



Indigenous fertility in Aotearoa New Zealand: How does ethnic identity affect birth spacing and timing?

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Abstract

The survival of Indigenous peoples in the CANZUS states of Canada, Australia, Aotearoa New Zealand, and the United States is nothing short of remarkable. Not only have Indigenous peoples thwarted colonial tropes of the *vanishing native* but, for decades, Indigenous population growth rates have significantly outpaced those of the dominant settler populations. The future survival of Indigenous peoples fundamentally rests on continued natural increase, and understanding the causes and consequences of fertility behaviour is critical. While total fertility rates for Indigenous women in CANZUS countries are relatively low, childbearing tends to be concentrated at younger ages in contrast to the dominant white populations. The fertility transitions of both settler and Indigenous populations in the CANZUS states are well documented, however, a significant gap remains: how cultural factors shape contemporary Indigenous fertility behaviours. Using Aotearoa as a case study, we explore the relationship between Māori cultural identity, birth timing, and the duration of birth intervals. We use the 1995 New Zealand Women: Family, Employment and Education survey data to further test the impact of cultural identity on birth transition rates using the piecewise exponential model and Kaplan-Meier estimates. We find that women who identify *Mainly Māori (exclusively or primarily)* are at greater risk of bearing much earlier to first birth but not necessarily subsequent births. However, because of the earlier start, Māori have a longer reproductive window to bear more children, and at higher birth orders still bear earlier than non-Māori. The empirical evidence strengthens our case to suggest that cultural orientation has some influence on Indigenous fertility and contributes to the development of Indigenous-centred theories of fertility and demography more broadly.

Keywords Indigenous fertility · Māori fertility · Cultural identity · Ethnic identity · Ethnic identification · Birth timing · Parity · Birth intervals

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Introduction

The survival of Indigenous peoples in the CANZUS states of Canada, Australia, Aotearoa New Zealand (Aotearoa), and the United States is an extraordinary feature of those countries' demographic histories. Indigenous minorities have shared colonial histories of dispossession, subjugation, and systemic racism, along with contemporary forms of exclusion manifesting in over-representation on myriad measures of socio-economic disadvantage (Anderson et al., 2016; Gracey & King, 2009; King et al., 2009). Not only have Indigenous peoples put paid to colonial tropes of the *vanishing native* but, for decades, Indigenous population growth rates have significantly outpaced those of the dominant settler populations due to a combination of youthful age structure, higher fertility, and a post-1970s resurgence of Indigenous identity (Andersen, 2008; Big Eagle & Guimond, 2009; Johnstone, 2011a; Nagel, 1995; Pool, 1991, 2015; Snipp, 1989; Taylor et al., 2020). Absent the option of migration-driven growth, the future survival of Indigenous peoples will fundamentally rest on continued natural increase. Understanding the causes and consequences of fertility behaviour, and what it portends for future trends, is critical.

The fertility transitions of both settler and Indigenous populations in the CANZUS states have been well documented (see, for example, Cannon & Percheski, 2017; Haines, 1989; Haines & Steckel, 2000; Johnstone, 2011a, 2011b; Pool, 1991; Pool et al., 2007; Sullivan, 2005), but significant gaps remain. One understudied area is how cultural factors shape contemporary Indigenous fertility behaviours. By *culture* we mean the ideas, customs, social behaviours, values, and worldviews associated with a collective (Jenks, 2005). While total fertility rates for Indigenous women in CANZUS countries are relatively low, childbearing tends to be concentrated at younger ages, in stark contrast to the deferred childbearing of women from the dominant white populations (Johnstone, 2011a). Observing a pattern of early Indigenous childbearing across all CANZUS countries, Johnstone (2011a) argued that colonisation was an “explicit and pervasive influence on all exogenous drivers of the proximate determinants of fertility” but was largely erased from demographic theory and approaches (p. 117).

Taking Johnstone's challenge as a starting point, we focus on the fertility of Indigenous Māori women in Aotearoa and explore the relationship between Māori cultural identity, birth timing, and the duration of birth intervals. Using retrospective fertility data from Aotearoa's only nationally representative fertility survey, we examine whether Māori women who identify exclusively or primarily as Māori have an earlier first birth, and shorter birth duration than women who identify as Māori but see themselves primarily as European. The assumption is that how women ethnically identify themselves—or *expressed identification* (Kukutai, 2007, 2011a; Liebler & Kana'ianupuni, 2003; Roth, 2005; Saperstein, 2012)—is one facet of a deeper cultural orientation that is promotive of early childbearing. However, the coercive state policies of assimilation, the suppression of language and culture, and the alienation of land, has had intergenerational impacts on identity and knowledge of whakapapa (genealogy) (Barcham, 1998;

Rarere, 2022; Mahuika, 2019; Te Rito, 2007a). We use expressed identification as a proxy for cultural orientation and try to unpack how it might be implicated in the persistence of earlier Māori childbearing.

We begin with a brief demographic history with a particular focus on how two very distinct fertility transitions have transpired in Aotearoa, involving quite different fertility and family formation patterns (Pool et al., 2007). Conventional models and theories, such as the Demographic Transition, have been the default explanations for understanding Indigenous fertility. However, as a prelude to our analysis, we attempt to move towards a more plausible explanation behind these distinct patterns by outlining the relationship between Indigenous identity and fertility. Central to this relationship is the impact of colonisation. We then outline our data source, methods, and the key variables that we use to test our premise—that ethnic identity affects birth timing and spacing. We then present the results of our analyses, and end with a discussion of what these results mean in the broader context of Indigenous identity and fertility.

Background

Aotearoa is a multi-ethnic settler colonial state with an estimated population of 5.2 million (Stats NZ, 2023a).¹ In the 2018 census the dominant group of predominantly Anglo settler origins known as Pākehā or European² comprised 70.2% of the population, while Māori made up 16.5%, Asian peoples 15.1% and Pacific peoples 8.1%.³ Colonisation has been instrumental in land confiscation, and the suppression of language, culture and institutions, and its legacy continues in Aotearoa today. One of the aims of colonisation has been to displace Indigenous identity. For example, the state has attempted to define and redefine who is Māori, as if they are a homogeneous group, in instruments such as the census (Kukutai, 2011a, 2011b; Kukutai & Pool, 2014; Pool, 1991). However, Māori identity is complex and multi-faceted (Barcham, 1998; Borell, 2005; Durie, 1995, 1998; McIntosh, 2005; Walker, 1989; Webber, 2008), and central to identity is whakapapa or shared descent (Mahuika, 2019; Taonui, 2011; Te Rito, 2007b). As a result of colonisation, contemporary intergenerational ethnic inequities persist (Ajwani et al., 2003; Callister & Blakely, 2004; Chapple, 2000). However, Te Tiriti o Waitangi (The Treaty of Waitangi) has been the over-arching convention for bringing the Crown to account for the colonial injustices of the past and addressing the enduring intergenerational effects on Māori. The Māori renaissance, which began in the 1970s, served as an important platform for the revival of te reo (the Māori language), culture, and identity, and

¹ As at 31 December 2022, according to Stats NZ update on 10 March 2023.

