



Parental smoking and related behaviours influence adolescent tobacco smoking: results from the 2001 New Zealand national survey of 4th form students

Robert Scragg, Murray Laugesen and Elizabeth Robinson

Abstract

Aims To investigate whether parental smoking and other parental behaviours are risk factors for smoking in 14- and 15-year-old children.

Methods National cross-sectional survey of 14 930 female and 14 341 male 4th form students who answered an anonymous, self-administered questionnaire in November 2001.

Results The effect of both parents smoking on the risk of daily smoking by students varied significantly ($p < 0.0001$) between ethnic groups, being strongest for Asian students (adjusted relative risk (RR) = 6.64 compared with students of non-smoking parents), intermediate for European (RR = 3.11) and Pacific (RR = 3.05) students, and weakest for Maori (RR = 1.74). Adolescent smoking was also positively associated with pocket money amount and living in a home where people smoked. Two thirds of daily smoking could be explained by the combined exposure to one or more of the following factors: parental smoking, pocket money $> \$5$ per week, and smoking in the house.

Conclusions Parental behaviour is a key determinant of smoking by New Zealand adolescents. Efforts that target the role of parents should be pursued, such as health promotion strategies that advise parents about the possible benefits of banning smoking in the home, limiting pocket money, and not providing cigarettes to their children.

Most adult tobacco smokers began smoking during their teenage years. Previous research has contrasted the relative importance of peer influences from teenage friends with those from parents in determining whether or not teenagers smoke. For example, findings from the National Longitudinal Study of Adolescent Health in the United States showed that risk of adolescent smoking is influenced more by the smoking behaviour of friends than of parents,¹ consistent with an earlier review concluding that friends were a more important determinant of smoking behaviour than parents.² In contrast, a Norwegian study reported that, while smoking by friends was an important predictor of smoking behaviour during adolescence, smoking by mothers was the most important long-term predictor of smoking as students progressed into adulthood.³ A US cross-sectional study found that adolescents of parents who quit smoking were less likely to be smokers,⁴ while parental smoking was the strongest predictor of smoking in a school sample of low smoking prevalence (0.3% weekly smokers) from eastern China.⁵ Cross-sectional surveys from Australia have consistently reported that parental (or family) smoking is a risk factor for adolescent smoking.⁶⁻⁸

Inconsistent findings about the strength and effect of parental smoking on the risk of adolescent smoking have emerged from previous New Zealand studies. A Wellington study at two co-educational secondary schools found that smoking by friends, siblings and parents were all significantly associated with student smoking, although parental smoking had the weakest association.⁹ Repeat surveys at a Wairoa high school reported that maternal smoking was associated with student smoking in both 1975 and 1989.¹⁰ A larger national survey of 4th form students at 99 schools in 1992 also found that parental smoking was associated with an increased risk of student smoking.¹¹ These findings contrast with results from cohort studies in Dunedin and Christchurch, collected in the 1980s, which show no effect of parental smoking behaviour on adolescent smoking after controlling for smoking by friends.^{12,13} A Rotorua study, which did not examine parental smoking, reported that student smoking was associated with peer smoking in males (Maori and European) and in Maori females, and with sibling smoking in European females.¹⁴

The influence of parents on adolescent smoking is not confined to the direct effect of their own smoking behaviour. Australian studies have found that the amount of pocket money provided to children and parental supervision of adolescent leisure time were both related to adolescent smoking.^{7,8} Recent results from the 2000 national 4th form survey in New Zealand showed that the provision of more than \$10 per month pocket money explained 30% of smoking by girls and 25% by boys.¹⁵ Parents are also a major source of cigarettes for adolescents.¹⁶

Since 1997, annual surveys of 4th form students (aged 14–15 years) have been carried out in New Zealand.¹⁷ In 1999, the survey was extended to all schools with 4th form students, so that the survey sample (about 30 000 students each year) has ethnic subgroups with a wide variation in smoking prevalence. This variation ranges sevenfold, from very low levels in Asian girls to the highest levels in Maori girls.¹⁸ The purpose of this study is to examine, in detail, the role of parental smoking on adolescent smoking. In particular, we wish to determine whether:

- the effect of parental smoking on adolescent smoking varies by ethnicity;
- ethnic variations in adolescent smoking are explained by parental smoking;
- parental smoking is related to the provision of cigarettes and pocket money to adolescents.

Methods

Details of previous national surveys of tobacco smoking and purchasing by 4th form students, carried out in November of 1992, and yearly during 1997–2000, have been reported.^{11,15,17,18} All New Zealand schools with 4th form students were invited to participate in a further survey carried out in November 2001. The school response rate was 71.9% (332 out of 462 approached).

