

# **Does socio-economic inequality explain ethnic differences in nicotine dependence?**

## **Evidence from a New Zealand birth cohort**

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**Abstract**

**Objective.** The present study examined the role of socio-economic status and cultural identity in the association between ethnicity and nicotine dependence, in a birth cohort of over 1000 young people studied to age 30.

**Methods.** Data were gathered on ethnicity, cultural identification, nicotine dependence, and socio-economic factors, as part of a longitudinal study of a New Zealand birth cohort (the Christchurch Health and Development Study).

**Results.** Those reporting Māori identity had rates of nicotine dependence that were significantly ( $p < .05$ ) higher than rates for non-Māori. Control for socio-economic factors reduced the associations between ethnic identity and nicotine dependence to statistical non-significance. In addition, there was no evidence of a statistically significant association between Māori cultural identity and nicotine dependence; nor was there evidence of gender differences in the association between ethnic identity and nicotine dependence, net of socio-economic factors.

**Conclusions.** The higher rates of nicotine dependence observed amongst Māori appear to be attributable to differences in socio-economic status. Efforts to improve the socio-economic standing of Māori should therefore help to reduce rates of nicotine dependence in this population.

Keywords: ethnic identity, New Zealand Māori, nicotine dependence, socio-economic status, longitudinal study

One of the more persistent health anomalies within New Zealand involves inter-ethnic differences in rates of tobacco consumption (1). Although a decline in the national prevalence rate of smoking was observed between the 1980s and 1990s, analyses examining smoking by ethnic sub-populations suggest that during this period relative smoking prevalence rates for Māori increased (2-5). In 2006, it was estimated that the smoking prevalence rate for adult New Zealanders was 23.5%; however, amongst Māori, the prevalence rate for smoking was 45%. Given the incontrovertible evidence that smoking is a significant ‘downstream’ risk factor for serious health conditions such as chronic cardiovascular disease, respiratory diseases, lung and other cancers, each of which can lead to premature disability or death (6, 7), these figures are of immediate as well as future concern.

Several epidemiological studies have indicated the presence of disparate smoking patterns between ethnic groups in New Zealand (3, 4, 8). One focus of this research has involved elucidating the risk factors that might contribute to the elevated rates of smoking by Māori. A range of genetic, behavioural and environmental factors have been examined in these studies. For example, Lea et al found evidence that Māori had slower rates of nicotine metabolism than European New Zealanders, due to an increased frequency of a particular gene variant related to nicotine metabolism (9). McLeod and colleagues reported that Māori ethnicity was one of the strongest predictors of smoking during the first trimester of pregnancy (10), while Scragg et al found that Māori adolescents were at greater risk of daily smoking by age 15 than were adolescents of any other ethnicity (11). Also, Thomson and colleagues, in a review of the literature, found evidence that Māori had risks of being exposed to second-hand smoke that were twice those of non-Māori (12). In addition, a number of studies have suggested that the relative socio-economic positioning of Māori may be related to increased risk of smoking, nicotine dependence, and smoking-related morbidity and mortality (5, 8, 13).

The socio-economic perspective is one of the key explanations in the understanding of differential rates of smoking and nicotine dependence (14). A number of studies have shown that rates of smoking and nicotine dependence are greater amongst members of socially disadvantaged

groups (15-17). It has been well documented that Māori are at greater risk of socio-economic disadvantage when compared with other New Zealanders classified by ethnicity (18-20). This fact in turn raises the possibility that it is the relative economic disadvantage of Māori that leads to Māori being more likely to smoke, more likely to meet criteria for nicotine dependence, and less likely to quit. The socio-economic explanation also implies that Māori are no more likely to smoke tobacco than non-Māori experiencing similar social and economic circumstances.

A second, somewhat related perspective involves a systemic theory of colonisation and relates to Māori cultural identity. From this perspective, historical and structural processes originating from the colonial settlement of New Zealand have resulted in contemporary health disparities where Māori are over-represented (21-25). Such processes include the introduction of tobacco to Māori along with the imposing of Eurocentric beliefs, values, and practices upon Māori, which it is contended led to the social and political fragmentation of Māori society. As a corollary, it is claimed that Māori have experienced cultural disconnection and social defeat, the results of which are observable in the higher rates of nicotine dependence, tobacco-attributed illness and mortality among Māori today (22). Therefore, this position proposes that the disproportionate rate of tobacco consumption by Māori is directly linked to loss of attachment to cultural domains and a thwarted cultural identity.