² Pākehā is a popular colloquial term to describe the majority white population in Aotearoa (British settlers and their descendants) but “has not been institutionalised as a statistical term” (Kukutai, 2011a, 2011b, p. 60). For example, in the census the majority group is labelled ‘New Zealand European’, and ‘European’ at Level 1 of the Statistical Standard for Ethnicity (Kukutai, 2011a, 2011b).

³ Ethnicity in the census is a multiple-response variable, and hence the total sum of the ethnic groups exceeds 100%.

many have taken this opportunity to reconnect with their cultural identity and their whakapapa. However, there is significant heterogeneity within the Māori population with regards to individual and familial access and connection to te ao Māori (Māori society) (Houkamau & Sibley, 2010).

Māori and Pākehā demographic histories—including fertility and family formation patterns—have followed very different trajectories in terms of timing and mechanisms (Pool, 1991; Pool et al., 2007). After decades of high birth rates, the Māori fertility transition occurred in the decade 1966 to 1976 and, up until that time, was one of the most rapid transitions observed anywhere in the world (Pool, 1991; Pool et al., 2007). Pākehā fertility had declined about a century earlier, facilitated by later marriage, and was only temporarily disrupted by a prolonged post-war baby boom (Pool et al., 2007). By contrast, the utilization of more effective contraceptive methods was a key factor that facilitated the Māori fertility transition—between 1966 and 1976 the total fertility rate dropped from 5.5 to 3.1 (Pool, 1991). Although ethnic differences in fertility levels have diminished over time (Pool, 1991; Pool et al., 2007; Pool & Sceats, 1981), Māori birth rates have consistently exceeded Pākehā and have never intersected (Fig. 1)⁴.

While the average fertility of Māori is not much different to that of Pākehā women, important differences remain. One relates to peak childbearing ages, where Māori fertility has been concentrated at the younger ages. Since 1966, Māori teenage fertility has been relatively high (compared to all other groups), albeit declining over time. Māori age-specific fertility was highest at ages 20–24 years (Pool, 1991), until it shifted upwards to 25–29 years in 2013 (Stats NZ, 2023b). In comparison, between 1966 and 1976, Pākehā age-specific births⁵ peaked at 20–24 years, then shifted upward to 25–29 years between 1977 and 2001, and for the last two decades has peaked at ages 30–34 (Stats NZ, 2023b). The shift to older maternal ages is more marked for Pākehā women and has somewhat widened the differentials with Māori. The median age of Māori mothers was 24.7 years in 1966 and has slowly shifted upwards to 27.7 in 2022 (Stats NZ, 2023c). For the same period, the median age of Pākehā mothers⁶ was 25.3 and increased to 31.2 (Stats NZ, 2023c). Based on census data for 1981, 1996, and 2006, Aotearoa has also experienced increasing levels of childlessness (Boddington & Didham, 2009; Didham & Boddington, 2011), however the difference in levels of childlessness between Māori and European is profound. In 2006, the proportion of childless Māori women aged 40–44 was around 11 per cent, compared to 16 per cent for European women (Stats NZ, 2023d). In the 2018 Census, the proportion of childless Māori women aged 40–44 years (14%) was also significantly lower than for non-Māori (17%) (Stats NZ, 2023d).

⁴ There was no Māori data available between 1991 and 1996.

⁵ This is age-specific data for all Aotearoa women. Data specifically for Pākehā women were not available but we can assume that the rates for the dominant Pākehā will be similar. For further analysis of age-specific fertility patterns and trends between Māori and non-Māori, see Jackson et al. (1994). The main point is that Māori age-specific fertility is younger than non-Māori women.

⁶ This is median ages for all Aotearoa mothers. Data specifically for the dominant Pākehā women were not available but we can assume that the rates for the dominant Pākehā will be similar. The main point is that the median age of Māori mothers is younger than non-Māori mothers.

The demographic transition model has often been the default framework for understanding fertility transitions, including Indigenous ones. However, in recent decades the second demographic transition (SDT) has been deployed to explain key post-1970s demographic changes in developed countries, notably: sustained sub-replacement fertility, multiple living arrangements other than marriage, the disconnection between marriage and procreation, depopulation, and aging populations (Lesthaeghe, 2014). A key criticism of the SDT is that it is a phenomenon typical of Northwestern Europe and mainly European populations of the CANZUS states, and is therefore less applicable to *other cultures* (Lesthaeghe, 2014). Like its predecessor, the SDT also does not consider colonisation as a distal determinant of Indigenous fertility (Johnstone, 2011a), nor does the SDT take into consideration the relevance of Indigenous perspectives around family formation or fertility. As a way forward, we consider a more plausible explanation behind these distinct patterns by exploring the relationship between Indigenous identity and fertility.

The relationship between Indigenous identity and fertility

Studies of Māori fertility have typically focused on demographic and political-economic explanations for ethnic differences in fertility levels, parity, and birth timing (Jackson et al., 1994; Pool, 1974, 1977, 1991; Statistics NZ, 2004; Zodgekar, 1975). In particular, the Māori fertility transition, along with other Indigenous populations in colonised nation states who have undergone notable fertility transitions, has been principally interpreted as further evidence of a *global convergence* of fertility behaviour (Johnstone, 2011; Taylor, 2011). Demographic transition theory, and other key low-fertility theories (e.g., rational choice and gender equity) have often been the default explanations for understanding these transitions. However, Johnstone (2011) points out that colonisation has played a unique and key role in Indigenous population change. Pool (2015) particularly shows the impact of colonisation on early Māori demography, and the enduring domino effect on other aspects of Māori society, including social, economic, and cultural. The point is that none of the dominant demographic theories have been well suited for understanding the fertility experiences of colonised Indigenous populations fertility because they do not account for the impacts of colonisation (Johnstone, 2011).

Another feature of demographic studies on Māori fertility is the tendency to bifurcate Māori and non-Māori fertility which serves to promote a unidimensional representation of Māori (Johnstone, 2011; Kukutai, 2011b; Kukutai & Pool, 2014; Taylor, 2009), and obscure important intra-group differences in fertility behaviour. Other research in the critical Indigenous demography space has emphasized unique issues pertaining to the interpretation of Indigenous population change (Didham & Boddington, 2011; Taylor, 2009, 2011) but there is room to develop theoretical frameworks that incorporate Indigenous perspectives. Some strands of scholarship provide a useful starting point. Nearly fifty years ago Māori demographer Ted Douglas (1977) proposed a cultural explanation for the Māori fertility transition by analysing some of the cultural responses deeply embedded within close-knit rural tribal communities. Others have hinted at the potential of cultural factors playing

