THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

# Youth experiences of secondhand smoke exposure in New Zealand: evidence from 5 national surveys (2000 to 2008)

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**Abstract**

**Aims** To describe trends in young people's exposure to secondhand smoke (SHS), and to their exposure to household rules around smoking in New Zealand (NZ) over the period 2000 to 2008.

**Methods** We examined self-assessed perceptions of exposure to SHS in the home and while travelling in vehicles, and home smoking restrictions, both inside the home (indoor) and on the property (outside). Data were from the 2000, 2002 and 2004 Youth Lifestyle Study and 2006 and 2008 Youth In-depth Survey of 14- to 15-year-olds in NZ.

**Results** Downward trends in young people being exposed to SHS at home since 2000 ($p<0.001$) and in vehicles since 2002 ($p<0.001$) were found. Unrestricted indoor and outdoor smoking declined, with 31% of homes being completely smokefree in 2008. Māori and Pacific young people were significantly more likely to be exposed to SHS at home (OR 3.2 and 2.0 respectively) and in vehicles (OR 3.1 and 2.3 respectively).

**Conclusions** Declining rates of SHS exposure for young people in their homes and while travelling in vehicles are encouraging. However, 35% of young people are still being exposed to SHS in their homes and 32% in vehicles. Although smokefree homes are increasing, there is still much work needed to reduce the rates of SHS exposure for our young people, and especially Māori and Pacific young people.

People are regularly exposed to secondhand smoke (SHS). Worldwide in 2004 it was estimated that 40% of children aged 0-to-14-years, and 33% of non-smoking adult males and 35% of non-smoking adult females were regularly exposed to SHS indoors, resulting in an estimated 603,000 deaths and 10·9 million disability-adjusted life-years (DALYs).[1]

In New Zealand (NZ), SHS has been estimated to kill around 300 people per year,[2-4] and cause a substantial burden of morbidity, particularly for children.[5] The harmful effects of SHS in young people have been extensively researched, showing that exposure increases the risk of respiratory illnesses, ear problems, asthma, lung function,[6-9] and, more recently, poorer mental health.[10] In NZ, a greater risk of exposure has been found among low income individuals and for Māori.[11, 12]

Given the association between SHS exposure and poorer health, it is important to monitor SHS exposure and examine trends over time. Decreases in SHS exposure have been seen both overseas[13] and in NZ,[12] but SHS is still thought of as one of the "most common indoor pollutants worldwide" (p.144).[1]

Despite reductions in overall exposure, there are still some areas where SHS may impact young people, in particular smoking in the home and smoking in vehicles.

These are the most significant sites of SHS exposure for most children in the USA,[14] and in NZ, 10 to 14% of young people 15-to-19-years were exposed to SHS in their home in 2009, significantly higher than older age groups. A similar number have also been exposed to SHS in a vehicle in the past week.[15]

Efforts to reduce the harm caused by SHS have included both legislative as well as voluntary policies. With regard to legislation, in NZ the Smoke-free Environments Act was introduced in 1990 with subsequent amendments made in 2003 banning smoking in public places including work places, restaurants and bars.

These legislative smokefree policies have been successful at reducing SHS exposure and improving indoor air quality.[16] Furthermore, social marketing campaigns have fostered voluntary adoption of smokefree homes and cars policies by the public. Data show that these campaigns have been successful in changing behaviour in both NZ,[17,29,30] as well as internationally.[9] The main benefit is reduced SHS exposure for those living in the home.[6,14] However, additional benefits for young people exist including reduced experimentation with smoking,[23] and lower likelihood of smoking uptake.[17] These findings appear to be stronger for strict smoking bans compared with partial bans, consistent with a recent review of the effect of home smoking restrictions on youth behaviour.[17]

Research in NZ suggests that there is support for smokefree homes.[18,19] There is also support for banning smoking in cars,[20,21] but this has not been given a high priority by policy makers.[22,23] Recently the NZ Māori Affairs Select Committee published their recommendations to the Government on achieving the goal of NZ being smokefree by 2025, and emphasising the extension of the Smoke-free Environments Act to include banning smoking in vehicles, particularly those carrying children.[24]

The aims of this study were to describe trends in young people's exposure to SHS, and to their exposure to household rules around smoking in NZ over the period 2000 to 2008.

