Risk-taking behaviour and fatherhood

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Abstract

Becoming a father is a milestone in most men's lives. Quantitative as well as qualitative studies across various academic disciplines show that becoming a father leads to positive behavioural responses and wellbeing outcomes, suggesting a shift towards a more risk-averse personality. The underlying assumption is that behavioural changes may arise due to a greater sense of responsibility, engagement, and the desire to have a physical presence after childbirth. However, studies also indicate that the degree of post-birth behavioural response might depend on a child's gender. My research aims at understanding how fathers' risk behaviour changes after a child's birth. I use Stats NZ's Integrated Data Infrastructure (IDI), particularly the Accident Compensation Corporation (ACC) claims data, to identify non-work-related injuries like sports and household accidents. I use the identification strategy of Fadlon and Nielsen (2019) and a dynamic difference-in-differences model to estimate how the number of accidents changes compared to pre-birth levels. I provide evidence that men reduce their likelihood of making non-work-related injury claims for up to two years post-childbirth. Importantly, by classifying the empirical analysis by injury types, I find that this variation is largely driven by a change in behaviour with respect to sport-related injury claims for older fathers and younger non-European fathers. I do not find empirical evidence that the child's gender further influences fathers' tendency to experience injuries from non-work-related injuries.

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Attestation of authorship

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university of other institution of higher learning.

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Disclaimer

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) which is carefully managed by Stats NZ. For more information about IDI please visit https://www.stats.govt.nz/integrated-data/.

1 Introduction

The transition to fatherhood is often recognised as a significant milestone in a man's life. It is well-documented in the existing literature that family formation is generally associated with positive life outcomes across various domains including employment, education, health, and crime (for example, Dasgupta et al., 2022; Hadley and Hanley, 2021; Shawe et al., 2019; Massenkoff and Rose, 2020; Reeves, 2006). Changes in these wellbeing measures may be explained by the effect parenthood has on a man's risk behaviour. It is widely accepted having a child serves as a "turning point" for men to stray away from reckless behaviour and become more responsible (for example, Taubman-Ben-Ari & Noy, 2011; Reeves, 2006).

The benchmark study that analyses the effect of parenthood on risk behaviour is that of Görlitz and Tamm (2020) who use self-reported risk measures from a longitudinal survey. The authors document a strong positive relationship between fatherhood and risk-aversion which is persistent up until the child is six years old, with the most significant effects on risk-aversion occurring in the year after childbirth.

There also exists a body of literature to suggest that the gender of a child can affect the extent to which a father adjusts his behaviour after childbirth. For instance, fathers of sons tend to have better family relationships compared to fathers of daughters (Lundberg et al., 2007; Dahl and Moretti, 2008). Fathers of sons are also less likely to face a criminal conviction compared to fathers of daughters (Dasgupta et al., 2022; Dustmann and Landersø, 2021).

I contribute to the literature on the effect of fatherhood on risk behaviour by first measuring the impact of becoming a first-time father on injury incidence. The underlying assumption is that injury incidence serves as a suitable proxy for risk behaviour, in that risk-seeking individuals are more likely to become injured. I use the Accident Compensation Corporation (ACC) data on injury claims from Statistics New Zealand's (Stats NZ) Integrated Data Infrastructure (IDI). Second, by using this dataset on injuries as an outcome variable, I further test whether the child's gender at birth can further influence a man's risk behaviour. My contribution is therefore twofold:

1.) To quantify risk behaviour, I use a novel dataset that holds due to the no-fault policy in the universe of accident claims; and
2.) This is the first study of its kind, where I use population wide-administrative data and a quasi-experimental research design to ascertain the causal effect of fatherhood on risk behaviour in a New Zealand context.

Using the identification strategy of Fadlon and Nielsen (2019) and a dynamic difference-in-differences analysis, I compare the incidence of injuries experienced by fathers before and after childbirth to that of a comparable group of future (soon-to-be) fathers. Similar to the findings of Görlitz and Tamm (2020), I provide some evidence of risk-aversion occurring as a result of fatherhood which remains persistent for some time after childbirth. In particular, I show that there is a general decrease in the propensity to make a non-work-related injury claim right after childbirth which remains persistent up until the child is two years old.

However, there is heterogeneity across factors such as ethnicity and fathers' age. As I stratify the population of interest, I note that the effect on non-work-related injuries is largely driven by sport injury claims from men aged over 30, and non-European men aged under 30. However, there is no convincing evidence that is suggestive of a significant change in men's behaviour in response to childbirth with respect to household injury claims. Furthermore, the effect of having a child on sport injury claims is further amplified when the father has had at least one non-work-related injury prior to the conception of the child. Fathers with a pre-conception injury may also be more likely to adjust their behaviour with respect to household injuries, however this finding is not robust.

Unlike with family relationships and criminal outcomes (such as those discussed by Lundberg et al., 2007; Dahl and Moretti, 2008; Dasgupta et al., 2022 & Dustmann and Landersø, 2021), there is very little evidence that the gender of the child has any additional compounding or mitigating effect on the degree of injury incidence after childbirth.

The remainder of this thesis proceeds as follows: section 2 provides a literature review on fatherhood and its effect on various wellbeing outcomes and role-model behaviour, and a theoretical framework behind risk and its role in decision making; section 3 outlines the institutional background behind the role of the ACC and attempts to justify the use of ACC injury claims data as a proxy for risk behaviour; section 4 describes the data, namely from the IDI, defines the population of interest and the restrictions I impose for this study; section 5 describes the empirical strategy of Fadlon and Nielsen (2019) and Dustmann and Landersø (2021) and how I apply these to my research questions; section 6 presents the results from my primary research question and plausible interpretations; section 7 presents results from my secondary research question; and section 8 concludes.

2 Literature Review

2.1 Being a good role model

Fatherhood marks a crucial point of a man's life. Additionally, fathers' perceived self-importance, i.e., how important the role of fatherhood is to a man, directly affects their involvement in child-rearing activities (Tichenor et al., 2011). As the perception of fatherhood moves away from its traditional role as patriarchal breadwinners, paternal involvement in childcare is becoming more widely recognised as an important issue (Mintz, 1998). Many studies show paternal involvement has positive consequences on family formation. Paternal time investments through constructive activities such as caregiving, extra-curricular activities, and child education has been shown to strengthen emotional bonds between fathers and their children (Lamb, 2004; Pleck and Masciadrelli, 2004). Strong paternal engagements also improve other family relationships and reinforces marital stability (Kalmijn, 1999; Simonelli et al., 2016). These activities can broadly be attributed to three factors of paternal involvement: (1) physical presence, (2) engagement, and (3) sense of responsibility (Lamb et al., 1985).

Having a child can potentially change fathers' risk preferences, due to the three above-mentioned factors of paternal involvement. For instance, a father who is more involved in child-rearing activities will spend more time with their children, and thus, will not have as much time for other activities that may often trigger health risks. Allender et al. (2008) reviews numerous studies that confirm this assumption, suggesting that on average fathers are more likely to abstain from extra-curricular activities such as sport when compared to men without children. Furthermore, there is evidence to suggest that fathers become more responsible with complex tasks such as driving, especially in the presence of their child. Taubman-Ben-Ari & Noy (2011) show qualitatively with 16 interviewees that parenthood led to more responsible and alert driving, especially when their child was in the vehicle with them. This added responsibility could be observed across other activities as well. Reeves (2006), for instance, conducted interviews with ten young men who utilised social services in the Southeast of the United Kingdom. It was found that family formation events positively impacted men deviating from criminal and "reckless" behaviour, and these effects appear to be greater when men had their first child.

2.1.1 The influence of culture in role model behaviour

Tichenor et al. (2011) show that fathers' perception on their importance in the upbringing of their child also varies by cultural factors, with some ethnicity indicators having significant effects on fathers' perceived importance. In a New Zealand context, Hennecke et al. (2022) also shows that ethnicity plays a role in the degree of paternal involvement.

Māori and Pacific fathers more likely to be involved in the daily care of their children at 9 months compared to NZ European fathers, and Pacific fathers more likely to be involved in childcare at 2 years compared to NZ European fathers. Pacific fathers are also more likely to provide high-quality childcare and participate in activities with their children compared to NZ European and Māori fathers.

2.1.2 The timing of fatherhood

There are numerous studies that examine the timing of fatherhood and its associated behavioural- and health-related effects. A study by Elniö et al. (2019) uses data from 3600 men in Britain from two cohorts: a 1958 cohort of men who had at least one child when aged 23, 33 and 41-42; and a 1970 cohort of men who had at least one child when aged 26, 29-30, 34-35, 38-39 and 42. The outcome variable was a self-reported health question where respondents were asked to rate their health status from "poor" to "excellent". With the dependent variable of interest being the age when the father had their first child, the authors utilise logistic regression models. Results find robust evidence that having a child at younger ages is associated with poorer midlife health outcomes.

Despite having better health outcomes in the long term, older fathers-to-be tend to exhibit negative expectations and fear about aspects of their partners' pregnancies and childbirth. For instance, Schytt and Bergström (2014) find that 29 percent of men aged over 34 were ambivalent or pessimistic about the upcoming birth compared to 26 percent of men aged 28 – 33 and 18 percent of men aged under 27, and this was statistically significant at the 1 percent level. This could suggest a complicated relationship between a father's age, preparedness, and health outcomes. I postulate that negative expectations could reflect a heightened sense of responsibility, especially if the concerns associated with negative or ambivalent feelings arise from a man's desire to protect his family.[1]

Cooney et al. (1993) aim to distinguish the magnitude of paternal involvement across different ages of first-time fathers. The authors create a nationally representative sample of 13,017 men aged over 18 from the National Survey of Families and Households in the United States. Utilising multivariate regressions, the authors find that 29 percent of "late" fathers are actively involved with their children's upbringing with positive affects compared to 17 percent of "on-time" fathers and 23 percent of "early" fathers.[2] In this study, late fathers are (intuitively) older, are more financially secure and have higher

[1] Older paternal age is also associated with pregnancy-related complications and therefore increased health risks for the child, as highlighted by Sartorius and Nieschlag (2010). This could trigger more fear among fathers.

[2] "Late" fathers are also more likely to be involved with negative affect typologies than "on-time" and "early" fathers. Negative affect typologies with respect to paternal involvement refers to fathers who may be actively involved but exhibit negative feelings and behaviours about fatherhood.

educational attainment on average. They are therefore also more aware of the importance of active parental involvement.

2.1.3 The role of gender

Several empirical studies also show that a child's gender can influence the degree of the positive behavioural response of a father. In this context, many studies show that fathers are more likely to present themselves as a role model when they have a son compared to having a daughter. Dahl and Moretti (2008) show that fathers of first-born girls are 3.1 percent less likely to be present in the household than fathers of first-born boys. Furthermore, there is evidence that the first-born child's gender affects marital status. While married parents of first-born girls are more likely to be divorced, a daughter's parents are also less likely to marry each other if the child is conceived out of wedlock. Fathers are also less likely to engage in attempts of paternal custody. On the other hand, Lundberg et al. (2007) find that boys' parents are less likely to separate, and boys are more likely than girls to take their father's surname. However, there is only weak evidence that suggests greater paternal involvement with sons versus daughters when the parents are unmarried.

A more relevant study to my thesis comes from Dustmann and Landersø (2021). The authors show that for young, first-time fathers in Denmark, there are no statistically significant differences in criminal outcomes for fathers who will have sons versus daughters before conception. However, after the birth of their first child, fathers of sons are less likely to face a criminal conviction. One year after childbirth, fathers are 2.5 percent less likely to face a criminal conviction if they have a son rather than a daughter. They are also 3.3 and 2.3 percent less likely to face a criminal conviction two and three years after childbirth if they have a son, respectively. This finding provides key insights into the role model hypothesis and is also consistent with findings from Dasgupta et al. (2022) in a New Zealand context who show that young fathers with a son are more likely to be employed, have higher earnings and better qualifications compared to fathers with a daughter.

In the context of relationship development, Lamb and Lewis (2004) conclude that fathers spend more time with their infant children when they have sons compared to when they have daughters, although this preferential treatment is negligible beyond infancy (Lytton & Romney, 1991). Kalmijn (1999) finds that fathers' participation in child-rearing, particularly in aspects such as physical care and education, is slightly reduced when their first child is a girl. Fathers' differential treatment based on gender is persistent across various fields, with even neuroscientific studies such as Mascaro et al. (2017) showing that fathers were more engaged in physical play and used more achievement-related language with sons than with daughters. On the other hand, the authors also show that

fathers spoke more openly about emotions and used more analytical language with daughters than with sons. However, in contrast to the aforementioned studies which allude to more preferential treatment for boys, this study notes an interesting finding when observing brain responses to visual stimuli, particularly to pictures of their own children. It shows that fathers' respond more significantly to happy expressions of their daughters compared to sons in the part of the brain responsible for reward and emotional regulation.

2.2 Measuring Risk

The expected utility (EU) theory as formalised by Von Neumann & Morgenstern (1947) can be used to evaluate a decision with uncertainty with regards to risky acts. An individual's EU is influenced by their utility from an economic payoff of the outcome(s), weighted by the probability of their occurrence. An individual's decision can be split into two broad categories of risk: (1) risky if the decision is associated with two or more distinct outcomes, and (2) riskless if there is only one possible outcome. The risky decision D has expected utility:

$$EU_i(D) = PU(x) + (1 - P)U(y) \qquad (i)$$

The individual i receives x with probability P, and y with probability $1 - P$ (where $0 < P < 1$ and $x < y$).

The riskless decision D' therefore has the expected utility

$$EU_i(D') = U(z) \qquad (ii)$$

Where the individual i receives z with certainty.

If the expected utility of both the risky and riskless decision are equal, i.e., $EU_i(D) = EU_i(D')$, then z is considered to be the certainty equivalent for individual i's risky decision D, where $EU_i(D) = U(z)$. Therefore, smaller values of z will satisfy risk-averse individuals' certainty equivalent condition, and the value of z will fall below the expected value of the risky decision. A risk averter therefore has a concave utility function with a diminishing marginal utility. Larger values of z will satisfy risk-seekers' certainty equivalent condition, with the value of z exceeding the expected value of the risky decision. A risk seeker therefore has a convex utility function with increasing marginal utility. In layman's terms, a risk averse individual is more willing to accept a certain outcome with a lower-valued reward than a risky outcome with a higher-valued reward. The opposite is true for a risk seeker.

Assuming that fatherhood leads to a switch to a more risk averse behaviour, this would be attributed to a change in U such that the difference between the certainty equivalent of a risky decision and the expected value of the decision decreases, i.e.:

$$\left[z - \big(P(x) + (1-P)(y)\big) \mid EU_i(D)_{post} = EU_i(D')_{post}\right] < \left[z - \big(P(x) + (1-P)(y)\big) \mid EU_i(D)_{pre} = EU_i(D')_{pre}\right] \qquad (iii)$$

Where pre and $post$ denote the pre- and post-childbirth period respectively. This simply means that a father is less risk tolerant, and willing to accept the certain outcome over the risky outcome after fatherhood; their utility function becomes more concave.

A risk-seeking individual's perception on such a scenario could also be attributed to optimism, where they perceive themselves to be more likely to face more favourable outcomes, i.e., a lower self-perceived value of P (for example, Morrongiello and Rennie (1998) on the risk of unintentional injury arising from sport-participation). Tversky and Kahneman's (1992) cumulative prospect theory model also allows for distortions to self-perceived probabilities. Fatherhood can therefore also impact P, where their perception of the likelihood of an undesirable outcome occurring increases.

However, an individual's risk attitude is not set in stone and can differ by factors such as, age and other life events (Rosen et al., 2003; Nicholson et al., 2005.) For instance, Josef et al. (2016), Mata et al. (2016) and Mamerow et al. (2016) show that the propensity of risk-seeking behaviour decreases with age. Individual-level risk attitude may also vary on a decision level, especially where the risk is context-dependent. An example of this stems from a study by Fryt et al. (2021) who show varying patterns of different types of risk-taking behaviour across different age groups. For instance, the authors show that young adults are more likely than adolescents to engage in positive risk-taking behaviour such as sport-participation, while the adolescents are more likely than young adults to become involved in negative risk-taking and delinquent behaviour such as substance use and violent or non-violent crimes. Furthermore, given the variation in responsiveness to childbirth (as discussed in section 2.1.2), it may be that older fathers' risk behaviour responds to childbirth differently based on his age.