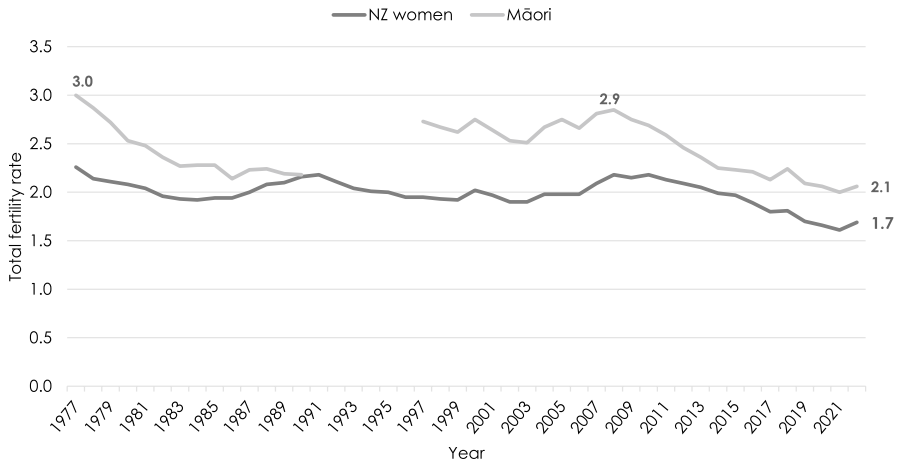


Fig. 1 Total fertility rates for Aotearoa NZ (all women) and Māori women, 1977–2022 *Data source:* Statistics NZ infoshare Table DFM044AA(Annual June), last updated 18 May 2023. Note: No data available for Māori between 1991 and 1996

a role in Māori demography but have not examined it in any depth. For example, Pool (1991) concluded that differences in family-formation patterns were “clearly affected by cultural difference in approaches to creating families” (p. 167). Johnstone et al. (2001) argued that, despite high levels of interdependence, the different demographic transitions of Māori and Europeans were “the result of the maintenance of Māori cultural traditions” (p. 3). Zodgekar (1975) mainly focused on socio-economic and demographic explanations behind the Māori fertility transition, but acknowledged the relevance of the “maintenance of a distinct cultural identity”, “large family norms”, and the “retention of tribal, kinship and familial associations” (p. 346).

Recent works have explored how differences in Māori cultural identity are associated with a range of socio-economic and demographic characteristics and outcomes, including fertility outcomes. Expressed Māori identification in data collection instruments, such as a census, can provide insights into cultural differences in behaviour, living conditions, and outcomes (Kukutai, 2011a). The boundaries between Māori and Pākehā have become more complex because of intermarriage, rapid ethnic diversification, changing ideologies around the nature of ethnicity, and what it means to be Māori (Kukutai, 2011a). Kukutai (2010) explored the association between expressed ethnic identification and intra-group differences by combining census indicators to configure a range of Māori subgroup categories. Developed as a heuristic device, the *core-periphery* model, helped to conceptualise Māori identification in more complex ways beyond the Māori/Pākehā binary (Kukutai, 2011a). The spectrum ranged from those who identified *solely* based on ancestry (the *periphery*), to those who identified as Māori by ancestry, tribe, and exclusive ethnicity (the *core*). Her analysis showed compelling evidence of ethnic and socio-economic segmentation between Māori

(Kukutai, 2010, 2011a). Empirical studies have also shown significant ethnic, cultural, and socio-economic differences between Māori, which suggest that those who strongly identified as Māori appeared to have the least favourable outcomes (Ajwani et al., 2003; Callister & Blakely, 2004; Chapple, 2000; Cunningham et al., 2002; Kukutai, 2004).

In a novel paper, Rarere (2018) asked whether there were “still some undercurrents of culture that influence the way in which Māori women think about family formation, the value of children, childbearing and rearing in terms of timing, spacing, and number of children” (p. 29). Using data from the 2013 New Zealand census, she explored the relationship between fertility outcomes (average number of children per woman and percentage childless) and expressed identification. The latter was a composite variable using responses to census questions on ethnic identity, iwi (tribal) affiliation and Māori descent, and is useful here because expressed identification involves a degree of choice rather than an actual reporting of parental ethnicities (Kukutai, 2007). Her analysis showed that Māori women with multiple ties to Māori identity (i.e., those who identified exclusively as Māori by ethnicity and ancestry and had at least one tribal affiliation) had lower levels of childlessness and more children, on average, than women who identified as Māori solely based on ancestry. The relationship between *thicker* ties to Māori identity and higher fertility also held across all levels of education and geographic location. The compelling evidence suggested that *culture* does matter in Māori fertility outcomes, however, the analysis was limited to the concepts, constructs, and measures of the census. In a follow-up paper, Rarere (2022) explored the Māori concept of whakapapa (genealogy) as a potential factor underlying fertility patterns. She asked: What are the important influences that have sustained contemporary Māori fertility patterns? Drawing on the theoretical framework of Mana Wahine (Māori women discourses), she conducted semi-structured interviews with Māori women to foreground their lived experiences and perspectives of family formation and fertility. As a cultural framework, Mana Wahine harnesses and advances Māori womens’ knowledges and theories, and foregrounds Māori perspectives of the position and status of Māori women (Jahnke, 1997; Pihama, 2001; Simmonds, 2011, 2014; Smith, 1992). For example, wāhine (women) are revered as *whare tangata* (womb)—the creators of life—past, present, and future generations (Higgins & Meredith, 2011; Mikaere, 2017). The research addressed a major gap in the Māori fertility literature where there has been very little emphasis on Māori cultural understandings of fertility, and to move closer to a broader understanding of how Indigenous identity shapes the fertility choices of Māori women. She described this orientation as being whakapapa centred—that is, valuing the genealogical relationships and kinship structures that collectively cohere Māori as a people. She found that preserving whakapapa was a very important motivation for having children but the timing of having them needed to be considered in the wider socio-economic context. For example, some women encouraged their children to get an education and build a career first before starting a family.

This present paper builds on earlier research by specifically looking at the timing of births, and the duration of birth intervals. For quite some time, Māori age specific fertility rates were concentrated at the younger adult ages of 20–24 years, and the timing of births matters in relation to parity. Using the Kaplan-Meier estimates

and piecewise exponential models we explore how the timing of fertility, and the duration of birth intervals vary by expressed identification. In doing so it aims to contribute to a fuller understanding of how cultural identity is associated with earlier childbearing among Māori women.

Data and methods

New Zealand women: family, employment and education survey

Our analysis draws on retrospective data from the New Zealand Women: Family, Employment and Education (NZWFEE) survey administered in October and November 1995 by the Population Studies Centre (PSC) at The University of Waikato⁷⁸ (Johnstone et al., 2001). This section provides an overview of the survey with more detail found in a technical report produced by Marsault et al. (1997).

