A national survey of cigarette smoking in fourth-form school children in New Zealand

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Abstract

Aims
To determine the prevalence of cigarette smoking in 14 and 15 year old school children in New Zealand and to examine associated risk factors.

Methods

Results
Questionnaires from 14 097 fourteen and fifteen year-olds were analysed. 65.6% had tried smoking, and 36.1% regarded themselves as smokers. Females and Maori had significantly higher prevalence rates. Of Maori females 44.6% were current smokers (more than one per month) compared to 24.0% for the whole group, and 33.0% were daily smokers. Pacific Island students, who have similar socioeconomic disadvantage to Maori, have a lower relative risk of smoking (RR) 0.79, (95% confidence interval (CI) 0.68, 0.91), than Europeans.

Major independent risk factors were identified and population attributable risk was calculated for parental smoking (22.9%), poor knowledge of adverse health effects (7.3%) and watching televised sports (13.4%). These three modifiable factors accounted for 36.1% of the total smoking prevalence in these children.

Conclusion
The continued high prevalence of smoking in New Zealand children, especially in Maori and in females, prove current public health measures to be inadequate. Our results suggest that strategies aimed at decreasing parental smoking, improving student knowledge of adverse health effects and preventing tobacco sponsorship of television sports could greatly decrease the smoking prevalence in this age group.
Introduction

While tobacco consumption has fallen in New Zealand to be one of the lowest among OECD countries, this decline is largely attributable to older smokers. There has been no significant change over the last 10 years in the smoking prevalence in young adults, especially female, and Maori. Eighty percent of adult smokers first smoked as children and about a third of children have tried cigarettes by the age of eleven. Every year nineteen thousand New Zealand teenagers become regular smokers (J Gaiser, Cancer Society of NZ 1994 personal communication).

The New Zealand Smoke-Free Environments Act 1990 confirmed the legal age for tobacco sales as 16 years and prohibited tobacco advertising, with tobacco sponsorship to cease from July 1995. The impact of this legislation on illegal sales and smoking rates in children is unknown.

There are no definitive data on smoking prevalence in New Zealand children under the age of 16 years and, as in most other countries, these are excluded from routine national statistics. From 1961 the studies addressing this issue in New Zealand have usually been local surveys, with small numbers, especially of ethnic groups, and poor definition of terms relating to smokers. This study is the first truly national survey in this age group and evaluates socio demographic factors which influence teenage smoking and quantifies their importance.

Method

In November 1992 one hundred and twenty five secondary schools throughout New Zealand were asked to participate in the national survey of fourth-form students. The fourth-form was chosen because 98.5% are under 16 years of age. Schools were selected from a complete list provided by the Ministry of Education of all schools (n=391) in New Zealand with fourth-form students, except for Southland district (for logistical reasons). Ninety-nine schools out of the 125 agreed to participate (school response rate 79%). The schools were selected on a nonrandom basis to ensure that a representative proportion of the following types of school was included: single-sex (n=43) and coeducational (n=56), private (n=10) and public (n=89), urban (n=71) and rural (n=28). The geographic distribution by district was similar for participating and nonparticipating schools (p>0.50). However, because larger schools were selected in order to increase the sample size, the average number of students of all ages estimated to be on the rolls of participating schools was higher than for non participating schools in the study area (955 vs 505).

A sixteen-item questionnaire was used without any personal identifiers to guarantee anonymity. Information was obtained on the frequency and quantity of smoking, ethnicity, knowledge of adverse health effects, exposure to sports on television, parental smoking and source and accessibility of cigarettes. Ethnicity was self assigned in accord with the national census. "Current smokers" were defined as those smoking one cigarette or more per month, "occasional smokers" were fewer than one per month, "ex smokers" were those who had answered affirmatively to the question "have you ever smoked a cigarette, even just a few puffs?" But had answered "never" when asked "how often do you now smoke?" In current smokers, "heavy" was defined
as more than 21 cigarettes per week. Consent for the study was obtained from school principals in place of parents and the study was approved by the Auckland Area ethics committee.

From the 19,966 questionnaires distributed, 14,636 questionnaires were returned (student response 73%). After excluding invalid and incomplete questionnaires (n=265), and students aged thirteen (n=57) or sixteen (n=217), a total of 14,097 questionnaires from children aged 14 and 15 were able to be analysed. The total numbers for each variable in Table 1 vary slightly from this because of missing information.

