# Appendix – Mortality rate ratios for current- and ex-smokers versus never smokers, by ethnic group

We have previously shown that the ethnic specific mortality rate ratios for current versus never, and ex- versus never-smokers varies over time (increases from the 1980s to 1990s) and by ethnicity (greater for non-Māori non-Pacific than Māori).[1] One way to conceptualise this is that as the never-smoker mortality rate declines for reasons other than not smoking (e.g. improved diets, better health services), the impact of smoking grows in percentage or relative risk terms.[2] Indeed, it is the rate difference (not the rate ratio) that appears to be more constant across ethnicity and time in New Zealand during the 1980s and 1990s. This pattern may vary in the future as the proportion of deaths with tobacco as a major determinant changes over time for reasons other than tobacco control (e.g. changes in cardiovascular disease incidence) and even changes in tobacco products (e.g. tar content). Nevertheless, the assumption that NZCMS-derived *relative* risks apply uniformly over time and by ethnicity in New Zealand seems incorrect. Therefore, we extended methods developed elsewhere [3, 4] to apply NZCMS-derived risks by sex, age and ethnicity. Noting that life expectancy is steadily increasing, and more rapidly over the long-run (100 years) for Māori than non-Māori, we selected a medium scenario (from Blakely et al, 2010[Blakely, Carter et al. 2010]) of future mortality rate reductions among never-smokers such that mortality rates reduce by 2% and 2.75% per annum at all ages for non-Māori and Māori never-smokers, respectively. Furthermore we selected the 'medium scenario' of 1% per annum reduction in the rate difference for current versus never-smokers at each year of age. Thus, using the smoothed mortality rate and rate ratio (current versus never) estimates by smoking and ethnicity from the 1996-99 NZCMS cohort,[3, 4] the future projected RRs beyond 1996 are:

$$RR_{1996+t,i,j} = 1 + \frac{(RR_{1996,i,j} - 1) \times (1 - 0.01)^t}{(1 - k_j)^t}$$

$$k_j = \begin{cases} 0.0275, & j = Māori \\ 0.02, & j = non - Māori \end{cases}$$

where *i* is the sex by age-group, and t is the number of years post 1996. The equations also work for years pre-1996, by specifying *t* as a negative integer. Data and projections, however, for ex- versus never-smokers are more difficult due to the changing nature of the ex-smoker group. In the future the ex-smokers are likely to be of "longer average time since smoking" with consequently lower smoking-related mortality risk than current-smokers. Accordingly, we kept the ex-smoker RRs constant in the future (in contrast to the above equations which will see a steady increase in the

current-never smoker RR). Sensitivity of the base model predictions to changes in the relative risk values, including replacement with risks from the US Cancer Prevention Survey II (CPSII), removing the projected changes in risks over time, and varying risks upwards or downwards by 20%, were also evaluated. The CPSII and NZCMS-derived relative risks (for selected age groups and years) are shown in Tables 1 and 2 below.

**Appendix Table 1: RRs for current and ex-smoker versus never smoker, for CPSII, by selected age groups.**

| | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | 45-49 | 65-69 | 85+ | 45-49 | 65-69 | 85+ |
| Current vs never | 2.81 | 2.63 | 1.24 | 2.06 | 2.30 | 1.32 |
| Ex vs never | 1.46 | 1.65 | 1.03 | 1.41 | 1.38 | 1.07 |

**Appendix Table 2: RRs for current and ex-smoker versus never smoker, for NZCMS derived RRs, by selected age groups.**

| | Males | | | | | | Females | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Māori | | | Non-Māori | | | Māori | | | Non-Māori | | |
| | 45-49 | 65-69 | 85+ | 45-49 | 65-69 | 85+ | 45-49 | 65-69 | 85+ | 45-49 | 65-69 | 85+ |
| Current vs never | | | | | | | | | | | | |
| 2011 | 1.50 | 1.73 | 1.61 | 2.05 | 2.33 | 1.85 | 1.27 | 1.80 | 1.54 | 1.72 | 2.37 | 1.73 |
| 2025 | 1.64 | 1.93 | 1.78 | 2.21 | 2.53 | 1.98 | 1.34 | 2.03 | 1.69 | 1.83 | 2.57 | 1.84 |
| 2040 | 1.84 | 2.22 | 2.02 | 2.41 | 2.78 | 2.14 | 1.45 | 2.34 | 1.91 | 1.97 | 2.83 | 1.98 |
| Ex versus never | | | | | | | | | | | | |
| 2011 | 0.87 | 1.20 | 1.43 | 1.06 | 1.41 | 1.48 | 1.31 | 1.85 | 1.71 | 1.25 | 1.72 | 1.49 |
| 2025 | 0.83 | 1.25 | 1.55 | 1.07 | 1.47 | 1.55 | 1.40 | 2.09 | 1.92 | 1.29 | 1.83 | 1.57 |
| 2040 | 0.78 | 1.33 | 1.72 | 1.08 | 1.55 | 1.64 | 1.53 | 2.43 | 2.20 | 1.33 | 1.96 | 1.66 |


[1] Hunt D, Blakely T, Woodward A*, et al.* The smoking-mortality association varies over time and by ethnicity in New Zealand. *Int J Epidemiol* 2005;**34**:1020-1028.

[2] Wilson N, Blakely T, Tobias M. What potential has tobacco control for reducing health inequalities? The New Zealand situation. *International Journal for Equity in Health* 2006;**5**(1):14.

[3] Carter KN, Blakely T, Soeberg M. Trends in survival and life expectancy by ethnicity, income and smoking in New Zealand: 1980s to 2000s. *New Zealand Medical Journal* 2010;**123**(1320):13-24.

[4] Blakely T, Carter K, Wilson N*, et al.* If nobody smoked tobacco in New Zealand from 2020 onwards, what effect would this have on ethnic inequalities in life expectancy? *New Zealand Medical Journal* 2010;**123**(1320):26-36.