



## If nobody smoked tobacco in New Zealand from 2020 onwards, what effect would this have on ethnic inequalities in life expectancy?

Tony Blakely, Kristie Carter, Nick Wilson, Richard Edwards, Alistair Woodward, George Thomson, Diana Sarfati

### Abstract

**Background** Smoking contributes to the 7 to 8 year gap between Māori and non-Māori life expectancy (2006 Census). To inform current discussions by policy-makers on tobacco control, we estimate life-expectancy in 2040 for Māori and non-Māori, never-smokers and current-smokers. If nobody smoked tobacco from 2020 onwards, then life expectancy in 2040 will be approximated by projected never-smoker life expectancy.

**Method** Life-tables by sex/ethnicity/smoking status for 1996–99 were estimated by merging official Statistics New Zealand life-tables, census data and linked census-mortality rate estimates. We specified six modelling scenarios, formed by combining two options for future per annum declines in mortality rates among never-smokers (1.5%/2.5% and 2.0%/3.5% for non-Māori/Māori; i.e. assuming a return to long-run trends of closing ethnic gaps as in pre-1980s decades), and three options for future per annum reductions in the mortality rate difference comparing current to never-smokers (0%, 1% and 2%).

**Results** In 1996–1999, current smokers had an estimated 3.9 to 7.4 years less of life expectancy relative to never-smokers. This smoking difference in life expectancy was less among Māori than among non-Māori.

If the 2006 census smoking prevalence remains unchanged into the future, we estimate the difference in 2040 between Māori and non-Māori life expectancy will range from 1.8 to 6.1 years across the six scenarios and two sexes (average 3.8). If nobody smokes tobacco from 2020 onwards, we estimate additional gains in life expectancy for Māori ranging from 2.5 to 7.9 years (average 4.7) and for non-Māori ranging from 1.2 to 5.4 years (average 2.9). Going smokefree as a nation by 2020, compared to no change from the 2006 Census population smoking prevalence, will close ethnic inequalities in life expectancy by 0.3 to 4.6 years (average 1.8 years; consistently greater for females).

**Discussion** If smoking persists at current rates it will become an even greater constraint on life expectancy improvements for New Zealanders in the future. Continued increases in life expectancy, and closing of the Māori:non-Māori gaps in life expectancy, would be greatly assisted by the end of tobacco smoking in Aotearoa-New Zealand by 2020.

The public health case for concern and action on tobacco use in Aotearoa-New Zealand is overwhelming; 4500 to 5000 deaths per year in New Zealand can be attributed to tobacco use.<sup>1</sup>

The long-run trends in life expectancy show continual improvement in non-Māori life expectancy and a substantial increase in Māori life expectancy since the turn of the 19<sup>th</sup> Century.<sup>2-4</sup> Over the last century, average annual reductions in mortality have been approximately 3.5% per annum for Māori and 2.0% per annum for non-Māori (Woodward and Blakely, work in progress). Such reductions do not occur by chance, but reflect concerted policy and public health efforts, in addition to general improvements in health services and standard of living. Furthermore, closing of ethnic inequalities in life expectancy are far from guaranteed, as evidenced by a widening of Māori:non-Māori life expectancy gaps in the 1980s and 1990s associated with structural changes in New Zealand society.<sup>3,5-7</sup>

The gap in life expectancy between Māori and non-Māori c.2006 remains large at 7 to 8 years, but has narrowed from the 9 to 10 year gap c.1996.<sup>3,4,7</sup> Such a pattern suggests the possibility of a return to long-run trends of closing ethnic gaps in mortality in New Zealand.

One of the greatest obstacles to extending the long-run improvements in life expectancy into the future is tobacco use. We have previously quantified the impact of smoking on ethnic and socioeconomic inequalities in New Zealand during the 1990s.<sup>8-11</sup> A Tupeka Kore Vision has been developed which seeks the end of tobacco use in New Zealand by 2020.<sup>12</sup>

This paper asks the question: if New Zealand did end tobacco smoking by 2020, what would the effect be on life expectancy by 2040, and in particular the gap between Māori and non-Māori?

