

# Influence of smoking by family and best friend on adolescent tobacco smoking: results from the 2002 New Zealand national survey of Year 10 students

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The causes of smoking initiation during adolescence, when most people start smoking, is an important public health issue because of the very high attributable mortality and morbidity caused by tobacco smoking. Primary determinants of adolescent smoking are peer pressure from friends who smoke and the effect of parental smoking. Epidemiological studies have concluded that peer effects are much stronger than parental. For example, a review of studies since 1980 found that the odds ratios of adolescent smoking associated with parental smoking were typically lower than 2.<sup>1</sup>

Reasons for the weak parental effect have been proposed. It is possible that parental smoking is not predictive of adolescent smoking or, alternatively, inconsistent findings can be attributed to other factors.<sup>2</sup> One explanation for the latter is that many studies have been cross-sectional and therefore have not studied the period when adolescent smoking is initiated.<sup>1</sup> A Norwegian study found that peer smoking was strongly associated with regular adolescent smoking in cross-sectional analyses, while parental smoking predicted the development of regular adolescent smoking in longitudinal analyses.<sup>3</sup> Many studies have examined a limited range of adolescent smoking behaviours and it is possible that parental smoking is more strongly associated with

regular tobacco use by adolescents rather than with experimentation.<sup>4,5</sup> A further explanation for the inconsistent results observed for parental smoking is that many studies have had small sample sizes and, given the low prevalence of tobacco smoking in adolescence, in many studies the small number of smokers has limited the likelihood of detecting significant associations between parental and adolescent smoking. For example, in the review by Avenevoli et al. about half of the studies had sample sizes of less than 1,000 students.<sup>1</sup>

The direct effect of parental smoking on adolescent smoking has been examined in several previous Australian studies.<sup>6-13</sup> Within New Zealand, there have been studies in Wellington,<sup>14</sup> Wairoa,<sup>15</sup> Dunedin,<sup>16</sup> Christchurch,<sup>17</sup> and a national sample.<sup>18</sup> Those studies that have examined both parental and peer effects have generally found that the latter are stronger.<sup>7-12,14,16,17</sup>

More recently, we have reported that parental smoking is a primary determinant of adolescent smoking in a 2001 national survey of New Zealand Year 10 students and that parental smoking itself, in combination with other factors under parental control (e.g. provision of pocket money, allowance of smoking in the home), explains about two-thirds of adolescent smoking.<sup>19</sup>

Other studies have also shown that smoking in the home<sup>20</sup> and increased

## Abstract

**Objective:** To compare the relative importance on adolescent smoking of the influence from parental smoking and peer smoking.

**Method:** National New Zealand cross-sectional survey of 14,936 female and 14,349 male Year 10 students (aged 14 and 15 years) who answered an anonymous self-administered questionnaire in November 2002.

**Results:** Adolescents with both parents smoking had the highest smoking risk compared with those with one or neither parent smoking. The relative risk of adolescent daily smoking associated with both parents smoking, compared with neither, varied with ethnicity, being 2.34 (95% CI 2.05-2.67) in Maori, 2.87 (2.21-3.73) in Pacific Islanders, 11.37 (7.87-16.42) in Asian, and 4.92 (4.35-5.55) in European/Other students, adjusting for age and sex. These values were lower than the adjusted relative risks of daily adolescent smoking associated with having a best friend who smoked: 4.18 (3.59-4.88) in Maori, 5.19 (3.98-6.76) in Pacific Island, 14.35 (9.48-21.71) in Asian and 10.18 (9.07-11.43) in European/Other students. Adolescent smoking was also positively associated with pocket money amount and living in a home where smoking was allowed, both parental-related factors. Combined exposure to one or more of the following factors – parental smoking, pocket money >\$5 per week and smoking in the house – explained 64% of daily adolescent smoking, very similar to the 67% attributable to best friend smoking.

**Conclusion:** Parental behaviour is a key determinant of smoking by New Zealand adolescents and explains a similar proportion of daily adolescent smoking to that by peer smoking.