2.3 Fatherhood on Risk

A study by Torche and Raufe (2019) examines the effect of fatherhood on a multitude of health behaviours such as drinking, smoking and drug use. The authors also study the effect of fatherhood on body weight and a self-reported measure of health. Results show that the direction and magnitude of the parenthood effect is dependent on the health outcome in question. For instance, childbirth is associated with an increase in a father's weight, but a decrease in alcohol consumption. This somewhat reinforces the conclusion

postulated by Umberson and Gove (1989) who suggest that parenthood can both positively and negatively affect psychological well-being as different aspects of well-being are affected differently. It can also be the case that when risk behaviour is proxied by injuries, the direction and strength of the relationship between fatherhood and injury incidence may vary depending on the type of injury in question. For instance, Allender et al. (2008) shows decreased participation in sport as a result of parenthood due to time constraints, while having a child is also associated with more careful driving as a result of parental responsibility and protectiveness (Taubman-Ben-Ari and Noy, 2011).

A landmark study on the effect of fatherhood on risk preferences stems from Görlitz and Tamm (2020). This study uses self-reported risk measures using the German Socio-Economic Panel (SOEP). Utilising a panel from 3 years prior to childbirth up to 18 years post-childbirth, the authors implement a dynamic difference-in-differences model to investigate variation in self-reported measure of risk before and after childbirth. Self-reported risk behaviour is measured on a scale from 1 being “extremely risk-averse” to 10 being “very willing to take risks”. They show that parenthood has a significant and positive effect on risk-aversion as early as two years prior to the birth of the child, with the largest reduction in risk-taking behaviour occurring the year during, and the year after childbirth. At both time points, there was a 0.3-point reduction in self-reported risk-seeking behaviour. These significant reductions in self-reported risk-seeking behaviour continue for up to 6 post-childbirth at -0.2 points. It should be noted that when the authors use the model specification without additional family controls, the negative effect of fatherhood on risk-aversion is significant at the 10 percent level 2 years prior to childbirth but not at 1 year prior to childbirth. Pre-childbirth period treatment effects are not significant in the model specification that includes additional family controls. However, post-childbirth period treatment effects are robust, as they are similar in magnitude in both models.

The self-reported measure used in the SOEP has been shown by Dohmen et al. (2011) to be linked to actual risk-taking behaviour who uses paid lottery experiments to test its validity using a representative sample from the SOEP. In addition, Booth and Nolen (2012) also show that self-reported risk attitude is positively correlated with actual risk attitude, adding extra confidence in the validity of self-reported measures of risk. This is reassuring, especially where the validity of self-reporting measures is sometimes questionable. This is because they could be underreported due to self-serving bias; inattentiveness; and motives to misrepresent risk attitudes, especially where there are minimal to no incentives as discussed by Camerer and Hogarth (1999). These biases could be especially problematic as there is little guidance on how self-reported measures can be adjusted to show real risk attitude (Norwood et al., 2016).

2.4 Summary

While there may be heterogeneity across paternal characteristics such as demographic and socio-economic background, all aforementioned studies allude to the general effect of fatherhood as having a positive influence on parents' wellbeing outcomes such as through improved health; more favourable labour market and criminal outcomes; stronger paternal involvement; and risk-averse preferences.

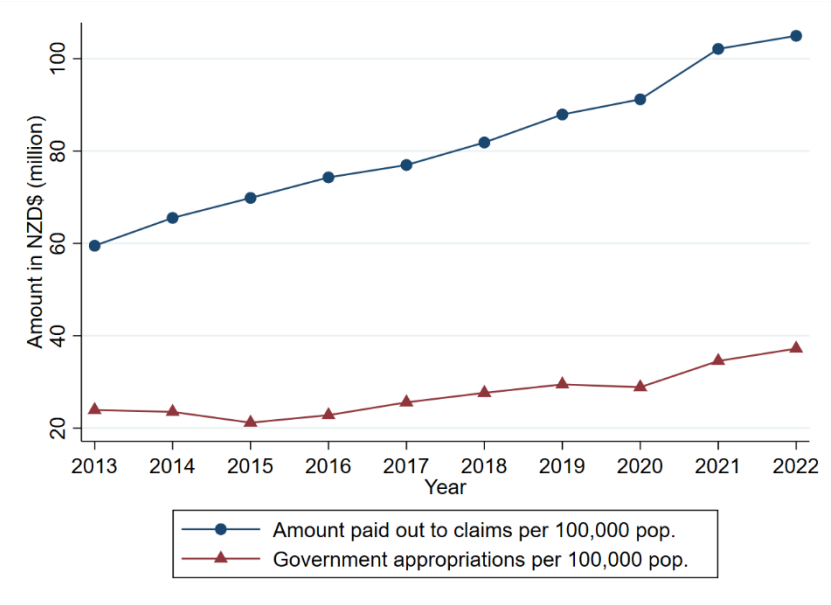
3 Background

Since the 1900s, New Zealand has been the exemplar of accident compensation. The Workers' Compensation Act (1922), for instance, ensured employers provided weekly compensation to injured workers through insurance, labelling itself a 'no fault' system (Accident Compensation Corporation (ACC), 2018). By 1973, amendments to the Accident Compensation Act (1972) allowed all people injured at work or in motor vehicle accidents in New Zealand to be covered by the act, which was funded by employers, motor vehicle owners and the government (ACC, 2018). The Accident Compensation Act (ACA 2001) administered by the Ministry of Business, Innovation and Employment covers all injured people in New Zealand, extending to those injured due to non-work-related factors including sports since 2001. The purpose of this legislation is to minimise the prevalence of injuries on individuals' health and financial wellbeing, as well as provide appropriate compensation during rehabilitation, and when full rehabilitation is not possible.

Claims covered under the ACA bear a substantial cost to the economy. In 2021, the ACC paid $1.5 billion to new accident claims in addition to $3 billion in pre-existing claims from prior to 2021 (ACC, 2022a). Payments made for accident claims typically fund medical expenses, travel expenses and income compensation. Funding for these payments is derived from their relevant sources through ACC levies which are paid by earners and motor-vehicle owners in New Zealand (ACC, 2022a). There are five accounts that cover various accident types, which is highlighted in Table A. 1 of the appendix. While the burden that ACC levies impose on individuals have been continuously decreasing, the total number of injury claims made in New Zealand have seen an upward trend in recent years. Figure 1 shows that government funding and the amount paid to ACC claims has been increasing over time, while Figure 2 shows that the burden imposed on individuals for ACC accounts has been decreasing over time.[3]

[3] Government appropriations are sourced from the general tax pool (ACC, 2022b).

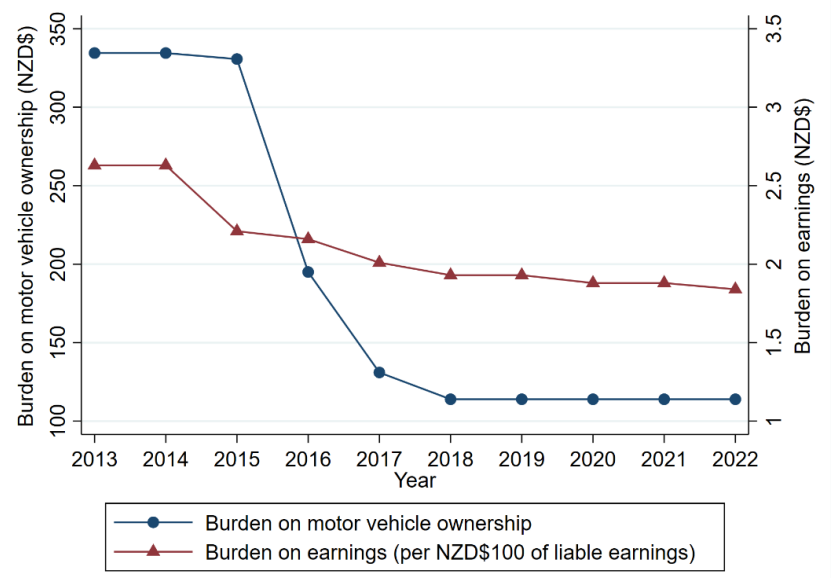
Figure 1. ACC funding from government appropriations and ACC claims paid from 2013 to 2022, in $million.



Note: The horizontal axis plots the financial years ending in June.

Source: own calculations based on data from ACC (2023a) retrieved from acc.co.nz and population data from Stats NZ (2023) retrieved from stats.govt.nz

Figure 2. Direct burden on individuals for ACC accounts from 2013 to 2022



Notes: The burden on motor vehicle ownership is the average ACC levy paid per motor vehicle owned, measured in dollars on the left-hand vertical axis. The burden on earnings is the ACC levy payable on earnings, measured in dollars per $100 of liable earnings on the right-hand vertical axis. The horizontal axis plots the financial period ending in June.

Source: own calculations based on data from ACC (2023a) retrieved from acc.co.nz

Injuries can have lasting consequences on an individual such as negative labour market outcomes in the future, with the magnitude of this effect varying by the severity of the injury. Crichton et al. (2005) use New Zealand ACC compensation data as a proxy for injury severity and show that individuals who sustain injuries resulting in more than three months of ACC compensation have lower future employment rates and earnings, and higher benefit dependence. Injuries can also have long-term effects on the community and create direct and indirect economy-wide losses (for example, Tompa et al., 2021 and Leigh et al., 1997).

Due to the nature of 'no fault' cover, ACC claims are a potentially viable proxy for risk behaviour, as there is no financial disincentive for an individual from making an injury claim, including claims made for minor injuries. Furthermore, due to the coverage of ACC claims extending to all types of injuries, this administrative dataset provides a more objective measure of risky behaviour compared to the survey data commonly used by the existing literature. Following the role-model hypothesis, fatherhood would be expected to be negatively associated with the incidence of injuries resulting from risky behaviours. The underlying reasons could be attributed to the aspects of parental involvement outlined by Lamb et al. (1985). To broadly summarise:

- A father's desire to be physically present and engaging will naturally introduce time-constraints where the father may be less likely to engage in risky-behaviour including physical activities like sport. However, spending more time at home could also mean a father would be more likely to sustain an injury in the household.
- The newfound responsibility of a father may result in more "careful" behaviour, therefore reducing the likelihood of sustaining an injury from everyday activities such as driving or household chores.

While the above hypotheses are purely speculation, the following sections will outline the relationship between accident incidence and risk behaviour, especially where an individual's level of risk-seeking behaviour is a strong predictor of their likelihood of becoming physically injured.

3.1 The concept of risk

Typically, the concept of risk simply refers to a situation with uncertainty (Knight, 1921). In the context of people's physical actions and their potential consequences on future wellbeing outcomes, Tariq and Gupta (2022) define risky behaviour as "acts that increase the [likelihood] of disease or injury" which - moving forward - is the definition this thesis will refer to.

Differences in risky behaviour across individuals can be influenced by variation in several characteristics including gender, age, socio-economic background, and personality traits (Rosen et al., 2003; Nicholson et al., 2005). However, even with such factors held constant, there is the potential for an individual's risk attitude to be further influenced by major life events such as unanticipated health or economic shocks, or family formation events such as marriage and childbirth. For instance, evidence suggests that new fathers stray away from risky behaviour. Shawe et al. (2019) recruit a sample of 573 men and found that nearly half of the respondents had made a positive health change before pregnancy, such as implementing a healthier diet or reducing alcohol and cigarette consumption.

3.2 The relationship between risk behaviour and accident incidence

There is an abundance of existing research that attempt to show the relationship between risk behaviour and accident or injury incidence amongst youth. One such study uses data from the Canadian iteration of the World Health Organisation-Health Behaviour in School-Aged Children study and employs a logistic regression using risky behaviour as an explanatory variable on the number of injuries a child sustained (Pickett et al., 2002). The authors measure the adolescents' risk-attitude as the count of the number of behaviours they demonstrated, the maximum number of which is 7. This pertains to tobacco use, drug use, insobriety, seatbelt use, helmet use, arguments with parents, and bullying peers. Adolescents with more risky behaviours were up to 4.1 times more likely to sustain a physical injury than their counterparts who had no risk behaviours. In a separate study, a higher proportion of youths who had reported being injured exhibited risky and anti-social behaviour when compared to youths who had not been injured in South Pacific Island nations (Denny et al., 2016).[4] These studies in addition to many others (for example, Demmler et al., 2017; de Looze et al., 2012; Shore and Janssen, 2020) consistently show that injury incidence is a strong predictor of risk attitude in youths and adolescents, but few studies show this for adult men. As previously mentioned, the distinction between the types of accidents is particularly important, especially where specific accidents, such as those resulting in occupational injuries are more likely to be influenced by confounding factors (for instance, Görlitz and Tamm, 2020 and Jafari et al., 2019).

[4] Again, risky behaviour refers to activities such as alcohol and tobacco use, in addition to behaviours such as truancy and fighting.

3.2.1 Risk and Sports

Extra-curricular physical activities such as sport are likely to be affected by fatherhood due to its effect on two major factors of paternal involvement, i.e., physical presence and engagement, where new fathers may face time constraints (Allender et al., 2008) or are less likely to perceive leisure as an important aspect to well-being development (Tichenor et al., 2011). Some studies suggest that athletes are statistically more likely to demonstrate risky health behaviours than their non-athletic counterparts (Nattiv et al., 1997) while other studies perceive the act of sport participation in itself to be a risky behaviour, albeit a positive one (Patel and Luckstead, 2000). Regardless of this, athletes are more likely than non-athletes to become injured, with the prevalence of injuries varying by sport type (Powell and Barber-Foss, 1999).

3.2.2 Risk and Household Injuries

When looking at how fatherhood may affect household accidents with respect to the three factors of paternal involvement, the nature of the relationship is uncertain. While more active paternal involvement may be associated with greater responsibility, it may also be associated with health risks, both within and outside the household. Beyond existing literature suggesting a switch to more cautious or health-conscious behaviour after fatherhood (for example, Taubman-Ben-Ari and Noy, 2011; Torche and Raufe, 2019; Umberson and Gove, 1989; Dustmann and Landersø, 2021), there is limited research that examines whether childbirth increases parents' risk of home-injuries and health hazards within a household.

3.2.3 Risk and Driving

Road accidents have the potential to be very serious for victims and bear substantial socio-economic costs. Jakob et al. (2006) note that the externalities associated with road accidents, in particular social costs, are becoming more widely recognised in conducting cost-benefit analyses despite being difficult to measure at market value. These social costs comprise of costs that arise from the consequences associated with accidents, such as the loss of life, reductions in life quality, reductions in productivity, medical, legal, and damage to vehicles (Ministry of Transport, 2021). To this end, the Ministry of Transport (2021) estimated the social cost of road-accidents to be approximately $4.6 billion in 2019. On an individual level, these social costs are approximately $4.5

million per fatal road injury, and approximately $470,000 and $25,000 per serious non-fatal road injury and minor road injury respectively.

On this note, risky drivers are more likely to perform stunts, violate traffic rules, drive without proper skills and knowledge, drive while intoxicated or under the influence of drugs, and not wear safety equipment (Zamani-Alavijeh et al., 2009). A New Zealand study shows that young drivers overrepresent road-accidents and fatalities in proportion to their representation of licensed drivers, with close to half of young drivers being reported to be involved in speeding and taking other thrill-seeking risks (Fergusson et al., 2003; Scott-Parker et al., 2009; Begg and Langely, 1999). Road accident incidence, especially amongst younger drivers is directly related to risk-seeking personality, with risky driving factors explaining up to 57 percent of the variation in road accidents (Ferreira et al., 2009).[5] Empirical studies on the effect of parenthood on driving behaviour is scarce, but survey findings from Taubman-Ben-Ari and Noy (2011) show that the most persistent parenthood effect on driving is a greater sense of responsibility and awareness of accident consequences, although this effect is only apparent in the actual driving behaviour of a small proportion of the sample. Moreover, while a child's physical presence may create an increased sense of responsibility, the authors note that having a child in a vehicle can create further distractions and therefore accidents.

