

IS THE SOCIO-ECONOMIC GAP IN CHILDHOOD EXPOSURE TO SECONDHAND SMOKE WIDENING OR NARROWING?

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Abstract

Objective

The social gradient in smoking contributes substantially to the health gap between the rich and poor. Passive smoking by children is associated with increased risk of more severe asthma, respiratory diseases and infections, middle ear disease and Sudden Infant Death Syndrome. This study examined trends in the social gradient of children's exposure to second-hand smoke (SHS) in Australian households between 2001 and 2010.

Design

Series of cross-sectional national household surveys.

Results

Between 2001 and 2010, the proportion of Australian households containing a child aged under 15 and a smoker declined by 22%. However, there was no change in the most disadvantaged households, with half of these households still containing at least one smoker in 2010. There was a social gradient in outdoor smoking in all survey years but the prevalence of outdoor only smoking increased in all socioeconomic groups by around 50% between 2001 and 2010. The presence of a child aged 5 or under in the household increased the chances that smokers only smoked outdoors.

Conclusion

Children's exposure to indoor smoking in households that contain a smoker is declining in all socioeconomic groups but the social class differentials in such exposure remain. The proportion of children who live with a smoker declined in all social groups except the most disadvantaged

households, with half of these households still containing a smoker in 2010. More needs to be done to reduce SHS exposure of children in socially disadvantaged households.

Background

Children are particularly vulnerable to the effects of secondhand tobacco smoke (SHS). Passive smoking by children is associated with increased risk of more severe asthma, respiratory diseases and infections, bacterial meningitis, middle ear disease and Sudden Infant Death Syndrome.[1] Worldwide, 40% of children were exposed to SHS in 2004 and 61% of the disease burden from SHS was borne by children. [2]

Domestic environments (e.g. home and car) are the most important sources of exposure to SHS for children.[3] Indoor smoking bans reduce the level of exposure to smoke particulates but they do not eliminate it .[4] This may be due to particulates entering through doorways or windows from outdoor smoking and tobacco smoke residues on the smoker's skin and clothing (thirdhand smoke). A recent study highlighted such smoke incursion as being a likely source of SHS exposure in children living in non-smoking households located in multiunit dwellings.[5] Nonetheless, indoor household smoking bans are an important harm reduction measure for decreasing nonsmokers' exposure to tobacco smoke from living with a smoker.

Indoor home smoking bans have become more common over the past 10-20 years in many developed countries, including Australia.[6-9] Data from the 1995 and 1998 National Drug Strategy Household Surveys indicate that the proportion of smoking households with indoor smoking bans increased from 32% to 44%. Similar trends were reported in annual cross-sectional survey data from Victoria which shows that the percentage of households in which the smoker(s) always or usually smoked outside increased from 53% in 1998 to 73% 2008. [7 8] A number of factors appear to influence whether a home adopts an indoor smoking ban. These include belief in the harmful effects of SHS, higher socioeconomic status (SES) and the presence of non-

smokers in the household. Households with small children are more likely to have a household indoor smoking ban.[7 10-14]

Studies in several high income countries have reported a strong relationship between socioeconomic factors and children's exposure to SHS.[12 15-17] In Germany, exposure of pre-school aged children to SHS in the home and in cars is associated with low parental education, unemployment, low household equivalent income, non-German nationality, single-parent family and family size. In smoking households, indoor smoking bans were less likely among those who had low parental education, were unemployed, in poverty, single-parent family and migrants. Smoking when children are present was associated with unemployment and low parental education. [16] Studies in the US also report that indoor smoking bans are less common among low SES households.[12] The introduction of public smoking bans in Wales had a measureable impact on children's exposure to SHS overall, but not among children in the lowest SES groups, who were the most exposed before the ban. [15]

Indigenous Australians are among the most socially disadvantaged in Australian society. In 2008, 63% of Aboriginal and Torres Strait Islander children aged less than 15 years lived in a smoking household compared to 32.2% of non-indigenous children. Between 2004 and 2008, there was no decrease in the percentage of indigenous children living in smoking households but the percentage who lived with an indoor smoker declined from 29% to 21%. [18]

In 2008, smokers in Victoria were more likely to report always or usually smoking outdoors if children were present in the home (82.2% vs 65.9%). Those in households with a child under the

age of 5 were more likely to smoke outdoors than those with older children (91.1% vs 76.7%).