## Methods

**Sample selection—**The Youth Lifestyle Study (YLS) and Youth In-depth Survey (YIS) used methods and key measures from the international Global Youth Tobacco Survey (GYTS), developed by the World Health Organization and the Centers for Disease Control and Prevention to monitor tobacco use among youth across countries.[25]

The study data came from the 2000, 2002 and 2004 YLS surveys, and the 2006 and 2008 YIS surveys of Year 10 high school students from randomly selected secondary schools in NZ, undertaken by the Health Sponsorship Council. A two-stage cluster sample design, with random selection of participating classes was used. The sampling strategy was intended to result in a representative sample of Year 10 school students with survey weights at the individual student level used for this purpose. More details are contained elsewhere.[26-28]

The survey used a self-report questionnaire for students administered during school class time. The response rate for schools was 80.5% and from students was 84.9%, giving an overall response rate of 68.3% for 2008.[27] The response rate for schools was 78.0% and from students of 83.7, giving an overall response rate of 65.3% in 2006.[27] The overall response rate in 2004 was 74.6%[29] and in 2002 was 58.2%.[30]

Table 1 describes the sample of students taking part each year. Ethical approval for this study was given by the Ministry of Health's multi-regional ethics committee in 2008.

**Measures—**The YLS and YIS surveys assessed self-reported smoking attitudes, behaviours, and knowledge and information on youth culture and lifestyle. Student age, sex and ethnicity data were also collected.

Exposure to SHS around young people in their home was examined through the question: *During the past 7 days, on how many days have people around you smoked in your home?* From 2004 participants were also asked who the people were that had been smoking around them in their home. The response options in the 2004 survey included: *mother; father; best friend; brothers and sisters*; *family friends; other relatives or caregivers*. The two more recent surveys included *grandparents* and referred to *older brothers and sisters.*

Smoking around young people in vehicles was examined through the following two questions in 2006 and 2008: *During the past 7 days, did anyone smoke in your presence while you were travelling in cars or vans?* Participants were also asked: *During the past 7 days, which of the following people have smoked around you while you were travelling in cars or vans?* The list of options was the same for smoking exposure.

To assess what rules were in place around smoking at home, young people were asked: *At your home is smoking allowed anywhere inside, only in set areas, or nowhere inside your home?* A similar question was asked for smoking outside on the property.

**Analysis—**Descriptive statistics are provided by year of survey for all variables, including both sample characteristics and key measures. Regression models were used to investigate changes in key measures over time, adjusting for demographic variables (sex; age groups of: up to and including 13, 14, 15, and 16 and older; and ethnicity using prioritised ethnicity with the order of priority being from highest to lowest: Māori, Pacific Peoples, Asian, Other, and NZ European) as predictors of interest in themselves and to reflect changes in sample characteristics over time when looking at trends. Ordinal logistic regression was used to model days exposed to SHS at home and elsewhere and household smoking rules with outcomes dichotomised when proportionality did not hold.

Exposure to SHS in vehicles, specific people contributing to SHS, and other specified locations where SHS exposure has occurred were modelled using binary logistic regression. Interactions between survey year and other predictors (including household rules) were investigated and retained where statistically significant. All analyses included a random effect for school to model cluster effects.

All analyses were performed using Stata v11.1 software.[31] All significance tests were two-sided, with $p<0.05$ considered statistically significant. Adjusted odds ratios (aORs) and 95% confidence interval (CI) are presented.

## Table 1. Demographic characteristics of total sample, 2000–2008 (percentages)

| Variables | | Total sample | | | | |
|---|---|---|---|---|---|---|
| | | 2000 n=1610 | 2002 n=2756 | 2004 n=3400 | 2006 n=3200 | 2008 n=3066 |
| Sex | Males | 47.8 | 49.2 | 50.7 | 49.3 | 50.8 |
| | Females | 52.2 | 50.8 | 49.3 | 50.7 | 49.2 |
| Age (years) | <14 | 0.27 | 1.4 | 1.1 | 0.6 | 0.79 |
| | 14 | 56.4 | 74.6 | 61.7 | 64.5 | 61.1 |
| | 15 | 39.4 | 22.7 | 36.2 | 34.0 | 37.0 |
| | 16+ | 3.9 | 1.3 | 1.0 | 0.81 | 1.2 |
| Ethnicity | NZE* | 58.5 | 56.2 | 48.5 | 57.1 | 52.2 |
| | Māori | 17.2 | 20.6 | 24.9 | 20.8 | 25.0 |
| | Pacific | 10.8 | 10.5 | 11.6 | 8.6 | 11.8 |
| | Asian | 4.8 | 6.9 | 7.6 | 4.7 | 9.0 |
| | Other | 8.6 | 5.8 | 7.4 | 8.8 | 2.0 |

* NZE represents New Zealand European.