3.3 Underutilisation of ACC services

In Section 1, I discuss heterogeneity arising from differences in background. However, differences in upbringing may not only influence accident incidence, but also the likelihood of making a claim after being injured. Ethnic disparities in the utilisation of healthcare services in New Zealand is a topic that has been under the scope of research in recent history. Many existing studies show the underutilisation of healthcare services for specific population groups. In particular, Māori and Pacific populations are found to have lower rates of utilisation of primary and child healthcare services when compared to NZ Europeans (for example, Lewycka et al., 2023; Bourke et al., 2023; Yee, 2023)

The same sentiment follows the case of ACC claims. Analyses performed by Wren (2015a and 2015b) show that Māori underrepresent the utilisation of ACC services when compared to the overall population. Reid et al. (2022) estimate that more than 20,000 injuries sustained by Māori per year go unclaimed when compared to non-Māori. While some of the underrepresentation of ACC receipts are influenced by differences in Māori perception of injury, it is also influenced by inaccessibility, unresponsiveness, and

[5] The authors use the Kaiser-Meyer-Olkin test to determine the suitability of factors analysis, in which the factors are extracted to risky driving, distracted driving, and what is labelled as "driving errors of omission" which includes behaviours such as failing to indicate.

systemic differences in values (Wren, 2015a and 2015b). Aide memoirs from the ACC body itself acknowledge systemic bias against Māori and Pacific (ACC, 2021a and 2021b). For both groups, institutional racism and inaccessibility play a major role in hindering service use; while awareness gaps, language barriers and other administrative difficulties are the challenges present for Pacific.

Such disparities could have important implications in my study, especially when analysing the population with differences in demographic characteristics. I discuss these implications and how they will be addressed in section 5.4.1.

4 Data

4.1 Integrated Data Infrastructure

To analyse the relationship between fatherhood and risk behaviour, I use population-wide administrative data housed in Stats NZ's Integrated Data Infrastructure (IDI). The IDI contains administrative data from various government ministries and agencies, Stats NZ surveys, census, and non-governmental organisations. This data is on the individual-level and contains information on various life aspects such as education, earnings, migration, justice, and health (Stats NZ, 2022). Individuals are linked across datasets via a unique, confidentialised identifying number.

4.1.1 Population of interest

To construct the population of interest, I begin with the Department of Internal Affairs (DIA) data on childbirth. The DIA records monthly birth information on all births that take place in New Zealand from 1840 and allows me to identify parent-child pairs. To ensure comparability across fathers included in my sample, I look at first-born singleton children born between 2007 and 2018 (both inclusive), who are able to be linked to a non-missing male parent. The potential effect of the first-born child on a father's risk behaviour could mitigate a father's response to subsequent childbirths; hence I do not consider children born at later parities. Furthermore, I exclude multiple-births due to their potentially confounding effect on risk-attitude and their small representation of the proportion of live births in New Zealand (Ministry of Health; 2016, Stats NZ, 2017).[6] The DIA records also provide information on the child's gender. If the gender of the child cannot be ascertained, I exclude these observations from my analysis as this is a crucial aspect of my second research objective, analysing the effect of child gender of a father's accident-related health outcome.

I link additional datasets to provide a detailed description of my population of interest. This includes Stats NZ's core "personal details" data, which provides demographic information about individuals. I include the individual's ethnicity to account for heterogeneity across upbringing. For my sample creation, I define each individual to be either European or non-European.[7] The personal details data also contains individuals' birth years and months. The information present in the personal details data is derived from multiple datasets in the IDI with prioritisation rules (Stats NZ, 2022).

[6] In 2016, 1000 live births were multiple births (Ministry of Health, 2016), which make up approximately 1.6 percent of all live births in that year (59,430, Stats NZ, 2017).
[7] If the individual identifies with European and non-European ethnicities, he is classified according to Stats NZ's prioritisation rules.

I include an indicator representing the father's marital status based on DIA data on marriage and civil unions. I include an indicator of whether the father was born in New Zealand based on his own records in the DIA births dataset.

I further restrict my sample to focus on fathers that are aged between 20 and 37 when they had their first child.[8] I select the lower age limit at 20 years old due to the nature of the identification strategy (explained further in section 5). Very young fathers (such as teenagers) may not have much incentive to make an ACC claim, especially if they are not in employment or if there is a minor injury as they would not be receiving compensation. In addition, existing literature suggest that risk behaviour decreases with age. Therefore, the analysis in this thesis will stratify fathers into different age categories to take potential age differences in injury incidence into account. This thesis will also look at the risk-outcomes of fathers who tend to be more risk-seeking, defined by their pre-conception risk behaviour.

4.1.2 Outcome of interest

The novelty of this study comes from its measure of risk behaviour, which is proxied by the father's accident incidence according to the ACC claims data. This is based on the assumption that riskier individuals are more likely to experience adverse health consequences such as accident-induced injuries. The ACC data contains accident data on the daily level and documents the various types of accidents that occur in New Zealand. This data is detailed to the point where it contains descriptions of the injuries and on the part(s) of the body where the injury was sustained. Other useful detailed information on the injury claim include:

- The date of the claim: i.e., the date the claimant reported the injury to the ACC directly or through a medical practitioner.
- The date of the injury: the date the injury was sustained.
- Indicators of how the injury was caused: detailed description of the cause of the injury, e.g., collisions, lacerations, loss of balance, swerving of vehicle, etc.
- The primary scene of the injury: the general type of location where the injury was sustained, e.g., at home, at a sport/recreation facility, on the road, etc.
- Amounts paid out in earnings compensation, medical expenses, and travel expenses.

[8] Due to the nature of the identification strategy outlined in section 5, the age range of fathers in this analysis is 18 – 39, due to the two-year window on either side of childbirth that will be considered.

- Indicators for whether it was a work accident or road accident: A work-related accident is defined in agreement between Stats NZ, ACC and the Ministry of Business, Innovation and Employment as “all fatal and serious non-fatal injuries that occur while a person is at work in New Zealand”.
- An indicator for whether the claim was accepted.

I generate additional indicators to represent non-work-related accidents if the injury did not occur in the workplace; sport accidents if the injury was caused during sports or physical activity; and household accidents if an injury occurred at home. Understanding the type of accident is a critical part of the analysis, so I exclude accidents that have no contextual information or accident claims that were not accepted. Claim indicators, as well as the number of claims are aggregated on the half-yearly level and matched to the half-yearly panel of four years surrounding childbirth via the individual’s unique identifying number.

It is particularly important to be able to distinguish between work and non-work-related claims. This is because while work-related claims could be attributed to risk behaviour, they are also likely to be confounded by unobserved traits that are correlated with individuals’ labour market choices as well as risk preferences. The importance of this distinction is further amplified by claims made by Görlitz and Tamm (2020) who do not find convincing evidence of changes in risky labour market behaviour associated with parenthood.

4.2 Data structure

To analyse the potential link between fatherhood and risk behaviour in a dynamic framework, I construct a four-year panel around the childbirth with two years on either side. I choose this time horizon due to the nature of the identification strategy which will be further explained in Section 5.1. I aggregate ACC injury claims into the half-yearly level, i.e., if one or more injuries occurred during a 6-month period according to the event time, then the injury indicator takes on a value of 1. This is to avoid the large number zero-values in claim indicators at the monthly level. The data used in my analysis is a balanced panel dataset containing approximately 640,000 observations with 16 observations per father (8 when a father is in the control group, and 8 when he is in the treatment group) when considering the entire sample. I centre the event time $r = 0$ when the observed period is the 6 months prior to childbirth.

The outcome variables are indicators that take on a value of 1 if an individual made at least one claim pertaining to a household accident or a sport accident in a specific half-year. This can further be aggregated into what I define as non-work-related accidents. I

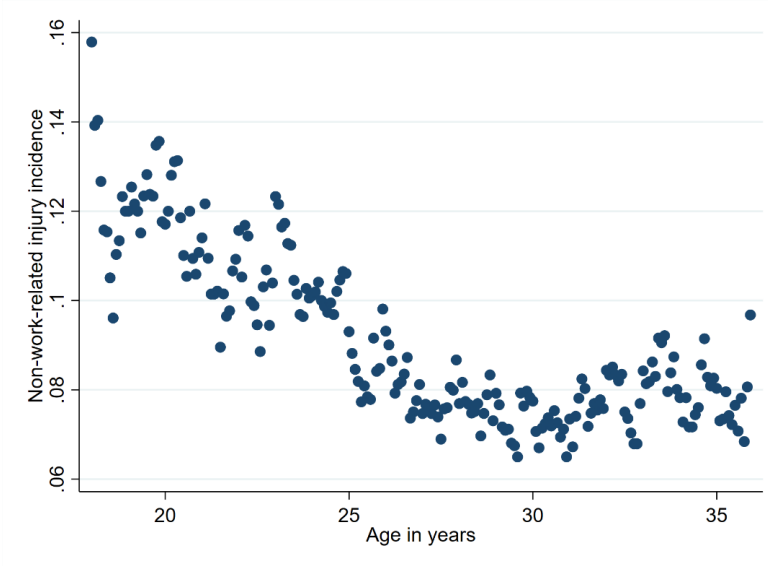
also consider road accidents in part of my analysis. The estimated average treatment effects on the treated (ATT) estimates on the outcomes variables therefore measure the change in the probability of making a claim pertaining to non-work-related accidents.

Figure 3 shows injury claims incidence rates for non-work-related injuries by father's age in their first half-year observation window (2-to-1.5 years prior to childbirth). It is clear that very young men have higher rates of injury claims, but this decreases as the men gain maturity. The injury claim rates appear to bounce back after men turn 30, albeit at a much slower rate with more variation. While many studies show a negative relationship between age and risk, I speculate that the shape of the relationship between age and injury incidence as shown in Figure 3 is unique to the population of interest and not of men in general. For instance, I earlier discuss the case of men who delay parenthood (such as Elniö et al., 2019 and Cooney et al., 1993) and their tendency to have better health outcomes and being more actively involved. Older fathers are likely to understand the importance of their health and their involvement and how this drives their relationship with their child. As such, I suspect that older first-time-fathers are more likely to be present in the household, and thus more involved in household injuries; and they are more likely to participate in sport, thus more likely to be involved in sport injuries compared to younger first-time-fathers.

Table 1 provides summary statistics of my population of interest. The first observation of note is that most Europeans are born in New Zealand (70 percent) compared to non-Europeans (36 percent). Asians comprise the largest share of the non-European sample at 48 percent. The gender split of children born in the sample is also close to even. I also note that a higher proportion of the treated group are married before the panel begins, and this proportion further increases by the time the panel ends. 33 percent and 22 percent of Europeans and non-Europeans respectively are married at the end of the panel. A higher proportion of younger fathers are non-European, with 49 percent of non-Europeans having a child before the age of 30, compared to 42 percent for Europeans. The treated group make more non-work-related injury claims than the control group, however, this variation is largely accounted for by the household injury claims.[9] The treatment group is exposed to a lower number of sport- and road-related injury claims.

[9] In section 6.1.1 and Appendix C, I conduct t-tests for differences in means of injury claims incidence across treatment groups, and pre- and post-treatment periods.

Figure 3. Injury claims incidence by father's age at the birth of their child



Notes: The vertical axis measures the number of men who had at least one non-work-related injury claim as a proportion of all men of the same age taken in the first half-year observation window of each individual. The horizontal axis measures the age of the man in years from 18 years old to 35.9 years old, from 2-to-1.5 years prior to childbirth.

Source: Own calculations based on data in Stats NZ's IDI.

Table 1. Summary statistics of the population of interest

	Non-European		European	
	Mean	**Cumulative Mean**	**Mean**	**Cumulative Mean**
Age at birth of child				
20	0.02	0.02	0.02	0.02
21	0.04	0.07	0.03	0.05
22	0.05	0.11	0.04	0.09
23	0.05	0.16	0.04	0.12
24	0.05	0.21	0.04	0.17
25	0.05	0.25	0.04	0.21
26	0.05	0.30	0.05	0.26
27	0.05	0.36	0.05	0.30
28	0.06	0.42	0.05	0.36
29	0.07	0.48	0.06	0.42
30	0.07	0.55	0.06	0.48
31	0.07	0.62	0.07	0.55
32	0.07	0.70	0.07	0.62
33	0.07	0.77	0.07	0.70
34	0.06	0.83	0.08	0.78
35	0.06	0.90	0.08	0.85
36	0.06	0.95	0.08	0.93
37	0.05	1.00	0.07	1.00
Ethnicity				
Asian	0.48		-	
Māori	0.28		-	
Pacific	0.20		-	
MELAA	0.06		-	
European	-		1.00	

Table 1. Summary statistics of the population of interest (continued)

	Non-European		European	
	Soon-to-be fathers / Control* (SD)	Fathers / Treatment* (SD)	Soon-to-be fathers / Control* (SD)	Fathers / Treatment* (SD)
Personal characteristics				
Born in New Zealand	0.36	0.36	0.70	0.70
Married [1]	0.03	0.11	0.05	0.18
Married eventually [2]	0.22	0.22	0.33	0.33
Son [3]	0.52	0.52	0.51	0.51
Injury claims				
Non-work-related injuries [4]	0.68 (1.63)	0.77 (1.59)	0.86 (1.50)	0.96 (1.51)
Household injury	0.24 (0.61)	0.35 (0.73)	0.36 (0.74)	0.49 (0.88)
Road injuries	0.03 (0.19)	0.03 (0.18)	0.06 (0.26)	0.05 (0.23)
Sport injuries	0.44 (1.45)	0.42 (1.38)	0.50 (1.24)	0.46 (1.18)
Pre-conception non-work-related injury	0.15	0.19	0.22	0.26
Pre r = -1.5 non-work-related injury	0.06	0.08	0.09	0.10
N =	**23793**	**23793**	**16275**	**16275**

Notes:

* The assignment of treatment is discussed in section 5.
(1) If married before or at the beginning of the panel
(2) If married by child's second birthday
(3) = 1 if the child is a boy.
(4) The sum of sport and household injuries
Source: Own calculations based on data in Stats NZ's IDI.

5 Methodology

The first objective of this thesis is to ascertain the causal effect of having a child on a father's risk behaviour. The underlying framework behind ascertaining any causal effect stems from the potential outcomes causal model first set out by Rubin (1974) and further highlighted by Angrist and Pischke (2008) & Cunningham (2021). With relevance to my objective, the potential outcomes causal model is in the form of the equation:

$$\delta_i = Y_i^1 - Y_i^0 \qquad (iv)$$

Where δ_i is the causal effect of having a child of individual i and Y_i is the potential outcome of the individual i where:

$$Y_i = \begin{cases} Y_i^1 \text{ if } c_i = 1 \\ Y_i^0 \text{ if } c_i = 0 \end{cases} \qquad (v)$$

$c_i = 1$ if the individual i has a child, and $c_i = 0$ if the individual i does not have a child. The causal effect δ_i is simply the difference between the two potential outcomes. Herein lies the first challenge in identifying a causal effect: a father cannot be observed in both states of fatherhood at the same time point. In the context of my objective "the causal effect of fatherhood on risk behaviour", I am interested in the risk behaviour of fathers as a result of the birth of their child in particular. This is labelled by Angrist and Pischke (2008) and Cunningham (2021) as the "average treatment effect on the treated (ATT)" and is expressed by the following equation:

$$ATT_i = (Y_i^1 \mid c_i = 1) - (Y_i^0 \mid c_i = 1) \qquad (vi)$$

Like the potential outcomes causal model, the second term $(Y_i^0 \mid c_i = 1)$ cannot be observed as this refers to a non-father who has a child. Angrist and Pischke (2008) note that in a randomised control trial, there is no selection bias problem, and the ATT can be expressed as follows:

$$ATT_i = \underbrace{(Y_i^1 \mid c_i = 1)}_{a} - (Y_i^0 \mid c_i = 1) = \underbrace{(Y_i^1 \mid c_i = 1)}_{a} - \underbrace{(Y_i^0 \mid c_i = 0)}_{b} \qquad (vii)$$

Where the terms a and b are observable factors. A randomised control trial is the experimental ideal as it ensures that treatment is exogenous (Angrist and Pischke, 2008 & Cunningham, 2021). Given that this is not the case with childbirth, I attempt to simulate a randomised control trial by employing a dynamic difference-in-differences (DD) analysis similar to that of Fadlon and Nielsen (2019) to ascertain estimates of the ATT. I henceforth refer to this approach as the FN approach.