Against this background, this paper uses data gathered over the course of a 25-year longitudinal study to examine the extent to which ethnic differences in nicotine dependence can be explained by socio-economic differences. The study also aimed to examine the role of variations in cultural identity in relation to differences in nicotine dependence. More generally, the aims of the paper are to explore the origins of the higher rate of tobacco use and nicotine dependence by Māori.

## **Methods**

The data were gathered during the course of the Christchurch Health and Development Study (CHDS). In this study a birth cohort of 1265 children (635 males, 630 females) born in the

Christchurch (New Zealand) urban region in mid-1977 has been studied at birth, 4 months, 1 year and annually to age 16 years, and again at ages 18, 21, 25, and 30 years. Information from a variety of sources has been used including: parental interviews; teacher reports; self-reports; psychometric assessments; medical and other record data (26, 27). The present analyses were based on those individuals for whom data was available on ethnic identity at birth and age 21 years, and nicotine dependence at ages 18, 21, 25, and 30. Sample sizes ranged from 987 to 1025 (78% to 81% of the original cohort).

### *Ethnic identity*

The present study used two measures of ethnic identity, and one measure of cultural identity. These measures were as follows:

1. At the time of birth, mothers of cohort members were asked a series of questions pertaining to the ancestry, ethnic identification and family history of the cohort member. As part of this questioning, mothers were asked to indicate whether the child was of New Zealand Māori ethnicity. Those cohort members whose mothers reported having Māori ancestry or Māori ethnic identification were classified as being of Māori ethnicity at birth (11.2% of the sample).
2. At age 21 years respondents were asked about their ancestry, cultural identification, level of participation in Māori cultural domains, and proficiency in the Māori language (28). On the basis of this questioning, 11.1% of sample members self-identified as New Zealand Māori. Of these individuals, 81.6% had also been classified as being of Māori ethnicity at birth.
3. In addition, self-reports of ethnicity at age 21 were used to further classify participants on a measure of cultural identity (28), using measures suggested by Pomare and colleagues (29), in order to examine the extent to which self-reported cultural identification, as defined by the individual's report of the extent to which s(he) identifies as Māori, may be related to nicotine dependence. Classification of participants according to cultural identity showed that, amongst those reporting Māori ethnicity at age 21, 45.9% reported sole Māori identity, and 54.1%

reported Māori ethnic identity and identity with another ethnic group. Comparisons of the sole Māori and Māori/other group, undertaken to demonstrate the validity of the classification, showed consistent statistically significant ( $p < .05$ ) differences between the groups in terms of participation in Māori culture. For the purposes of the present analyses, those reporting sole Māori identity were classified as having a sole Māori identity, while those reporting both Māori identity and another ethnic identity were classified as having Māori/other ethnic identity. All other participants were classified as being non-Māori.

#### *Nicotine dependence, ages 18, 21, 25, and 30*

At each assessment at ages 18, 21, 25, and 30 years, participants were questioned as to the frequency with which they had smoked cigarettes during the month prior to the assessment, using a 6 point scale ranging from non-smoker to smoking 21+ cigarettes per day. In addition, those participants who reported smoking during the previous month were questioned as to their experience with a number of symptoms of nicotine dependence during that year. These measures of nicotine dependence at ages 18, 21, 25, and 30 years were obtained using custom-written questions based on the generic DSM-IV (30) criteria for nicotine dependence. Participants were classified as being nicotine dependent at each age if they met the DSM-IV criteria for nicotine dependence at that age.

#### *Socio-economic background covariate factors*

The socio-economic background of cohort members was assessed using several indicator measures chosen from the database of the study. These included:

*Maternal and paternal education (at birth).* The education level of the natural mother and father of each participant was assessed at the time of the survey participant's birth using a three point scale which reflected the highest level of educational achievement attained.

*Family living standards (0-10 years).* At each year an assessment of the material living standards of the family was obtained via interviewer rating on a five point scale that ranged from

“very good” to “very poor”. These were averaged over the 10-year period to give a measure of family living standards during this period.