Students anonymously answered a one-page questionnaire on age, sex, ethnicity (self-assigned) and smoking behaviour (frequency of smoking, source of cigarettes). Smokers were asked if they acquired their cigarettes from any of the following sources: bought themselves, received from a family member, or received from a friend or someone else. Students were also asked about parental smoking, whether people smoked inside the home, and how much pocket money they received in a usual month (30 days). The Ministry of Education classification of schools by socioeconomic decile (from the low of 1 to high of 10) was used to code students for socioeconomic status (SES).¹⁹ Consent for the survey was obtained from school principals in place of parents. The Ministry of Health Auckland Ethics Committee gave permission to survey without formal referral to the Committee.

A total of 31 002 questionnaires were returned by schools with 43 696 students on their rolls (70.9% student response). Analyses were restricted to 29 271 students who were 14 and 15 years old, with known sex, ethnicity, student smoking and parental smoking status. Excluded were students of: age 13 years (n = 273), age 16 years (455), other ages (26) or unknown (128); unknown sex (91); unknown ethnicity (288); unknown student smoking status (343); and unknown parental smoking status (127).

All statistical analyses were made using SUDAAN (Release 7.5.6, 2000), which corrects standard errors and confidence intervals for any design effect from clustering of students by school.

Unconditional logistic regression and logit models for ordinal and nominal outcomes were used to estimate adjusted odds ratios, which were converted to relative risks.²⁰ In ethnic comparisons, 'other' students (n = 444) have been combined with 19 812 European students. The population attributable risk was calculated by estimating the attributable proportion for the exposed cases within each exposure category using standard methods.²¹

Results

The survey sample contained 14 930 girls (Maori 2563, Pacific Islands 948, Asian 1171, European 10 248) and 14 341 boys (Maori 2442, Pacific Islands 898, Asian 993, European 10 008). The prevalence of daily smoking varied with ethnicity. In girls there was a tenfold variation, from Maori 34.4%, Pacific 19.4%, European 11.4% to Asian 3.3%; and two- to threefold variation in boys, from Maori 19.1%, Pacific 14.1%, European 10.0% to Asian 7.3%.

There were 3977 (13.6%) students who had both parents as smokers, 7807 (26.7%) who had one smoking parent, and 17 487 (59.7%) with both parents as nonsmokers. Table 1 shows how parental smoking was related to other variables. The distribution of sex did not vary with parental smoking category ($p > 0.05$). However, students with both parents smoking were more likely to be Maori (37.2%), compared with students with one parent smoker (23.3%) and with neither parent smoking (9.7%); while the proportions of Asian and European students were each highest for students with neither parent smoking (8.7% and 76.3%, respectively), compared with the other two parental smoking categories.

Students with both parents smoking were more likely to be at a school in the lowest two deciles (15.6%) compared with students with one parent smoker (12.0%) and with neither parent smoking (6.1%). Students with both parents smoking were more likely to have smoking in the house (74.3%), be given >\$50 pocket money per month (38.5%), and to be daily smokers (31.6%), than students with one parent smoker (51.1%, 34.7% and 18.3%, respectively) and with neither parent smoking (11.3%, 28.0% and 7.2%, respectively). In contrast, the percentages of students smoking less than daily did not vary greatly with parental smoking (Table 1).

Table 1. Relationship between number of parents in the house who smoke and other variables

Variable	Parent smokes			p value
	Both (%) (n = 3977)	One (%) (n = 7807)	Neither (%) (n = 17 487)	
Sex				
Female	50.8	51.4	50.9	0.76
Male	49.2	48.6	49.1	
Ethnicity				
Maori	37.2	23.3	9.7	<0.0001
Pacific	7.3	8.1	5.3	
Asian	2.4	7.1	8.7	
European	53.1	61.5	76.3	
School SES decile				
1, 2 (low)	15.6	12.0	6.1	<0.0001
3, 4	25.2	19.8	14.2	
5, 6	26.7	25.6	22.6	
7, 8	20.5	22.3	25.7	
9, 10	12.1	20.3	31.4	
People smoke in house (% Yes)	74.3	51.1	11.3	<0.0001
Pocket money (\$/month)				
0–10	18.2	21.0	24.8	<0.0001
11–20	11.1	11.5	14.6	
21–30	10.5	10.3	10.9	
31–40	11.1	12.0	12.2	
41–50	10.6	10.5	9.6	
>50	38.5	34.7	28.0	
Student smoking behaviour				
Daily	31.6	18.3	7.2	<0.0001
Weekly	6.8	6.8	5.0	
Monthly	5.7	6.1	5.4	
Less often	13.7	15.8	14.5	
Previous smoker	23.9	26.8	23.7	
Never smoked	18.2	26.1	44.3	