A DD approach however not only compares the differences in outcomes between the treatment and control groups, but also the differences in time (with particular interest

across event time) within groups. Cunningham (2021) introduces four new terms: a pre-period for a treatment group $pre(T)$; a post-period for a treatment group $post(T)$; a pre-treatment period for an untreated group $pre(U)$; and a post-treatment period for an untreated group $post(U)$. In the context of a DD analysis, equation (vii) can now be extended to the entire population and estimated as:

$$ATT = \left(\bar{y}_T^{post(T)} - \bar{y}_T^{pre(T)}\right) - \left(\bar{y}_U^{post(U)} - \bar{y}_U^{pre(U)}\right) \quad (viii)$$

Where $\bar{y}$ is the sample mean outcomes for a particular group at a particular point in time relative to the event time. Where there are multiple time periods, equation (viii) can further be expressed as:

$$\delta_r = ATT_r = \left(\bar{y}_T^{r(T)} - \bar{y}_T^{f(T)}\right) - \left(\bar{y}_U^{r(U)} - \bar{y}_U^{f(U)}\right) \quad (ix)$$

Where f is a reference time point that estimates of the ATT in time period r are measured relative to. Therefore $r \neq f$.

5.1 Fadlon and Nielsen (2019) Background

The goal of Fadlon and Nielsen (2019) was to identify any potential causal effects of a health shock on an individual's behavioural responses, and the spillover effect this might have on family behavioural responses. The underlying thought in this identification strategy is that a sample of "treated individuals" are compared to a control sample of individuals who are "yet-to-be treated" some time in the near future.

(1) A treatment group that experiences an event at time τ; and
(2) A control group that experiences the same event at time $\tau + \Delta$.

As the events in (1) and (2) are the same event, the treatment and control groups are defined by their time-to-event. The length of the periods for which one can observe and compare treatment and control groups depends on the size of Δ. The rationale behind this approach is that if the event were not to occur, the outcomes of the treatment and control group would run parallel, with differences in outcomes being attributed to differences in Δ. There is therefore a compromise to be made when choosing the size of Δ. Comparability between treatment and control groups is more valid when choosing a small Δ as the time horizon does not allow for many changes in individual characteristics. On the other hand, choosing a larger Δ allows one to analyse differences in outcomes for a longer time horizon. I choose $\Delta = 4$, which allows for outcomes to be analysed for up to 2 years post-childbirth.

5.2 Implementing the Fadlon and Nielsen (2019) approach

Using the FN approach but with relevance to childbirth effects on risk-taking behaviour, I proceed with the following model:

$$y_{it} = \alpha + \beta treat_{it} + \sum_{r=-1}^{2} \gamma_r \times I_r + \sum_{r=-1}^{2} \delta_r \times I_r \times treat_{it} + \omega X_{it} + \lambda T_t + \epsilon_{it} \qquad (1)$$

Where y_{it} is the measure of risk behaviour for father i at time t, proxied by the probability of making an injury claim. The variable $treat_i$ is a dummy indicator that is equal to 1 if the father has received treatment (childbirth) and zero if not; I_r is an indicator for time relative to the assigned treatment period $r = 0$, where r is the observation window from 6 months prior.[10] r also moves in 0.5-year increments. X_{it} is the vector of individual-specific control variables, while T_t denotes time fixed effects.

I utilise three different outcome variables y_{it} in my analysis. The first includes a catch-all indicator of non-work-related injuries flag, which equals 1 if the individual made a household and/or sport injury claim at time t or 0 otherwise. Furthermore, I also look at two separate indicators of household and of sport injury claims.

The parameter of interest δ_r measures the treatment effect for a time period with respect to the time period $r = -1.5$ as the reference period. The treatment effect is the difference in the mean propensity to make an injury claim relative to the observation window 2-to-1.5 years pre-childbirth, hence, δ_r must be interpreted for every $r \neq -1.5$.

5.2.1 Assumptions

This dynamic DD requires two major assumptions to hold: (1) parallel trends and (2) no anticipation effects (Borusyak et al., 2022). For the parallel trends assumption (1) to hold, it must be that $(\delta_r \mid 12r < k, r \neq -2) = 0$.[11] This assumption states that if the treated fathers did not have a child, they would face the same accident incidence trajectory as the fathers who have children later. In this instance, k represents the number of months prior to childbirth.

Typically, in a dynamic DD model, $k = 0$, however, this can lead to the potential for the no-anticipation-effects assumption (2) to be violated in this study. Given that the FN approach is best suited to studies analysing effects of shocks, applying it to the effect of fatherhood may require this assumption to be relaxed as in Borusyak et al. (2022). I can

[10] For example, $r = 0.5$ is the observation window from 0-to-6 months post-childbirth, i.e., the first 6 months after childbirth.
[11] I multiply r by 12 due to the differences in the time-level between r and k.

do this by allowing for anticipation where $-9 \leq k \leq 0$, i.e., sometime between the likely conception and the childbirth event. It is important to note that it is difficult to ascertain a specific value of k that is representative of the entire population. A large proportion of pregnancies are planned (for example, Ministry of Health, 2019), and therefore I can expect k for this population to be negative and large in magnitude. For the share of the population that had unplanned pregnancies or were ambivalent according to the Ministry of Health (2019), I can expect k to be closer to 0. It is also important to distinguish between planning for a child and anticipating a child. While planning may certainly influence anticipation, this distinction is particularly important to ensure that $k \geq -9$ and there are enough observations in the pre-treatment period to empirically test the parallel trends assumption.

To further test the relationship between fatherhood and the likelihood of injury incidence, I also re-estimate equation (1) for men who had at least one non-work-related injury claim prior to the conception of their child. Due to the design of this analysis, there may be a drop in injury claims after the observation window between 1-to-0.5 years prior to childbirth. To ensure that men respond to childbirth with a change in injury incidence, there should ideally be a further discontinuity in the first six months post-childbirth. This approach is similar to that carried out by Dasgupta et al. (2022) who look at the effect of the gender of the child on the criminal outcomes of fathers with a pre-birth conviction. To measure whether a man had a pre-conception accident, I create a dummy indicator that is equal to 1 if the man made a non-work-injury claim between 24 months and 9 months before childbirth before aggregating the data structure to a half-yearly level.

5.2.2 Addressing endogeneity

According to Angrist & Pischke (2008) and Cunningham (2021), endogeneity is a major limitation that can generate biased estimates in a DD analysis such as in the analysis presented in this thesis. In the case of research question of “what is the effect of fatherhood on a man’s risk behaviour?”, endogeneity can arise from multiple sources such as:

1. Selection bias: men who are fathers may systemically differ from men who are not fathers, and failing to account for these differences can lead to bias in estimates.
2. Measurement error: if there are errors present in how explanatory or dependent variables are measured, bias can arise in estimates.

3. Omitted variables: where factors including individual-specific characteristics that could be correlated with risk-taking behaviour and childbirth decisions are unaccounted for such as unobserved individual or circumstantial traits.
4. The direction of causality is reversed: where risk attitude may affect the likelihood of having a child. For instance, it may be that risk-seeking men are less likely to use contraceptives which could lead to a higher rate of unplanned pregnancies. On the other hand, risk averse men may be more responsible and thus could have a higher rate of planned pregnancies.

Cunningham (2021) suggests that a potential method of checking the validity of DD analysis is to conduct a pre-treatment covariate balance based on observable characteristics to see whether treatment and control groups are comparable.

The benefit of the FN approach is that comparability holds in their setting, in that a control group of individuals who receive treatment sometime in the future provides validity to the parallel trends assumption. Throughout section 6, I show that pre-treatment parallel trends hold, allowing me to validate the parallel trends assumption in the context of fatherhood and injury incidence.

Simply put, the analysis only compares the treated with the not-yet-treated and does not consider the never-treated. This could potentially enhance the comparability between the treatment and control group as the men in the population of interest would not systemically differ based on their treatment status. Furthermore, if measurement or omitted variable errors were to occur, their effects on the treatment and control group would be the same.

5.3 The gender effect

The second objective is to identify whether there is an additional effect of the child's gender on risk behaviour. To do this, I estimate a model similar to that of Dustmann and Landersø (2021):

$$y_{it} = \alpha + \beta_r son_i + X_i b + \epsilon_{ir} \quad (2)$$

Where y_{it} is again, the probability of making a non-work-related claim for father i at time t, and the dummy variable son_i is equal to 1 if the father's first-born child is a boy, or 0 if the child is a girl. β_r is therefore the causal effect of the child's gender on risk behaviour. X_i denotes a vector of variables that contain individual or family characteristics. I assume the child's gender to be exogenous to the model as it is plausibly randomly assigned and the inclusion or omission of X_i should therefore not affect estimates of β_t. I again centre

$r = 0$ on the six-month period ending at childbirth. Estimates of β conditional on $r \leq 0$ indicate the gender effect on risk behaviour before the birth of the child and estimates of β conditional on $r > 0$ indicate the gender effect on risk behaviour after the childbirth. Furthermore, the sample will now only consist of fathers around the birth of their first child; the control group as constructed through the FN approach is removed.

There is however a possible concern that could affect exogeneity in this study as explained by Dustmann and Landersø (2021). Specifically, selective abortion could create spurious correlation between gender and accident claims incidence. The authors – in their original study - address this by conducting a balancing test. In a New Zealand context, I am not severely concerned with such an issue due to the laws surrounding abortion which make it difficult to abort a foetus on the basis of sex. The details of this legislation are outlined in Appendix B. Independent of this, Table 1 shows the gender distribution of children born in this sample is almost split evenly, similar to the gender breakdown according to the estimated resident population of New Zealand as at September, 2022 (Stats NZ, 2022).

5.4 Limitations

5.4.1 ACC claims

There are a number of limitations associated with using ACC claims data to proxy risk behaviour. First, despite the no-fault nature of ACC claims, there may be some additional factors that influence whether an individual actually makes a claim for their injuries. This could include factors such as:

- inaccessibility or unwillingness to utilise ACC services;
- time-constraints or other administrative barriers associated with making a claim, which could also include potential cultural or language barriers (e.g., with filling out forms, talking to a medical practitioner, etc.);
- low (perceived) severity of an injury, i.e., an injury is not serious or not perceived to be serious enough to make a claim;
- personal lack of awareness of the ACC scheme; and/or
- the potential incentive for employed individuals to overstate the severity of an injury.

These factors could have potential implications on an accurate representation of injury claims for certain groups depending on cultural background, income, education and/or deprivation. As discussed in section 3.3, Māori and Pacific underrepresent ACC receipts, potentially indicating underutilisation of ACC services when compared to Europeans. To address this issue, along with accounting for potential cultural differences in risk behaviour, I stratify the population of interest into Europeans and non-Europeans in my

analysis (such as in section 6.3) to make for more like-for-like comparisons. An important note is that the underutilisation of ACC services is largely a problem specific to Māori and Pacific, but stratifying the non-European population of interest further will result in small sample sizes and wider confidence intervals for regression estimates.

5.4.2 Using road injury claims as a proxy

Despite the trend in road-accidents showing evidence of a fatherhood effect on risk behaviour, the number of road accidents in my sample are low, with road-accident claim rates being less than 1 percent for any group at any given time point. According to the Ministry of Transport (2021), approximately 35 percent of crashes between 2007 and 2021 were serious or fatal (N = 154,246), while the remainder of crashes were minor, including “fender-benders”. Such accidents as these are less likely to constitute an ACC claim, and thus road-accidents are potentially not as viable a proxy due to their underrepresentation of actual risk behaviour. In addition, the actual age of the control group means many individuals in the control group may not be exposed to the same conditions as the treatment group which facilitates a higher risk of road injury (e.g., driving).

6 Results: Primary Analysis

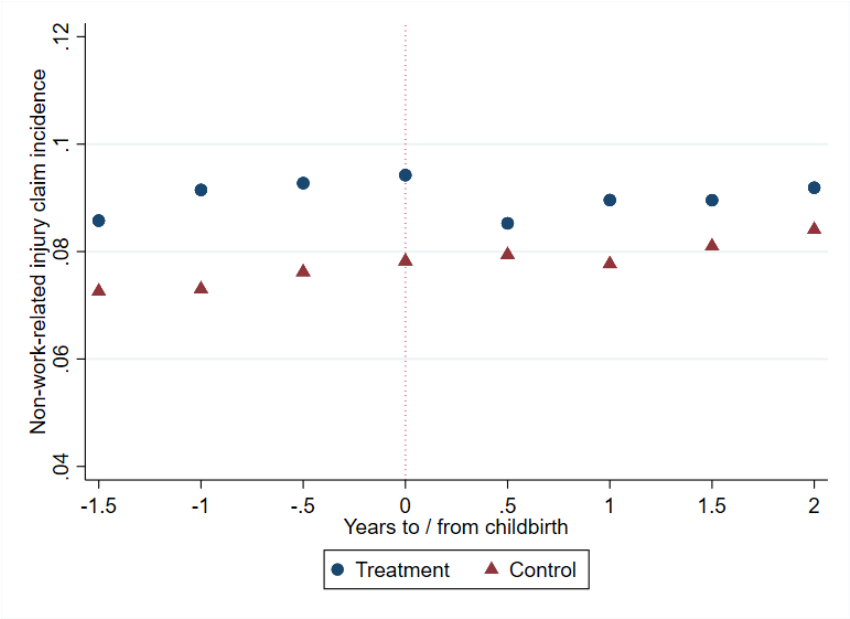
6.1 Descriptive statistics

Based on the father's treatment status, I first analyse the rate at which men are involved in non-work-related accidents. Non-work-related accidents include sport-related accidents and household accidents. Panel A of Figure 4 lends credibility to my hypothesis, and supporting evidence such as that of Görlitz and Tamm (2020), that having a child leads to a decrease in risk-seeking behaviour due to the sharp drop from 9.3 percent of treatment group having made a non-work-related injury claim in the half-year before childbirth, to 8.5 percent in the half-year beginning at childbirth. The change in claim incidence for the control group for the same period is an increase from 7.8 percent to 7.9 percent and does not noticeably deviate from its trajectory. Furthermore, Panel A of Figure 4 also lends support to the two assumptions that my identification strategy requires: parallel trends and no anticipation effects, as (1) the trajectory of claim rates between the treatment and control group move similarly prior to childbirth and (2) claim rates for the treatment group do not decrease until the half-year beginning at childbirth.

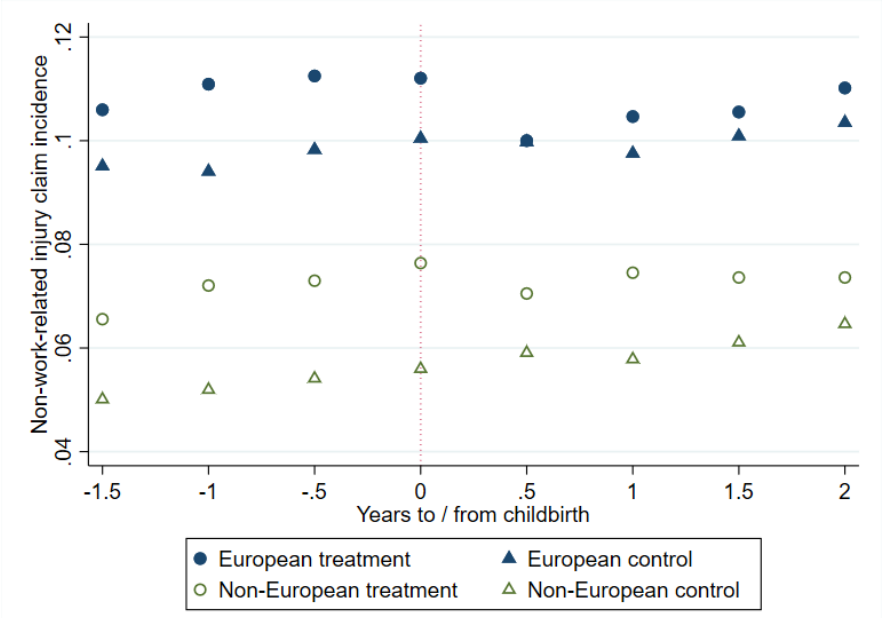
The non-work-related injury claim incidence for the control group is also above the treatment group at every time point, with the trajectory of both groups' claims trending upwards. This is driven by two major factors: (1) a majority of the non-work-related injury claims are comprised of fathers' household injuries, which as I discuss later, does not respond strongly to childbirth, and (2) a majority of the population of interest are aged over 30 (see Table 1) who see an increasing propensity to make non-work-related injuries (see Figure 3).