*Family socio-economic status (at birth, and at age 14).* This was assessed at the time of the survey participant’s birth, and again when the participant was aged 14 years, using the Elley-Irving scale (31) of socio-economic status for New Zealand. This scale classifies SES into 6 levels on the basis of paternal occupation ranging from 1 = professional occupations to 6 = unskilled occupations.

### *Missing Data*

As noted previously, the analyses were based on 987 to 1025 sample members, depending upon the number of cohort members interviewed at each assessment. To assess the possible effects of sample selection bias, tests were conducted to examine the extent to which the obtained samples were representative of the original cohort of 1,265 participants enrolled in the study. This analysis showed that there were slight but statistically significant ( $p < .05$ ) tendencies for the obtained sample to under-represent individuals from more socially disadvantaged backgrounds (low parental education, low socio-economic status, single-parent family). To take these biases into account, the sample was post-stratified into a series of groups on the basis of these characteristics, and the probability of study participation estimated for each group using the methods described by Carlin, Wolfe, Coffey, and Patton (32). All analyses were then repeated with the data for the analysis samples weighted by the inverse of the probability of study participation. In addition, there were small amounts of missing data for some covariate factors. To examine the implications of missing values, regression imputation of missing data was conducted and the analyses repeated with the missing values on each covariate replaced by the imputed values. In all cases, these reanalyses produced essentially the same pattern of results to those reported here, suggesting that the conclusions of this study were unlikely to have been influenced by missing data and selection bias.

## Results

### *Associations between ethnic identity and nicotine dependence at age 25*

Table 1 shows the cohort divided into Māori and non-Māori groups based on ethnicity reported at birth. For each group the Table reports on the percentage of cohort members meeting DSM criteria for nicotine dependence at ages 18, 21, 25 and 30 years. The comparison at each assessment is tested for statistical significance using the chi-square test of independence. The Table shows that, at each assessment, those who were classified as having Māori ethnicity at birth had rates of nicotine dependence that were significantly ( $p < .05$ ) higher than rates for non-Māori. Rates of nicotine dependence amongst non-Māori ranged from 12.8% to 23.5%, whereas rates of nicotine dependence amongst Māori ranged from 22.6% to 39.8%.

The associations between the repeated outcome measures of nicotine dependence and ethnicity were modelled using Generalized Estimating Equation (GEE) methods (33, 34) with logistic regression. The GEE approach pools the repeated measures of each outcome at each time period to produce an estimate of the population-averaged effect of the predictors on each outcome, and provides estimates of the pooled odds ratio (OR). Table 1 also reports the OR, which provides an approximate measure of the risks of a given outcome amongst Māori when compared to the risk for non Māori, pooled over the period 18-30 years. This analysis showed that, over the period 18-30 years, Māori had odds of nicotine dependence that were approximately 2.27 times greater than those of non-Māori .

INSERT TABLE 1 HERE

### *Tests of socio-economic explanations*

To examine the extent to which ethnic differences in nicotine dependence could be explained by socio-economic factors, the associations between ethnic identity at birth and nicotine dependence at ages 18, 21, 25 and 30 were adjusted for socio-economic factors. The logistic regression model



presented in Table 1 was extended to include measures of socio-economic status including maternal and paternal education, socio-economic status at birth and at age 14, and average family living standards to age 10 (see Methods).

The results of this analysis are shown in Table 2 which shows both the unadjusted and adjusted OR and 95% CI for the associations between ethnic identification and nicotine dependence at ages 18-30. The Table shows that adjustment for socio-economic factors reduced the associations between ethnicity and nicotine dependence to statistical non-significance, although there remained some suggestion of a small but non-significant association between ethnicity and nicotine dependence (OR = 1.39; 95% CI = 0.93-2.08). Statistically significant ( $p < .05$ ) covariate factors included: average family living standards ages 0-10; and family socio-economic status at age 14. Estimates of the population attributable risk suggested that, after adjustment, Māori ethnicity accounted for just 3.1% of the risk of nicotine dependence amongst the cohort.