**Statistical method.** All statistical analyses were made using SAS Version 6.04 (Cary, NC). The Cochran-Mantel-Haenszel statistic was used to compare adjusted proportions. Relative risks, adjusted for various confounders, were estimated using the Mantel-Haenszel odds ratio for cohort studies. Population attributable risks were calculated using the exposure proportions of the total sample.8

**Results**

*Table 1. - Relative risk of smoking associated with sociodemographic and modifiable lifestyle factors.*

<table>
<thead>
<tr>
<th></th>
<th>Current Smokers</th>
<th>Relative risk (95%)</th>
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<tbody>
<tr>
<td></td>
<td>Yes (n)</td>
<td>Yes (%)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1869</td>
<td>25.6</td>
</tr>
<tr>
<td>Female</td>
<td>1449</td>
<td>21.6</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>1088</td>
<td>20.7</td>
</tr>
<tr>
<td>15</td>
<td>2244</td>
<td>25.4</td>
</tr>
<tr>
<td><strong>Ethnic group</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maori</td>
<td>657</td>
<td>35.3</td>
</tr>
<tr>
<td>Pacific Is</td>
<td>147</td>
<td>18.5</td>
</tr>
<tr>
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<td></td>
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<tr>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Asian</td>
<td>38</td>
<td>6.4</td>
</tr>
<tr>
<td>European</td>
<td>2469</td>
<td>23.0</td>
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**Parents smoke**

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<tbody>
<tr>
<td>Both</td>
<td>655</td>
<td>36.0</td>
<td>1164</td>
<td>1.97 (1.82, 2.13)</td>
<td>1.75 (1.61, 1.90)</td>
</tr>
<tr>
<td>One</td>
<td>1126</td>
<td>29.2</td>
<td>2733</td>
<td>1.59 (1.49, 1.71)</td>
<td>1.50 (1.40, 1.61)</td>
</tr>
<tr>
<td>Neither</td>
<td>1466</td>
<td>18.3</td>
<td>6543</td>
<td>1</td>
<td>1</td>
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**Think smoking bad for health**

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<tbody>
<tr>
<td>Yes</td>
<td>2876</td>
<td>22.0</td>
<td>10213</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No or not sure</td>
<td>412</td>
<td>53.0</td>
<td>366</td>
<td>2.41 (2.21, 2.63)</td>
<td>2.43 (2.23, 2.65)</td>
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**Watch TV sports**

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<tbody>
<tr>
<td>Yes</td>
<td>2946</td>
<td>24.2</td>
<td>9252</td>
<td>1.18 (1.08, 1.29)</td>
<td>1.18 (1.07, 1.29)</td>
</tr>
<tr>
<td>No</td>
<td>386</td>
<td>20.5</td>
<td>1499</td>
<td>1</td>
<td>1</td>
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Of the study population, 37.3% were aged 14 and the remainder were aged 15. 48% were male and 52% female. The group comprised 76.8% children of European descent Europeans, 13.3% Maori, 5.6% Polynesians and Melanesians from other Pacific islands (Pacific Islanders) and 4.3% of Asian descent, mainly Indian or Chinese Asians.

Figures 1 and 2 describe the smoking behaviour of these groups. Of the total group 34.4% had never smoked (range 14.2% in Maori females — 75.3% in Asian females). Of those who had tried smoking 36.6% were current smokers (range 20.0% in Asian females to 52.0% in Maori females). Of ever-smokers, after adjustment for sex, Maori (p<0.001) and Asians (p<0.001), but not Pacific Islanders (p=0.45), were less likely to have quit smoking (exsmokers) compared to Europeans.
Figure 1. Distribution of smoking frequency by ethnic group in female New Zealand schoolchildren aged 14 and 15 years.

Smoking frequency of female NZ children, 14-15 yrs, 1995

Figure 2. Distribution of smoking frequency by ethnic group in male New Zealand schoolchildren aged 14 and 15 years.

Smoking frequency of male NZ children, 14-15 yrs, 1995
Of the total group, 24.0% were current smokers, with 25.8% of all females and 22.1% of males. Maori females had almost twice the prevalence of any other group, with 44.6% being current smokers and 33.0% smoking daily, almost three times the mean daily prevalence for the total group (12.1%). Of Maori males, 17.1% were daily smokers. Fewer Pacific Islanders of both sexes smoked currently than Europeans but this group were intermediate between Maori and Europeans with regard to daily smoking. Asian children had the lowest prevalence for either sex.

Figures 3 and 4 describe the number of cigarettes consumed in the last week for males and females. Males smoke more heavily than females with 18.8% versus 15.6% of all smokers using more than 21 cigarettes per week ($\chi^2-(1\text{df})=7.50$, $p=0.006$) and this is true for all groups except Maori where females smoke more. After adjustment for sex, Maori ($p<0.001$) and Pacific Islanders ($p=0.023$) smoke more heavily than European smokers.

Table 1 describes variables associated with current smoking. Smoking prevalence was 20% higher in girls than boys after adjustment for age and ethnicity. Maori were approximately 50% more likely to smoke and Pacific Islanders 20% less likely than Europeans to be smokers, after adjustment for age and sex. Asians had the lowest relative risk for smoking.