Figure 4. Non-work-related claim incidence

Panel A



Panel B



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line.

Source: Own calculations based on data in Stats NZ's IDI.

Panel B of Figure 4 shows that the potential decrease in risk-seeking behaviour is more prevalent amongst European fathers. For European fathers in the treatment group, the average claim rates decrease by 5 percent from the pre- to the post-childbirth period,

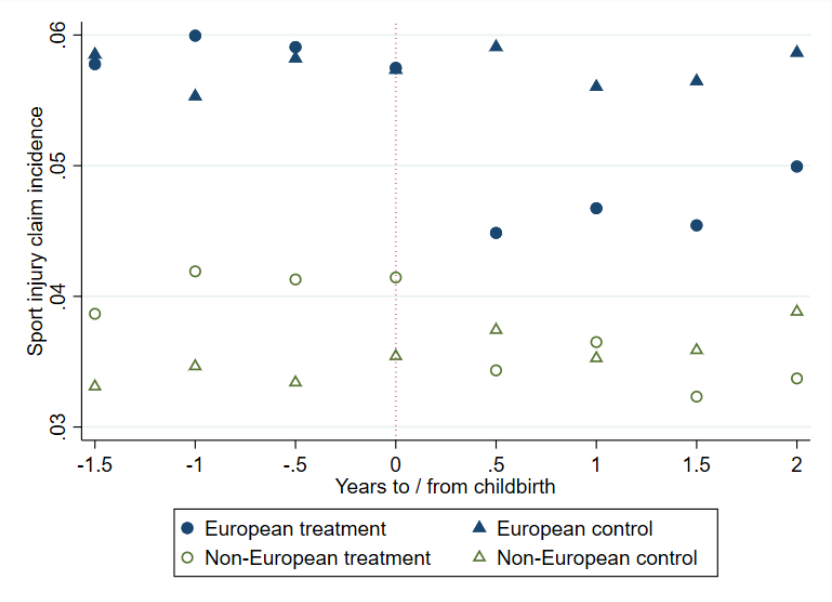
while claim rates from r = 0 to r = 0.5 decrease by 11 percent. For non-European[12] fathers in the treatment group, average claim rates between the pre- and post-childbirth period increase by 1.8 percent, although the claim rates from r = 0 and r = 0.5 decrease by 8 percent. However, non-Europeans generally have significantly lower claim rates, regardless of parental status. The average non-work-related claim rate is around 10 percent for European men, and around 7 percent for non-European men in the four-year window around childbirth. The ethnic differences in non-work-related claim rates may support findings by Hennecke et al. (2022) and Tichenor et al. (2011) who find ethnic differences in paternal involvement and fathers' self-perceived importance.[13] However, these ethnic differences also likely reflect the underutilisation of ACC services by Māori and Pacific discussed in section 3.3.

6.1.1 Fatherhood and sport accidents

Fatherhood may have large effects on sport injury claims due to its effect on all three factors of paternal involvement as previously discussed, which potentially makes sport accidents the most likely proxy for risk. Figure 5 shows a sharp decrease in sport-related injury claims during the half year of childbirth for the treatment groups, and the propensity to make sport-related injury claims remains relatively low and stable up to two years post-childbirth. Similar to non-work-related accidents in general, the decrease in sport-related accident claim rates is more prevalent amongst European fathers when compared to non-European fathers. However, it is again worth noting that claim rates among non-Europeans is generally lower than Europeans, regardless of parental status. The average sport-related injury claim rate in the four-year window around childbirth for all European and non-European fathers in my sample is 4.6 percent and 3.6 percent respectively. In Table 2, I show that the difference in means of sport-related injury claim incidence is significantly greater than 0 for the treatment group, but not the control group.

[12] Non-European fathers are those that identified as Māori, Pacific, Asian, MELAA or other.
[13] In particular, Hennecke et al. (2022) shows that Māori and Pacific show a higher degree of paternal involvement relative to Europeans.

Figure 5. Sport injury claim incidence by ethnicity and treatment status



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line.

Source: Own calculations based on data in Stats NZ's IDI.

Table 2. T-test results for the difference means of sport-related injury claims incidence in the pre- and post-treatment period

Treatment group	Treatment	Control
Pre-treatment period mean	0.050	0.046
Post-treatment period mean	0.041	0.048
Pre- minus post-treatment mean	0.009	-0.002
t-statistic	12.641	-1.906
p-value	<0.01	0.9717

Note: the p-value is associated with the hypothesis that the difference in means between the pre-treatment and post-treatment period is greater than 0.

Source: Own calculations based on data in Stats NZ's IDI.

6.1.2 Fatherhood and household accidents

The hypotheses proposed in Section 2.2.2 could explain the trends in household-accident claims. For fathers in general, there is no convincing variation in the trajectory of household-accident claims for the treatment group versus the control group. When looking at European fathers, Panel A of Figure C. 1 shows that there is a slight decrease in household-accident during the semi-annual period immediately succeeding the childbirth but continues to increase over time following the short-termed drop. For non-European fathers, the change is seemingly non-existent, although of note once again is the lower claim rates for non-Europeans in general, as shown by Panel B of Figure C. 1.

Table C. 1 shows that the post-treatment means for both the control group and the treatment group are larger than the respective pre-treatment means. This indicates that household injury claim incidence trends upwards for both groups, although it could also potentially indicate that childbirth may lead to more household injuries. If this is the case, it is difficult to distinguish looking at trends alone, as the trajectory of the control and treatment groups seems almost identical.

6.1.3 Fatherhood and road accidents

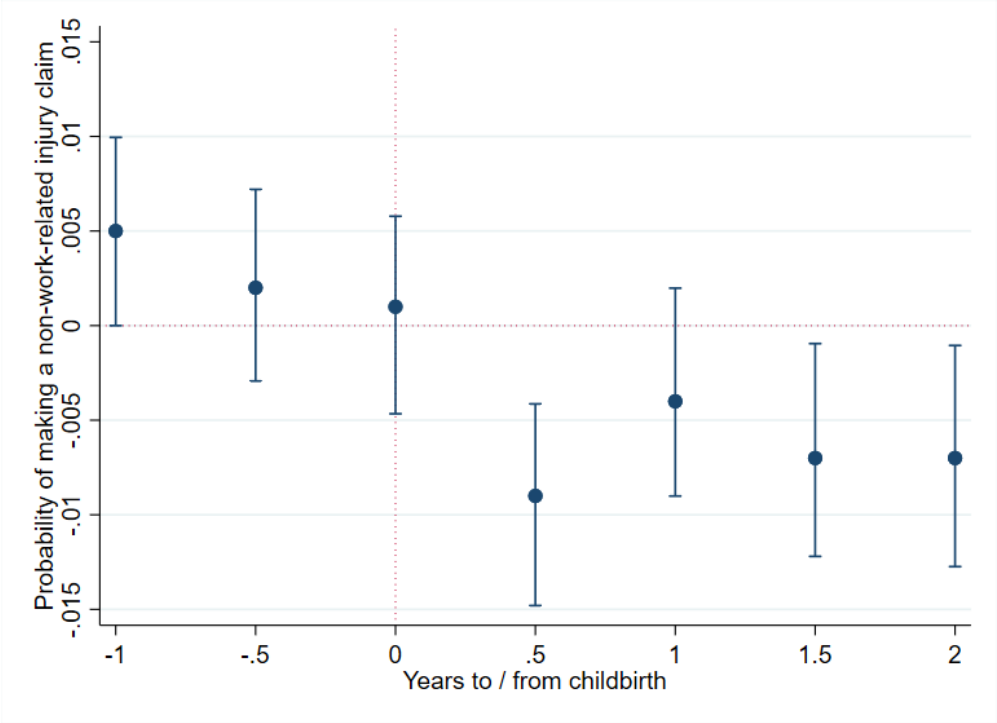
The evolution of fathers' road injury claims is presented in Figure C. 2 and shows a sharp drop in road-accident claim rates between two half-years prior to childbirth (around the time of conception), and the half-year of childbirth.

Table C. 2 also shows differences in pre- and post-conception road-accident claim rates. However, non-Europeans again generally have lower road-accident claim rates, averaging a claim rate of around 0.4 percent, compared to 0.6 percent for Europeans.

6.2 Regression estimates

My primary analysis attempts to estimate the causal effect of having a child on a father's risk behaviour. As detailed in section 5, this is done by employing a dynamic DD with the outcome variable, risk, proxied by non-work-related injury claims. The treatment group is constructed following the approach adopted by Fadlon and Nielsen (2019). These estimates of $\hat{\delta}_r$ in equation (1) are presented visually in Figure 6.

Figure 6. DD estimates of the fatherhood effect on non-work-related injury claims (whole sample)



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the ATT are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

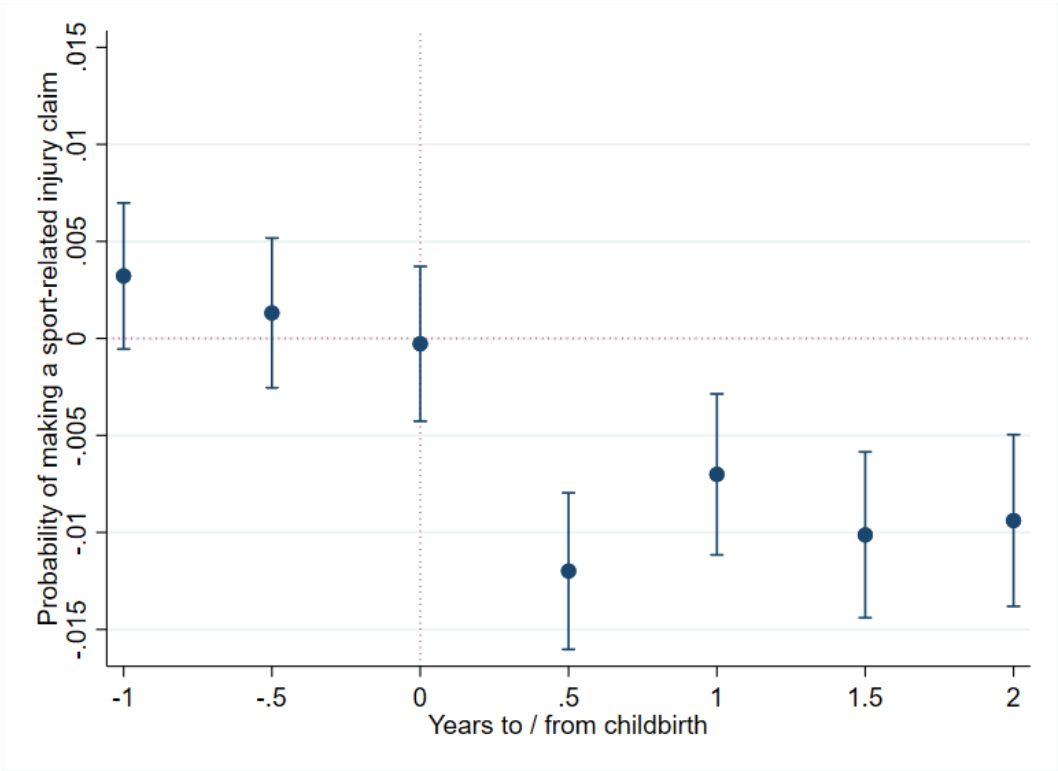
The probability of a father making a non-work-related injury claim decreases by 0.9 percentage points in the first six months of childbirth ($p < 0.01$). For reference on the magnitude of this change, I refer to Table 1 to show that the control group's non-work-related claims incidence is 17.8 percent in the pre-conception period.[14] A 0.9 percentage point decrease is therefore equivalent to a 5 percent decrease relative to the average share of the pre-conception control group (PCC). Non-work-related accident incidence remains low up to 2 years post-childbirth, though this result is insignificant at the 0.5-to-1-year window post-childbirth. The estimates suggest that having a child has immediate and lasting negative effects on a man's risk behaviour compared to men who are not yet fathers.

I further disaggregate the outcome variable of my primary analysis to sport-related and household-related injury claims to reflect potential effects on the three factors of paternal involvement. This is shown in Figure 7 and Figure 8 respectively. Sport accidents offer

[14] This is the average of the pre-conception non-work-related injury indicator weighted by the total count of the control group by ethnicity.

more convincing evidence of a fatherhood effect when compared to household accidents, and seemingly explain most of the variation in the change in non-work-related accidents that arise because of fatherhood. In the pre-childbirth period, the estimated coefficients of the ATT are no longer significant when using sport accidents as the outcome variable, offering more validity to the parallel-trends assumption. In the post-childbirth period, estimated coefficients of $\hat{\delta}$ are more significant, showing a more substantial fatherhood effect. The period $r = 0$ ATT suggests that the probability of being involved in a sport accident decreases by 1.2 percentage points in the half-year beginning at childbirth ($p < 0.01$), and the negative effect is persistent for up to 2 years post-childbirth.

Figure 7. DD estimates of the fatherhood effect on sport injury claims (whole sample)



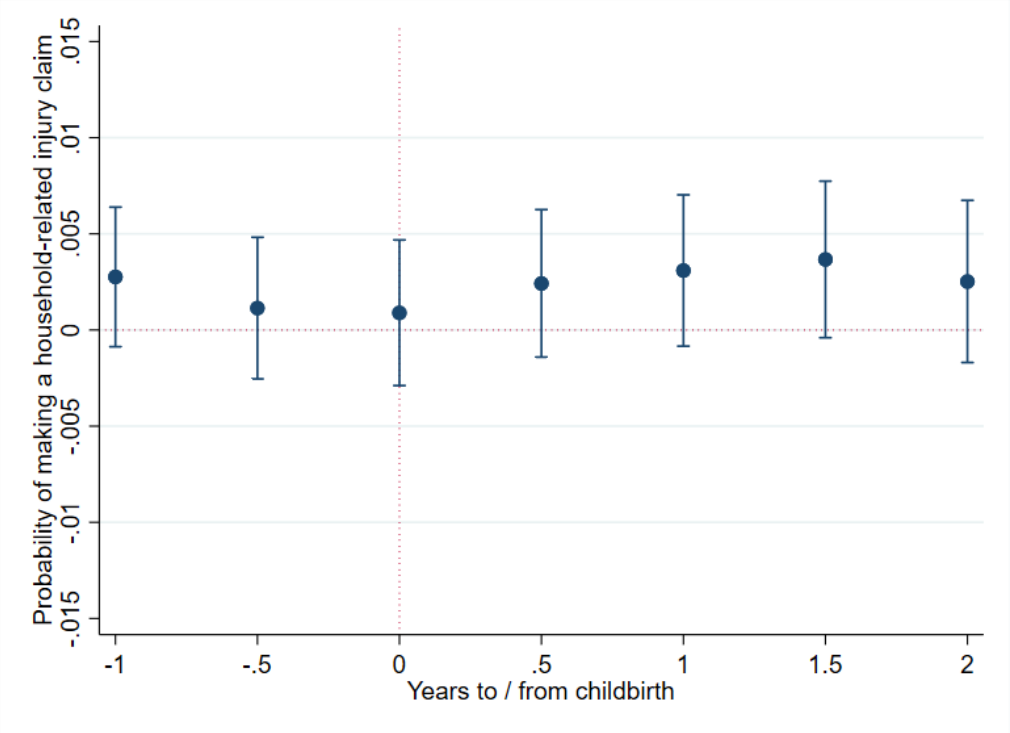
Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the ATT are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

On the other hand, using household accidents as the outcome variable for the whole sample of fathers shows no evidence of a fatherhood effect on risk behaviour for fathers aged 20 – 37, as shown by Figure 8. Contrary to expectations, estimated coefficients of $\hat{\delta}$ in the post-treatment period are positive, although these are mostly insignificant with

the exception of the observation window at 1-to-1.5-years post-childbirth, which is significant at the 10 percent level.