## Results

**Sample characteristics—**The total sample consisted of approximately equal number of males and females, with most participants being 14 years of age and of NZ European ethnicity (see Table 1 above).

**Exposure to secondhand smoke in the home—**Table 2 shows there has been a downward linear trend (adjusted linear trend p<0.001) in SHS exposure for young people in their home from 49% in 2000 to 35% in 2008. In terms of the number of days exposed, with the exception of 5-6 days, the percentage decreases seem proportional at almost all levels which appears to support the hypothesis that exposure is not shifting to a lower category as much as it is ceasing altogether (Figure 1).

**Table 2. Exposure to SHS in the home, vehicles, and places other than their home in past week, and household smoking rules (%)**

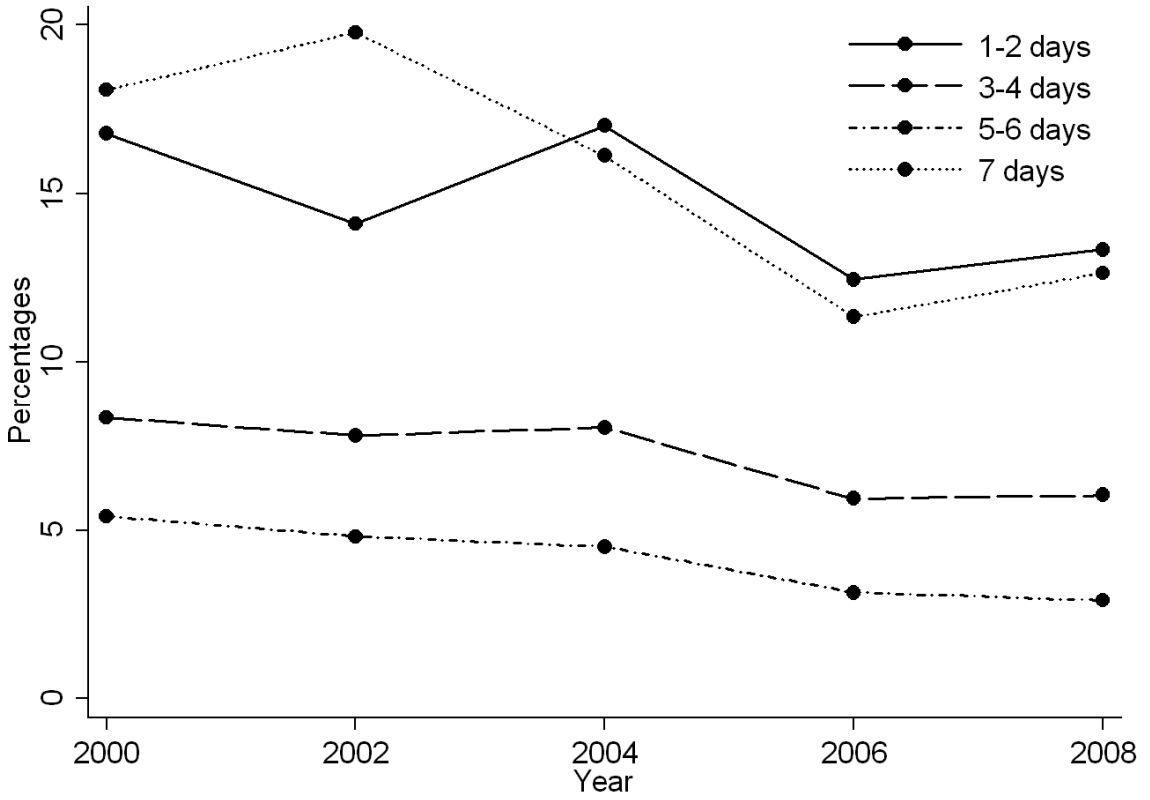
| Variables | | Year of survey | | | | | P value |
|---|---|---|---|---|---|---|---|
| | | 2000 | 2002 | 2004 | 2006 | 2008 | |
| SHS exposure | In home | 48.6 | 46.5 | 45.7 | 32.9 | 34.9 | p<0.001 |
| | In vehicles | | | 42.1 | 29.0 | 30.9 | p<0.001 |
| Is smoking allowed inside your home? | Anywhere inside | | | 17.1 | 9.3 | 7.0 | p<0.001 |
| | In set inside areas | | | 12.3 | 10.7 | 10.4 | |
| | Nowhere inside | | | 70.6 | 80.0 | 82.6 | |
| Is smoking allowed outside your home? | Anywhere outside | | | 71.4 | 60.5 | 55.8 | p<0.001 |
| | In set outside areas | | | 10.7 | 11.5 | 12.6 | |
| | Nowhere outside | | | 17.9 | 28.1 | 31.6 | |
| Smokefree home and property | Total smoking ban | | | 17.2 | 27.5 | 30.9 | p<0.001 |

