

BRIEF REPORT

Observed smoking in cars: a method and differences by socioeconomic area

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Objectives: To establish a reproducible method to estimate the point prevalence of smoking and second-hand smoke (SHS) exposure in cars, and to compare this prevalence between two areas of contrasting socioeconomic status.

Method: A method involving two teams of observers was developed and evaluated. It involved observing 16 055 cars in Wellington, New Zealand. Two of the observation sites represented a high and a low area of deprivation (based on a neighbourhood deprivation index) and three were in the central city.

Results: A 4.1% point prevalence of smoking in cars was observed (95% confidence interval (CI) 3.8% to 4.4%). There was a higher prevalence of smoking in cars in the high deprivation area relative to the other sites, and particularly compared to the low deprivation area (rate ratio relative to the latter 3.2, 95% CI 2.6 to 4.0). Of cars with smoking, 23.7% had other occupants being exposed to SHS. Cars with smoking and other occupants were significantly more likely to have a window open (especially if the smoker was not the driver). The observation method developed was practical, and inter-observer agreement was high (κ value for the "smoking seen in car" category 0.95).

Conclusions: Observational studies can be an effective way of investigating smoking in cars. The data from this survey suggest that smoking in cars occurs at a higher rate in relatively deprived populations and hence may contribute to health inequalities. Fortunately, there are a number of policy options for reducing SHS exposure in cars including mass media campaigns and laws for smoke-free cars.

In New Zealand, legislation has successfully made public environments such as workplaces and bars completely smoke-free.¹ Also, recent health promotion measures have focused on reducing smoking in homes. Many New Zealand smokers now consider their cars to be "sanctuaries from non-smoking environments".² However, smoking in cars exposes others in the vehicle to the harmful effects of secondhand smoke (SHS) in a particularly confined space. Little is known about the prevalence of this specific hazard and so we aimed to develop a reproducible method to observe the point-prevalence of smoking and SHS exposure in cars. Given particular concern about health inequalities in the New Zealand setting, we also aimed to establish whether there were differences in these smoking patterns by levels of socioeconomic deprivation.

METHODS

Site selection

Two teams of two observers performed a roadside observation of 16 055 cars from five different sites in the Wellington area.

Two thousand cars were sampled at each of the three central business district sites and approximately 5000 at each of two suburban sites. The latter were chosen to represent areas of high and low deprivation using the NZDep 2001 index (a neighbourhood index of deprivation).³ The two suburban sites also had geographical boundaries that meant that there was only one major road in and out of each suburb.

Sites were necessary that allowed observers to stand within approximately 1–2 m of a moving car. This allowed observers to see the hands and faces of all car occupants. Site selection criteria included high traffic flow rates and where traffic speed would be slowed down to approximately 30 km/h due to the road layout (the overall average flow rate was 882 cars/h). The maximal flow rate out of all sites was 22 cars/min and at this rate data collection was still found to be feasible.

Sample times

Sampling was performed at peak traffic times during week days when occupants were likely to be commuting to and from work (that is, 8–10 am and 4–6 pm). There was an even split of car numbers counted in morning and evening sample times at each site. Sampling was between 23 August and 1 September 2005 (spring in New Zealand).

Data collection and analysis

All the cars in the adjacent lane passing the observation points were counted and observed to see if any of the occupants were smoking. One observer was responsible for using a hand-held mechanical number counter to record total number of cars that passed by, and also voiced the other data observations. The other recorded these data on a pre-formatted data collection sheet. The data recorder also attempted to observe each car, and confer with the other observer as to what was seen in the car (but dual observation was not always possible if this person was still writing when a subsequent car with smoking went past).

Vehicles that were excluded from the study were: (1) cars that did not permit visibility of occupants (for example, tinted windows); and (2) vans, trucks or passenger buses (smoking is prohibited on public transport in New Zealand). Where smoking was seen in a car, data were collected on: (1) whether the driver was smoking; (2) whether there were any passengers in the car; and (3) whether the car had any windows open. Smoking was defined as the presence of a cigarette, pipe or cigar in either the hands or mouth of any occupant within a car. Pilot testing of the method was performed before the data collection, and inter-observer variation between observers was assessed on a sample of 500 cars (for the two groups in close proximity on the same street). It was found to be unfeasible for two observers to also accurately record the precise number of occupants or if any were children. Data were double entered into a database and

statistical analyses were conducted using Excel and OpenEpi (Emory University).

RESULTS

Evaluation of the method

The two-observer method appeared to be practical for the amount and type of data being collected. The κ value for the “smoking seen in car” category for the two observer groups was 0.95, indicating high levels of chance-corrected agreement between the observers. Analysis for other observational data relating to when smoking was occurring produced κ values that were all 0.78 or greater. There were also no statistically significant differences in the final results obtained between the two observer groups.