Figure 8. DD estimates of the fatherhood effect on household accidents (whole sample)



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the ATT are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

6.2.1 Model validity

Figure 6, Figure 7 and Figure 8 seek to provide evidence for parallel trends and to ascertain a reasonable estimate of when I can expect anticipation effects to occur. When sports and household injury claims are aggregated (non-work-related accidents), the model shows evidence of an inverse relationship between fatherhood and risk-taking behaviour. However, this effect becomes stronger when the outcome of interest is disaggregated into sport injury claims but is seemingly non-existent when disaggregated into household injury claims. Furthermore, while estimated coefficients of the ATT trend downward in the pre-treatment period leading to childbirth, these estimates are insignificant, providing evidence in favour of parallel trends. This also shows that there are no statistically significant anticipation effects; the behaviour of the treated fathers does not meaningfully deviate from the control group's trajectory until the 6-month period beginning at childbirth. The model which only considers sport accidents most strongly

supports my hypothesis that having a child leads to a decrease in a man's risk-seeking behaviour.

When using the aggregated non-work-related claims as the outcome variable, I noted a potential violation of the parallel trends assumption in the 2 year to 1.5 year observation window pre-childbirth. This estimate is independently insignificant when looking at sport and household injuries separately. To bolster parallel trends in the pre-treatment period, I conduct F-tests of joint significance for pre-treatment estimates of $\hat{\delta}$ with all three outcome variables. I present these F-statistics and their p-values in Table 3. I cannot reject the hypothesis that pre-treatment estimates of the ATT are not significantly different from zero for any outcome variable, which helps validate the parallel trends assumption for this DD model.

Table 3. F-test statistics of overall significance for the pre-treatment ATT

Outcome variable	F-statistic	p-value
Non-work-related injury claim	1.54	0.2028
Sport-related injury claim	1.38	0.2477
Household-related injury claim	0.77	0.5089

Source: Own calculations based on data in Stats NZ's IDI.

6.3 Heterogeneity

As discussed in section 1, risk attitude can vary based on individual characteristics such as age and background. To address potential heterogeneity issues, I next estimate equation (1) separately by different age-groups (20 – 30; and over 30) and further by ethnicity (European and non-European).

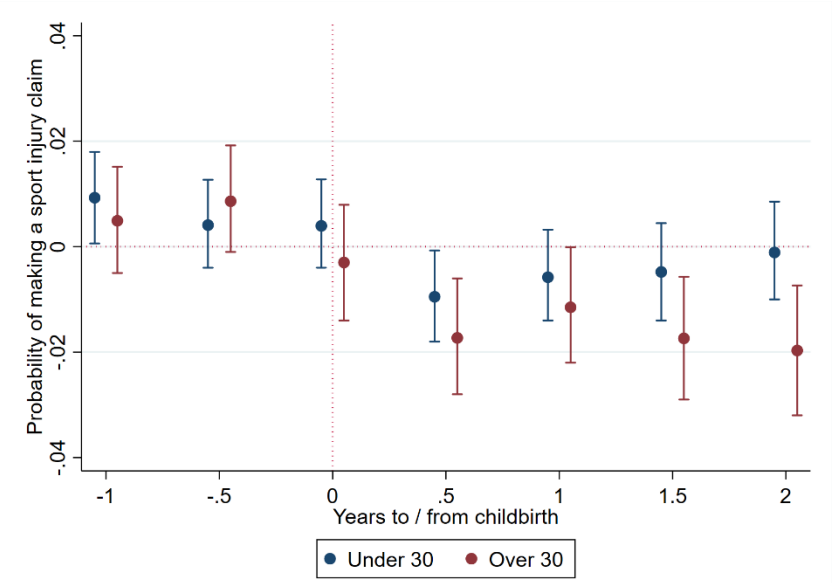
6.3.1 Sport injuries

With respect to sport injury claims as the outcome variable of interest, I present estimates of the ATT in Figure 9. Panel A and Panel B of Figure 9 show that all first-time fathers show some response to childbirth with respect to sport-related injury claims.

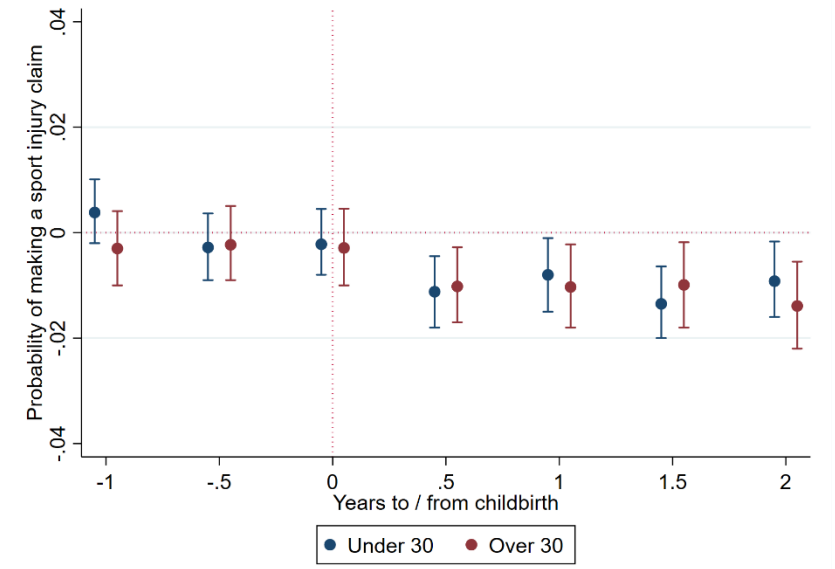
Panel A of Figure 9 shows that for European fathers, those aged under 30 see a decrease of 0.9 percentage points in the probability of making a sport-related injury claim in the first six-months post-childbirth ($p < 0.05$). There continues to be negative estimates of the ATT for European fathers under 30 in the post-treatment period, however, these are insignificant. For European fathers over 30, there is a sharper 1.7 percentage point decrease in the probability of making a sport related injury claim in the first six-months post-childbirth ($p < 0.01$). Unlike their younger counterparts, the decrease in the propensity to make sport injury claims remains persistently negative and significant for up to 2 years post-childbirth.

Figure 9. DD estimates of the fatherhood effect on sport-related injury claims

Panel A. Europeans



Panel B. Non-Europeans



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the ATT are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

Panel B of Figure 9 shows that the magnitude of the sport injury claim response to childbirth is similar for non-European men under 30 and over 30. For both age groups of non-European men, there is a 0.01 percentage point decrease in the probability of making a sport-related injury claim in the first six-months post childbirth ($p < 0.01$). This effect is persistent and significant for up to two years post-childbirth.

I again note a significant estimate of the ATT in the pre-treatment period for European fathers under 30. To verify the pre-treatment parallel trends assumption for this particular sample, I conduct an F-test of joint significance of the pre-treatment ATT and derive an F-statistic of 1.48 ($p = 0.2186$). This allows me to reject the hypothesis that pre-treatment estimates of the ATT are not significantly different from 0.

6.3.2 Household injuries

I now present estimates of the ATT for household injury claims as the outcome variable of interest in Figure 10. There is no convincing evidence of a fatherhood effect on first-time fathers' propensity to make household injury claims except in the case of non-European fathers aged over 30.

Unlike in the case of sport injuries, non-European fathers aged over 30 see an increase in the probability of making a household-related injury claim the in the two observation windows from 0.5-to-1.5 years post-childbirth. For both observation windows, the estimated coefficient was 0.007 ($p < 0.1$). For this subset of fathers, there are consistent positive estimates of the ATT in the post-treatment period until the end of the panel, although most estimates are insignificant. However, this could still indicate some direct relationship between having a child and the propensity to become injured at home.

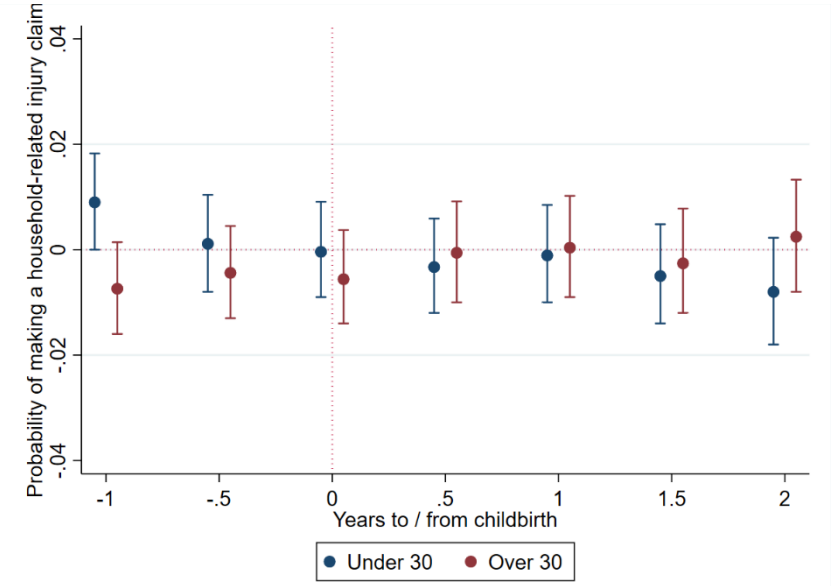
6.3.3 Possible interpretations

All fathers generally respond to childbirth with a decrease in the propensity to make a sport injury claim, although this effect is short-lived for European fathers aged under 30. Insofar as using injury claims as a proxy for risk, sport injuries are likely the most suitable proxy in that natural time-constraints are introduced for fathers, and fathers therefore choose to spend their time in less risky environments such as playing sport.

I theorise that a higher household injury propensity in response to childbirth (such as the case with non-European fathers aged over 30) might arise as a result of spending more time at home, and therefore an increase in the likelihood of being involved in a household injury. This may especially be the case for fathers over 30 presupposed they are more financially stable and able to stay at home, or more aware of the importance of paternal involvement.

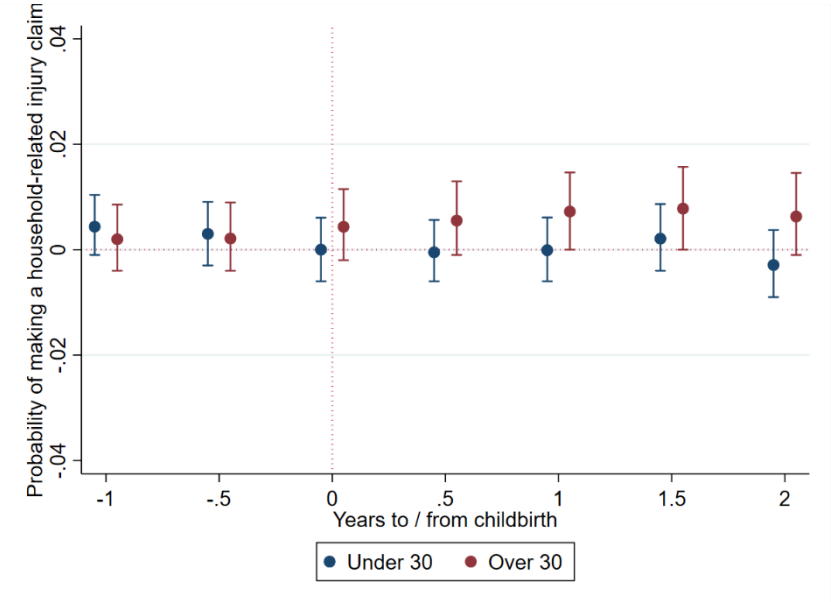
Figure 10. DD estimates of the fatherhood effect on household injury claims

Panel A. Europeans



Note:
Pre-treatment parallel trends for fathers under 30 validated in Table C. 1 of Appendix C.

Panel A. Non-Europeans



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the ATT are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

In addition, if it is assumed that men spend more time at home after having a child and post-treatment estimates of household injury claim estimates remain relatively unchanged, this could indicate a reduction in household injury claim incidence as a proportion of the time spent at home. However, I note that it is not possible to validate these interpretations with the available data outlined in section 4.

6.3.4 Road injuries

For fathers aged over 30, I also estimate equation (1) with road injury claims as the outcome of interest. Despite descriptive statistics showing a drop in road injury claim rates just before childbirth (See Figure C. 2), there is only weak evidence that European fathers adjust their road behaviour in the first six months of childbirth. The probability of making a road injury claim for European fathers aged over 30 decreases by less than half a percentage point in the first six months after childbirth ($\delta_{0.5} = -0.003, p < 0.1$). I present estimates of the ATT in Figure C. 3 of Appendix C.

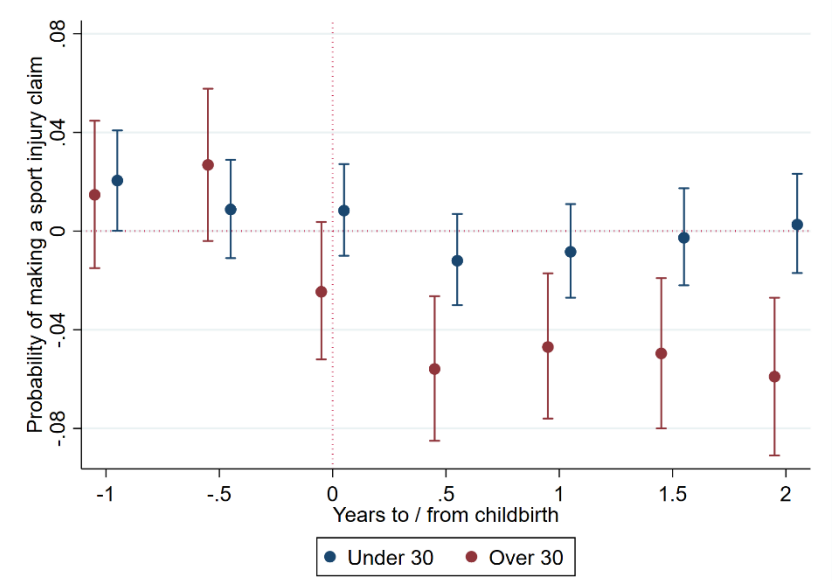
6.4 Pre-conception behaviour

6.4.1 Approach 1

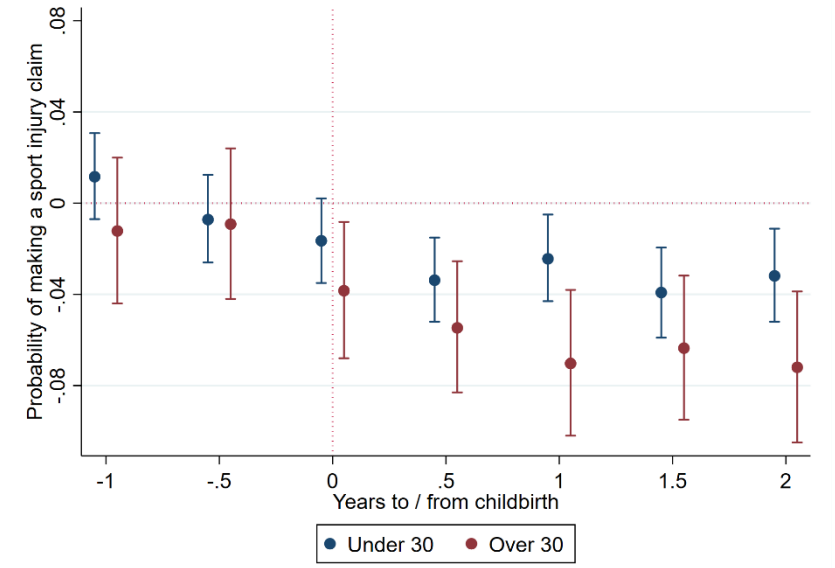
Up until this point, I have discussed the potential effects that parenthood has on the risk behaviour of fathers in general. However, it is also useful to look at men with a pre-conception injury claim and how fatherhood potentially affects these men's propensity to make injury claims. After estimating equation (1) using a sample of men with an injury in their pre-conception period, the estimates of the ATT on sport-related injury claims are largely consistent with section 6.3.1, but stronger in magnitude. These estimates are presented in Figure 11. Panel A of Figure 11 shows that there is again no convincing evidence of a fatherhood effect on European fathers aged between 20 – 30, even for those who have an injury prior to conception. European fathers aged over 30 experience a 5.6 percentage-point decrease in the propensity to make a sport-related injury claim in the first 6 months post-childbirth (31 percent reduction relevant to the PCC, $p < 0.01$). The post-treatment estimates of the ATT for European fathers aged over 30 are negative and significant for up to 2 years post-childbirth.