Parental smoking was strongly associated with childhood smoking. Compared with children whose parents did not smoke, those with one parent who smoked were 50% more likely and those with two parents who smoked were 75% more likely to be current smokers, after adjustment for sex, age and ethnicity (Table 1). While 69.1% of Maori children have one or both parents who smoked, this was less likely to be the case in Pacific Island (53.9%), European (36.8%), and Asian (26.1%) children. Children of a smoking parent are more likely to smoke daily (with both parents 24.5%, one parent 16.6%, no parent 7.4%, $\chi^2(2\text{df})=488.34$, $p<0.001$), more heavily (with both parents 26.7%, one parent 17.6%, no parent 12.8%, $\chi^2(2\text{df})=77.08$, $p<0.001$), and are less likely to be exsmokers, ie, to have quit (with both parents 36.6% quit, one parent 42.3%, no parent 49.1%, $\chi^2(2\text{df})=79.34$, $p<0.001$) than children whose parents do not smoke. Such children are also more likely to deny or be unclear about the health hazards of smoking (both parents 8.6%, one parent 6.9%, no parent 4.3%, $\chi^2(2\text{df})=66.52$, $p<0.001$).
To assess their knowledge of adverse effects of smoking, children were asked whether smoking can be bad for people’s health. Those children who answered "No or not sure", were 2.4 times more likely to be smokers than children who answered "Yes" (Table 1).

Health knowledge was less in males (6.8%) compared with females (4.5%) $\chi^2$(1df)=34.51, p<0.001, in nonEuropeans (Maori 8.5%, Pacific Islanders 10.6%, Asian 6.1%, versus European 4.7% said no or not sure, $\chi^2$(3df)=80.05, p<0.001), and interestingly in children who watch televised sport (5.9% versus 3.7% who do not, $\chi^2$(1df)=15.46, p<0.001).
Children who watched televised sport, most of which is sponsored by tobacco companies in New Zealand, were 18% more likely to be smokers, after adjusting for sex, age and ethnicity, than those who did not watch these programmes (Table 1). Logistic regression analyses showed all variables in Table 1, when included in the same model, to be independently associated with risk of smoking.

Population attributable risk was calculated. Parental smoking was the most important identified modifiable risk factor, accounting for 23% of current smoking. About 13% of smoking prevalence could be attributed to watching televised sporting programmes and about 7% to opinions that smoking was not harmful to health. Overall, 36% of the smoking prevalence could be attributed to these three factors.

Discussion

This study represents the largest national survey of smoking in New Zealand school children. The group consists of 29% of all fourth formers with a comparable ethnic composition to that found nationally at this age level where Maori account for 19% and Pacific Islanders 7%.

The slight underrepresentation of Maori in our sample, the departure from school of some 15 year olds into the workplace, and absenteeism will be factors which would tend to underestimate the true prevalence of smoking in 14 and 15 year olds in this study. While no pretest or biochemical validation of the answers in the questionnaire was undertaken, previous studies using this method have established the accuracy of responses in this age group, including the question on experimental smoking about which our questionnaire was very specific: "have you ever smoked, even one puff?" The very large number of the sample and the very low percentage of spoiled questionnaires supports the lack of internal difficulties with the questionnaire and a high degree of consistency was found within the samples from different schools.

Prevalence. In New Zealand, as in the United Kingdom, there was concern that tobacco use had actually increased in recent years in young adults and children. In this context it was essential to obtain national information on smoking behaviour and to include the high risk groups. The best longitudinal data on smoking in children derives from the Dunedin birth cohort using interview methods, but there were inadequate numbers of Maori and other nonEuropeans. The overall prevalence may have fallen slightly over 5 years from 27% current smokers in 15 year olds in 1987 down to 24.0% in our group of 14 and 15 year olds. Previous studies have included together occasional and never smokers, perhaps because of an assumption that low levels of smoking have little significance. Recent data from the Dunedin cohort show that 40.3% of occasional smokers (within the last 3 years but not in the last month) at 15 years went on to become current smokers by the age of 18 years, and 55.4% current smokers at 15 years went on to be daily smokers at 18 years (Stanton WP et al unpublished). This has enormous potential for public health intervention, with an opportunity to advise individuals with regard to their future risks before physical dependence to nicotine is established.

Smoking in females. By 1976 smoking prevalence had become higher in New Zealand school girls than boys and this difference has persisted in children and in New Zealand adults aged 15-24. In support of similar findings in the UK,
although there are more females who smoke currently, males are more likely to be daily smokers, and to smoke more heavily. This is true for all ethnic groups except Maori, where females smoke more heavily. Despite smoking fewer cigarettes, having better health knowledge, and having less exposure to TV sports, females were found to have a lower quit rate. This raises the issue of dependence which was found to be greater in female adults and children in recent studies. Thomas thought this was more likely to be a perceptual rather than a physiological difference. This study shows that this pattern does not apply equally to all ethnic groups.

