The Sex Ratio at Birth Is Higher in Māori than in Non-Māori Populations in Aotearoa New Zealand

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ABSTRACT

Aims: The sex ratio at birth approximates 0.515 (male : total, M/T), with 515 boys per 485 girls. Many factors have been shown to influence M/T including acute and chronic stress. Increasing maternal age is associated with a decline in M/T. In Aotearoa New Zealand, circa 15% of the population identify as of Māori heritage. This populationis generally considered to be socioeconomically disadvantaged. This study analysed M/T for Māori and non-Māori M/T births in Aotearoa New Zealand and relates these to mean maternal age at delivery.

Methods: Live births by sex and maternal age at delivery were available from the website of Tatauranga Aotearoa Stats NZ for 1997–2021.

Results: This study analysed 1,474,905 births (28.4% Māori) Pooled data shows that Māori M/T is significantly higher than non-Māori M/T (chi = 6.8, p = 0.009). Mean maternal age at delivery was less for Māori mothers but this was not statistically significant.

Conclusions: Several studies have shown that M/T is decreased in socioeconomically deprived populations, and for this reason Māori M/T is expected to be lower and not higher than non-Māori M/T. A lower mean maternal age at delivery might have explained the M/T differences noted in this analysis but this was not a statistically significant difference.

KEYWORDS

humans; sex ratio; New Zealand; age; maternal; native Hawaiian or other Pacific Islander

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INTRODUCTION

The sex ratio at birth is expected to approximate 0.515 (male to total births, M/T), such that 515 boys are born for every 485 girls (1). A wide range of factors have been shown to influence M/T (2), including acute stressful events and these may be not only natural events, such as earthquakes and floods (3, 4), but also man-made such as terrorist attacks and contracting economies (5, 6). Races have been shown to have different M/T ratios and it has been speculated that these may be innate (7), or due to environmental factors such as chronic stress (8). Increasing maternal age is associated with a decline in M/T, a factor that should be accounted for when comparing large groups, if possible (9).

In Aotearoa New Zealand, circa 15% of the population identify as of Māori heritage, tangata whenua (Indigenous people) and 7.8% of Pacific heritage (10). The Māori are a minority population originating from Australasia and compared other local populations, are overall considered to be socioeconomically disadvantaged (11, 12) and experience the poorest health statistics like many Indigenous peoples around the world (13–15).

This study was carried out to ascertain whether there were any significant M/T differences between Māori and non-Māori M/T ratios in Aotearoa New Zealand and to relate this to mean maternal age at delivery.

METHODS

Live births by sex were available as quarterly data from the website of Aotearoa New Zealand's national statistics office, Tatauranga Aotearoa Stats NZ (16). Data for Māori and total births (from which non-Māori were obtained by subtraction) were available for contiguous years for the period 1997–2021. 95% confidence intervals for M/T were calculated using the equations of Fleiss (binomial) (17). Mean maternal age at delivery was available for December for each year for the period studied for Māori and non-Māori births.

Data was analysed in bespoke Excel sheets as created for the Write a Scientific Paper Course (WASP), including

Tab. 1 Māori and non-Māori male and female births and M/T with 95% confidence intervals.

1997–2021	Māori	Non-Māori
M	215,790	540,702
F	203,538	514,875
Total	419,328	1,055,577
UCI	0.5161	0.5132
M/F	0.5146	0.5122
LCI	0.5131	0.5113

Tab. 2 Maternal ages at birth (1997–2021), Māori and non-Māori births.

	Māori	Non-Māori
Weighted mean	26.37	30.15
Weighted median	26.00	30.00
Weighted SD	7.03	10.25
Conf. Int. (95%)	2.49	3.63

