseries of passive smoking. *Hum Exp Toxicol* 2001;20:61–83.
30. Bailar JC. Passive smoking, coronary heart disease, and meta-analysis. *N Engl J Med* 1999;340:958–9.
31. Davis JW, Shelton L, Watanabe IS, Arnold J. Passive smoking affects endothelium and platelets. *Arch Intern Med* 1989;149:386–9.
32. Nilsson R. Environmental tobacco smoke revisited: the reliability of the data used for risk assessment. *Risk Anal* 2001;21:737–60.
33. Mengersen KL, Merrilees MJ, Tweedie RL. Environmental tobacco smoke and ischaemic heart disease: a case study in applying causal criteria. *Int Arch Occup Environ Health* 1999;72(Suppl):R1–40.

34. Ministry of Health. Tobacco facts May 2002: Public Health Intelligence Occasional Report No. 2. Wellington: Ministry of Health; 2002.
35. Serra C, Cabezas C, Bonfill X, Pladevall-Vila M. Interventions for preventing tobacco smoking in public places. [Systematic Review] Cochrane Tobacco Addiction Group Cochrane Database of Systematic Reviews. Issue 3, 2001.
36. Chapman S, Borland R, Scollo M, et al. The impact of smoke-free workplaces on declining cigarette consumption in Australia and the USA. *Am J Public Health* 1999;89:1018–23.
37. Hopkins DP, Briss PA, Ricard CJ, et al. Reviews of evidence regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. *Am J Prev Med* 2001;20(2S):16–66.
38. Fichtenberg CM, Glantz SA. Effect of smoke-free workplaces on smoking behaviour: systematic review. *BMJ* 2002;325:188.
39. CM Research NZ Ltd. Auahi Kore/Smokefree Research Report. Wellington: Health Sponsorship Council; 2001. p. 43.
40. Forsyte Research. TVC/Me Mutu Campaign Monitoring - First Baseline Report. Wellington: The Quit Group; 2001. p. 49.
41. Glantz SA. Effect of smokefree bar law on bar revenues in California. *Tob Control* 2000;9:111–2.
42. Cremieux PY, Oullette P. Actual and perceived impacts of tobacco regulation on restaurants and firms. *Tob Control* 2001;10:33–7.
43. Scollo M, Lal A. Summary of studies assessing the impact of smoking restrictions on the hospitality industry. Melbourne: VicHealth Centre for Tobacco Control, 2001.
44. Ducatman AM, McLellan RK. Epidemiological basis for an occupational and environmental policy on environmental tobacco smoke. *J Occup Environ Med* 2000;42:1137–41.
45. Parrott S, Godfrey C, Raw M. Costs of employee smoking in the workplace in Scotland. *Tob Control* 2000;9:187–92.
46. Patten CA, Gilpin E, Carvin SW, Pierce JP. Workplace smoking policy and changes in smoking behaviour in California: a suggested association. *Tob Control* 1995;4:36–41. Available online. URL: <http://tc.bmjournals.com/cgi/reprint/4/1/36.pdf>
47. McGhee SM, Adab P, Hedley AJ, et al. Passive smoking at work: the short term cost. *J Epidemiol Community Health* 2000;54:673–6.
48. Ryan J, Zwerling C, Jones M. Cigarette smoking at hire as a predictor of employment outcome. *J Occup Environ Med* 1996;38:928–33.
49. Ryan J, Zwerling C, Orav E. Occupational risks associated with cigarette smoking: a prospective study. *Am J Public Health* 1992;82:29–32.
50. Jacobson PD, Wasserman J. The implementation and enforcement of tobacco control laws: policy implications for activists and the industry. *J Health Polit Policy Law* 1999;24:567–98.
51. Chapman S, Borland R, Lal A. Has the ban on smoking in New South Wales restaurants worked? A comparison of restaurants in Sydney and Melbourne. *Med J Aust* 2001;174:512–5.
52. Miller C, Wakefield M, Kriven S, Hyland A. Evaluation of smoke-free dining in South Australia: support and compliance among the community and restaurateurs. *Aust NZ J Public Health* 2002;26:38–44.
53. Jones K, Wakefield M, Turnbull DA. Attitudes and experiences of restaurateurs regarding smoking bans in Adelaide, South Australia. *Tob Control* 1999;8:62–6.
54. Shiell A, Chapman S. The inertia of self-regulation: a game-theoretic approach to reducing passive smoking in restaurants. *Soc Sci Med* 2000;51:1111–9.

55. Heloma A, Jaakkola MS, Kahkonen E, Reijula K. The short-term impact of national smoke-free workplace legislation on passive smoking and tobacco use. *Am J Public Health* 2001;91:1416–8.
56. Repace JL, Lowrey AH. An enforceable indoor air quality standard for environmental tobacco smoke in the workplace. *Risk Anal* 1993;13:463–75.
57. Junker MH, Danuser B, Monn C, Koller T. Acute sensory responses of nonsmokers at very low environmental tobacco smoke concentrations in controlled laboratory settings. *Environ Health Perspect* 2001;109:1045–52.
58. Reeder A, Blair A. Environmental tobacco smoke: views from the Dunedin hospitality industry on prohibition of smoking in licensed premises. *NZ Med J* 2000;113:476–9.
59. National Health Committee. Guidelines for smoking cessation (Revised 2002). Wellington: National Health Committee; 2002.
60. Thomson G, Wilson N. The tobacco industry in New Zealand: a case study of the behaviour of multinational companies. Wellington: Wellington School of Medicine, University of Otago; 2002. Available online. URL: <http://www.wnmeds.ac.nz/Academic/Dph/Publicationsreports/TobaccoMonograph.pdf>