To attempt to answer this question, we present estimates of life expectancy for Māori and non-Māori, and current- and never-smokers, in 1996–99 and then project these life expectancy estimates out to 2040. Assuming a substantive upgrade in tobacco control such that smoking prevalence is negligible by 2020, and allowing a 20 year wash-out period for the majority of tobacco's effect on excess mortality, we assume that life expectancy in 2040 will be that projected for never-smokers.

## Methods

In an accompanying paper in this issue of the *Journal*,<sup>7</sup> we present life-tables and life expectancies for multiple combinations of time, ethnic group, income tertiles and smoking status, using mortality rates from linked census-mortality data.<sup>7</sup> Here we use life-tables and life expectancy by sex/smoking/ethnicity, estimates of future mortality decline among never-smokers, and estimates of future rate differences for current- versus never-smokers (and ex- compared to never-smokers in one analysis), to estimate life expectancy in 2040.

## Life-tables and life expectancy

Briefly, the method used to create the life-tables brings together three pieces of information:

- The official Statistics New Zealand life-tables by year and sex;
- The distribution of the total New Zealand population by the variables of interest (e.g. the proportion who smoke and ethnicity); and
- Estimates of the differences in subpopulation mortality rates (from the New Zealand Census-Mortality Study [NZCMS]).

These three inputs were combined to produce mortality rates by single year of age for each subpopulation, and complete life-tables including central death rates ( $m_x$ ) and probabilities of death ( $q_x$ ), calculated for each age ( $x$ : 0-100), which were then used to derive other life-table functions such as life expectancy for each subpopulation. The life-tables used in this paper were generated for males

and females by ethnicity (Māori and non-Māori), and smoking status (never-, current- and ex-smoker), for the 1996-99 census-mortality cohort. For smoking life-tables, mortality rates up to age 14 were assumed to be those of the sex by ethnic group (i.e. not stratified by smoking status). (The 2006 Census, which also includes a smoking variable, is not yet linked to mortality data.)

## Projections

We focus first on projections for never- and current- smokers. The method of estimation to 2040 involved three steps:

- Estimating mortality rates by single year of age for never-smokers (by sex and ethnic group) in 2040;
- Estimating mortality rate differences (by single year of age) between current- and never-smokers in 2040, and adding this to the never-smoker mortality rates to get the smoker mortality rates; and
- Deriving life-tables and life expectancy in 2040 using these estimated mortality rates ( $m_x$ ) to calculate mortality risk ( $q_x$ ) and remaining life-table parameters.

These steps are outlined in more detail below.

**Step 1**—We set an initial estimate of the annual percentage reduction in never-smoker mortality rates  $m_x$  of 2.5% for Māori and 1.5% for non-Māori. These figures are consistent with Statistics New Zealand projections for low, medium and high mortality scenarios of 2.1%, 1.6% and 1.0% percent per year reductions in mortality rates for males (ethnic groups combined), and 2.4%, 1.8% and 1.3% percent per year reductions for females

([http://www.stats.govt.nz/methods\\_and\\_services/TableBuilder/population-projections-tables.aspx](http://www.stats.govt.nz/methods_and_services/TableBuilder/population-projections-tables.aspx)).

We modified these estimates to allow for ethnic variation in mortality rate reductions (the long-run trends suggest mortality rates are falling faster for Māori), and assumed that mortality reductions in the future will be the same for males and females. Extrapolating to 2040, we multiplied the non-Māori  $m_x$  in 1996, for every single year of age, by  $0.985^{44} = 0.514$ , where 0.985 is one minus the annual percentage reduction of 1.5% and 44 is 2040 minus 1996. The Māori  $m_x$  was multiplied by  $0.975^{44} = 0.328$ .

We also projected more optimistic annual reductions in mortality rates of 3.5% per annum for Māori and 2.0% per annum for non-Māori using the long-run trends of improving life expectancy over the last 100 years.

**Step 2**—We have previously found that the mortality rate difference (not the rate ratio) comparing smokers to never-smokers, is consistent across time and ethnic group.<sup>11</sup> Therefore, we set one option for the smoking:non-smoking mortality rate differences in 2040 as being the same as that observed in 1996-99. However, constant rate differences over time mean increasing rate ratios if the mortality rate among never-smokers is reducing.