**Key words:** Adolescent, family, parents, peer group, tobacco.

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amounts of pocket money<sup>7,13,21-24</sup> are associated with increased risk of adolescent smoking. In this paper we report further results from a large national survey carried out in 2002 with a multi-ethnic sample, where we compare the relative importance on adolescent smoking of the influence of parental smoking and peer smoking.

## Methods

The same methods were used in the current report as in previous national surveys of Year 10 students, first carried out in November 1992 and then yearly during 1997-2001.<sup>18,19,21,25,26</sup> All New Zealand schools with Year 10 students (n=459) were invited, and 309 agreed to participate in a further survey carried out in November 2002 (school response rate=67.3%).

Students answered an anonymous two-page questionnaire on age, sex, ethnicity (self-assigned) and smoking behaviour. The questionnaire asked whether the student had ever smoked a cigarette (even just a few puffs). Those who answered 'no' were classified as never smokers. Those who answered 'yes' were queried about the frequency of their current smoking (at least once a day, at least once a week, at least once a month, less often,

never). Students were asked whether any of the following people smoked: mother, father, older brother or sister, best friend. They were also asked whether people smoked inside their house, and how much pocket money they received in a usual month (30 days). The Ministry of Education classification of schools by socio-economic decile (from the low of 1 to high of 10) was used to code students for socio-economic status (SES).<sup>27</sup> Consent for participation of students in 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 its committee.

A total of 30,972 questionnaires were returned by schools from 43,425 students on school rolls (71.3% student response). Analyses were restricted to 28,689 students who were 14 and 15 years old with known sex, ethnicity, student smoking and parental smoking status, after excluding the following students: age 13 years (n=209), 16 years (504), other ages (5) or unknown age (158); unknown sex (90); unknown ethnicity (414); unknown student smoking status (307); and unknown smoking status by parents or best friend (n=596). In ethnic comparisons, because students could choose more than one ethnic group, a priority

**Table 1: Relationship between number of parents who smoke, and whether best friend smokes, with other variables.**

Variable	Parent smokes				<i>p</i> value	Best friend smokes		
	Both	Mother	Father	Neither		Yes	No	<i>p</i> value
<b>n</b>	<b>(3,971)</b>	<b>(3,504)</b>	<b>(3,827)</b>	<b>(17,387)</b>		<b>(8,668)</b>	<b>(20,021)</b>	
<b>Age (%)</b>								
14 years	45.6	47.5	45.5	47.2	0.10	44.8	47.7	<0.0001
15 years	54.4	52.5	54.5	52.8		55.2	52.3	
<b>Sex (%)</b>								
Female	52.4	52.0	50.9	49.9	0.43	57.9	47.5	<0.0001
Male	47.6	48.0	49.2	50.1		42.1	52.5	
<b>Ethnicity (%)</b>								
Maori	36.1	29.7	17.1	9.8	<0.0001	25.8	13.0	<0.0001
Pacific	7.0	6.3	9.0	5.8		7.0	6.2	
Asian	2.4	0.9	13.6	9.1		4.3	9.3	
European	54.4	63.1	60.2	75.4		62.8	71.6	
<b>People smoke in house (% Yes)</b>	73.2	58.1	41.7	7.9	<0.0001	39.9	22.0	<0.0001
<b>Older sibling smokes (% Yes)</b>	46.0	32.3	27.7	17.2	<0.0001	40.0	17.7	<0.0001
<b>Best friend smokes (% Yes)</b>	54.1	37.1	29.6	23.5	<0.0001	–	–	–
<b>Pocket money per month (%)</b>								
<\$10	17.8	19.6	21.8	25.4	<0.0001	17.3	25.7	<0.0001
\$11-20	11.5	11.8	12.7	14.9		11.6	14.7	
\$21-30	9.6	10.4	10.0	10.6		9.6	10.7	
\$31-40	11.1	11.5	11.4	11.6		11.0	11.7	
\$41-50	10.3	11.4	9.8	9.3		10.9	9.2	
>\$50	39.8	35.3	34.3	28.3		39.5	28.1	
<b>Student smoking behaviour (%)</b>								
Daily	31.4	20.0	13.3	6.5	<0.0001	32.8	3.8	<0.0001
Weekly	5.8	5.9	5.6	4.0		10.5	2.2	
Monthly	4.9	6.2	5.6	4.5		8.6	3.3	
Less often	11.3	12.3	12.3	10.8		15.3	9.5	
Previous smoker	27.7	32.3	29.5	27.6		20.3	32.0	
Never smoked	18.9	23.3	33.7	46.5		12.5	49.3	

system was used to classify any student choosing Maori as such, then any Pacific student as such, followed by any Asian student as such. For the remainder, 'Other' students (n=363) have been combined with 19,416 European students.