NZWFEE was Aotearoa's first and only nationally representative survey on fertility and family formation and was based on the questionnaire for *Promotion of Fertility and Family Surveys in ECE countries* (Johnstone et al., 2001; Marsault et al., 1997). NZWFEE collected a wide range and depth of fertility-related and family formation questions including: history of pregnancies and partnerships; number of children (live-born, adopted, step and foster); fertility regulation and contraceptive history; views on having children; educational history; work history; and major demographic and socio-economic characteristics of the respondents' current partner (Marsault et al., 1997). NZWFEE permits far more nuanced analyses of Māori fertility patterns than is possible using the national census (Rarere, 2018). For example, the census does not collect the time-specific variables required for event history analyses, nor does it collect other family and fertility-related variables for defining our risk-sets, such as relationships data. Although NZWFEE was conducted more than 30 years ago, it remains relevant because it is the only dataset that allows for a detailed empirical analysis on the relationship between Māori identity and the timing of birth and birth spacing. There is no other dataset in Aotearoa, including the census, that allows us to do this.

The survey targeted Aotearoa women aged 20–59 years at the time of interview. Those aged under 20 were excluded as they were more likely to be mobile or living with their parents, and therefore less likely to be available for an interview, and/or have less exposure to family formation events (Marsault et al., 1997). The upper age limit was extended to 59 years to allow for retrospective comparisons between the family formation behaviours of women aged 45–59 years, who were the first cohort

⁷ The Population Studies Centre, which was established in 1982, is now known as Te Ngira: Institute for Population Research at The University of Waikato (see <https://tengira.waikato.ac.nz/about-us/history/population-studies-centre>). The PSC researchers and administrators involved in the design and administration of the NZWFEE are no longer employed at The University. Data collection (fieldwork, coding, and data entry) was subcontracted to an external agency - Market Research Limited (Marsault et al., 1997).

⁸ The electronic datasets are stored on a secure server at the PSC, University of Waikato, now known as Te Ngira: Institute for Population Research.

to access modern contraception, with women aged under 45 (Marsault et al., 1997). Participants were selected through a random, proportionately stratified, cluster sampling method (Pool, 1999). A total of 3017 women were interviewed from three sample groups: main sample ($n = 2507$), Māori oversample ($n = 180$), and Midland Regional Health Authority (MRHA)⁹ oversample ($n = 330$) (see Table 1). Although the main sample is representative, a Māori oversample was needed to help boost numbers to conduct more detailed analyses with statistically valid results (Marsault et al., 1997). The PSC was also contracted by MRHA to oversample the Midland Health region so that the Authority could obtain sufficient numbers to derive statistically valid results at the regional level (Marsault et al., 1997). An added benefit of the Midland oversample was the increase in the number of Māori and rural women in the final sample because the region has a higher proportion of both Māori and rural populations (Marsault et al., 1997). For our analyses, weights have been applied to adjust for the oversampling of Māori respondents from the Māori and Midland samples. In effect, the number of Māori will be adjusted down, and the proportions are representative of the national population at the time of the 1991 NZ Census (see Table 1).

Method

Event History Analysis (EHA) explores the role of time in causal explanations and can incorporate other mediating factors that potentially impact the timing of events (Blossfeld et al., 2019; Mills, 2011). Here we are not looking to demonstrate *causal* relationships per se but to establish further empirical evidence that serves as an important “link in a chain of reasoning about causal mechanisms” (Blossfeld et al., 2019, p. 22). EHA is commonly used in fertility analyses (Van Hook & Altman, 2013), and in our case, we use EHA to explore the timing and duration until the occurrence of a birth (including subsequent), and how these differ by ethnic identification, controlling for education, location and age. A piecewise exponential model is our preferred method of EHA where time is divided into smaller periods, and it is assumed that the hazard rate remains constant within these time periods but can change between periods (Mills, 2011). This is logical given that fertility (or fecundity) is sensitive to time/age. The piecewise model also gives us the flexibility to use time variant and time invariant variables, particularly within the constraints of the survey data. Because of the complex structure of our data, with multiple episodes

⁹ Four Regional Health Authorities (RHAs) were established in 1993 and configured by areas with populations ranging between 750,000–1,000,000: Northern, Midland, Central, and Southern. The RHAs were funded by the central government’s Ministry of Health, and had the responsibility of monitoring the health needs of their populations, purchasing the appropriate health and disability services, and monitoring the performance of providers with whom they entered purchase agreements (New Zealand Parliamentary Library, 2009).

and spells for each woman, we had to manually create time spans of 24-month periods for episode splitting¹⁰ using Stata (version 17).¹¹

We begin with a descriptive analysis by exploring median time to each birth. Because of small numbers we have grouped birth orders higher than six. We then use the Kaplan-Meier survival model for first, second and third birth analyses, which estimates the proportion of women who remain across time. In the case of first births, however, the Kaplan-Meier estimates the proportion of women who remain childless at the end of the observation period. For our first birth analysis, we go against conventional demographic approaches to reproductive age (Coale & Trussell, 1974) by starting our process time at age 12 on the basis that it is the earliest age at which one woman from the sample birthed her first child, and this is generally regarded as the age of menarche. All women are either right-censored at time of first birth or up to age 45 years or until the survey interview date¹², whichever occurs first. For the transition to second birth, and likewise with subsequent births, the process time starts immediately after the date of previous birth. Again, the women are right-censored when they experience the birth event, age 45, or the survey interview date, whichever comes first. We convert and use time in terms of months rather than a calendar date.

Variables

Time to live birth is the dependent variable in this study. Women who did not give birth over the observation period ($n=615$) are treated as childless, even if they had adopted or fostered children or had stepchildren ($n=63/615$). To exclude the gestation period from the process time, we measure time to the conception of a live birth.¹³ The conception date is derived by subtracting approximately 9 months¹⁴ from the birth date (months) of each child. For consistency throughout this paper, we use the term *birth(s)* to include conception time. Regardless of parity, twin (or multiple) children are removed from the analysis so that births are treated as a singleton.

Ethnic identification is the primary explanatory variable¹⁵. The ethnic categories used in NZWFE followed the Standard Classification of Ethnicity (Marsault et al.,

¹⁰ We used this method rather than using the 'stsplit' function in Stata. For further information on data transformation and data management techniques in preparation for piecewise modelling, see Baron and Kruger (2017).

¹¹ The original data was stored and managed in Statistica.

¹² November 1995.

¹³ Although the survey collected data on the womens' pregnancy and birth histories, we only consider live births in this analysis.

¹⁴ The birth dates (year and date) are converted into 'months'. We then deduct approximately 9 months (40 weeks gestation period divided by 4.35 (the average number of weeks in a month) to get an estimated date of conception).

¹⁵ Ethnicity is a key public policy variable in Aotearoa. Thus the collection of ethnicity data is standard practice across government and research.