For example, the rate ratio comparing current- to never-smokers *within* Māori is roughly 1.5 in 1996-99. Under the assumption of 2.5% per annum reduction in Māori never-smoker mortality rates to 2040, a constant rate difference would see the rate ratio increase to  $1 + (1.5 - 1)/0.328 = 2.5$ . We also explored the effects of alternative assumptions of 1% and 2% per annum reductions in the rate difference, applied similarly within sex by ethnic groups. Under the 2% per annum reduction in the rate difference (and the 2.5% reduction in Māori never-smoker mortality rates), the rate ratio of 1.5 in 1996 would be about 1.6 in 2040.

**Step 3**—With mortality rates by single year of age for all sex/ethnicity/smoking status groups, life-tables were easily calculated for 2040. Because of the relatively simple nature of our projections and the differential mortality rate declines by ethnic group, it was possible for estimated Māori never-smoker mortality rates to be less than non-Māori never-smoker mortality rates in 2040 for some single years of age, and likewise for estimates of Māori current-smoker mortality rates to be less than non-Māori current-smoker rates in 2040. It is possible that Māori mortality will fall below that of non-Māori at some time in the future, if the long-run trend since 1900 continues. However, for the purposes of this analysis, we assumed no more than convergence and therefore, where necessary, forced the Māori rate to equal the projected non-Māori rate in 2040.

**Ex-smokers**—The ex-smoker compared to never-smoker mortality rate differences and rate ratios obtained from the NZCMS should be treated with caution. This is because we do not have data on the

time since quitting, which makes ex-smoker mortality experience in 1996-99 difficult to interpret and potentially unreliable as the basis for future projections. Nevertheless, to provide a point of comparison, we also calculated life expectancy in 2040 for sex by ethnic groups assuming the 2006 census distribution of smoking behaviour (never-, current-, and ex-smoker). A parallel method to that described above for current-smoker mortality rate projections was used for ex-smokers.

## Sensitivity analyses

In addition to varying the percentage annual decline in never-smoker mortality rates, and percentage decline in the smoking:non-smoking mortality rate difference, we tested two other assumptions. First, life expectancy in the future will be influenced by mortality over the age of 100, as the proportion of centenarians in the population increases.

Thus, we extended the life-tables out to age 120 by simply assuming that the mortality rate increased by 6% per year of age for every year of age over 100, where 6% is approximately the change in mortality by year of age from 90 to 100. (The methods and life-tables in the accompanying paper in this *Journal*<sup>7</sup> apply to age 100, the top end of current 'official' Statistics New Zealand life-tables.) Altering this 6% percent increase down to 4% and up to 10% had only a negligible influence of the results presented in this paper, and is therefore not discussed further here.

Second, we had to estimate mortality rate ratios for smokers compared to never-smokers beyond the age of 80 in the accompanying paper,<sup>7</sup> because the 1996-99 census-mortality cohort only included deaths up to age 77. Our assumption was that the predicted mortality rate ratio for current-smokers compared to never-smokers at age 80 reduced linearly to 1.0 by age 100. For the estimates to 2040 in this paper, we investigated setting a minimum rate ratio (and hence rate difference) at all ages – essentially ages above 80 years. Setting such a minimum at 1.2, or even 1.5, had negligible impact on the estimations in this paper, so is not presented further.

A copy of the Microsoft Excel spreadsheet used to generate all estimates in this current paper is provided at the NZCMS website ([www.uow.otago.ac.nz/nzcms-info.html](http://www.uow.otago.ac.nz/nzcms-info.html)), and allows interested users to alter any of the input assumptions specified above.