All statistical analyses were made using SAS callable SUDAAN (Release 9.0.0, Research Triangle Park, NC), which corrects standard errors and confidence intervals for any design effect from clustering of students by school. The PROC CROSSTAB procedure was used to calculate adjusted relative risks. The PROC MULTLOG procedure was used for unconditional logistic regression to estimate adjusted odds ratios, which were converted to relative risks.<sup>28</sup> The population-attributable risk was calculated by estimating the attributable proportion for the exposed cases within each exposure category using standard methods.<sup>29</sup>

## Results

There were 14,522 girls (Maori 2,619, Pacific Islands 859, Asian 1,025, European 10,019) and 14,167 boys (Maori 2,214, Pacific Islands 993, Asian 1,200, European 9,760) in the survey sample. Students from low SES decile schools were under-represented in the sample, with 9.4% of students from deciles 1-2, 16.9% from deciles 3-4, 22.8% from deciles 5-6, 27.0% from deciles 7-8, and 24.0% from deciles 9-10. The prevalence of smoking daily varied with ethnicity and sex. There was a nine-fold variation in daily smoking prevalence among girls, from Maori 34.3%, Pacific 17.6%, European 10.8% to Asian 3.9%; and two-fold variation among boys from Maori 16.8%, Pacific 10.8%, European 8.6% to Asian 7.5%.

There were 3,971 (13.8%) students who reported that both

**Table 2: Relative risk of daily smoking by 2002 Year 10 students associated with smoking by parents, older sibling and best friend, adjusted for age and sex, by ethnicity.**

Ethnicity	Smoking by family and best friend	Daily smoking		Relative risk (95% CI)
		Yes	No	
<b>Parents smoke</b>				
Maori	Both	545 (38.0%) <sup>a</sup>	889	2.34 (2.05-2.67)
	Mother only	284 (27.3%)	757	1.66 (1.42-1.96)
	Father only	172 (26.2%)	484	1.63 (1.39-1.91)
	Neither	272 (16.0%)	1,430	1.00
Pacific	Both	76 (27.3%)	202	2.87 (2.21- 3.73)
	Mother only	37 (16.7%)	184	1.70 (1.19-2.43)
	Father only	49 (14.2%)	296	1.46 (1.08-1.99)
	Neither	97 (9.6%)	911	1.00
Asian	Both	43 (44.3%)	54	11.37 (7.87-16.42)
	Mother only	8 (25.0%)	24	8.39 (4.01-17.54)
	Father only	23 (4.4%)	498	1.21 (0.80-1.84)
	Neither	56 (3.6%)	1,519	1.00
European/Other	Both	584 (27.0%)	1,578	4.92 (4.35-5.55)
	Mother only	373 (16.9%)	1,837	3.10 (2.73-3.52)
	Father only	266 (11.5%)	2,039	2.12 (1.83-2.45)
	Neither	711 (5.4%)	12,391	1.00
<b>Older sibling smokes</b>				
Maori	Yes	704 (36.4%)	1,229	1.78 (1.60-1.99)
	No	569 (19.6%)	2,331	1.00
Pacific	Yes	150 (24.3%)	468	2.67 (2.12-3.36)
	No	109 (8.8%)	1,125	1.00
Asian	Yes	73 (30.0%)	170	10.14 (7.29-14.10)
	No	57 (2.9%)	1,925	1.00
European/Other	Yes	948 (22.5%)	3,262	3.47 (3.17-3.80)
	No	986 (6.3%)	14,583	1.00
<b>Best friend smokes</b>				
Maori	Yes	1,017 (45.4%)	1,223	4.18 (3.59-4.88)
	No	256 (9.9%)	2,337	1.00
Pacific	Yes	188 (30.8%)	422	5.19 (3.98-6.76)
	No	71 (5.7%)	1,171	1.00
Asian	Yes	98 (26.4%)	273	14.35 (9.48-21.71)
	No	32 (1.7%)	1,822	1.00
European/Other	Yes	1,541 (28.3%)	3,906	10.18 (9.07-11.43)
	No	393 (2.7%)	13,939	1.00