Logistic regression was used to run multivariate models to investigate the effects of the variables in Table 1, plus parental smoking and student age, on the risk of being a daily smoker. Ethnicity was found to have strong interactions ($p < 0.0001$) with parental smoking, pocket money and sex, so ethnicity-specific analyses, for males and females combined, were carried out (Tables 2 to 5). Age 15 years was most strongly related to risk of daily smoking in European students (Table 5) compared with Maori, Pacific or Asian students (Tables 2 to 4). The risk of daily smoking associated with female sex, compared with male, was most increased in Maori students (relative risk (RR) = 1.88, Table 2), followed by Pacific (RR = 1.45, Table 3) and European (RR = 1.20, Table 5), but decreased in Asian students (RR = 0.43, Table 4). School SES decile was generally inversely associated with risk of daily smoking in all ethnic groups, particularly among European students where the relative risk was 50% higher in deciles 1 and 2 compared with deciles 9 and 10 (Table 5). Parental smoking, particularly by both parents, compared with neither parent smoking, showed the greatest effect on risk of daily smoking among Asian students (RR = 6.64, Table 4), a

moderate effect among European (RR = 3.11, Table 5) and Pacific (RR = 3.05, Table 3) students, and lowest effect among Maori (RR = 1.74, Table 2). The relative risk associated with living in a house where people smoked was also highest in Asian students (RR = 2.99, Table 4) compared with other ethnicities. The amount of pocket money was positively associated with risk of daily smoking in all ethnic groups, with the relative risks for the highest pocket money category (>\$50 in the last 30 days), compared with the lowest (\$0–10), being higher for Asian (RR = 3.32, Table 4) and European (RR = 2.45, Table 5) students than for Maori (RR = 1.47, Table 2) and Pacific (RR = 1.46, Table 3).

Table 2. Maori students – adjusted relative risk (95% confidence intervals) of daily smoking associated with demographic, parental and related variables

Variable	n	Daily smoking (%)	Relative risk (95% CI)*	p value
Age (years)				
14	2288	25.6	1.00	0.07
15	2717	28.1	1.10 (0.99, 1.21)	
Sex				
Male	2442	19.1	1.00	<0.0001
Female	2563	34.4	1.88 (1.68, 2.10)	
School SES decile				
1, 2 (low)	1039	29.5	1.30 (1.02, 1.63)	0.3
3, 4	1440	28.0	1.30 (1.00, 1.65)	
5, 6	1259	27.7	1.23 (0.97, 1.52)	
7, 8	766	24.9	1.18 (0.90, 1.50)	
9, 10	483	19.9	1.00	
Parental smoking				
Both	1480	37.1	1.74 (1.48, 2.01)	<0.0001
One	1821	28.5	1.46 (1.25, 1.69)	
None	1704	16.4	1.00	
Smoking in house				
Yes	2345	35.3	1.50 (1.34, 1.68)	<0.0001
No	2602	19.3	1.00	
Pocket money (\$/month)				
0–10	725	18.9	1.00	<0.0001
11–20	481	22.5	1.09 (0.86, 1.37)	
21–30	479	28.4	1.40 (1.11, 1.73)	
31–40	544	25.9	1.24 (0.98, 1.56)	
41–50	571	27.7	1.33 (1.06, 1.64)	
>50	1961	30.0	1.47 (1.24, 1.73)	

*adjusted for all other variables in the table; calculated from odds ratios estimated by logistic regression

Table 3. Pacific Island students – adjusted relative risk (95% confidence intervals) of daily smoking associated with demographic, parental and related variables

Variable	n	Daily smoking (%)	Relative risk (95% CI)*	p value
Age (years)				
14	804	16.4	1.00	0.9
15	1042	17.2	1.02 (0.83, 1.25)	
Sex				
Male	898	14.1	1.00	0.007
Female	948	19.4	1.45 (1.11, 1.87)	
School SES decile				
1, 2 (low)	759	19.5	1.38 (0.94, 1.96)	0.004
3, 4	487	14.0	0.90 (0.59, 1.35)	
5, 6	244	20.1	1.35 (0.81, 2.14)	
7, 8	187	11.8	0.80 (0.41, 1.47)	
9, 10	164	13.4	1.00	
Parental smoking				
Both	291	35.1	3.05 (2.42, 3.77)	<0.0001
One	631	18.4	1.67 (1.31, 2.10)	
None	924	10.1	1.00	
Smoking in house				
Yes	626	24.8	1.44 (1.13, 1.82)	0.004
No	1175	12.9	1.00	
Pocket money (\$/month)				
0–10	440	13.9	1.00	0.009
11–20	272	14.3	1.06 (0.64, 1.67)	
21–30	186	14.5	0.93 (0.54, 1.56)	
31–40	180	15.0	0.99 (0.56, 1.67)	
41–50	193	21.8	1.65 (1.11, 2.34)	
>50	499	21.2	1.46 (1.03, 2.03)	