Results of the observation study

For all sites collectively, there was a 4.1% point prevalence of smoking in cars (95% confidence interval (CI) 3.8% to 4.4%) (table 1). There was a higher prevalence of smoking in cars in the high deprivation area compared to the central business district sites and particularly to the low deprivation area (rate ratio (RR) for the latter 3.2, 95% CI 2.6 to 4.0; p < 0.0001). The prevalence of smoking in cars was significantly higher in the morning (than the afternoons) and significantly higher on days that were overcast or had rain (compared to sunny days) (table 1).

Nearly all of the smoking was by drivers (95.3%) rather than by passengers. Of cars with smoking occurring, other occupants were present in 23.7% and so this group were being exposed to SHS.

The majority of cars with smoking present had a window open (81.9%). This proportion was significantly higher if a passenger was present than not (87.2% v 80.3%, respectively, RR 1.09). Furthermore, a window was even more likely to be open if it was the passenger smoking rather than the driver smoking (that is, 96.8% v 81.2%, RR 1.19).

DISCUSSION

Quality of the method

A strength of the method was the use of direct observation of behaviour, rather than self-reported data, which is subject to bias. The experiences with piloting the method and the inter-observer variation results (high κ scores) suggested that the method was reliable. However, a limited number of sites was sampled, at specific times of the day during two months, and so the results may not be representative for the prevalence of smoking in cars in Wellington city overall. Our experience suggests that counting the number of passengers would require a larger observer team and possibly the use of photography.

Smoking prevalence

The overall point prevalence rate for smoking in cars at 4.1% is likely to underestimate greatly the prevalence of smoking per car trip. This is because smokers could start smoking at any point during travel (or even smoke more than one cigarette per trip). We are not aware of any other published estimates for observed smoking in cars—though a number of studies have collected self-reported data on whether or not respondents smoke in cars.⁴⁻⁷

The socioeconomic gradient

We found a significantly higher rate of smoking in a high deprivation area compared to a low deprivation area. This pattern is consistent with other New Zealand data for active smoking⁸ and for exposure to SHS.⁹ It is also consistent with a US study that found that lower household income was associated with a lower prevalence of car smoking bans.⁵

Table 1 Prevalence of smoking in cars by site, time, and weather conditions

Key characteristics	Total cars observed		Any smoking in the car		Rate ratio for smoking in cars versus no smoking (95% CI)		Driver smoking in cars with smoking		Other occupant present in cars with smoking		Window open in cars with smoking	
	n	%	n	%	n	%*	n	%*	n	%*	n	%*
Sites												
High deprivation area site (Wainuiomata)	5055	6.4	325	6.4	3.18 (2.55 to 3.97)	316	97.2	69	21.2	264	81.2	
Central business district (3 sites)†	6000	3.9	233	3.9	1.92 (1.53 to 2.42)	216	92.7	62	26.6	195	83.7	
Low deprivation area site (Karori)	5000	2.0	101	2.0	1.0 (reference)	96	95.1	25	24.8	81	80.2	
Total (95% CI for per cents)	16055	4.1 (3.8 to 4.4)	659	4.1		628	95.3 (93.4 to 95.8)	156	23.7 (20.5 to 27.1)	540	81.9 (78.8 to 84.8)	
Time of day												
Morning (8–10 am)	8055	4.6	372	4.6	1.29 (1.11 to 1.50)	354	95.2	81	21.8	314	84.4	
Afternoon (4–6 pm)	8000	3.6	287	3.6	1.0 (reference)	274	95.5	75	26.1	226	78.8	
Weather												
Overcast/rain	8939	4.5	400	4.5	1.23 (1.05 to 1.43)	379	94.8	85	21.3	335	83.8	
Sunny	7116	3.6	259	3.6	1.0 (reference)	249	96.1	71	27.4	205	79.2	

*Calculated as a proportion of the number of cars with any smoking occurring (by driver or a passenger).
 †The corners of: Kent Terrace/Vivian St; Jervois Quay/Cable St; and Taranaki St/Vivian St (n = 2000 cars each).

What this paper adds

This study collected observation data on smoking behaviour in 16 055 cars. The novel observation method appeared to work successfully. The findings indicate that smoking in cars (at 4.1% point prevalence) is likely to be a significant source of secondhand smoke exposure. The data also indicate that smoking in cars occurs at a higher rate in relatively deprived populations and hence may contribute to health inequalities.

SHS exposure

Almost a quarter of cars with smoking occurring had occupants exposed to SHS, demonstrating that this is likely to be an important source of this hazardous exposure, particularly in countries like New Zealand where enclosed public places are smoke-free. There is some evidence from this study that smokers in cars are attempting to moderate air quality by opening a window if others are present.

Possible policy options

In some countries there is a majority of public support for legal restrictions on smoking in cars when children under 18 years are present (for example, in Australia^{7 10 11}) and one jurisdiction has already passed a law.¹² Some countries have also run mass media campaigns with themes on not smoking in cars (for example, New Zealand) and a specific programme has reduced the reported rate of such smoking.¹³ Such initiatives are largely based on concern around the harm from SHS, but efforts to remove smoking from cars can be strengthened by road safety concerns, given the evidence that smokers have higher motor vehicle crash mortality rates that are independent of alcohol consumption.¹⁴

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