Note:

(a) Row per cent.

parents were smokers, 3,504 (12.2%) that only their mother smoked, 3,827 (13.3%) that only their father smoked and 17,387 (60.6%) that neither parent were smokers; 8,668 (30.2%) students had a best friend who smoked. Table 1 shows how parental smoking and having a best friend who smoked were related to other variables. Parental smoking was unrelated to student age ( $p=0.10$ ) or sex ( $p=0.43$ ). Students with both parents smoking were more likely to be Maori (and less likely to be Asian or European), more likely to live in a house where there was smoking inside, have an older sibling who smoked and a best friend who smoked, have high amounts of pocket money (>\$50/month), and be a daily smoker, compared with students with one parent smoking or neither parent smoking. Except for the amount of pocket money, similar differences as above occurred when comparing students who reported only their mother smoked with those who reported only their father smoked (all  $p$  values <0.001).

The percentages of students smoking less than daily (i.e. weekly, monthly or less often) did not vary greatly with parental smoking (see Table 1). In contrast, the prevalence of daily smoking by students was highest for those with both parents being smokers (31.4%) and lowest for those with neither parent smoking (6.5%).

The variables associated with parental smoking were also related to having a best friend who smoked, except for the following differences. In contrast with parental smoking, where there was no association with age or smoking less than daily, students who had a best friend who smoked were more likely to be aged 15 years than 14 years, and were more likely to smoke less than daily (i.e. weekly, monthly and less often) (see Table 1).

The relative risks of daily student smoking associated with family and best-friend smoking behaviours are shown in Table 2, adjusted for age and sex. Ethnic-specific results are shown because of interactions with ethnicity. For parental smoking, there was a general pattern for the relative risk of daily student smoking to be increased with separate exposure to smoking by the father and by the mother, and for the combined effect of these exposures (i.e. from both parents) to be additive; except for the relative risk associated with the father only smoking among Asian students (relative risk (RR)=1.21), which was not significant ( $p=0.38$ ). Maternal smoking was strongest among Asian students (RR=8.39), and stronger than paternal smoking in European students (RR=3.10 versus 2.12); otherwise, the effects of maternal and paternal smoking were similar among Maori and Pacific students.

**Table 3: Relative risk of daily smoking by 2002 Year 10 students associated with smoking in the house, amount of pocket money and both variables combined with parental smoking, adjusted for age and sex, by ethnicity.**

Ethnicity	Risk factor	Daily smoking		Relative risk (95% CI)
		Yes	No	
<b>Smoking in house</b>				
Maori	Yes	689 (33.7%) <sup>a</sup>	1,353	1.69 (1.53-1.88)
	No	509 (19.9%)	2,055	1.00
Pacific	Yes	113 (23.2%)	374	2.25 (1.78-2.83)
	No	132 (10.2%)	1,156	1.00
Asian	Yes	67 (15.1%)	377	4.50 (3.19-6.34)
	No	57 (3.3%)	1,675	1.00
European/Other	Yes	974 (21.1%)	3,633	3.50 (3.19-3.83)
	No	877 (6.0%)	13,686	1.00
<b>Pocket money &gt;\$20/month</b>				
Maori	Yes	1,004 (28.6%)	2,506	1.46 (1.29-1.64)
	No	232 (19.5%)	961	1.00
Pacific	Yes	182 (16.6%)	912	1.82 (1.36-2.43)
	No	67 (9.5%)	637	1.00
Asian	Yes	99 (7.6%)	1,198	2.40 (1.52-3.80)
	No	27 (3.0%)	861	1.00
European/Other	Yes	1,418 (12.0%)	10,453	1.93 (1.76-2.12)
	No	469 (6.2%)	7,139	1.00
<b>Parents smoke and/or pocket money &gt;\$20 a month and/or smoking in house</b>				
Maori	Yes	1,121 (27.6%)	2,948	2.47 (1.89-3.22)
	No	47 (11.0%)	379	1.00
Pacific	Yes	221 (16.1%)	1,151	3.64 (2.22-5.98)
	No	16 (4.6%)	336	1.00
Asian	Yes	110 (7.3%)	1,408	3.09 (1.51-6.33)
	No	10 (1.6%)	612	1.00
European/Other	Yes	1,660 (11.9%)	12,347	3.93 (3.34-4.63)
	No	146 (3.0%)	4,730	1.00