**Note:** empty cells indicate years when that question was not asked.

Females were more likely (aOR 1.1, CI: 1.1 to 1.2, p=0.001) to be exposed to SHS in their home than males. Overall, ethnicity was a significant predictor over all years (overall p<0.001) with Māori (aOR 3.2, CI: 2.9 to 3.5, p<0.001) and Pacific (aOR 2.0, CI: 1.7 to 2.3, p<0.001) young people more likely to be exposed to SHS in their home compared with NZ European (Table 3). Those identifying as Asian were less likely (aOR 0.51, CI: 0.43 to 0.61, p<0.001) to be exposed to SHS in their home than NZ European.

Participants reported who had smoked around them in their home in 2008. Mothers were reported as smoking around them most often at 46%, and one-third (35%) had fathers who smoked around them in their homes. One-quarter (25%) of older brothers and 19% of older sisters were also reported to have smoked around young people in their homes. In terms of friends, 16% of best friends and 21% of other close friends were reported as smoking in the presence of the participants in their home.

**Figure 1. Percentage of young people exposed to SHS in their home 2000-2008 for numbers of days per week (excluding exposures on no days)**




**Exposure to secondhand smoke while travelling in vehicles—**There was a downward linear trend in young people's exposure to SHS in vehicles from 42% in 2004 to 31% in 2008 (adjusted linear trend p<0.001) (Table 2). Females were more likely to be exposed to SHS in vehicles than males (aOR 1.3, CI: 1.1 to 1.4, p<0.001).

Overall, ethnicity was a significant predictor over all years (overall p<0.001) with Māori (aOR 3.1 CI: 2.7 to 3.5, p<0.001) and Pacific (aOR 2.3 CI: 1.9 to 2.7, p<0.001) young people more likely to be exposed to SHS in vehicles compared with NZ European.

Those identifying as Asian were less likely (aOR 0.55, CI: 0.43 to0 .70, p<0.001) to be exposed to SHS in vehicles than NZ European (Table 3). Overall, age was a significant predictor over all years (overall p<0.001) with higher SHS exposure in vehicles for those 16 years and older compared with students under the age of 14 years (aOR 2.5, CI: 1.4 to 4.5, p=0.003).

As with smoking in homes, parents were the most significant contributors of SHS in vehicles; 41% of mothers and 33% of fathers smoked around young people in vehicles in the past week in 2008. One-fifth (19%) of older brothers and 18% of older sisters were also reported to have smoked around young people in vehicles.

A significant source of SHS exposure for young people in vehicles was people other than family members; one-third (32%) reported other people, such as visitors, smoked around them in vehicles and one-quarter (26%) of respondents had a family friend smoke in their presence while travelling in vehicles.

In terms of friends, 16% of best friends and 22% of other close friends were reported as smoking in the presence of the participants in vehicles in 2008.

**Household rules around smoking—**There is evidence that both unrestricted indoor and outdoor smoking has declined between 2004 and 2008 (adjusted linear trends p<0.001 for both). Combining these, there is evidence of an increase in homes and properties being entirely smokefree from 17% in 2004 to 31% in 2008 (adjusted linear trend p<0.001). Females were less likely to live at a smokefree home or property (aOR=0.8, CI: 0.7 to 0.9, p<0.001) compared with males. There was evidence of differences between ethnicities (overall p<0.001) with Māori (aOR=0.3, CI: 0.3 to 0.3, p<0.001) and Pacific (aOR= 0.7, CI: 0.6 to 0.8, p<0.001) less likely to live at smokefree homes or properties compared to NZ European; but Asian (aOR=2.0, CI: 1.7 to 2.3, p<0.001) and those of other ethnicities (aOR=1.6, CI: 1.3 to 1.9, p<0.001) were more likely compared to NZ European (Table 3).