Figure 11. DD estimates of the fatherhood effect on sport-related injury claims for fathers with a pre-conception injury

Panel A. Europeans



Panel B. Non-Europeans

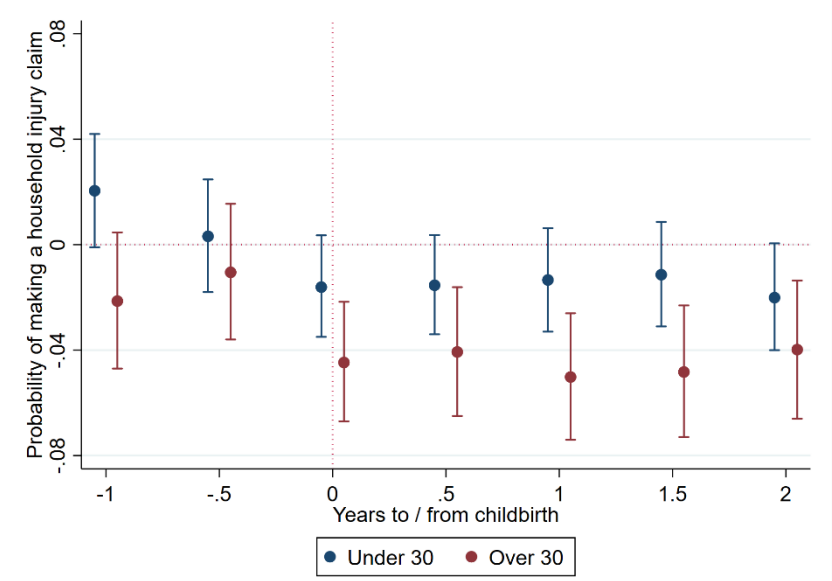


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the ATT are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

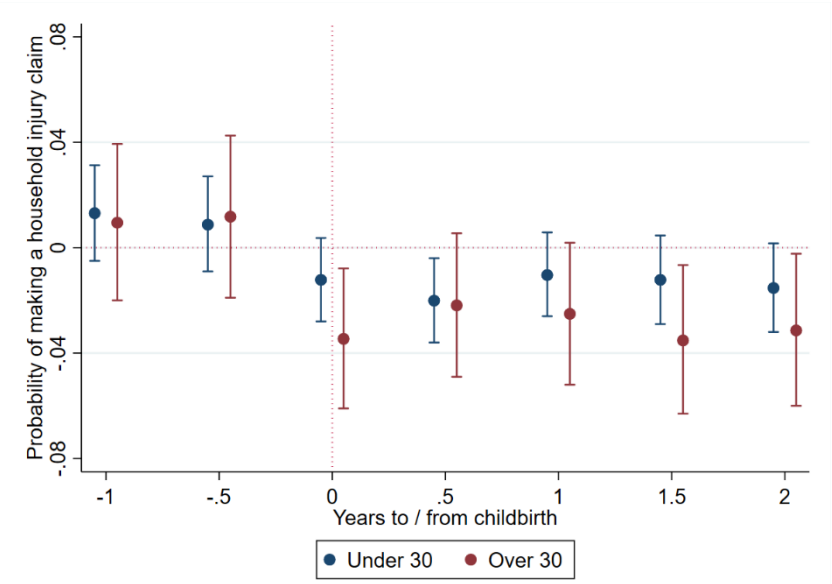
Source: Own calculations based on data in Stats NZ's IDI.

Figure 12. DD estimates of the fatherhood effect on household-related injury claims for fathers with a pre-conception injury

Panel A. Europeans



Panel B. Non-Europeans



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the ATT are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

Panel B of Figure 11 shows that the behaviour of non-European fathers aged 20 – 30 is again in contrast to their European counterparts where there is a significant decrease in the propensity to make sport-related injury claims after childbirth as suggested by post-treatment regression estimates of the ATT. Non-European fathers aged over 30 also see potential significant anticipation effects. For this group of fathers, there is a 3.8 percentage point decrease (21 percent decrease relevant to the PCC) in the probability of making a sport-related injury claim in the 6 months prior to childbirth ($p < 0.05$). In the first 6 months post-childbirth, the treatment effect is further amplified to a 5.5 percentage point decrease (31 percent decrease relevant to PCC, $p < 0.01$). Furthermore, for older non-European fathers, size of estimates of the ATT continue to grow in magnitude. By the 1.5-to-2-year observation window post-childbirth, the ATT is estimated to be -0.072 ($p < 0.01$).

Overall, the results shown in Figure 11 show that while the magnitude of a potential fatherhood effect on sport injuries is stronger for those with a pre-conception injury, the direction of their behavioural response is no different from fathers in general. To that end, I estimate the baseline specification with respect to household injuries for fathers with a pre-conception accident and present those results in Figure 12.

In contrast to Figure 10 where there is generally little to no indication of a response in household-injury behaviour to childbirth, Figure 12 shows that all older fathers and non-European men aged 20 – 30 with a pre-conception injury show at least some decline in household-related injury incidence as a result of childbirth. However, it should be noted that the validity of these results could potentially be impacted by the design of the sample specification. Restricting the sample to men with a pre-conception injury only may result in the tendency for injury claims to decrease after conception, regardless of whether treatment has been assigned or not.

For men aged over 30, there are significant and negative post-childbirth regression estimates with respect to household injury claims beginning in the 6-month period prior to childbirth. However, these estimates are stronger in magnitude and more consistent for European men, whereas estimates for older non-European fathers are statistically insignificant for a few post-treatment periods. For non-European men aged under 30 with a pre-conception injury, there appears to be an immediate but short-lived response to childbirth with respect to their household injury claim incidence. In the first 6 months after childbirth, there is a 2 percentage-point reduction in the probability of making a household injury claim ($p < 0.05$).

Restricting the sample to men aged over 30 at the birth of their first child, I estimate the baseline specification with road injury claims as the outcome variable of interest. There

is some evidence to suggest a decrease in the propensity to make a road-injury claim, particularly in the first six months after childbirth for non-Europeans, and in the observation window from 0.5-to-1-year after childbirth for Europeans. However, there are a few significant pre-treatment estimates for both groups and confidence intervals are wider than regression models that consider other outcome variables of interest.

6.4.2 Approach 2: A Sensitivity Analysis

As mentioned in section 5, the significant pre-treatment estimates shown in Figure 12 may arise as an unintended consequence of the identification strategy design. As a robustness check to validate estimates of the ATT, I create a dummy variable if the father has been involved in a non-work accident in the 2-to-1.5-year observation window prior to childbirth. I then remove this observation window from my analysis, hence, the reference period is now the 1-to-0.5 years prior to childbirth.

The advantage of this identification strategy is that it removes any spurious pre-treatment or anticipation effect arising solely from the pre-conception restriction. The disadvantage is that there now exist fewer pre-treatment periods to bolster parallel trends. In addition, the further restriction now results in a smaller sample size, therefore increasing standard errors and the width of the confidence intervals. The goal of this sensitivity analysis is to support the post-childbirth estimates of the ATT ascertained through Approach 1.

I present estimates of the ATT from my sensitivity analysis in Figure C. 5 to Figure C. 7 of Appendix C. I find that results are similar to the point-estimates for sport-related injury claims presented under Approach 1, although the magnitude of point estimates for fathers aged 20 – 37 are stronger than in Approach 1, while the magnitude of point estimates for fathers aged over 30 are weaker than in Approach 1. I compare the estimates of Approach 1 and 2 in Table 4. The F-test results for most regressions under Approach 1 show that pre-treatment estimates of the ATT are significantly different from 0, while the opposite is true for Approach 2. This could indicate that decreases in household injury claim propensity during the pre-treatment period are spurious under Approach 1, rather than being attributable to anticipation effects. However, in the case of sport-injury claims for non-European fathers aged 20 – 30, pre-treatment estimates of the ATT are negative and significant under both approaches while the sign of all estimates under both approaches are the same in their respective time windows.

Estimates of the ATT on household injury claims under Approach 2 are insignificant and more in line with results presented in section 6.3.2. This is a strong indication of spuriousness in the significance of ATT estimates under Approach 1.

Table 4. Comparison of point estimates of the ATT between Approach 1 and Approach 2

Years to/from childbirth	European: Sport				European: Household				Non-European: Sport				Non-European: Household			
	Under 30		Over 30		Under 30		Over 30		Under 30		Over 30		Under 30		Over 30	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
-1	0.020**	-	0.015	-	0.020*	-	-0.021	-	0.012	-	-0.012	-	0.012	-	0.009	-
	(0.010)		(0.015)		(0.011)		(0.013)		(0.010)		(0.016)		(0.010)		(0.015)	
-0.5	0.009	-0.011	0.027*	0.007	0.003	-0.007	-0.011	0.011	-0.007	-0.023*	-0.009	-0.020	-0.007	-0.001	0.012	0.002
	(0.010)	(0.013)	(0.016)	(0.020)	(0.011)	(0.013)	(0.013)	(0.016)	(0.010)	(0.013)	(0.017)	(0.023)	(0.010)	(0.011)	(0.016)	(0.018)
0	0.008	-0.001	-0.025*	-0.010	-0.016	-0.012	-0.045***	0.003	-0.017*	-0.032**	-0.038**	-0.037	-0.017*	-0.011	-0.035**	0.001
	(0.010)	(0.013)	(0.014)	(0.021)	(0.010)	(0.013)	(0.012)	(0.016)	(0.009)	(0.013)	(0.015)	(0.025)	(0.009)	(0.011)	(0.014)	(0.019)
0.5	-0.012	-0.036***	-0.056***	-0.045**	-0.015	-0.016	-0.041***	-0.009	-0.034***	-0.054***	-0.055***	-0.079***	-0.034***	-0.012	-0.022	0.016
	(0.010)	(0.013)	(0.015)	(0.022)	(0.010)	(0.013)	(0.013)	(0.018)	(0.010)	(0.014)	(0.015)	(0.024)	(0.010)	(0.011)	(0.014)	(0.019)
1	-0.008	-0.022	-0.047***	-0.068**	-0.013	-0.017	-0.050***	-0.013	-0.024**	-0.047***	-0.070***	-0.082***	-0.024**	-0.010	-0.025*	0.013
	(0.010)	(0.014)	(0.015)	(0.020)	(0.010)	(0.013)	(0.012)	(0.018)	(0.010)	(0.014)	(0.016)	(0.026)	(0.010)	(0.011)	(0.014)	(0.020)
1.5	-0.003	0.001	-0.050***	-0.053**	-0.011	-0.016	-0.048***	0.000	-0.039***	-0.062***	-0.064***	-0.079***	-0.039***	0.003	-0.035**	-0.012
	(0.010)	(0.015)	(0.016)	(0.022)	(0.010)	(0.014)	(0.013)	(0.019)	(0.010)	(0.015)	(0.016)	(0.025)	(0.010)	(0.012)	(0.015)	(0.020)
2	0.003	-0.006	-0.059***	-0.053**	-0.020*	-0.023	-0.040***	-0.008	-0.032***	-0.056***	-0.072***	-0.097***	-0.032***	-0.017	-0.031**	0.002
	(0.011)	(0.015)	(0.016)	(0.022)	(0.011)	(0.014)	(0.013)	(0.018)	(0.011)	(0.015)	(0.017)	(0.027)	(0.011)	(0.011)	(0.015)	(0.021)
F	1.33	0.46	5.62	0.36	4.71	0.43	5.87	0.29	3.26	3.04	2.44	1.15	3.88	0.61	5.87	<0.01
Prob > f	0.264	0.631	<0.01	0.6996	<0.01	0.648	<0.01	0.752	0.021	0.048	0.063	0.318	<0.01	0.545	<0.01	0.9952

6.5 Summary

Most fathers exhibit some tendency to respond to childbirth by a change in their circumstances that reduce their propensity to become injured. This is reflected more heavily with the outcome variable of interest being sport-related injury claims; all groups of fathers experience a reduction in their propensity of being involved in sport injuries., although this experience is short-lived for European fathers under the age of 30. Assuming injury claims are a viable proxy for risk behaviour, I have also shown that a father's pre-conception behaviour potentially amplifies the degree of fathers' risk-averse behaviour in response to childbirth. However, and importantly, there is no robust evidence to support the claim that neither household injury claims nor road injury claims are a strong predictor of risk behaviour.

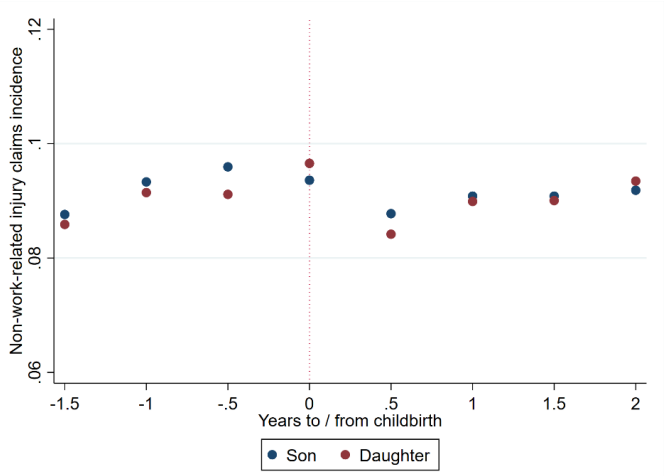
7 Results: Secondary Analysis

The primary research goal of this thesis was to document the effect of parenthood on injury claims incidence, with the rationale being that those who are involved in more injuries are likely to be more risk-seeking than those that are not. This section will present results from my secondary research question: to what extent, if any, is the change in risk behaviour arising from fatherhood prompted by the gender of the child?

I present descriptive statistics of the differences in non-work-related injury claims incidence for men who father a son versus men who father a daughter around the time horizon surrounding childbirth in Figure 13. There is a drop in non-work-related injury incidence for both groups of men right after childbirth, but the vertical distance between the two groups remains negligible, with the sign of the difference alternating across the event time horizon.

The injury claim incidence for sport and road injuries across the event time horizon are presented in Figure C. 8 and Figure C. 9 respectively. There still remains negligible differences in injury incidence rates by the gender of the child when I disaggregate the outcome variable.

Figure 13. Non-work-related injury incidence by child gender



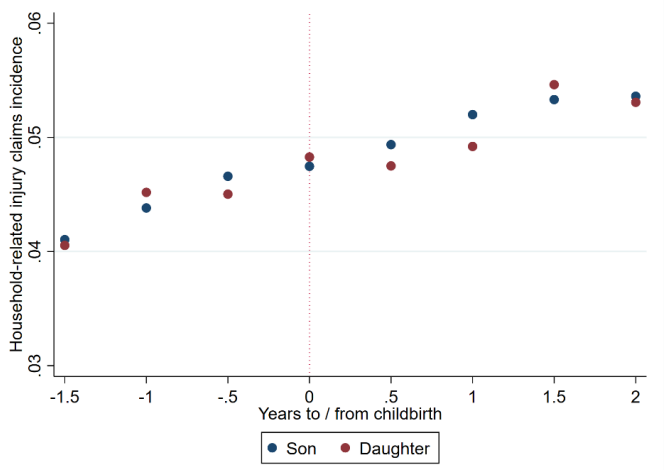
Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line.

Source: Own calculations based on data in Stats NZ's IDI.

Figure 14 shows the household-related injury claim incidence across the event time horizon. The injury incidence trends upwards even after childbirth. Another observation of note is the first six months after childbirth (r = -1.5), where there is a small change in claims incidence for fathers of girls, but not for fathers of boys. Furthermore, for most observation windows, the differences in claims incidence by gender remain negligible except at r = 0.5 and r = 1. This could potentially suggest some differences in how

fathers choose to spend their time in engaging in child-rearing in the short term depending on the gender of the child.