Outdoors-only smoking was more common among smokers living in higher SES areas (74.9% in highest SES quintile vs 66.4% in two lowest SES quintiles).[7]

Reducing the health inequality caused by smoking is an important government policy goal in the United Kingdom,[19] the United States [20] and Australia.[21] A 2001 Australian Government occasional paper on passive smoking noted that there was an “urgent need for national monitoring of restrictions on smoking in the home, particularly among disadvantaged communities”. The authors recommended the collection of annual trend data at a national level to document social change and for evaluating interventions.[8] This recommendation is yet to be implemented.

The aim of this study was to determine if the social gradient, i.e. a trend of decreasing exposure with increasing SES, of children’s exposure to SHS in Australian households changed between 2001 and 2010. It used data from a series of national representative cross-sectional surveys of smoking to answer this question. We hypothesized that reductions in SHS exposure would be observed in all SES groups, but that greater reductions would be observed in the highest SES groups.

Methods

The National Drug Strategy Household Surveys (NDSHS) are conducted by the Australian Institute of Health and Welfare (AIHW) and the Australian Department of Health and Ageing every three years to measure the prevalence, behaviour, knowledge, awareness, and attitudes

towards alcohol, tobacco, and illicit drug use in representative samples of the Australian population [22-25]. The de-identified datasets for the 2001, 2004, 2007 and 2010 surveys were provided by the Australian Institute of Health and Welfare and accessed via the Australian Social Science Data Archive.

The surveys use multi-stage random sampling of households with the sample stratified by region and over-sampling in some states and territories. In each household the selected respondent was the person aged 12 and over whose birthday was next. Selecting only respondents in households containing a smoker and a child aged under 15 gave final sample sizes of 3,504 in 2001, 3,082 in 2004, 1,927 in 2007 and 2,192 in 2010. The response rates were 50% in 2001, 46% in 2004, 54% in 2007 and 51% in 2010. Further details about the sampling and data collection are available elsewhere.[22-25]

Household smoking was measured in each survey by the question “In the last 12 months, have you or any other member of your household smoked at least one cigarette, cigar or pipe of tobacco per day in the home?” Participants could choose from “Yes, inside the home”, “No, only smoke outside the home” and “No-one at home regularly smokes” as responses.

Socioeconomic disadvantage was measured using an index of relative socioeconomic disadvantage converted into quintiles. This is an area-based measure of disadvantage compiled by the Australian Bureau of Statistics and takes into consideration income, education, employment, and occupations within census collection districts. For more details on this index refer to [26].

Weights were applied to the data to align the sample to the Australian population. To account for the reduction in statistical power caused by the complex sampling design, the sample size was proportionally reduced to the 'effective sample size' based on the mean design effect calculated across key measures in the survey.[22-25] All analyses were performed in IBM SPSS version 20.0.0. In smoking households, the percentage that reported only smoking outdoors was calculated for each year and socioeconomic group. The relative percentage change between 2001 and 2010 and the absolute difference in prevalence between highest and lowest socioeconomic groups was calculated for these smoking variables. Logistic regression was used to determine the relationship between only smoking outdoors (in households containing a smoker), and socio-demographic factors (socioeconomic group, child aged under 6 in household, couple or single parent) for each year. We tested for interactions between year and the independent variables by: 1) combining the data from the first (2001) and last (2010) years and included survey year as a co-variate in the analysis; 2) computing interaction products between each of the independent variables and survey year; and 3) testing whether the addition of the interaction products improved the fit of the multivariable model. There were no significant interactions with year and inclusion of the interaction products did not alter the main effects.

Results

Between 2001 and 2010, the proportion of Australian households containing a child aged under 15 and a smoker declined by 22% (Table 1). This decline occurred in both single and two-parent households but the decrease was greatest in two parent households; around half of all single parent households were still smoking in 2010 (Table 1). In each year there was a clear social

gradient in the prevalence of smoking in households with dependent children. Between 2001 and 2004 the gap between the lowest and the highest socioeconomic groups widened from 21% to 32%. However, there was no change between 2004 and 2010 (Table 2). There was no change in the proportion of the households containing a smoker among those in the most disadvantaged households, with half of the households containing children in the bottom quintile still containing at least one smoker in 2010 (Table 2).