The implication of the findings in Table 2 is that the associations between ethnicity and nicotine dependence shown in Table 1 were largely, if not wholly, explained by the greater exposure of young Māori to socio-economic disadvantage. After adjustment for these factors, there was little evidence to suggest that being of Māori ethnicity *per se* was a risk factor for nicotine dependence in adulthood.

INSERT TABLE 2 HERE

#### *Supplementary analyses*

*Ethnicity at age 21.* In order to examine the robustness of the analyses to alternative methods of classification of ethnicity, the analyses above were repeating using a measure of ethnicity (Māori ; non-Māori ) obtained when the participants were aged 21 years in place of the measure of ethnicity reported at birth (see Methods). Estimates of the pooled OR for the association between ethnicity at age 21 and nicotine dependence at ages 18-30 showed that Māori

were at significantly increased risk of nicotine dependence as compared with non-Māori (OR = 1.69; 95% CI = 1.19-2.40;  $p < .01$ ). Adjustment for socio-economic factors reduced the association to statistical non-significance (OR = 0.99; 95% CI = 0.64-1.53;  $p > .90$ ). The results of this analysis suggested that, irrespective of the age at which ethnicity was measured, the associations between ethnicity and nicotine dependence were explained by the greater exposure of young Māori to socio-economic disadvantage.

*Cultural identity at age 21.* A further analysis examined the extent to which differences in Māori cultural identity, measured at age 21, were associated with nicotine dependence during the period 18-30 years. In this analysis, the measure of cultural identity, operationalized as a pair of design variates, was used in place of the measure of ethnicity at age 21. Tests of the unadjusted associations showed that cohort members of sole Māori identity were significantly ( $p < .05$ ) more likely than either those of Māori /other identity, or non-Māori, to meet criteria for nicotine dependence during the period 18-30 years (sole Māori OR: 2.44; 95% CI = 1.52-3.94; Māori /other identity OR: 1.20; 95% CI 0.73-1.97). However, adjustment for family socio-economic background in childhood reduced these associations to statistical non-significance (sole Māori OR: 1.34; 95% CI = 0.75-2.42; Māori /other identity OR: 0.75; 95% CI 0.42-1.37). The results of this analysis suggested that the associations between cultural identity and nicotine dependence were explained by the greater exposure of young Māori to socio-economic disadvantage.

*Tests of gender differences.* In order to examine whether there were gender differences in the links between ethnic identity, nicotine dependence, and socio-economic factors, the GEE models presented in Tables 1 and 2 (above) were modified to fit regression terms nested within gender for the measures of ethnic identity and each socio-economic factor (35). Then, Wald chi-square tests of gender equality for ethnic identity and socio-economic factors were performed for each predictor. The results of these analyses suggested that there were no statistically significant gender differences for the measures of ethnic identity and each of the socio-economic factors (all  $p$ -

values  $> .05$ ), suggesting that the associations between ethnic identity and nicotine dependence, net of socio-economic factors, did not differ according to gender.

## **Discussion**

This research has used data gathered over the course of a 25-year longitudinal study to examine the linkages between ethnicity and cigarette smoking in a New Zealand birth cohort. This study leads to two major conclusions.

First, in agreement with previous research (1-5, 8, 36, 37), there were consistent trends for cohort members reporting a Māori identity to have higher rates of nicotine dependence from ages 18-25. On average, Māori had risks of nicotine dependence that were 2.27 times greater than those of non-Māori.

Second, the results of regression analyses suggested that the linkages between ethnicity and nicotine dependence were largely explained by the linkages between ethnicity and socio-economic disadvantage. Statistical adjustment for socio-economic factors including: paternal education level; socio-economic status at birth and during adolescence; and average family living standards to age 10; for the most part explained the associations between ethnicity and nicotine dependence in young adulthood. Estimates of the population attributable risk suggested that, after adjustment, Māori ethnicity accounted for just 3.1% of the risk of nicotine dependence amongst the cohort. The net effect of relative socio-economic disadvantage was to place young Māori at greater risk of nicotine dependence from early adulthood to age 30. These results were consistent irrespective of whether Māori identity was assessed at birth, or at age 21.