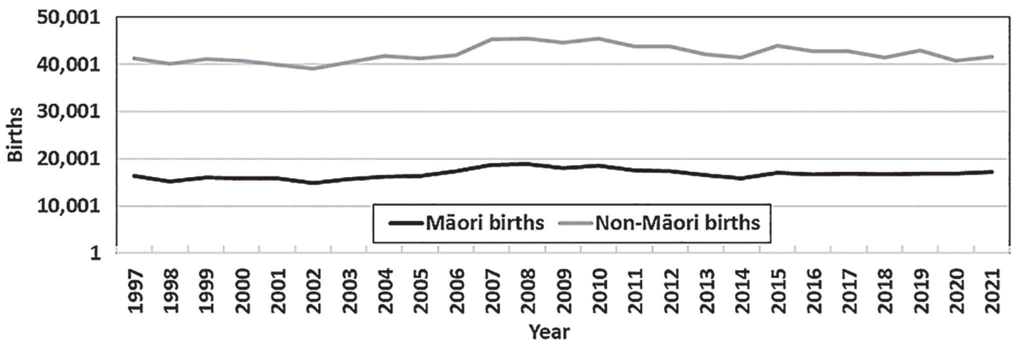

Fig. 1 Live births, Māori and non-Māori, 1997–2021.

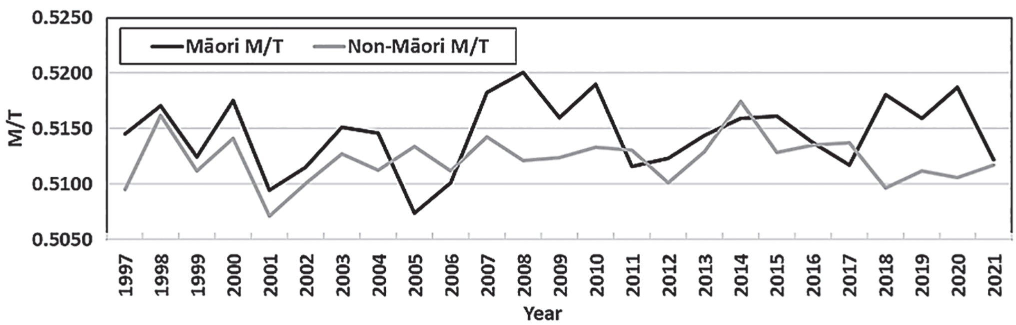

Fig. 2 M/T, Māori and non-Māori births, 1997–2021.

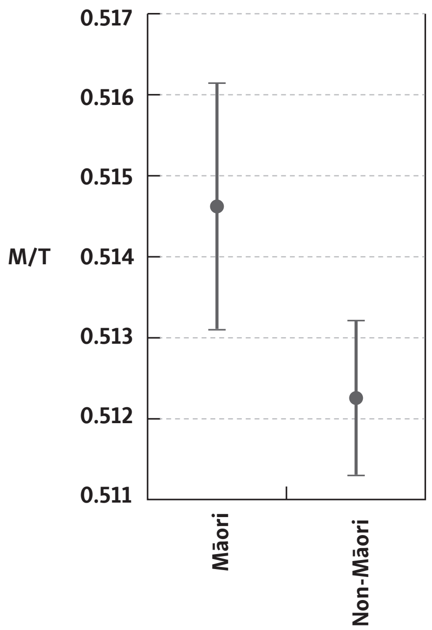

Fig. 3 Pooled M/T (1997–2021), Māori and non-Māori births.

chi tests, confidence intervals for proportions and weighted means t tests (18). A p value of ≤ 0.05 was taken to represent a statistically significant result.

RESULTS

This study analysed 1,474,905 births (28.4% Māori) over the period 1997–2021. Birth rates were stable (Figure 1) and M/T variations were within expected 95% confidence intervals with Māori M/T overall generally higher than non-Māori M/T (Figure 2). Pooled data in table 1 shows that Māori M/T is significantly higher than non-Māori M/T for the study period (chi = 6.8, p = 0.009 – Figure 3).

Maternal ages at delivery are plotted in figure 4. The distributions appear different with younger Māori mothers overall, and summary statistics are shown in table 2. However, t-testing for weighted means showed no significant difference between weighted mean maternal ages at delivery for Māori and non-Māori births (t = 1.74, p = 0.086 (two-tailed).

DISCUSSION

Internal population M/T differences have been described. For example, Hungarian Gypsies invest more heavily in daughters than sons when compared with the rest of the Hungarian population (19). Similarly, differences have been noted in a more modern U.S. populations and in and Kenyan Mukogodo hunter-gatherers (20, 21).