In 2001, just over half of all 'smoking' households with children under the age of 15 reported that smoker(s) only smoked outdoors. This increased to 85% in 2010 (Table 1). Outdoor only smoking increased in both single and two-parent households, with the greatest percentage increase in single parent households (Table 1). There was a social gradient in outdoor only smoking in all survey years but outdoor only smoking increased by around 50% in all socioeconomic groups between 2001 and 2010 (Table 3). Outdoor only smoking showed the slowest increase in the lowest socioeconomic quintile. The gap between the lowest and highest socioeconomic groups in 2010 was similar to that in 2001 (Table 3).

The association between socioeconomic status and having a smoker in the household strengthened between 2001 and 2010 (Table 4). The strength of the relationship between household smoking and being a single or two parent household was similar in 2001 and 2010.

There was no change between 2001 and 2010 in the association between outdoor only smoking and socioeconomic status, household structure and whether the household contained a child aged under 6 (Table 3). Smoking households with children in the most disadvantaged areas were

about half as likely to only smoke outdoors as their counterparts in the least disadvantaged areas. Similarly, single parent households were about half as likely to only smoke outdoors as two parent households. The presence of a child aged 5 or under in the household did not reduce the chances of having a smoker in the household in any of the survey years (Table 4) but increased the chances that the smoker(s) would only smoke outdoors in all survey years (Table 5).

Discussion

Exposure of children to tobacco smoke in the home has decreased substantially in Australian households over the past decade. This is the result of the steady decline in the proportion of those households with children that also include a smoker and a substantial increase in the proportion of smoking households that report no indoor smoking. The decrease in children's exposure to household smoking was seen in all socioeconomic quintiles, except for the most disadvantaged quintile, among which around half of households still contained at least one smoker. On this measure of exposure to SHS, the gap between the most and least disadvantaged households has increased. However, the social gradient in exposure to indoor smoking in smoking households, did not change between 2001 and 2010 because there were similar increases in the proportion of smokers reporting that they only smoked outdoors in all socioeconomic quintiles.

Indoor household smoking bans are promoted for the protection of children in public health campaigns such as 'safe sleeping' guidelines for infants. Most Australian states and territories now ban smoking in vehicles carrying children. The presence of young children in the home appears to motivate smokers to refrain from smoking indoors rather than to quit. Indoor smoking bans may be particularly important in the most disadvantaged households where smoking

prevalence remains high. A recent cohort study of new Indigenous mothers reported that most of the participants had at least one smoker in the household and smoking prevalence among the participants increased from 45% during pregnancy to 63% at 7 months postpartum.[27] However, after the baby was born reported indoor smoking decreased substantially from 31% to 16%.

The decline in indoor smoking in smoking households containing children between 2001 and 2010 in all socioeconomic groups suggests that smokers in socioeconomically disadvantaged households are attempting to reduce their child(ren)'s exposure to SHS. However, the best way to protect children from SHS is for parents to quit smoking. The lack of progress in reducing the prevalence of smoking among the most socioeconomically disadvantaged households containing children between 2001 and 2010 indicates that further action is needed. Increasing public awareness about the hazards of 'thirdhand' smoke could further motivate these smokers to quit.

Limitations

The measurement of indoor and outdoor smoking in this study was via self report without biochemical confirmation of SHS exposure. As smoking, and particularly indoor smoking, becomes more socially unacceptable, it is possible that surveys will under-report household smoking. Mumford et al found home smoking bans were reported inconsistently for 12% of the households in the 1998/1999 Tobacco Use Supplement to the U.S. Current Population Survey for which there was data provided by two or more adults.[28] Our results probably overestimate the prevalence of outdoor only smoking among smoking households. Other sources of SHS exposure, such as from residing in multiunit dwellings [5], non-custodial parents and non-

household sources were not included in the study. The measure of SES used in the study was a proxy measure based on residential area, rather than characteristics of the individual households such as household income.