## Results

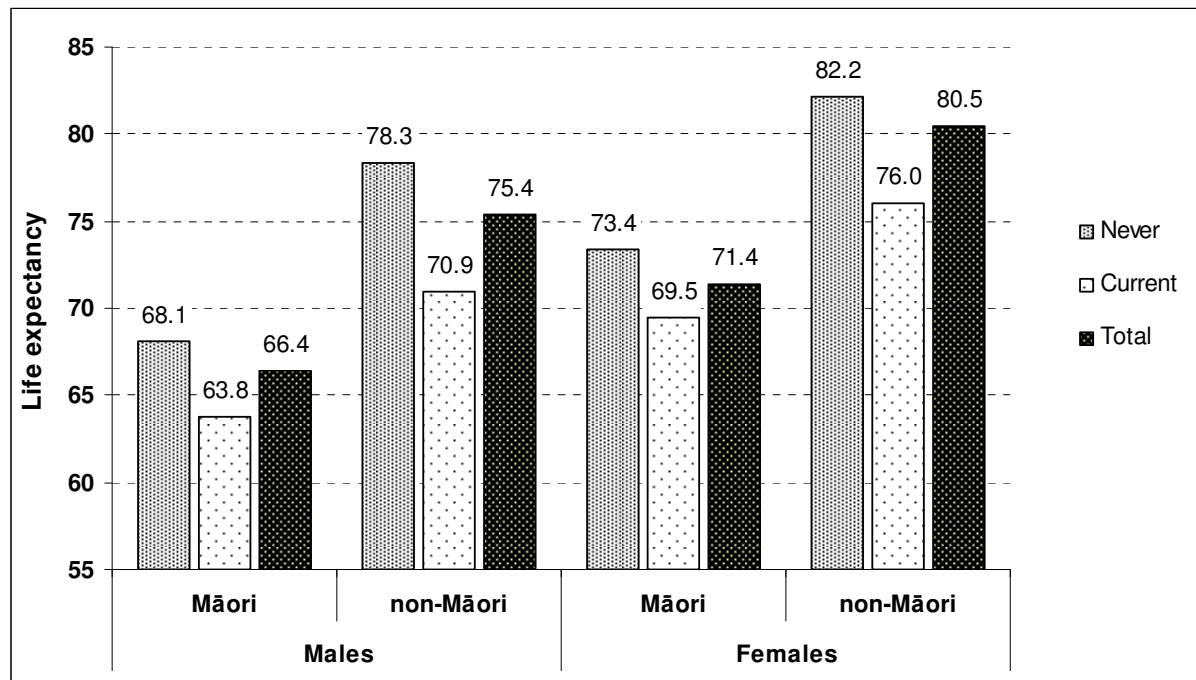
### Life expectancy 1996–9

Figure 1 shows estimates of life expectancy in 1996–99, the most recent cohort for which we have smoking data. The estimates are reproduced in Table 1, with the addition of gaps in years of life expectancy between Māori and non-Māori within smoking status groups, and conversely gaps in life expectancy between smoking status groups within Māori and non-Māori populations.

**Table 1. Life expectancy estimates for 1996-99 (observed)**

1996–99 (i.e. Figure 1)		Life expectancy by smoking status			Smoking gap	
		Never	Current	Total	Never: Current	Never: Total
<b>Males</b>	Māori	68.1	63.8	66.4	4.3	1.7
	Non-Māori	78.3	70.9	75.4	7.4	2.9
	Ethnic gap	10.2	7.2	9.0		
<b>Females</b>	Māori	73.4	69.5	71.4	3.9	2.0
	Non-Māori	82.2	76.0	80.5	6.2	1.7
	Ethnic gap	8.8	6.5	9.1		

**Figure 1. Life expectancy in years for 1996-99, by sex, ethnicity and smoking status**



Two patterns are evident. First, current-smokers have lower life expectancy among males and females for Māori and non-Māori strata. However, the gap between current- and never-smokers is less among Māori than among non-Māori (4.3 and 3.9 years among Māori males and females respectively, compared to 7.4 and 6.2 years among non-Māori).

Second, Māori have lower life expectancy in all smoking strata. However, the gap between Māori and non-Māori is greater among never-smokers than among current-smokers (10.2 and 8.8 years for male and female never-smokers respectively, compared to 7.2 and 6.5 years for current-smokers).

### Projections to 2040

Table 2 shows our projected 2040 life expectancy estimates for never- and current-smokers for the six scenarios. Assuming New Zealand is smokefree by 2020, and allowing for a wash-out period of 20 years for past smoking-related mortality risk, then we might assume that 2040 life expectancies are approximated by the never-smokers.