Note:

(a) Row per cent.

There were no differences between sexes in the gender-specific associations of maternal and paternal smoking with adolescent smoking for the same sex (data not shown).

The relative risk of daily smoking associated with having an older smoking sibling, adjusted for age and sex, was significantly increased in all ethnic groups, but strongest in Asian students (RR=10.14), and weakest in Maori (RR=1.78). Having a best friend who smoked had a very strong effect on daily smoking, with the relative risk varying from 14.35 in Asian and 10.18 in European students, to 5.19 in Pacific and 4.18 in Maori students (see Table 2).

The associations that variables measured in the questionnaire, which are influenced by parental decisions, have with daily smoking by students are shown in Table 3, adjusted for age and sex. Smoking in the home was associated with a significantly increased relative risk of student daily smoking, particularly among Asian and European students. In all ethnic groups, students who received more than \$20 pocket money per month also had an increased risk of daily smoking compared with students who received less, with the relative risks being strongest in Asian students. Combined exposure to either or both of the above two variables plus parental smoking was associated with a significantly increased risk of daily smoking in all ethnic groups (see Table 3).

Logistic regression analyses were carried out with models that included all the variables in Tables 2 and 3 to determine whether they had independent associations with daily smoking (see Table 4). In each ethnic group, the above variables were still significantly associated with daily smoking, except for the relative risks associated with paternal smoking in Pacific and Asian students and smoking in the house in Asian students. However, the strength of the relative risks for parental smoking and smoking in the house was substantially reduced, while the relative risks for best friend smoking remained strong.

The main confounders for parental smoking were having an older sibling who smoked, smoking in the home, and having a best friend who smoked, while pocket money >\$20 per month had no confounding effect (data not shown). It is possible that some of the variables included in Table 4 (e.g. smoking in the home, amount of pocket money, older sibling and best friend smokes) are intermediary steps in the causal pathway from parental smoking to adolescent smoking, and if so these variables should not be controlled when examining for the full effects of parental smoking.

The adjusted ethnic-specific relative risks of daily smoking, associated with combined exposure to parental smoking and/or the related modifiable parental behaviours of smoking in the home and amount of pocket money (see Table 3), and having a best friend who smoked (see Table 2), were used to calculate attributable risks for daily smoking associated with these variables (see Table 5). A high proportion of students (77%) were exposed to one or more of the following variables: parental smoking, smoking in the house and/or pocket money >\$20/month; so that the attributable risk for this combination variable was high (64%) and equivalent to the attributable risk for exposure to a best friend who smoked (67%). The latter variable had higher relative risks but a lower exposure (30%) in the study sample.

## Conclusions

We have shown in a large, national, multi-ethnic sample of adolescents that parental smoking is a major risk factor for daily smoking by youth, particularly in ethnic groups with low smoking prevalences (e.g. Asians); and that parental smoking, in combination with factors under parental control, including allowing smoking in the home and provision of more than \$5 per week pocket money, explains a similar proportion of adolescents

**Table 4: Ethnic-specific relative risks (95% confidence intervals) of daily smoking associated with parental, sibling and best friend smoking, and with demographic variables; each variable adjusted for all other variables in the table plus age and sex – students in 2002 Year 10 survey.**