Conclusions

The proportion of households with children who live with a smoker declined by 17-35% in all socioeconomic groups, except those living in the most disadvantaged areas. Half of these households still contained a smoker in 2010. While children living with a smoker in the most disadvantaged households remain most exposed to indoor smoking, there has been substantial progress in increasing outdoor only smoking in Australian households with children over the past decade in all socioeconomic groups. Overall, the proportion of smoking households containing children who report outdoor only smoking increased from 56% to 85% between 2001 and 2010. More work is needed to reduce social class differentials in exposure of children to SHS.

Table 1: Prevalence of smoking in households containing a child under the age of 15 overall and according to household structure

	2001		2004		2007		2010		% change between 2001 and 2010	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Smoker(s) in household	44.3	(42.7-45.9)	40.8	(39.5-42.1)	37.3	(35.6-39.0)	34.6	(33.1-36.1)	-21.9	(-26.3--17.5)
Couple	40.3	(38.6-42.1)	36.8	(35.4-38.3)	33.5	(31.7-35.3)	30.5	(28.8-32.2)	-24.3	(-29.6--19.0)
Single	59.0	(54.8-63.1)	58.0	(54.5-61.5)	56.8	(51.8-61.8)	51.8	(46.7-56.9)	-12.2*	(-22.8--1.5)
Smoker(s) in smoking households only smoke outdoors	55.6	(53.2-58.0)	69.5	(67.6-71.4)	78.5	(76.1-80.9)	85.4	(83.5-87.3)	53.6	(46.1-61.1)
Couple	60.0	(57.3-62.8)	73.7	(71.6-75.9)	81.7	(79.1-84.3)	89.7	(87.7-91.7)	49.4	(41.7-57.0)
Single	42.4	(37.0-47.9)	55.0	(50.3-59.6)	66.2	(59.8-72.5)	72.6	(66.3-79.0)	71.3	(44.7-97.9)

*Result should be interpreted with caution as Relative Standard Error lies between 25% and 50%.

Table 2: Households containing dependent children with someone who smoked in the last 12 months

SEIFA quintile	Year								% change between 2001 and 2010	
	2001	2004	2007	2010	2001	2004	2007	2010	2010	2010
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Lowest	51.0	(47.2-54.8)	55.9	(52.6-59.2)	53.1	(48.9-57.3)	51.1	(47.3-54.9)	**	
Second	50.0	(47.0-53.1)	48.0	(45.0-51.1)	42.7	(38.7-46.8)	41.4	(37.7-45.0)	-17.4%*	(-26.2- -8.5)
Third	45.5	(41.8-49.2)	43.0	(40.1-45.8)	41.6	(37.6-45.6)	34.6	(31.3-37.9)	-23.9%	(-33.5- -14.3)
Fourth	44.9	(40.6-49.1)	36.7	(34.0-39.4)	31.7	(28.3-35.1)	30.7	(27.7-33.7)	-31.6%	(-49.9- -22.3)
Highest	30.1	(26.9-33.3)	24.2	(21.7-26.8)	21.1	(17.9-24.2)	19.5	(16.7-22.2)	-35.4%	(-46.8- -24.0)
Gap lowest to highest	20.9	(15.9-25.9)	31.6	(27.5-35.8)	32.0	(26.8-37.2)	31.7	(27.0-36.3)		

*Result should be interpreted with caution as Relative Standard Error lies between 25% and 50%.

** Result not displayed as Relative Standard Error >50%

Table 3: Percentage of smoking households containing children with a smoker that only smokes outdoors

SEIFA quintile	Year									
	2001		2004		2007		2010		change between 2001 and 2010	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	95% CI
Lowest	51.5	(46.1-56.9)	56.6	(52.2-61.0)	72.3	(67.1-77.4)	77.4	(72.9-81.8)	50.2	(32.3-68.1)
Second	50.0	(45.7-54.3)	66.8	(62.7-70.9)	78.3	(73.1-83.5)	87.1	(83.2-90.9)	74.1	(57.2-91.1)
Third	57.6	(52.1-63.0)	76.2	(72.5-80.0)	80.9	(76.0-85.9)	84.9	(80.6-89.1)	47.4	(31.6-63.1)
Fourth	58.8	(52.5-65.0)	72.3	(68.1-76.4)	82.3	(77.3-87.2)	91.0	(87.6-94.4)	54.9	(37.5-72.3)
Highest	67.2	(61.3-73.2)	80.8	(76.0-85.5)	81.3	(74.7-87.9)	90.4	(85.8-95.0)	34.4	(20.7-48.2)
Gap lowest to highest	15.7*	(7.7-23.7)	24.2	(17.7-30.6)	9.1*	(0.7-17.4)	13.0*	(6.6-19.5)		