Racial M/T differences had been historically ascribed to innate racial differences (7). However, it has been noted that in the United States that M/T is Asian or Pacific Islander > White > American Indian or Alaska Native > Black or African American. The lower M/T of Indian or Alaska Native and Black and African American in this country is tantamount to a constant loss of 3.5–4/1000 male births when compared to White M/T. Since race is the most significant variable associated with wealth inequality in the US, chronic socioeconomic stress may be responsible, in part or in full, for this M/T difference (8, 22). Similarly, in a large, United Nations dataset, it has been shown that M/T was More Developed Countries > Least Developed Countries (23), supporting the socioeconomic hypothesis for lower M/T due to chronic stress (24). This is in accordance with the Trivers-Willard hypothesis of parental investment which avers that natural selection has favoured parents who adapt to periconceptual and early pregnancy conditions, such as in conditions of stress, weaker (typically male) foetuses are lost paving the way for a new pregnancy that may be female and likelier to survive to term and to adult life and become pregnant, or another son perhaps under better conditions (25). Poor socioeconomic conditions are tantamount to chronic stress and may result in chronic lower M/T ratios (24).

Overall, M/T in Aotearoa New Zealand has been shown to be stable over the last few decades (26). The minority Māori are generally considered to be socioeconomically disadvantaged (11–15), and based on the socioeconomic hypothesis of M/T, Māori M/T is expected to be lower and not higher than non-Māori M/T. However, other factors may have influenced/biased M/T in these populations.

Increasing maternal age has been shown to be associated with a decline in M/T in offspring (9, 27, 28). It has been speculated a higher maternal age may in and of itself be a stressful factor in pregnancy (29), and since there is evidence that female live births are overrepresented in

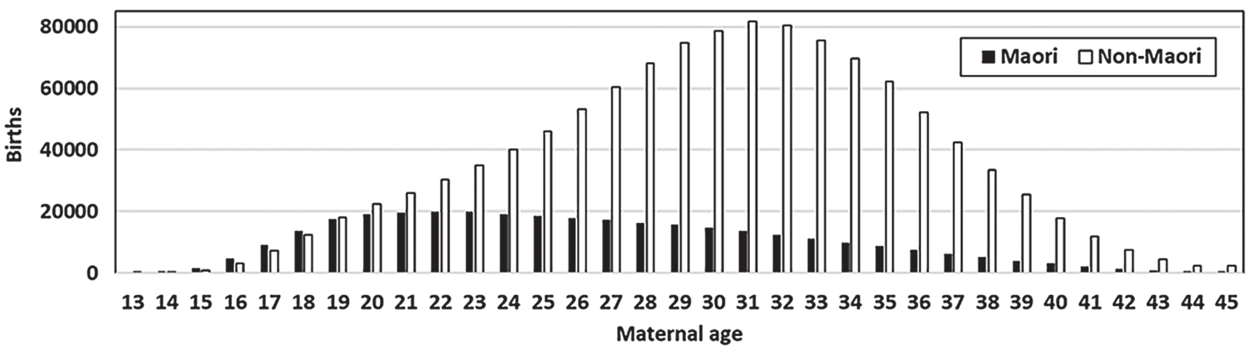

Fig. 4 Maternal ages at birth (1997–2021), Māori and non-Māori births.

stressful pregnancies (30), a lower mean maternal age at delivery might have explained the M/T differences noted in this analysis.

This study is limited by several factors. In the first instance, the lack of a statistically significant difference in mean maternal age between Māori and non-Māori may have been due to lack of power, with inadequate numbers. Furthermore, many factors influence M/T (2), including toxins (31), and the datasets available were very limited in scope and breadth, without individual maternal data.

Finally, all such studies are hampered by publicly available data that is insufficiently detailed, for example, monthly births by sex, despite the obvious fact that this data is routinely collected. National statistics offices may view the Centers for Disease Control natality database (CDC Wonder) as a suitable example for data availability, allowing researchers access to anonymous data for detailed studies (32). In practice, only very rarely do researcher gain access to highly detailed, anonymised data by individual, and this is typically data obtained from a researchers' own countries (33). In conclusion, M/T remains a fascinating field of study and access to more detailed data would immensely help researchers.

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