Variable	Maori	Pacific	Asian	European/Other
<b>Mother smokes</b>				
Yes	1.27 (1.10-1.45)	1.23 (0.91-1.65)	3.51 (2.06-5.72)	1.73 (1.52-1.96)
No	1.00	1.00	1.00	1.00
<b>Father smokes</b>				
Yes	1.36 (1.20-1.54)	1.28 (0.98-1.63)	0.93 (0.55-1.55)	1.26 (1.12-1.42)
No	1.00	1.00	1.00	1.00
<b>Older sibling smokes</b>				
Yes	1.41 (1.23-1.59)	1.83 (1.39-1.38)	4.82 (3.06-7.35)	2.07 (1.86-2.30)
No	1.00	1.00	1.00	1.00
<b>People smoke in house</b>				
Yes	1.26 (1.11-1.44)	1.43 (1.08-1.85)	1.41 (0.82-2.38)	1.73 (1.54-1.95)
No	1.00	1.00	1.00	1.00
<b>Pocket money &gt;\$20/month</b>				
Yes	1.31 (1.15-1.50)	1.60 (1.18-2.15)	1.67 (1.03-2.67)	1.56 (1.41-1.73)
No	1.00	1.00	1.00	1.00
<b>Best friend smokes</b>				
Yes	4.01 (3.56-4.48)	4.16 (3.09-5.46)	7.75 (5.23-14.75)	8.29 (7.44-9.20)
No	1.00	1.00	1.00	1.00

who smoke daily as that explained by peer smoking (about two-thirds).

A recent review has concluded that peer smoking is more strongly related to adolescent smoking than parental smoking.<sup>1</sup> Our paper challenges this conclusion and, in doing so, raises several issues. First, how should the relative importance of risk factors be assessed? Previous research has used the strength of relative risk to compare peer and parental smoking. However, a strong risk factor that occurs infrequently may cause fewer outcomes than a weak-to-moderate risk factor that is common. The preferred measure of effect, when ranking public health risk factors, is the population-attributable risk, which integrates into a single measure both the strength of a risk factor (i.e. the relative risk) and its frequency (prevalence). The data in Table 5 illustrates this point. The relative risks associated with parental smoking and related parental behaviours are lower than those associated with best friend smoking. However, the former occurs more frequently in the survey population than does exposure to best friend smoking (77% vs. 30%), so that the population-attributable risks are similar (64% vs. 67%).

Second, which variables should be controlled when assessing the effects from parental smoking? Previous studies typically have controlled for smoking by both older siblings and peers. However, since parental smoking is likely to have preceded the onset of smoking by older siblings, in most cases many of the parental factors that contributed to smoking by older siblings are likely also to be influencing younger children in the family. Therefore, smoking by older siblings should be considered as an intermediate step in the causal pathway from parental smoking to adolescent smoking, in which case it is not appropriate to adjust for older sibling effects, since this will under-estimate the parental effect.<sup>30</sup> The same argument can be applied to peer smoking, which is also a confounder of parental effects. It is plausible that parents who smoke, by allowing smoking in the home, create an environment

where peers who smoke are more likely to interact with, and befriend, their children. If so, part of the parental effect may be transmitted through peer smokers, in which case peer smoking also should be considered an intermediate step in the causal pathway and not adjusted for.

Third, what are the pathways and mechanisms by which parental smoking affects adolescent smoking? Besides peer and siblings pathways, the direct effect from the example of parental smoking is an obvious pathway. Parents who smoke may also increase the risk of their children smoking by allowing smoking in the home, since the latter has been shown to be a risk factor for adolescent smoking in a number of surveys.<sup>19,20</sup> Providing larger amounts of pocket money, which is associated with increased risk of cigarette purchasing by adolescent smokers,<sup>19</sup> is also associated with increased risk of adolescent smoking.<sup>7,13,19,21-24</sup> It is possible that other parental factors and behaviours contribute to adolescent smoking and that the proportion of adolescent smoking attributable to parental factors may be higher than we have reported.