Third, the results suggested that although those reporting a sole Māori cultural identity at age 21 had higher risks of nicotine dependence than either those reporting a Māori/other cultural identity, or non-Māori, adjustment for socio-economic factors also explained the associations between cultural identity and risks of nicotine dependence. These results lead to the conclusion that amongst Māori in this cohort, variations in cultural identity did not influence patterns of nicotine

dependence, once the confounding influence of socio-economic status was taken into account. Finally, tests of gender differences in the associations between ethnic identity and nicotine dependence, net of socio-economic factors, revealed no evidence that the links between ethnicity and nicotine dependence varied according to gender.

These findings clearly suggest that the factors influencing the higher rate of cigarette smoking amongst Māori are socio-economic rather than cultural in origin. The risk factors and life processes that led young Māori to cigarette smoking appear to be the same as those leading non-Māori to engage in the same behaviour. These findings in turn raise complex questions as to the nature of the associations between socio-economic status in childhood and smoking in adulthood. In an earlier study of the present cohort, Fergusson et al. found that exposure to adverse socio-economic factors in childhood predicted smoking in adolescence and young adulthood, and that these linkages were mediated via cognitive/educational factors, adolescent behaviour, and parental and peer smoking (14).

These results also provide empirical support to the social deprivation model described above to account for ethnic differences in substance use between Māori and other New Zealanders. The major implication of this finding is that improvements in the economic welfare of Māori may provide the most promising avenue to improve later smoking-related outcomes for Māori (38). It should be noted however that based on the evidence provided, such initiatives are likely to be of equal benefit to non-Māori experiencing similar problems with cigarette smoking and who are also raised in environments characterised by economic disadvantage.

The findings of the present study may also have implications for other research examining the links between ethnicity and smoking in New Zealand. For example, it could be argued that socio-economic status may serve as a mediating factor between genetic factors that influence nicotine metabolism and later smoking and nicotine dependence (9). Also, it may be possible that higher rates of socio-economic adversity amongst Māori may be related to lower rates of quitting smoking amongst pregnant women (10), and to higher risks of exposure to second-hand smoke

(12). Further research is needed to examine more closely the links between socio-economic adversity and other factors that may play a role in increasing the risk of smoking and nicotine dependence amongst Māori.

The present findings are subject to a number of caveats. In particular, the study findings are based on a single cohort born in a specific geographic region and studied over a specific time period. The extent to which the study findings generalise to other cohorts, times and regions is not known. In addition, although analyses suggested that this was not the case, it could be argued that sample attrition may have impacted the results of the present study. Finally, although the study has linked exposure to socio-economic adversity to higher rates of nicotine dependence amongst Māori, further research is needed to elucidate the pathways by which young Māori are more likely to begin smoking. In addition, research is needed that can identify the environmental and behavioural factors that may be linked to both socio-economic adversity and higher rates of smoking and nicotine dependence amongst Māori.

Within the limitations of the study the research suggests two major conclusions about ethnic disparities in the use of tobacco. First, Māori ethnic identification is associated with increased risks of cigarette smoking and nicotine dependence. Second, the higher rate of smoking by Māori can be attributed to socio-economic factors known to influence risk of cigarette smoking.

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Table 1. Associations between ethnicity (at birth) and nicotine dependence ages 18-30

	Ethnicity		p <sup>1</sup>
	Non-Māori	Māori	
<u>% Meeting criteria for DSM nicotine dependence</u>			
Age 18 n	12.8 910	22.6 115	<.01
Age 21 n	23.5 898	32.7 113	<.05
Age 25 n	20.9 890	39.8 113	<.0001
Age 30 n	19.4 876	38.7 111	<.0001
Pooled OR (95% CI)	1 -	2.27 (1.63 - 3.18)	

<sup>1</sup> Chi-square test of independence

Table 2. Pooled odds ratios for the associations between ethnicity and nicotine dependence ages 18-30 before and after adjustment for childhood socio-economic status factors.

	Ethnicity	
	Non-Māori	Māori
OR (95% CI) before adjustment	1 -	2.27 (1.63 - 3.18)
OR (95% CI) after adjustment <sup>1</sup>	1 -	1.39 (0.93 - 2.08)

<sup>1</sup> Statistically significant ( $p < .05$ ) covariate factors included: average family living standards ages 0-10; socio-economic status at age 14.