*adjusted for all other variables in the table; calculated from odds ratios estimated by logistic regression

Table 4. Asian students – adjusted relative risk (95% confidence intervals) of daily smoking associated with demographic, parental and related variables

Variable	n	Daily smoking (%)	Relative risk (95% CI)*	p value
Age (years)				
14	965	4.3	1.00	0.4
15	1199	5.8	1.20 (0.76, 1.86)	
Sex				
Male	993	7.3	1.00	<0.0001
Female	1171	3.3	0.43 (0.29, 0.64)	
School SES decile				
1, 2 (low)	104	8.7	1.30 (0.61, 2.70)	0.8
3, 4	316	6.0	1.17 (0.67, 2.01)	
5, 6	345	7.3	1.43 (0.79, 2.54)	
7, 8	333	5.7	1.16 (0.61, 2.19)	
9, 10	1048	3.5	1.00	
Parental smoking				
Both	94	35.1	6.64 (3.56, 11.49)	<0.0001
One	552	6.5	1.36 (0.76, 2.37)	
None	1518	2.7	1.00	
Smoking in house				
Yes	425	14.6	2.99 (1.72, 5.05)	0.0002
No	1713	2.7	1.00	
Pocket money (\$/month)				
0–10	616	2.4	1.00	<0.0001
11–20	287	1.1	0.42 (0.09, 1.88)	
21–30	185	1.1	0.42 (0.08, 2.00)	
31–40	210	3.8	1.24 (0.52, 2.94)	
41–50	189	4.2	1.58 (0.61, 3.98)	
>50	631	11.3	3.32 (1.90, 5.65)	

*adjusted for all other variables in the table; calculated from odds ratios estimated by logistic regression

Table 5. European students – adjusted relative risk (95% confidence intervals) of daily smoking associated with demographic, parental and related variables

Variable	n	Daily smoking (%)	Relative risk (95% CI)*	p value
Age (years)				
14	9587	9.4	1.00	<0.0001
15	10 669	11.9	1.25 (1.14, 1.37)	
Sex				
Male	10 008	10.0	1.00	0.002
Female	10 248	11.4	1.20 (1.08, 1.34)	
School SES decile				
1, 2 (low)	705	15.9	1.50 (1.08, 2.03)	0.04
3, 4	2753	13.2	1.17 (0.96, 1.42)	
5, 6	5124	12.5	1.21 (1.01, 1.44)	
7, 8	5716	9.6	1.03 (0.84, 1.24)	
9, 10	5811	8.5	1.00	
Parental smoking				
Both	2112	27.2	3.11 (2.72, 3.53)	<0.0001
One	4803	15.8	1.91 (1.70, 2.15)	
None	13 341	6.3	1.00	
Smoking in house				
Yes	5416	20.1	1.65 (1.47, 1.85)	<0.0001
No	14 581	7.3	1.00	
Pocket money (\$/month)				
0–10	4702	6.5	1.00	<0.0001
11–20	2722	7.4	1.19 (0.99, 1.44)	
21–30	2162	7.9	1.24 (1.04, 1.44)	
31–40	2451	10.0	1.56 (1.31, 1.84)	
41–50	1880	11.0	1.73 (1.44, 2.06)	
>50	5736	16.7	2.45 (2.14, 2.78)	

*adjusted for all other variables in the table; calculated from odds ratios estimated by logistic regression

The data in Tables 2 to 5 show that the relative risks of daily smoking by students associated with parental smoking, smoking in the house and amount of pocket money remain significantly different from 1.00 when adjusting for each other, and therefore they have separate effects on the risk of daily smoking. Of particular note, the effect of parental smoking remains independent of the adolescent smoking risk associated with smoking in the home.

The factors associated with the source of cigarettes were examined in student smokers (Table 6). In the questionnaire they were asked ‘Where do you get your cigarettes?’ and could choose one or more of the following options: ‘I buy them myself’, ‘From a family member’, and ‘From a friend or someone else’. Smokers were categorised into three groups according to the following priority system: the first group included any students who indicated that they bought cigarettes for themselves (n = 2719), the second included any remaining students who recorded that they obtained cigarettes from a family member (n = 1759), and the third included those receiving cigarettes from a friend or someone else (n = 6884). Smokers who did not answer any of these options (n = 211) were excluded from these analyses.