**Table 2. Projected life expectancy estimates for 2040 for six scenarios of varying reductions in never smoker mortality rates, and reductions in current-never smoker mortality rate differences**

Scenario		Smoking status			Smoking gap		Extent of ethnic
		Never	Current	Total (2006 †)	Never: Current	Never: Total	gap closure‡
		(i)	(ii)	(iii)	(iv)	(v)	(vi)
<b>A: 2.5%/1.5% p.a. ↓ Māori/non-Māori never smoking mortality; 0% p.a. ↓ in smoking rate difference</b>							
Males	Māori	82.3	71.6	77.1	10.7	5.2	0.7
	non-Māori	85.4	74.1	80.8	11.3	4.6	
	Ethnic gap	3.1	2.5	3.8			
Females	Māori	85.9	76.4	79.6	9.5	6.3	3.5
	non-Māori	88.6	79.1	85.8	9.5	2.9	
	Ethnic gap	2.7	2.7	6.1			
<b>B: 2.5%/1.5% p.a. ↓ Māori/non-Māori never smoking mortality; 1% p.a. ↓ in smoking rate difference</b>							
Males	Māori	82.3	74.4	78.7	7.9	3.6	0.5
	non-Māori	85.4	77.0	82.3	8.4	3.2	
	Ethnic gap	3.1	2.6	3.6			
Females	Māori	85.9	78.9	81.5	7.0	4.4	2.5
	non-Māori	88.6	81.7	86.7	6.9	1.9	
	Ethnic gap	2.7	2.8	5.2			
<b>C: 2.5%/1.5% p.a. ↓ Māori/non-Māori never smoking mortality; 2% p.a. ↓ in smoking rate difference</b>							
Males	Māori	82.3	76.6	79.8	5.7	2.5	0.3
	non-Māori	85.4	79.4	83.3	6.0	2.1	
	Ethnic gap	3.1	2.8	3.4			
Females	Māori	85.9	81.0	83.0	5.0	3.0	1.7
	non-Māori	88.6	83.7	87.4	4.9	1.2	
	Ethnic gap	2.7	2.8	4.4			
<b>D: 3.5%/2.5% p.a. ↓ Māori/non-Māori never smoking mortality; 0% p.a. ↓ in smoking rate difference</b>							
Males	Māori	86.6	73.3	79.9	13.2	6.7	1.3
	Non-Māori	87.7	74.9	82.3	12.8	5.4	
	Ethnic gap	1.2	1.6	2.5			
Females	Māori	89.8	78.0	81.9	11.8	7.9	4.6
	Non-Māori	90.8	80.0	87.4	10.8	3.3	
	Ethnic gap	1.0	2.0	5.5			
<b>E: 3.5%/2.5% p.a. ↓ Māori/non-Māori never smoking mortality; 1% p.a. ↓ in smoking rate difference</b>							
Males	Māori	86.6	76.6	81.9	10.0	4.7	0.9
	Non-Māori	87.7	78.1	84.0	9.7	3.8	
	Ethnic gap	1.2	1.5	2.1			
Females	Māori	89.8	81.0	84.3	8.8	5.5	



	Non-Māori	90.8	82.8	88.5	8.0	2.2	
	Ethnic gap	1.0	1.8	4.3			3.3
<b>F: 3.5%/2.5% p.a. ↓ Māori/non-Māori never smoking mortality; 2% p.a. ↓ in smoking rate difference</b>							
Males	Māori	86.6	79.3	83.4	7.2	3.2	
	Non-Māori	87.7	80.7	85.2	7.0	2.5	
	Ethnic gap	1.2	1.4	1.8			0.6
Females	Māori	89.8	83.5	86.0	6.3	3.8	
	non-Māori	90.8	85.1	89.3	5.6	1.4	
	Ethnic gap	1.0	1.6	3.3			2.3

† The total estimates are assuming the 2006 census population distribution of smoking continued to exist to 2040.

‡ The 'extent of ethnic gap closure' is the [never smoker ethnic gap] minus [total (as per 2006 census smoking distribution) ethnic gap]. That is, the reduction in the ethnic life expectancy gap resulting from ending tobacco smoking by 2020 c.f. alternative of 2006 census population smoking prevalences continuing.

For all scenarios, and all strata of ethnicity by smoking, there are substantial improvements in life expectancy compared to 1996-99. Regardless of the scenario, ethnic gaps within strata of smoking are also reduced. Gaps in life expectancy between current- and never-smokers (column iv, Table 2) range from 5 to 6 years in Scenario C (2.5/1.5% annual reduction in Māori/non-Māori never-smoker mortality; 2% per annum reduction in mortality rate difference between current- and never-smokers) up to 11 to 13 years in Scenario D (3.5/2.5% annual reduction in Māori/non-Māori never-smoker mortality; 0% per annum reduction in mortality rate difference between current- and never-smokers). Regardless of the scenario, the impact of smoking on life expectancy is more similar for Māori and non-Māori than that observed in 1996-99. ‘

If the 2006 census smoking prevalence remains unchanged into the future (i.e. ‘total’ in Table 2), we estimate the difference in 2040 between Māori and non-Māori life expectancy to range from 1.8 to 6.1 years across the six scenarios and two sexes (average 3.8 years; ‘ethnic gap’ estimates in column (iii)).