We observed (see Table 1) that both parental smoking and best friend smoking were each associated with established (daily) smoking by adolescents, whereas only best friend smoking was associated with less frequent smoking (weekly or monthly). This finding is consistent with previous cohort studies. For example, Flay and colleagues found that smoking by friends was correlated with the transition from trial to experimental smoking, whereas parental smoking was associated with the transition from experimental to regular smoking by adolescents;<sup>4</sup> while Chassin et al. reported that parental smoking was associated with smoking that began in adolescence and persisted into adulthood, but not with experimental smoking.<sup>5</sup> Our results are consistent with the proposal that parental smoking is associated with earlier initiation of smoking by adolescents than is peer smoking, so that by their mid-teens smokers with parents who smoke are already established on their smoking trajectory. In contrast, peer effects may be more

**Table 5: Population-attributable risks of daily smoking by Year 10 students, associated with combined exposure to parental smoking and/or receipt of pocket money >\$20 per month and/or smoking in the house, and with best friend smoking.**

Ethnicity	Proportion exposed	Relative risk <sup>a</sup>	Attributable risk for exposed	Attributable cases	Total cases	Population attributable risk <sup>b</sup>
<b>Combined exposure to parental smoking and/or pocket money &gt;\$20/month and/or smoking in the house</b>						
Maori	91%	2.47	60%	667	1168	57%
Pacific	80%	3.64	73%	160	237	68%
Asian	71%	3.09	68%	74	120	62%
European/Other	74%	3.93	75%	1,238	1,806	69%
<b>Total</b>	<b>77%</b>	<b>–</b>	<b>–</b>	<b>2,139</b>	<b>3,331</b>	<b>64%</b>
<b>Exposure to best friend smoking</b>						
Maori	46%	4.18	76%	774	1,273	61%
Pacific	33%	5.19	81%	152	259	59%
Asian	17%	14.35	93%	91	130	70%
European/Other	28%	10.18	90%	1,390	1,934	72%
<b>Total</b>	<b>30%</b>	<b>–</b>	<b>–</b>	<b>2,407</b>	<b>3,596</b>	<b>67%</b>

Notes:

(a) Adjusted for age and sex; from Tables 2 and 3.

(b) Attributable cases/total cases for each ethnic group.

important later on, during the mid-teen period of our survey, and be associated with smokers who are at an earlier phase of their smoking trajectory (e.g. as weekly or monthly smokers). In contrast, Bauman et al. have reported that parental and peer effects do not vary with age.<sup>31</sup>

We have found large variations in the effect of parental smoking between ethnic groups, with relative risks being highest for Asian students, who have the lowest smoking prevalence, and lowest for Maori students, who have the highest smoking prevalence (see Table 2). The inverse association between parental effect and adolescent smoking prevalence suggests that parental smoking is a primary driver for the introduction of smoking into adolescent communities where smoking is rare. Variations in the parental effect between ethnic groups have been reported in previous United States studies<sup>32,33</sup> and confirm results from our 2001 national NZ survey.<sup>19</sup> Although we found stronger effects from maternal smoking than paternal among Asian and European students of both sexes (see Table 2), we failed to find differences between sexes in the gender-specific associations of maternal and paternal smoking with adolescent smoking for the same sex, in contrast with previous studies.<sup>10,34,35</sup>

A major limitation of this study is that its cross-sectional design cannot distinguish cause and effect. Thus, the timing of when parental and peer effects occur can only be properly studied by cohort studies. Further, our measure of parental smoking did not allow for single-parent and extended family households; nor did our measure of smoking by older siblings identify students who did not have an older sibling. However, such measurement error, if random, is likely to have resulted in under-estimation of the effects associated with parental smoking. In addition, we did not examine the full range of personal variables associated with adolescent smoking (e.g. personality, attitudes), which could potentially confound the association with parental smoking. Neither did we include other parental variables (besides amount of pocket money and allowing smoking in the home) that may influence risk of adolescent smoking, in which case our measures of attributable risk in Table 5 may under-estimate the true value for parental factors. Further, our findings may not apply to students from decile 1 and 2 schools, who are under-represented in the study sample.

Despite these possible limitations, our findings potentially have important implications for public health strategies to prevent adolescent smoking. Previous efforts to prevent adolescent smoking have focused on school-based interventions against the effects of peer smoking. However, these interventions have had limited effect in preventing adolescent smoking.<sup>36</sup> Our attributable risk calculations (see Table 5) suggest that parental effects are as strong as peer effects. Interventions targeted at adult smoking and the role of parents may be more fruitful not only in preventing adolescent smoking, but in the potential added benefit of decreasing parental smoking.

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