Table 6. Adjusted relative risk of buying cigarettes, or getting them from a family member, compared with getting them from a friend or someone else, among smokers

Variable	n	Buy themselves		Family member		Friend/ someone else
		Yes (%)	Relative risk (95% CI)*	Yes (%)	Relative risk (95% CI)*	Yes (%)
Sex						
Male	4984	24.3	1.00	14.8	1.00	60.9
Female	6378	23.6	0.98 (0.90, 1.07)	16.1	1.04 (0.95, 1.13)	60.3
Age (years)						
14	5121	21.8	1.00	15.4	1.00	62.9
15	6241	25.7	1.19 (1.10, 1.27)	15.6	1.06 (0.96, 1.17)	58.7
Ethnicity						
Maori	2616	29.6	1.37 (1.24, 1.50)	22.1	1.37 (1.22, 1.53)	48.4
Pacific	724	24.5	1.19 (1.02, 1.39)	15.8	0.91 (0.70, 1.17)	59.8
Asian	341	32.8	1.44 (1.18, 1.74)	13.8	1.28 (0.95, 1.71)	53.4
European	7681	21.6	1.00	13.3	1.00	65.2
SES decile						
1, 2 (low)	1161	24.6	0.77 (0.63, 0.99)	22.2	1.49 (1.22, 1.81)	53.1
3, 4	1960	24.4	0.80 (0.67, 0.92)	20.0	1.36 (1.14, 1.61)	55.6
5, 6	2842	23.7	0.80 (0.69, 0.92)	16.5	1.26 (1.06, 1.49)	59.8
7, 8	2680	20.9	0.73 (0.62, 0.86)	13.8	1.10 (0.94, 1.29)	65.3
9, 10	2642	26.7	1.00	10.0	1.00	63.4
Parents smoke						
Both	2264	30.9	1.63 (1.47, 1.81)	26.3	2.69 (2.34, 3.08)	42.8
One	3607	25.6	1.29 (1.18, 1.40)	19.2	1.98 (1.75, 2.24)	55.2
None	5491	20.0	1.00	8.6	1.00	71.4
Smoking in house						
Yes	4561	28.7	1.35 (1.25, 1.46)	22.3	1.55 (1.37, 1.75)	49.0
No	6667	20.6	1.00	10.8	1.00	68.6
Pocket money (\$/month)						
0–10	1871	17.5	1.00	15.5	1.00	67.0
11–20	1189	15.1	0.83 (0.66, 1.02)	14.4	0.90 (0.73, 1.08)	70.6
21–30	1143	19.6	1.10 (0.93, 1.28)	14.9	0.96 (0.81, 1.14)	65.5
31–40	1287	21.0	1.21 (1.05, 1.39)	16.6	1.12 (0.93, 1.30)	62.5
41–50	1191	23.2	1.29 (1.11, 1.49)	16.2	1.05 (0.90, 1.23)	60.6
>50	4256	31.1	1.74 (1.57, 1.92)	15.5	1.13 (0.99, 1.29)	53.4

*adjusted for all other variables in the table; calculated from odds ratios estimated by logistic regression

Students who bought cigarettes were compared with those who received them from a friend or someone else (Table 6). In this table, row percentages for the sources of cigarettes – buying themselves, from a family member, or from a friend or someone else – are shown for each exposure level. Unadjusted relative risks of daily smoking can be calculated from the ratio of percentages; for example, the unadjusted relative risk of 15-year-olds buying cigarettes, compared with the reference category 14 years, is 25.7% / 21.8% = 1.18. However, all relative risks shown in Table 6 are adjusted for all other variables in the table. Fifteen-year-old students were more likely to purchase cigarettes than 14-year-olds; as were Maori, Pacific and Asian smokers compared

with Europeans. Students at low SES decile schools were less likely to purchase than those at the schools in the highest two deciles (9 and 10). There was a dose-response relationship between the number of smoking parents and the risk of students purchasing their own cigarettes, with students of both parents smoking being 63% more likely to do so than students of non-smoking parents. The amount of pocket money was also positively associated with the risk of purchasing cigarettes, that risk being 74% higher for students receiving >\$50 per month, compared with students receiving \leq \$10.

The risk of student smokers receiving cigarettes from a family member, when compared with those who received them from a friend or someone else, was higher for Maori compared with all three other ethnic groups, highest in low SES decile schools, and two and a half times higher if both parents smoked than if neither parent smoked. However, the amount of pocket money was unrelated to the risk of receiving cigarettes from family (Table 6).