Table 1 Number of NZWFEE respondents by sample and ethnic identification (weighted and unweighted)

Ethnic identification	Main sample	Māori over-sample	Midlands sample	Total	%
Māori	266	180	67	513	17.0
weighted ^a	183	125	51	360	11.9
European	2006		252	2258	74.8
weighted	2200		180	2380	78.9
Other	235		11	246	8.2
Weighted	269		8	277	9.2
Total (unweighted)	3017	180	330	3017	100.0

Source NZWFEE

^aTotal not exact due to rounding from weight adjustment

1997), and allowed respondents to identify with up to 10 ethnic groups¹⁶. Respondents were presented with a showcard and then asked to identify: *Which ethnic group(s) do you belong to?* For those who reported more than one ethnicity, the survey prompted them to choose a *main* ethnic group. The options provided included: *more than one*, *don't know/no*, and *other*. The inclusion of multiple and main ethnicity questions enabled us to reconfigure three ethnic identification categories to explore the relationship between Māori identity and fertility (see Table 2). *Mainly Māori* includes women who identified exclusively as Māori as well as women who identified as Māori and at least one other ethnicity but prioritised Māori as their main affiliation. We combined these two groups of women because evidence has shown that they share similar socio-demographic characteristics (Kukutai, 2011b). The *Mainly European* category consists of women who identified as both Māori and at least one other ethnicity, including European, but reported European as their main ethnicity. This category includes a small number of Māori-European women who did not record a main ethnicity ($n = 28$). We included them here because of the lack of preference to identify as Māori, but also to help boost numbers. The third category *non-Māori* includes all remaining women who reported an ethnicity other than Māori. Most of these women identified exclusively as European.

We use *partnership status* to determine the time when the women are at-risk of conceiving. Partnership status is defined broadly to include all types of unions—legal marriage, social/de facto marriage living together. Traditionally, marriage signalled exposure to intercourse either before or immediately after pregnancy (Pool et al., 1998)¹⁷. However, the link between marriage and exposure to intercourse has become increasingly separated, wherein an individual may have a number and various types of *unions* with different people throughout their life (McCluskey, 1999).

¹⁶ The maximum number of ethnic groups reported was four, which was reported by only one respondent.

¹⁷ The link between marriage and exposure was at least amongst Pākehā/European. For Māori, the legitimisation of unions was based more on community sanctions (social marriage) (see Pool et al., 1998; Pool, 1991).

Table 2 Reconfiguration of ethnic identification categories for analysis (weighted and unweighted)

Category label	Description of category	Unweighted		Weighted	
		n	%	n	%
Mainly Māori	Women who identified solely Māori + women who identified Māori plus one other ethnic group but specified Māori as their main ethnic group.	390	12.9	276	9.1
Mainly European	Women who identified as Māori and one other ethnic group (including European) but specified European as their main ethnic group + those who identified Māori and one other ethnic group (including European) but had no preference for main ethnic group.	119	3.9	81	2.7
Non-Māori	Women who solely identified European + those who identified as other ethnic group (excluding Māori).	2508	83.1	2660	88.2

Data source NZWFEE

In NZWFEE nearly 30 per cent of women reported having at least two relationships during the observation period.¹⁸ To accommodate this, the data were structured to account for multiple partnerships and *entry* and *exit* times over the observation period. A binary variable (*in a relationship*) was constructed, to denote whether a respondent had been in a relationship over the observation period, regardless of current marital or union status. In other words, partnership status functions as a time variant, that is, it considers the fact that women enter and exit relationships throughout the observation period and defines them 'at risk' of experiencing conception (and later birth) during the time periods when they are partnered. A partner was defined as a man whom a woman had an intimate relationship with and who lived in the same household (Marsault et al., 1997). The only women that we exclude from the analysis are those that have no data at all on partnership status throughout the observation period.

Given the strong inverse association widely observed between education and childbearing (Cochrane, 1979; Diamond et al., 1999; Michael, 1973) *highest education* is included as a time-invariant control variable, with the categories: no qualifications, secondary qualifications, tertiary qualifications other than university, and tertiary university qualifications. The other control variables are *age group* (12–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–59) and *location* (main urban area, minor urban area, rural) as per the Department of Statistics (1992) statistical standard. Urban areas are statistically defined boundaries with no administrative or legal basis. Main urban areas are centred on a city or major urban centre with a minimum population of 30,000. Minor urban areas are urbanised settlements centred around smaller towns with a population of 1000–9999. Rural centres have a population between 300 and 999.

As NZWFEE is a retrospective longitudinal survey, it relied heavily on the women recalling specific calendar-event details about their employment, pregnancy, birth, and reproductive histories. As our analysis explores timing and duration, we did encounter missing dates for births and partnerships histories. The dates were arranged in their most basic units. For example, *month* and *year* were arranged as individual variables. However, there were cases that did not have complete information (e.g., year specified but month missing or vice versa). We wanted to build a more complete calendar-event dataset, so we made some assumptions. For those records with missing months but non-missing years, we inputted the mid-year point (i.e., June as the month). Cases with missing years and non-missing months or coded as *residual-type* categories (e.g., don't know) were recoded as missing. This method was applied to both births and partnerships (entry and exit) dates.

¹⁸ 63% (1910) reported only ever having 1 partner; 7% (216) never had a partner.

Results

Descriptive overview

We begin with a descriptive analysis of key indicators by ethnic identification for the total sample ($n = 3017$) (see Table 3). There are marked differences by age groups, with the Mainly Māori group younger than their counterparts. The proportion of Māori young adults aged 20–29 years (39.4%) is significantly higher than non-Māori (22.4%) while the proportion of Mainly European young adults (34.2%) was closer to Mainly Māori. At the older ages, non-Māori had a much higher proportion of participants aged 40+ (46.6 per cent) compared to those who were Mainly Māori (28.4%), and Mainly European (29.7%).

There are also significant differences in education levels,¹⁹ which partly reflects age differences. Nearly half (45.5%) of Mainly Māori women had no qualifications at the time of survey, but just over a quarter (25.6%) had a diploma. On the other hand, a third of non-Māori (33.3%) had a degree level qualification. The proportions of Mainly European were evenly spread across the different education levels, although most of them (26.9%) had no qualifications. Nearly a quarter (24.9%) of Mainly European had a degree, which was substantially higher than Mainly Māori women (12.9%).

Although most women across all ethnic groups were in a legal or consensual relationship at the time of survey, the share of partnered varied across groups. Nearly one third of Mainly Māori women (31.6%) were single at the time of the survey but had a previous relationship, compared to non-Māori (17.9%), and Mainly European (23.1%). A much smaller proportion of Mainly European (4.0%) had never been in a relationship, compared to Mainly Māori (10.4%), and non-Māori (7.0%).

For each ethnic group, most resided in main urban areas (pop. > 30,000) with nearly three quarters of non-Māori women (73.7%) living in the cities compared to 62.1% Mainly Māori. However, a quarter of Mainly Māori women (25.0%) lived in smaller towns (pop. 1000–9999), relative to 12.7% of non-Māori. Similar proportions of Mainly European women lived in both small towns and rural areas (pop. 300–999), 16.0% and 17.3% respectively.

Despite a younger age profile, women who identified solely or mainly as Māori were far more likely than their non-Māori counterparts to have had at least three births (45.5% vs. 33.3%). Similarly, 42.0% of Mainly European women had at least three births. On closer inspection (not shown here), Māori women had more children at higher birth orders with 16% of Mainly Māori having at least five children compared to 9.2% Mainly European and 4% non-Māori. As expected, non-Māori women had the highest share of childlessness (21.5%). However, we were surprised that a higher share of Mainly Māori women had never given birth compared to Mainly European women (18.4% vs. 14.2%).