*Result should be interpreted with caution as Relative Standard Error lies between 25% and 50%.; SEIFA Socioeconomic Index for Areas

Table 4: Logistic regression of factors associated with having a smoker in the household by year

Variable		2001			2004			2007			2010		
		OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p
SEIFA	5 (highest)	1.00			1.00			1.00			1.00		<0.001
	4	1.83	(1.46-2.31)	<0.001	1.77	(1.48-2.13)	<0.001	1.70	(1.33-2.18)	<0.001	1.81	(1.44-2.27)	<0.001
	3	1.85	(1.49-2.29)	<0.001	2.27	(1.89-2.72)	<0.001	2.57	(1.99-3.32)	<0.001	2.10	(1.66-2.64)	<0.001
	2	2.20	(1.80-2.68)	<0.001	2.67	(2.21-3.22)	<0.001	2.63	(2.03-3.39)	<0.001	2.79	(2.21-3.52)	<0.001
	1 (lowest)	2.24	(1.80-2.79)	<0.001	3.61	(2.97-4.40)	<0.001	3.75	(2.90-4.86)	<0.001	3.98	(3.15-5.04)	<0.001
Household structure	Couple	1.00			1.00			1.00			1.00		
	Single	2.00	(1.66-2.43)	<0.001	2.09	(1.78-2.46)	<0.001	2.27	(1.80-2.85)	<0.001	2.05	(1.64-2.58)	<0.001
	Other	3.02	(2.12-4.31)	<0.001	2.60	(1.92-3.50)	<0.001	2.40	(1.58-3.65)	<0.001	1.79	(1.47-2.18)	<0.001
Child(ren)	None	1.00			1.00			1.00			1.00		

aged ≤5	1+	1.07	(0.93-1.22)	0.343	1.09	(0.97-1.22)	0.13	1.06	(0.90-1.23)	0.493	0.94	(0.81-1.08)	0.376
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SEIFA Socioeconomic Index for Areas

Table 5: Logistic regression of factors associated with outdoor only smoking in smoking households with children under the age of 15

Variable		2001			2004			2007			2010		
		OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p	OR	(95% CI)	p
SEIFA	5 (highest)	1.00			1.00			1.00			1.00		
	4	0.71	(0.49-1.04)	<0.001	0.67	(0.46-0.98)	0.038	1.04	(0.59-1.84)	0.882	1.15	(0.59-2.27)	0.682
	3	0.69	(0.48-0.99)	0.043	0.76	(0.52-1.11)	0.155	0.96	(0.55-1.67)	0.885	0.65	(0.34-1.22)	0.178
	2	0.52	(0.37-0.72)	<0.001	0.49	(0.34-0.71)	<0.001	0.83	(0.48-1.43)	0.497	0.80	(0.42-1.53)	0.506
	1 (lowest)	0.54	(0.38-0.77)	0.001	0.34	(0.24-0.49)	<0.001	0.63	(0.37-1.06)	0.082	0.43	(0.24-0.77)	0.005
Household structure	Couple	1.00			1.00			1.00			1.00		
	Single	0.54	(0.42-0.69)	<0.001	0.51	(0.41-0.64)	<0.001	0.50	(0.36-0.70)	<0.001	0.37	(0.25-0.56)	<0.001
	Other	0.55	(0.36-0.83)	0.004	0.71	(0.47-1.08)	0.107	0.62	(0.32-1.18)	0.141	0.50	(0.34-0.74)	0.001
Child(ren) aged ≤5	None	1.00			1.00			1.00			1.00		
	1+	1.68	(1.37-2.05)	<0.001	2.00	(1.65-2.43)	<0.001	2.17	(1.62-2.91)	<0.001	1.76	(1.23-2.52)	0.002

SEIFA Socioeconomic Index for Areas

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