Collectively, the analyses in Table 6 indicate that amount of pocket money is a risk factor for the self-purchasing of cigarettes, and that self-purchasing by student smokers, or receiving cigarettes from family members, is more common in families where both parents smoke. The public health significance of the combined effect of parental smoking, the related parental behaviours of pocket money amount and the decision about whether people smoke in the house, were examined in Table 7 by calculating ethnicity-specific attributable risks for exposure to these three variables, either separately or combined. The cut-off point for high pocket money was arbitrarily set at >\$20 per month, equivalent to >\$5 per week. The proportion of students exposed to one or more of these three risk factors was highest for Maori students (91%), followed by Pacific (80%), European (76%) and Asian (69%). However, the relative risk associated with this combination variable was highest for Asian students (RR = 14.74), so that the attributable risk was highest for Asian students (91%), followed by European (67%), Maori (68%) and Pacific (55%). For all ethnic groups combined, 67% of daily smoking could be explained by combined exposure to one or more of the following factors: parent smoking, pocket money >\$5 per week, and smoking in the house.

Table 8 contains relative risks for daily smoking in Maori, Pacific and Asian students, compared with European, which show the contribution to the increased smoking risk in Maori and Pacific students due to ethnic differences in exposure to various risk factors. In comparison with the relative risk of daily smoking adjusting for age and sex only, further adjusting for parental smoking decreased the increased risk of daily smoking in Maori students by about 40% (change in RR from 2.51 to 1.89). The increased risk in Pacific students decreased by one third (change in RR from 1.56 to 1.36). Additional adjustment for parental smoking had little effect on the relative risk for daily smoking in Asian students compared with European (from 0.47 to 0.51).

Additional adjustment for school SES decile also decreased relative risks for daily smoking, compared with Europeans, in Maori from 2.51 to 2.26, and in Pacific students from 1.56 to 1.31. Thus, ethnic differences in parental smoking and school SES decile both partly explain the increased risk of daily smoking in Maori and Pacific students compared with European.

Table 7. Adjusted relative risk of daily smoking by 4th form students associated with exposure to: parental smoking and/or receipt of pocket money >\$20 per month and/or smoking in the house, by ethnicity

Ethnicity	Exposure to one or more factors	Daily smoking			Relative risk (95% CI)*	Attributable smokers† (%)
		Yes n (%)	No	Total		
Maori	Yes	1216 (28.3)	3074	4290	3.32 (2.44, 4.37)	68
	No	35 (8.5)	379	414	1.00	
Pacific	Yes	271 (19.5)	1118	1389	2.54 (1.75, 3.58)	55
	No	26 (7.7)	311	337	1.00	
Asian	Yes	102 (7.0)	1352	1454	14.74 (5.16, 38.55)	91
	No	3 (0.5)	636	639	1.00	
European/other	Yes	1908 (12.9)	12 918	14 826	3.62 (3.13, 4.18)	67
	No	162 (3.5)	4413	4575	1.00	

*adjusted for age and sex, calculated from odds ratios estimated by logistic regression; †percentage of attributable smokers in each ethnic group

Table 8. Adjusted relative risks of daily smoking in Maori, Pacific and Asian 4th form students, compared with European

Variables added to age and sex	Relative risk (95%CI)*		
	Maori	Pacific	Asian
Age and sex only	2.51 (2.33, 2.50)	1.56 (1.37, 1.78)	0.47 (0.38, 0.58)
Parental smoking	1.89 (1.73, 2.04)	1.36 (1.18, 1.54)	0.51 (0.42, 0.62)
Smoking in house	2.19 (2.03, 2.36)	1.48 (1.29, 1.68)	0.50 (0.41, 0.62)
Pocket money	2.34 (2.16, 2.53)	1.62 (1.42, 1.86)	0.47 (0.38, 0.58)
School SES decile	2.26 (2.09, 2.45)	1.31 (1.14, 1.50)	0.51 (0.40, 0.60)

*calculated from logistic regression odds ratios

Discussion

The results of this study indicate that parental behaviours, including smoking, the amount of pocket money provided to children, and whether people smoke in the home, explain a significant proportion (67%) of daily smoking by adolescents, and are primary determinants of the elevated smoking prevalences in Maori and Pacific students. The dose-response associations with daily adolescent smoking observed for parental smoking and amount of pocket money (Tables 2 to 5) support the possibility that these associations are causal.