To better understand the relationship between Māori identification and parity, we explore differences in the timing of births, measured in months, from age 12 (time

¹⁹ Secondary (high school) is the minimum level of qualifications in Aotearoa's education system.

Table 3 Key indicators of total sample by ethnic identification (weighted)

Indicator (at time of survey)	Mainly Māori	Mainly European	Non-Māori
Number women (20–59 years) (n)	276	81	2660
<i>Age groups (%)</i>			
20–24 years	20.7	14.4	10.5
25–29 years	18.7	19.8	11.9
30–34 years	14.7	16.6	14.4
35–39 years	17.4	19.5	16.6
40–44 years	11.0	7.1	15.4
45–49 years	6.7	11.8	14.2
50–54 years	4.3	4.0	9.5
55–59 years	6.5	6.8	7.5
Median age (n)	32	34	38
<i>Highest education level (%)</i>			
None	45.5	26.9	22.7
Secondary	16.0	25.9	27.1
Diploma level	25.6	22.3	17.0
Degree+	12.9	24.9	33.3
<i>Partnership status^a (%)</i>			
Never been in a relationship	10.4	4.0	7.0
Formerly in a relationship	31.6	23.1	17.9
In a relationship	57.0	72.8	74.7
<i>Births (%)</i>			
None	18.4	14.2	21.5
1 to 2	36.1	43.9	45.5
3 or more	45.5	42.0	33.0
<i>Location (%)</i>			
Main urban	62.1	66.7	73.7
Minor urban	25.0	16.0	12.7
Rural centre	12.9	17.3	13.6

Source NZWFEE

^aMainly Māori and non-Māori do not total 100% because numerator excludes those who refused to answer question i.e., Mainly Māori n=3 and non-Māori n=9

zero). Consistent with our hypothesis, Table 4 shows that the median time to first birth was shortest for women who identified solely or mainly as Māori (59 months), followed by women who identified as Māori but perceived themselves mainly as European (63 months). The median time to first birth was considerably longer for non-Māori women (81 months). It is important to note here that the median times to first birth reflect cohort differences in fertility, particularly for non-Māori women. In an earlier analysis using NZWFEE data, Sceats (1999) noted that women who became mothers during the Baby Boom period started younger and had shorter birth intervals. Her analysis also showed that the median age at first birth successively increased for non-Māori birth cohorts. For example, the median age of first birth for

Table 4 Kaplan-Meier estimates of median length (months) of birth intervals by ethnic identification (weighted)

Ethnic identification	Birth interval to					
	First	Second	Third	Fourth	Fifth	Sixth and above
Mainly Māori	59	16	18	17	24	21
Mainly European	63	19	23	15	20	16
Non-Māori	81	14	18	21	16	15

Source NZWFEE

women aged 55–59 years in 1995 was 23.7 years compared to 26.5 years for women aged 25–29 years. In contrast, there was little change in the median age of first birth (21.0–22.4 years) for Māori—younger cohorts followed the patterns of earlier generations (Sceats, 1999). As another indicator of timing, Sceats (1999) noted that the median interval between the commencement of sexual activity and first birth was shorter for all women born prior to 1960 (i.e., those aged 35–59 years). Thus, the median duration for women aged 55–59 years was only 2.3 years compared to 7.61 years for women aged 20–24 years.

Looking at the time to second birth, the median durations were much closer in proximity across the three ethnic categories. For non-Māori women the interval from first to second birth is just over a year, 14 months, followed by 16 months for Mainly Māori women and 19 months for Mainly European women, suggesting that women who delay the start of childbearing are more likely to have their second child in quick succession, and perhaps to achieve their desired family size before the end of their childbearing years.²⁰ The time to third birth is slightly longer for all groups than to second birth but both Mainly Māori and non-Māori had similar median times (18 months), with Mainly European only marginally later (23 months). Interestingly, the median interval times for Mainly European and non-Māori were shorter at the higher birth orders (4+) than Mainly Māori.

Transition to first birth

Focusing on the transition to first birth, we limited the sample to those women who ever had a partnership and observed their birth histories from age 12 (time zero) to age 45 years (540 months). After setting these parameters, we end up with a total sample size of $n = 2799$, thus excluding 218 women from the original sample. We also note that this also excludes a relatively small proportion of those who may have a history of births but no record of a partnership, including those who had an incomplete partnership history.

Figure 2 shows the Kaplan-Meier survival estimates by ethnic identification for transition to first birth. As expected, Mainly Māori women had their first child much

²⁰ See Sceats (1999) for more detailed analyses by birth cohorts (age groups).

earlier than non-Māori women, with about 80 per cent having their first birth by age 24 (144 months duration). This was somewhat higher than Mainly European women²¹, and much higher than non-Māori women—for the latter group, approximately half had still not had a baby by age 24. At around age 30 (214 months), we see a crossover where Mainly European women have their first birth earlier than Mainly Māori women for the remainder of the period. The share of women who remain childless also varies by ethnic identification. By the end of the observation period, 431 women remained childless of which 7.4% ($n = 32$) were Mainly Māori, 90.7% ($n = 391$) were non-Māori women, and 1.9% ($n = 8$) were Mainly European.

We now look at the hazard ratios by ethnic identification (Table 5). Although our focus is on exploring the role of ethnic identification, as a proxy for cultural orientation, on birth timing, we also include key variables that are recognised as having an important influence on fertility. Thus, we estimate the effects of ethnic identification on the timing of births, while also controlling for education, age, and residential location. For comparison purposes, our reference group are non-Māori women aged 30–34 years with a university level qualification living in a main urban area.

After controlling for the other variables, the risk of first birth for Mainly Māori women was 69% higher (1.69) than non-Māori women. Likewise, the probability of a first birth for Mainly European women was 52% (1.52) higher than non-Māori²². Overall, this means that women who identified as Māori, whether sole or mixed, were more likely to have their first child earlier than non-Māori women and is consistent with the median interval lengths shown previously in Table 4.

The hazard rates were significant for all levels of education, and we also note a gradient where the rates decreased by education level, which is consistent with the literature on fertility studies where it is frequently observed that education and fertility have an inverse relationship (Cochrane, 1979; Diamond et al., 1999; Michael, 1973). In this case, women with no qualifications have a 99% (1.99) chance of conceiving their first child earlier than women with a university qualification.

Compared to all the age groups, the probability of a first birth was considerably higher for women aged 30–34 years, which is consistent with delayed childbearing. This is unsurprising given that the age-specific fertility trends since the 1960s in Aotearoa has seen a general shift of childbearing to older ages (Stats NZ, 2023b).

Women who live in small-town settlements were 30% (1.30) more likely to conceive their first child compared to women living in cities.