By comparing the life expectancy of ‘never-smokers’ and ‘total’ across scenarios A to F, we have estimates of the additional gains in projected life expectancy in 2040 if nobody smoked tobacco from 2020 compared to the 2006 smoking distribution continuing indefinitely (i.e. column (v) in Table 2). Accordingly, we estimate additional gains in life expectancy for Māori ranging from 2.5 to 7.9 years (average 4.7) and for non-Māori ranging from 1.2 to 5.4 years (average 2.9). That is, going smokefree as a nation will (we estimate) result in larger improvements in Māori life expectancy, compared to non-Māori, and therefore result in a closing in ethnic inequalities in life expectancy ranging from 0.3 to 4.6 years (average 1.8 years).

The estimated closing of ethnic gaps in life expectancy was consistently greater for females, reflecting the particularly high 2006 smoking prevalence among Māori females.

## Discussion

If the 2006 census smoking prevalence remains unchanged into the future, and background non-smoking related mortality continues to decrease more so for Māori

than non-Māori, we estimate that the difference in 2040 between Māori and non-Māori life expectancy will be about three and a half years (averaged across sex). However, if nobody smokes tobacco from 2020 onwards, we estimate *about 5 years* of additional gain in life expectancy for Māori (range across six scenarios and sexes 2.5 to 7.9 years) and *about 3 years* for non-Māori (range 1.2 to 5.4 years), therefore contributing *about 2 years* (range 0.3 to 4.6 years) of closing in ethnic inequalities in life expectancy.

We emphasise that our exact estimates are quantitatively uncertain. But we do conclude that if nobody smokes tobacco by 2020 in New Zealand there will be substantive improvements in overall population life expectancy. And it will be an important, if not necessary, step towards the ending of Māori:non-Māori inequalities in mortality by 2040—200 years after the signing of the Treaty of Waitangi.

A number of subsidiary findings also arise out of our projections. Perhaps surprisingly at first glance, we find that the gap between current- and never-smoker life expectancy in 1996-99 was *less* among Māori (4.3 and 3.9 for males and females respectively) than among non-Māori (7.4 and 6.2). The reason for this is that the absolute additional mortality burden from smoking (i.e. the rate difference in mortality between current- smokers and never-smokers) is about the same across ethnic groups, sexes and time.<sup>8</sup>

The corollary of this is that the relative risk comparing the mortality of smokers and never-smokers is *less* among Māori. This is due to the much higher background mortality among Māori never-smokers compared to non-Māori never-smokers, which in turn is due to all the other non-tobacco determinants of mortality that vary between Māori and non-Māori.<sup>9 11</sup> However, if as we assumed in this paper, Māori mortality rates fall faster than non-Māori mortality rates in the next few decades (i.e. if mortality rate reductions return to their long-run trends of the last century, as opposed to a reversed pattern in the 1980s and 1990s<sup>3 4 13</sup> associated with structural changes in the economy), then the relative impact of smoking on mortality among Māori will increase faster than among non-Māori. That is, the Māori life-table will move into a state where smoking has a larger impact on life expectancy gains than it does now.

Thus, by 2040 we estimate that the gap in life expectancy between current-smokers (hypothetical if the country is free of tobacco smoking by then) and never-smokers will be similar for both Māori and non-Māori (Table 2).

There are a number of limitations in our analyses. First and foremost, we necessarily make a number of assumptions to project life expectancy in 2040. Therefore, our projections must be interpreted as indicative only. For example, if it is assumed that mortality cannot continue to decline at the rates it has in the last 100 years, and that our 2.0%/3.5% per annum reductions in non-Māori/Māori never smoker mortality are too optimistic (partly because some of the rapid fall in mortality rates may be due to smoking cessation itself), then scenarios A, B and C would be assumed to be more accurate.