Our observation of an association between adolescent and parental smoking is consistent with previous research, both international and in New Zealand.^{3-7,9-11} A novel finding from our study is the variation in parental effect between ethnic groups, with the strength of the effect, which was highest in Asian students and lowest in Maori, being inversely related to the prevalence of student smoking in the subgroup (Tables 2 to 5). This finding is consistent with a recent publication from China that reported parental smoking was the strongest predictor of teenage smoking in a student sample where only 0.3% were regular smokers (weekly or more often).⁵ Our observation that parental smoking is most strongly associated with daily smoking,

rather than with less frequent smoking (Table 1), may explain why the Dunedin cohort study, which defined children as smokers if they had smoked at any time in the last two years, failed to report an independent effect from parental smoking.¹²

This study has also shown that parental smoking behaviour is associated with other factors that increase the risk of adolescent smoking. First, parents who smoke are more likely to give high amounts of pocket money (>\$50 per month) to their children (Table 1), while the amount of pocket money is a risk factor for adolescent smoking in all four ethnic groups (Tables 2 to 5). The latter finding confirms previous research on the positive association between amount of pocket money and risk of adolescent smoking.^{7,8,15,22,23} Second, parents who smoke are more likely to allow smoking in the house, which is an independent risk factor for daily smoking (Tables 1 to 5). Third, parents who smoke are more likely to provide cigarettes to their children or have children who purchase their own cigarettes (Table 6). A recent, US, qualitative study of 68 adolescent smokers provides insight into how parental smoking increases the risk of adolescent smoking.¹⁶ In this study parents were found to be the primary source of cigarettes for children at the onset of smoking, since children often started smoking using half-smoked cigarettes left in ashtrays by relatives, or by stealing cigarettes from their parents; while the practice of students spending school lunch money, supplied by parents, on purchasing cigarettes confirmed the importance of regular access to money in increasing the risk of smoking.

Parental smoking was identified in this study as a major factor explaining the increased smoking risk among Maori and Pacific adolescents. This finding is consistent with an earlier report that identification with Maori culture, which typically is provided to children by parents, was a risk factor for smoking among Maori students.²⁴ Ethnic differences in socioeconomic status also contributed to the increased risk of daily smoking in both Maori and Pacific students.

The threats to the validity of this study include its cross-sectional design, which cannot distinguish cause and effect. However, while it is possible that adolescent smoking behaviour could determine the amount of pocket money received, rather than the other way around, we can be certain that parental smoking precedes adolescent smoking in all or most cases. Any error in the measurement of student smoking status by our questionnaire is likely to have been non-differential, given the cross-sectional study design, in which case we may have underestimated relative risks associated with daily smoking. Further, measurement error is likely to have been contained in our measure of parental smoking, which did not allow for single-parent and extended-family households. Another study weakness is our inability to control for the effects from students peers, which were not recorded in the questionnaire and represent a further limitation of the study. Peer smoking could be a confounder of parental smoking only if they were associated with each other. Previous New Zealand studies have examined the separate effects of parental and peer smoking on adolescent smoking,⁹ but only the Dunedin and Christchurch cohort studies have controlled for the effect of peer smoking.^{12,13} Further research is required to clarify this in the New Zealand context, given the important public health implications of our findings.

The very high proportion of daily adolescent smoking explained by parental smoking and related behaviours suggests that parents have a central role in the prevention of adolescent smoking. Despite the conflicting evidence about the relative importance of peer and parental influences on smoking initiation in adolescence, preventive efforts

against adolescent smoking have focused on minimising the harm caused by fellow students, while the potential role of parents has been neglected.²⁵ However, our findings suggest efforts that target the role of parents should be pursued. These could include health promotion strategies, such as television campaigns that advise parents about the possible benefits of banning smoking in the home.²⁵ The data in Table 1 indicate that in two thirds of homes that allow smoking indoors, one or both parents are nonsmokers. Thus, any media campaign against smoking inside homes is likely to be well received so that some reduction should be achievable. Other health promotion strategies include advising parents not to provide cigarettes to their children, and limiting pocket money, which, if it is going up in smoke, will find favour with most parents, as few wish to pay for their children to smoke.¹⁵ In addition, efforts to support parents in attempts to stop smoking, such as the Quit campaigns, should be strengthened.⁴

Author information: Robert Scragg, Associate Professor in Epidemiology, School of Population Health, University of Auckland; Murray Laugesen, Public Health Physician, Health New Zealand; Elizabeth Robinson, Biostatistician, School of Population Health, University of Auckland, Auckland.

Acknowledgements: The survey was carried out by Action on Smoking and Health (ASH). The New Zealand Ministry of Health provided funds. We thank the students and staff from the participating schools.