Overall, no education was the strongest predictor of timing to first birth, followed by Māori identification, then women living in small towns, and then women in their early thirties.²³

²¹ For robustness, we conducted a likelihood ratio test (log-rank test). The difference in survival functions between Mainly Māori and Mainly European was statistically significant, $p = 0.0000$.

²² As noted previously, the difference in survival functions between Mainly Māori and Mainly European was statistically significant, $p = 0.0000$.

²³ We investigated the interaction between ethnic identification and education. We created a binary for each variable i.e., ethnic identification = Mainly Māori (consisting of all women who identified sole

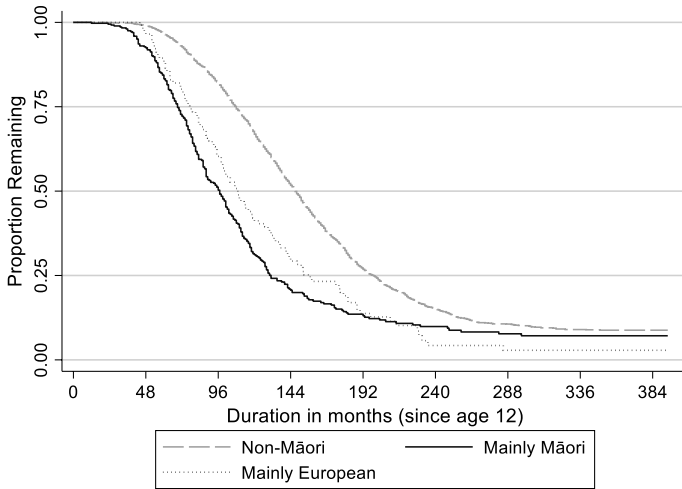


Fig. 2 Kaplan-Meier survival estimates for transition to first birth by ethnic identification (weighted)

Table 5 Hazard ratios to first birth for women who ever had a relationship (weighted)

	Predictors	Hazard ratios
Ethnic identification (time invariant)	<i>Non-Māori (reference)</i>	
	Mainly Māori	1.69***
	Mainly European	1.52**
Highest qualification (time invariant)	<i>Tertiary qualification (reference)</i>	
	No qualification	1.99***
	Secondary qualification	1.41***
Age groups (time variant)	<i>30–34 years (reference)</i>	
	12–19 years	0.00***
	20–24 years	0.01***
	25–29 years	0.01***
	35–39 years	0.57
	40–44 years	0.10*
Location (time invariant)	<i>Main urban area (reference)</i>	
	Minor urban area	1.30***
	Rural area	1.09

Source NZWFEE

+ $p < 0.1$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Footnote 23 (continued)

or mixed) and non-Māori; education=no education and education qualification (combining all those women with a qualification). The hazard ratio of the interaction between *Mainly Māori* with *No Qualifications* was 0.75 with $p = 0.065$, indicating that there is no association or interaction between ethnic identification and education.

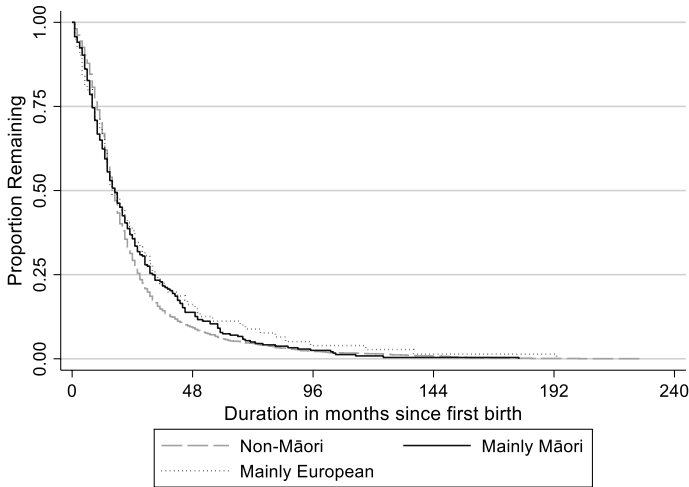


Fig. 3 Kaplan-Meier survival estimates for transition to second birth by ethnic identification (weighted)

Table 6 Hazard ratios to second birth for women who ever had a relationship (weighted)

	Predictors	Hazard ratios
Ethnic identification (time invariant)	<i>Non-Māori (reference)</i>	
	Mainly Māori	0.98
	Mainly European	0.89
Highest qualification (time invariant)	<i>Tertiary qualification (reference)</i>	
	No qualification	1.11 ⁺
	Secondary qualification	0.98
Age Groups (time variant)	<i>30–34 years (reference)</i>	
	12–19 years	0.62***
	20–24 years	0.80**
	25–29 years	0.89 ⁺
	35–39 years	1.10
	40–44 years	2.30**
Location (time invariant)	<i>Main urban area (reference)</i>	
	Minor urban area	1.12*
	Rural area	1.23***

Source NZWFEE

⁺ $p < 0.1$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Transition to second birth

The survival curves for the transition to second birth (Fig. 3) are much steeper and closer than the previous birth, making it more difficult to distinguish between the

three ethnic groups. However, at the two-year mark (24 months), it becomes a little clearer that non-Māori women have their second child earlier than both Mainly Māori and Mainly European women, and within four years of having their first child. The difference between Mainly Māori and Mainly European are minimal but starts to widen after four years, with Mainly Māori women birthing their second child slightly earlier.

The hazard ratios in Table 6 are consistent with the survival estimates. Although the rates are slightly below 1.00 for both Mainly Māori and Mainly European, ethnic identification is not a statistically significant predictor of the timing of second birth, once education, age and residence are accounted for. Once again, having no qualifications features as an important predictor to second birth but this time age becomes significantly correlated with the timing to second birth. In particular, the probability of bearing a second child was more likely for women aged 35 years and above, with the hazard ratio quite pronounced for women over 40 years (2.30). This seems logical given the pressure to have another child and/or complete the desired family size before the end of a woman's reproductive period. The chances of birthing a second child were slightly higher for women living outside of the cities, especially more so for women living in rural areas (1.23) albeit only slightly higher than women in small towns (1.12). Overall, the strongest predictor to second birth was women in their early 40s, and then women living in rural areas.

Transition to third birth

Like the transition time to second birth, we see steeper survival curves to third birth, although the differences between ethnic groups are a little more distinguishable. Mainly Māori birth earlier within the first two years (24 months), and Mainly European and non-Māori are about the same. However, around about the third-year mark, there is a cross-over of non-Māori with Mainly Māori. Between the 4-years (48 months) and 8-years (96 months) mark, the survival estimates are very close between the ethnic groups but seem to widen after 8-years with Mainly European birthing their third child later than their counterparts for the remainder of the observation period (Fig. 4).

When we look at the hazard ratios, only the age variable is significant to third birth, especially at older ages (35+ years). Again, the chances of women older than 40 years birthing faster to third birth are considerably higher (2.14) than women in their early 30s. In addition, the hazard rates for women aged 35–39 years are statistically significant. The rates for the other independent variables are close to the reference group but are insignificant (Table 7).