**Table 3. Ethnic differences in SHS exposure**

| Exposure | Ethnicity | aOR (CI) | P value |
|---|---|---|---|
| Exposure in the home | Māori | 3.2 (2.9 to 3.5) | <0.001 |
| | Pacific | 2.0 (1.7 to 2.3) | <0.001 |
| | Asian | 0.51 (0.43 to 0.61) | <0.001 |
| Exposure in vehicles | Māori | 3.1 (2.7 to 3.5) | <0.001 |
| | Pacific | 2.3 (1.9 to 2.7) | <0.001 |
| | Asian | 0.55 (0.43 to0 .70) | <0.001 |
| Household rules around smoking | Māori | 0.3 (0.3 to 0.3) | <0.001 |
| | Pacific | 0.7 (0.6 to 0.8) | <0.001 |
| | Asian | 2.0 (1.7 to 2.3) | <0.001 |

Reference category is NZE.

## Discussion

This study sought to examine trends in young New Zealanders experience with SHS between 2000 and 2008. Results showed a downward trend in SHS exposure at home since 2000 and in vehicles since 2002. There may be a number of reasons for this decline in SHS exposure.

Firstly, parents are the main contributor of SHS at home, and this is in line with a drop in adult smoking in other NZ research over this time.[32, 33]

Secondly, there is a higher awareness among New Zealanders of the dangers of SHS, and greater publicity around this issue. Social marketing campaigns targeting SHS exposure in the home and cars were implemented nationally in 2004 and 2006 respectively. There are data to show that these campaigns prompted behaviour change.[19, 34, 35]

Thirdly, the introduction of smokefree policies (2004) in indoor areas such as workplaces, restaurants etc., may have led to an overall reduction in smoking indoors, including homes and vehicles. This current study has shown a decline in unrestricted indoor and outdoor smoking, with one-third (31%) of homes being completely smokefree in 2008; consistent with earlier NZ[19] and international research. [36-38]

However, about one-third of young people are still being exposed to SHS in their home, and a similar proportion while travelling in vehicles. Additionally, Māori and Pacific young people were significantly more likely to be exposed to SHS at home and while travelling in vehicles, compared with their NZ European counterparts; consistent with previous research.[11, 12]

Health promotion around SHS for Māori and Pacific peoples should be a priority for the future. Further, continuing to provide appropriate cessation support for Māori and Pacific people will assist with reducing SHS exposure among young people.

Given the links between SHS and poor physical and mental health, and the risk of young people becoming smokers, it is important that NZ continue to address the issue of SHS exposure. New Zealand research has shown support for smokefree homes[18] and vehicles,[20, 21] it is important now as part of the Government's goal of making NZ smokefree by 2025.

This study is subject to some limitations. The surveys provide a series of cross-sectional snapshots, but do not allow us to disentangle causal relationships between reduced exposure to SHS and smokefree homes. Further, the same questions were not always asked each year which makes some of the comparisons from year to year more difficult.

The use of self-reported smoking data is subject to biases, including inaccurate recall of SHS exposure and social desirability bias. One of the significant strengths of this study, however, is the series analysis of five waves of national survey data to understand the patterns over time in young people's exposure to SHS in NZ. The surveys achieved relatively high participation rates and participants were representative of NZ students. [26, 27, 30]

It is encouraging that this study found declining rates of SHS exposure for young people in their homes and while travelling in vehicles. Nevertheless, significant numbers of young people are still being exposed to SHS, with Māori and Pacific young people being particularly affected.

Although smokefree homes are increasing, and more families are implementing home smoking restrictions, efforts to reduce the rates of SHS exposure for our young people are needed through more intensive tobacco control measures. These might include extending initiatives to reduce smoking in various settings such as cars, parks, beaches and shopping areas, and the provision of continuing education about the adverse health effects of SHS.

**Competing interests:** None declared.

**Funding:** The Year 10 In-depth Survey, formerly known as the Youth Lifestyles Survey, is funded by the Health Sponsorship Council. The Cancer Society Social and Behavioural research unit was supported by the Cancer Society of NZ and the University of Otago.

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**Acknowledgements:** The Year 10 In-depth Survey (YIS), formerly known as the Youth Lifestyles Surveys (YLS), is run by the Health Sponsorship Council (HSC). Since 2006, the YIS survey has formed part of the New Zealand Youth Tobacco Monitor (NZYTM), a collaborative project with the HSC, Action on Smoking and Health, and the Ministry of Health.

The HSC wishes to acknowledge the contribution of present and past members of the Research Coordinating Group who have provided advice on survey and questionnaire design.

The HSC also wishes to acknowledge the time and effort volunteered by many New Zealand secondary school principals, teachers and to thank the student participants.

TNS collected data on behalf of the HSC in 2002 and 2004, and Synovate (formerly known as Research Solutions) in 2006 and 2008. The authors of this research take responsibility for the outputs produced in this manuscript.

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