Correspondence: Associate Professor Robert Scragg, Epidemiology and Biostatistics Section, School of Population Health, University of Auckland, Private Bag 92019, Auckland. Fax: (09) 373 7624; email: r.scragg@auckland.ac.nz

References:

1. Bauman KE, Carver K, Gleiter K. Trends in parent and friend influence during adolescence: the case of adolescent cigarette smoking. *Addict Behav* 2001;26:349–61.
2. Conrad KM, Flay BR, Hill D. Why children start smoking cigarettes: predictors of onset. *Br J Addict* 1992;87:1711–24.
3. Oygard L, Klepp KI, Tell GS, Vellar OD. Parental and peer influences on smoking among young adults: ten-year follow-up of the Oslo youth study participants. *Addiction* 1995;90:561–9.
4. Farkas AJ, Distefan JM, Choi WS, Gilpin EA, Pierce JP. Does parental smoking cessation discourage adolescent smoking? *Prev Med* 1999;28:213–8.
5. Hesketh T, Ding QJ, Tomkins A. Smoking among youths in China. *Am J Publ Health* 2001;10:1653–5.
6. Hover SJ, Gaffney LR. Factors associated with smoking behaviour in adolescent girls. *Addict Behav* 1988;13:139–45.
7. O'Connell DL, Alexander HM, Dobson AJ, et al. Cigarette smoking and drug use in school children. II. Factors associated with smoking. *Int J Epidemiol* 1981;10:223–31.
8. Rissel C, McLellan L, Bauman A. Factors associated with delayed tobacco uptake among Vietnamese/Asian and Arabic youth in Sydney, NSW. *Aust NZ J Public Health* 2000;24:22–8.
9. Beaglehole R, Eyles E, Harding W. Cigarette smoking habits, attitudes and associated social factors in adolescents. *NZ Med J* 1978;87:239–42.
10. Shaw RA, Crane J, O'Donnell TV. The changes in smoking habits in a rural adolescent population, 1975–89. *NZ Med J* 1991;104:40–3.

11. Ford DJ, Scragg R, Weir J, Gaiser J. A national survey of cigarette smoking in fourth-form school children in New Zealand. *NZ Med J* 1995;108:454–7.
12. Stanton WR, Silva PA. Children's exposure to smoking. *Int J Epidemiol* 1991;20:933–7.
13. Fergusson DM, Lynskey MT, Horwood LJ. The role of peer affiliations, social, family and individual factors in continuities in cigarette smoking between childhood and adolescence. *Addiction* 1995;90:647–59.
14. Stanhope JM, Prior IA. Smoking behaviour and respiratory health in a teenage sample: the Rotorua Lakes Study, 1. *NZ Med J* 1975;82:71–6.
15. Scragg R, Laugesen M, Robinson E. Cigarette smoking, pocket money and socioeconomic status: results from a national survey of 4th form students in 2000. *NZ Med J* 2002;115(1158). URL: <http://www.nzma.org.nz/journal/115-1158/108/>
16. DiFranza JR, Coleman M. Sources of tobacco for youths in communities with strong enforcement of youth access laws. *Tob Control* 2001;10:323–8.
17. Laugesen M, Scragg R. Trends in cigarette smoking in fourth-form students in New Zealand, 1992–1997. *NZ Med J* 1999;112:308–11.
18. Scragg R, Laugesen M. Cigarette smoking declining in girls but not in boys. *NZ Public Health Report* 2001;8:33–6.
19. Data Management and Analysis Section. Ministry of Education socioeconomic indicator for schools. Wellington: Ministry of Education; 1997.
20. Zhang J, Yu KF. What's the relative risk? A method for correcting the odds ratio in cohort studies of common outcomes. *JAMA* 1998;280:1690–1.
21. Rockhill B, Newman B, Weinberg C. Use and misuse of population attributable fractions. *Am J Public Health* 1998;88:15–9.
22. Villalbi Hereter JR, Nebot Adell M, Comin Bertran E, Murillo Fort C. Early use of tobacco by students. *Rev Sanid Hig Publica (Madr)* 1990;64:613–23.
23. Grizeau D, Baudier F, Allemand H. Opinions and behaviours of French adolescents confronted with tobacco in 1995. *Arch Pediatr* 1997;4:1079–86.
24. Mitchell DR. A comparison of high school students' smoking behaviours in 1968 and 1981. *NZ Med J* 1983;96:534–6.
25. Proescholdbell RJ, Chassin L, MacKinnon DP. Home smoking restrictions and adolescent smoking. *Nicotine Tob Res* 2000;2:159–67.