Discussion

The purpose of this paper was to explore the association between Indigenous identity and fertility. Using the Kaplan-Meier estimates and piecewise exponential models we explored how the timing of fertility, and the duration of birth intervals vary by *expressed identification*. Our rationale for doing this is to better understand the distinct Indigenous fertility patterns in CANZUS countries, where childbearing tends to be concentrated at the younger ages, in stark contrast to the deferred childbearing of women from the dominant white populations. Research has shown that Māori have more children on average, and lower rates of childlessness than non-Māori, even at higher education levels (Rarere, 2018). Māori women also have their children earlier. Since the late 1970s Māori age-specific fertility has been concentrated at ages 20–24 years and has only recently (2013/2014) shifted to 25–29 years. Women who start reproduction earlier in their life generally have more children (i.e., higher completed fertility) relative to those who start later (Bumpass et al., 1978; Gyimah, 2003; Morgan et al., 2001; Morgan & Rindfuss, 1999). However, Morgan et al. (2001), notes that the link between early fertility and higher completed fertility does not necessarily depend on a more rapid pace of fertility. The authors state: “Because earlier childbearers have more years in which to have births, their fertility could be higher because they have longer to decide to have additional children and/or more years in which they could have a child that was unwanted at conception” (Morgan et al., 2001, p. 55). For obvious reasons timing does matter in fertility because it determines the number of children (parity) a woman bears over her reproductive period, and therefore the future size and composition of a population.

Based on our analysis the differences in timing between Māori and non-Māori are very clear and apparent, especially to first birth. There is little room to doubt that Māori start their child-bearing earlier than non-Māori. However, our primary interest is to explore Māori cultural identity as a determining factor in fertility. We assumed that how women ethnically identify themselves is one facet of a deeper cultural orientation, and hence, we used it as the best proxy for our study, and to get closer to understanding the role of cultural identity in fertility outcomes. We wanted to see whether Māori women who identify exclusively or primarily as Māori have an earlier first birth, and shorter birth duration than women who identify as Māori but see themselves primarily as European. After controlling for education, age, and residence (location), Māori ethnic identification (sole or mixed) was significant in explaining the transition to first birth. However, women who identified Mainly Māori had a higher risk to first birth than Mainly European, and the difference between the two was statistically significant. However, ethnic identification was insignificant for explaining the transition to second and third birth orders. The median length of time to first birth for women who identified exclusively or mainly as Māori was much shorter than for non-Māori. However, somewhat surprisingly, there was little difference in the median duration across all birth orders compared to women who identified as Māori but perceived themselves primarily European. Generally, we found that the survival estimates and hazard ratios for Mainly European were closer to Mainly Māori than non-Māori.

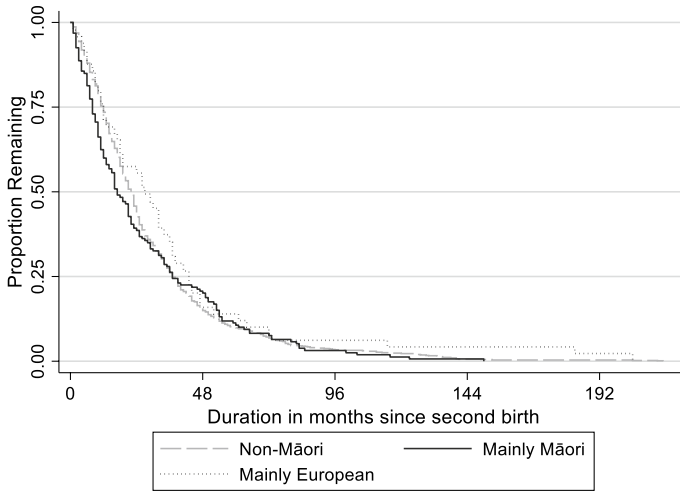


Fig. 4 Kaplan-Meier survival estimates for transition to third birth by ethnic identification (weighted)

Table 7 Hazard ratios to third birth for women who ever had a relationship (weighted)

	Predictors	Hazard ratios
Ethnic identification (time invariant)	<i>Non-Māori (reference)</i>	
	Mainly Māori	1.11
	Mainly European	0.85
Highest qualification (time invariant)	<i>Tertiary qualification (reference)</i>	
	No qualification	0.99
	Secondary qualification	1.02
	Other tertiary qualification	0.99
Age groups (time variant)	<i>30–34 years (reference)</i>	
	12–19 years	0.99
	20–24 years	0.81*
	25–29 years	0.88 ⁺
	35–39 years	1.58**
	40–44 years	2.14**
Location (time invariant)	<i>Main urban area (reference)</i>	
	Minor urban area	1.13
	Rural area	0.99

Source NZWFEE

⁺ $p < 0.1$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Conclusion

The broader motivation of this paper was to build better cultural understandings of Māori fertility as a means of contributing towards the development of broader

Indigenous-centred theories about Indigenous population change. Previous research has already shown that those with multiple ties to Māori have more children on average and lower rates of childlessness, even when taking into consideration education and location (Rarere, 2018). This paper builds more empirical evidence by investigating Māori cultural identity, as a proxy for cultural orientation, as an important determinant of the timing of births, including subsequent. We untangled cultural identity using ethnic group indicators in the NZWFEE survey to test our idea, and to better represent Māori realities. Is cultural orientation a key determinant of fertility? While we cannot be too definite about cultural orientation, the empirical evidence (including previous studies) suggests that there is something *culturally important* going on, but this is limited by cultural identifiers captured in data collection instruments. In terms of timing and spacing, cultural identity seems to be a key determinant in the timing to first births but not necessarily to second birth or third birth. However, birth intervals at the higher birth orders may not necessarily be a concern for Māori women (sole or mixed) because they have a longer exposure of risk to complete their fertility.

We also acknowledge that our study has limitations. Firstly, we acknowledge the potential for reverse causation. Given that ethnic identification is captured at the time of survey (i.e., after reported childbearing), there is the potential that, for example, earlier childbearing could lead to stronger identification as Māori. Secondly, we also note limitations with the survey data. In particular, we have used location and highest qualification as time invariant variables in our piecewise exponential modelling, knowing that of course these are both time-varying variables i.e., people migrate or gain qualifications at various points of time. However, we had limited time-specific data and histories in order to create these as time-varying variables.

There are issues with the discipline of demography—it predominantly draws on Western theories to interpret/understand Indigenous demographic behaviour. Research across the academy, and especially in a positivist-dominant discipline such as demography (Greenhalgh 1996; Kertzer and Fricke 1997; Petit 2013) has privileged Western knowledge systems while disregarding Indigenous worldviews (Axelsson and Sköld, 2011; Smith, 2021; Taylor, 2009). There is a need for more Indigenous-centric theories and/or culturally appropriate tools to complement and reframe how we should conduct and interpret demographic research of Indigenous fertility trends and patterns.

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Declarations

Conflict of interest The authors have no competing interests to declare that are relevant to the content of this article.

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