**Ethnic differences in smoking.** Maori adults have smoking rates twice that of the total non-Maori population: in 1993, 54% versus 27%. The prevalence of female smoking in Maori is higher than males over all age ranges and has not fallen over 13 years with 61% aged 15-34 being daily smokers. Our study confirms that this ethnic pattern is well established by the age of 15 years, in keeping with other studies which confirm Maori predominance in childhood smoking. While the overall percentage of smokers in the heavy (>21 per week) or moderate (>10 per week) groups is equivalent to similar recent studies on childhood smoking, Maori and Pacific Island smokers are shown here to smoke more heavily than European smokers. Shaw (1991) in a repeated study of the same school (mean age 15 years) from 1975 to 1989 demonstrated a trend to increased cigarette consumption in all groups, but significant only in Maori.

Why these major ethnic differences exist is not self evident. Less health knowledge in Maori, greater exposure to TV sports and to parental smoking compared to that of Europeans, may all be influential but does not account for the residual major independent risk. Maori are more often of lower socioeconomic status and have greater social disadvantage. Both factors are recognised in adults and in children to be highly associated with smoking. Importantly, Mitchell (1983) found that by adjustment for sex and socioeconomic status, the higher rate of smoking in Maori was no longer significant. However, he also found a significant association between a higher level of smoking and high cultural identity as a Maori ($\chi^2=7.95$, $p<0.05$).

The Pacific Island group have very similar measures of social disadvantage and socioeconomic status to Maori, but are culturally distinct and have a very different risk for smoking. This is the first study large enough to comment on the patterns of childhood smoking in Pacific Island people and Asians. The former have an intermediate position between Maori and European for both sexes for daily smokers only, but far more have never smoked. The majority of Asians have never smoked and those who have appear more likely to quit.

While we did not attempt to assess socioeconomic variables in this paper, they are unlikely to provide a simple explanation of these differences. Cultural factors, including peer and social pressures, would appear to be of central importance.

**Modifiable risk factors for smoking.** This study is not designed to be an exhaustive assessment of factors relating to smoking behaviour but we have been able to attribute 36% of smoking prevalence to three specific risk factors.
**Parental smoking.** Attitudes to smoking have long been recognised as a major influence on smoking behaviour and confirmed in local studies. We have quantified the magnitude of this which is claimed by others to be small in comparison to sibling effects. In agreement with others, we found the parental effect is independent of both sex and ethnicity. Education alone may not be able to overcome the powerful effect of parental modelling or attitude.

**Health knowledge.** We again demonstrated that the vast majority of children (approximately 95%) are familiar with adverse effects on health from smoking. This is in keeping with other studies over at least three decades. We have shown a significant difference in stated health knowledge in boys, non-Europeans, where parental smoking occurs and in those who are exposed to TV sports. Not all students may have had equal exposure to health messages through school, but the expression of uncertainty or negative belief may represent denial and nonacceptance of received information. Understanding this possible resistance may be crucial if we are to effect change in behaviour.

**TV advertising.** Watching televised sport increases the risk for smoking in children. It is not possible to show that this effect is causally related to tobacco sponsorship of televised sport, and this may be an association with the socioeconomic status of these families. However, this study provides important baseline data from which the effect of the total cessation of tobacco sponsorship in New Zealand, required by July 1995, can be assessed.

**Public health implications.** Current health promotion strategies over the past decade have had very limited impact on smoking prevalence in the high risk groups, even with culturally appropriate and targeted programmes using sporting role models, and Smokefree sponsorship. Despite extensive publicity in New Zealand, there has been no modification of smoking behaviour in young adult Maori women of child-bearing age and the incidence of cot death in this group remains among the highest recorded in the world. Hence, whilst this study would support a greater emphasis on changing parental smoking behaviour, in practice, this has proved difficult.

Voluntary restriction of sales to minors is ineffective. The government must be committed to enforcement of the existing law especially pertaining to tobacco sales to minors and advertising. We support further measures to limit access including increased tobacco taxation, increasing the legal age of the purchase of cigarettes from 16 to 18 years, as in the USA and Canada, and plain packs to discourage advertising from the producer.

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**Conclusion.**

This national study has confirmed the international trend to a high prevalence of smoking in females by the age of 14 and 15 years. Maori females have the highest
risk of any group. The lower relative risk of smoking in Pacific Island students who are of similar socioeconomic status to Maori suggests that cultural, and parental, influences are of major importance. Our results suggest that strategies aimed at decreasing parental smoking, improving student knowledge of adverse health effects and preventing tobacco sponsorship of television sports could greatly decrease the smoking prevalence in this age group.

Acknowledgements

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