As another example, we think that a 2% per annum decline in the smoking:non-smoking mortality rate difference into the future is unlikely, and that 0% or 1% is more likely. Accordingly, we have presented six scenarios in this paper for readers to peruse, and we have provided a copy of our Excel spreadsheet at the NZCMS website



to allow testing of alternative assumptions ([www.uow.otago.ac.nz/nzcms-info.html](http://www.uow.otago.ac.nz/nzcms-info.html)). We have also undertaken sensitivity analyses varying assumptions of the decaying smoking:non-smoking mortality rate ratio above age 80 and future mortality rate decline among never smokers above age 100 – neither greatly affected the results presented here.

Finally, and importantly, the general conclusion remains unaltered across the Scenarios we specified: smoking will have a bigger impact on life expectancy in the future; and if Māori life expectancy converges with non-Māori life expectancy then the impact of smoking will also become more similar between the two ethnic groups.

Second there are limitations in the underlying NZCMS data, including likely misclassification biases of smoking status and incomplete linkage of mortality records. Regarding the former, this has probably led to some underestimation of difference in mortality by smoking status, therefore underestimating differences in life expectancy between never- and current-smokers. Regarding the latter, we used linkage weights that have been shown elsewhere to correct reasonably well for linkage bias.<sup>14</sup>

Third, we have not explicitly allowed for passive smoking. This currently affects more Māori than non-Māori. As a result, we have probably further underestimated the full impact of smoking on ethnic gaps in mortality in 2040 if current smoking prevalence continues, and will have underestimated the overall gains in life expectancy and the impact on reducing ethnic gaps in life expectancy of ending smoking by 2020 .

Fourth, our estimates of the association of smoking with mortality will be prone to residual confounding. That is, smoking is associated with other risk factors that positively confound the smoking-mortality association. Indeed, we have shown this previously using NZCMS data for socioeconomic position as the potential confounder.<sup>15</sup> There is likely to be some off-setting between such residual confounding and the misclassification of smoking and non-inclusion of passive smoking, however it is difficult to know the net effect.

## **Policy implications**

What does this mean for policy making around tobacco control and reducing health inequalities? Simply, if tobacco is consumed in the future as it is currently, this will act as an increasingly important “handbrake” on overall improvements in life expectancy, and will also impede the closing of ethnic gaps in life expectancy. Ending tobacco smoking by 2020 will not only release greater life expectancy gains for the total New Zealand population, but also accelerate the closure of Māori:non-Māori gaps in life expectancy.

Is ending tobacco smoking in New Zealand by 2020 feasible? We argue “yes”, given the availability of a range of existing and plausible interventions. In addition to intensifying established tobacco control interventions (e.g. tax rises as just announced in New Zealand, plain packaging as just announced in Australia, removing residual marketing such as point-of-sale displays, and enhanced cessation services), new ‘endgame’ solutions are available. For example, a reducing quota mechanism, or sinking lid<sup>16</sup>, of 10 percentage points per annum reduction in tobacco imports from

2010 to 2020 would ensure that no tobacco is available for direct retail to the public by 2020.

Alternatively, large recurrent tax rises of about 20% per annum (accompanied by boosted and strong cessation services) may be able to drive prevalence down to less than 2% by 2020. Such end-game solutions have been voiced by both non-governmental organisations in New Zealand<sup>12</sup> and political leaders<sup>17</sup>, and are receiving serious scrutiny by the current Māori Affairs Select Committee Inquiry (due to report in the next few weeks). Such solutions may even be favoured by New Zealand smokers since a majority of them regret smoking<sup>18</sup>, and support stronger regulation of tobacco.<sup>19 20</sup>

## Conclusions

As mortality rates decrease in the future, the relative impact of smoking on mortality will increase. If nobody smoked tobacco in New Zealand from 2020 life expectancy will be substantially improved for all, and our average estimate is that ethnic inequalities in life expectancy will be about two years less (compared to a scenario of 2006 smoking prevalence continuing into the future). Making New Zealand smokefree by 2020 is achievable – but strong political will is needed, along with improved recognition of the desire of smokers to be free of their addiction.

**Competing interests:** Although we do not consider it a competing interest, for the sake of full transparency we note that some of the authors have undertaken work for health sector agencies working in tobacco control.

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