Figure 14. Household-related injury incidence by gender



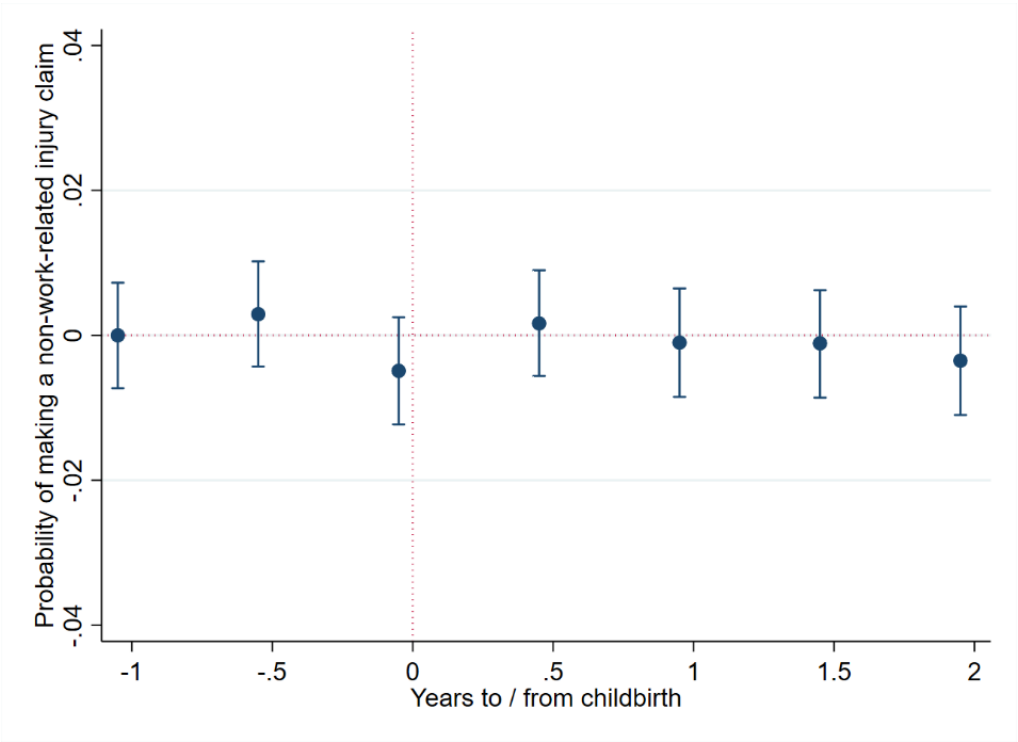
Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line.

Source: Own calculations based on data in Stats NZ's IDI.

7.1 Regression estimates

Turning to the empirical model outlined in section 5.3, I now remove the control group as constructed through the FN approach. I then compare the outcomes of non-work-related injury claims incidence between fathers of sons and fathers of daughters across the 4-year time horizon surrounding childbirth (2 years pre- and post-childbirth) by estimating equation (2). I present estimates of the gender effect on the probability of making a non-work-related injury claim in Figure 15. All pre- and post-childbirth regression estimates are close to 0, indicating no evidence of a significant additional gender effect on a father's propensity to make a non-work-related injury claim.

Figure 15. The gender effect on non-work-related injury claims

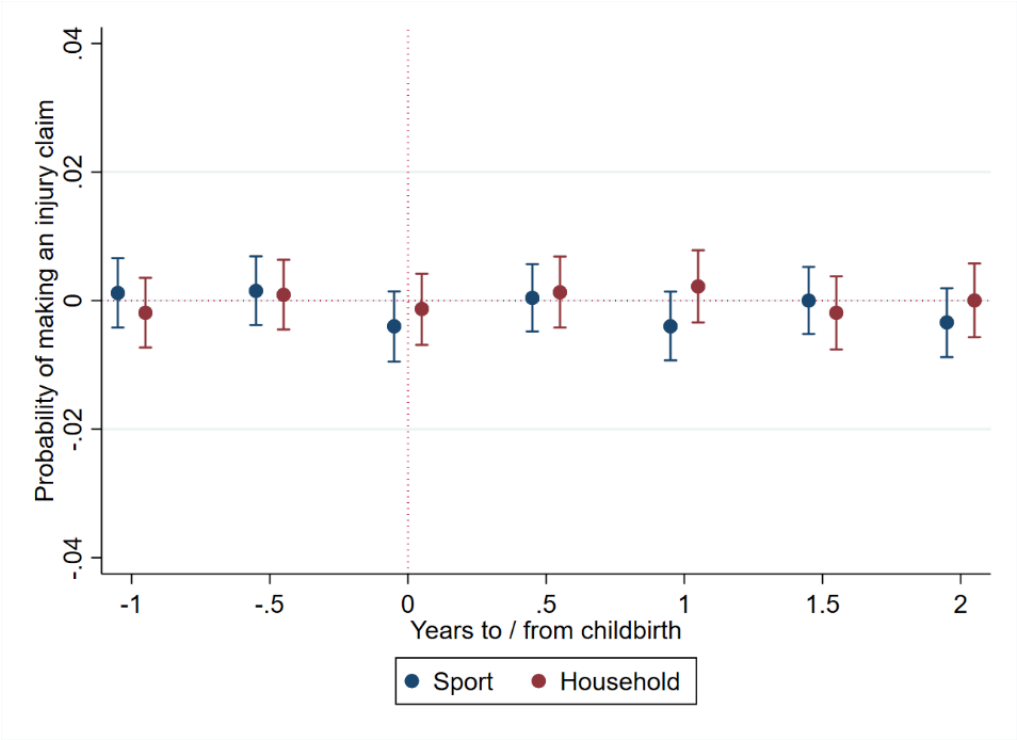


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the effect of a son are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

I re-estimate equation (2) using sport injuries and household injuries as outcome variables of interest and present the estimates of the effect of having a son in Figure 16. This does not show any stark change in the probability of making injury claims after childbirth and all confidence intervals surrounding point estimates contain 0 regardless of the injury type. There is therefore no evidence to suggest a further adjustment in behaviour after fathering a boy versus fathering a girl for up to two years after childbirth.

Figure 16. The gender effect on sport- and household-related injury claims



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates of the effect of a son are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

7.1.1 Heterogeneity

I again perform heterogeneity analyses based on fathers' ethnicity and age and present these estimates visually in Figure C. 10 and Figure C. 11 in Appendix C. The figures show no significant heterogeneity across ethnicity and age in the injury outcomes arising from fathers of sons when compared to fathers of daughters.

7.2 Pre-conception behaviour

In Dasgupta et al.'s (2022) study, the authors show that fathers with a conviction in the pre-birth period tend to have more favourable criminal outcomes when they have a son than when they have a daughter. I have analysed the effect of having a child on injury claims incidence for fathers with an injury prior to conception, but I now look at whether there exist gender preferences for these fathers based on their risk profile like the approach of Dasgupta et al. (2022).

I identify fathers with a pre-conception injury the same way as in sections 6.4.1 and 6.4.2, to which I again refer to as Approach 1 and Approach 2 respectively.

7.2.1 Approach 1

I present regression estimates of child gender effect on sport-related injuries in Figure 17. Most confidence intervals contain zero, indicating that pre-conception outcomes have little to no further influence of any gender effect on sport injuries. Two observations of note occur in the first six months after childbirth for younger European fathers, and the 1.5-to-2-year observation window for older European fathers. The point estimates in these windows indicate that fathers with a son exhibit a 2.6 and 3.0 percentage point decrease in the probability of making a sport-related injury claim respectively when compared to fathers of daughters ($p < 0.05$).

Regression estimates of the child gender effect on household-related injuries are presented visually in Figure 18. There is again nothing to suggest an additional child-gender effect on household-related injuries.

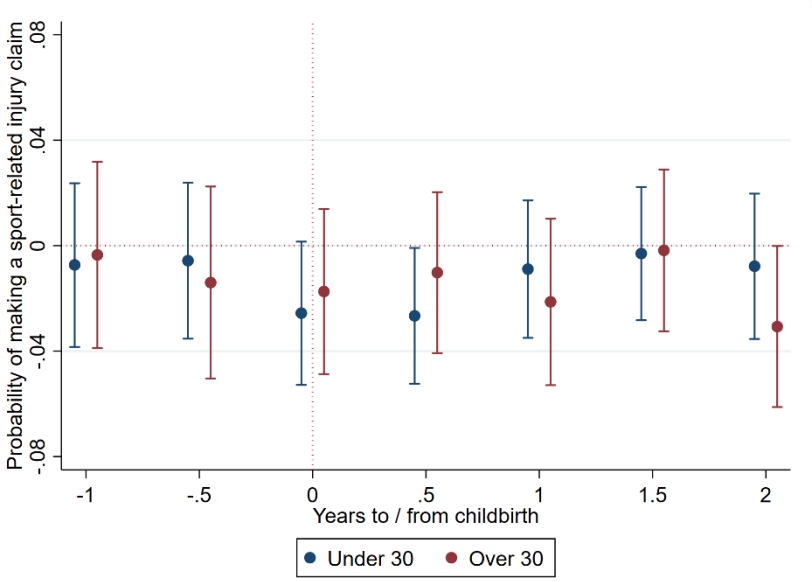
7.2.2 Approach 2

For consistency with this thesis' primary research question, I present regression estimates for the gender effect on injury claims incidence under Approach 2 from Figure C. 10 to Figure C. 13 of Appendix C. However, the removal of the treatment group and the restrictions imposed under Approach 2 result in very small sample sizes. This analysis concerns only 6 percent of the original population of interest.[15] Table 5 compares the point estimates for equation (2) for each sample and outcome variable. Most post-treatment estimates under both approaches are insignificant. There exist some large discrepancies between the two approaches, particularly for older non-European fathers with both sport- and household-related injury claims. This likely comes as a result of the small sample size.

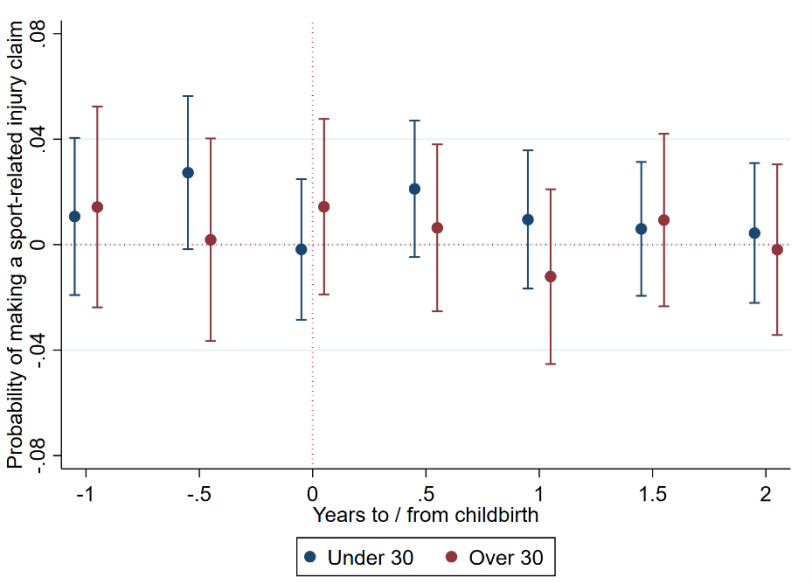
[15] More specifically, this is about 630 Europeans under 30, 840 non-Europeans under 30, 610 Europeans over 30 and 470 non-Europeans over 30.

Figure 17. The gender effect on sport-related injury claims for fathers with a pre-conception injury

Panel A. Europeans



Panel B. Non-Europeans

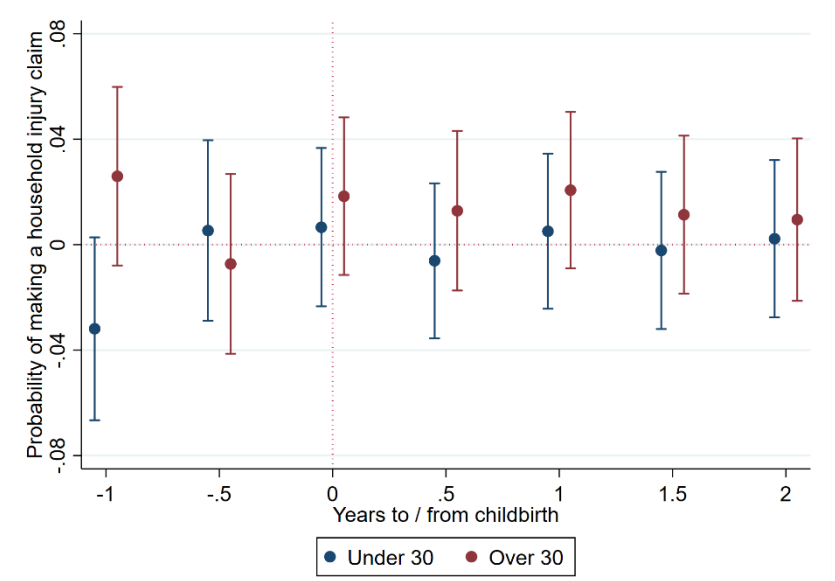


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

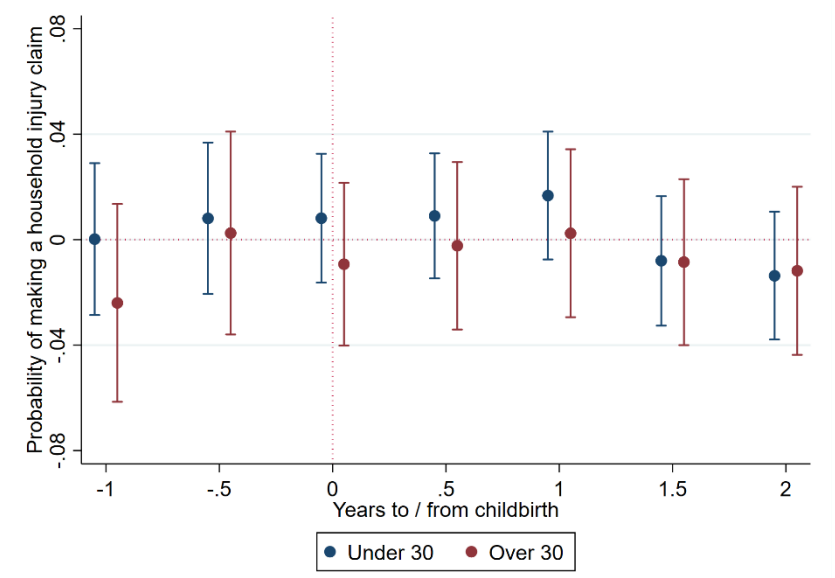
Source: Own calculations based on data in Stats NZ's IDI.

Figure 18. The gender effect on household-related injury claims for fathers with a pre-conception injury

Panel A. Europeans



Panel B. Non-Europeans



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

Table 5. Comparison of point estimates of the gender effect between Approach 1 and Approach 2

Years to / from childbirth	European: Sport				European: Household				Non-European: Sport				Non-European: Household			
	Under 30		Over 30		Under 30		Over 30		Under 30		Over 30		Under 30		Over 30	
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
-1	-0.007	-	-0.004	-	-0.032*	-	0.026	-	0.011	-	0.014	-	0.000	-	-0.024	-
	(0.016)	-	(0.018)	-	(0.018)	-	(0.017)	-	(0.015)	-	(0.019)	-	(0.015)	-	(0.019)	-
-0.5	-0.006	0.019	-0.014	-0.030	0.005	0.024	-0.007	-0.032*	0.027*	0.008	0.002	-0.042*	0.008	-0.006	0.002	0.047**
	(0.015)	(0.019)	(0.019)	(0.023)	(0.017)	(0.021)	(0.017)	(0.020)	(0.015)	(0.020)	(0.020)	(0.024)	(0.015)	(0.017)	(0.020)	(0.022)
0	-0.026*	-0.006	-0.017	0.023	0.007	0.009	0.018	0.016	-0.002	-0.030	0.014	-0.011	0.008	-0.003	-0.009	0.017
	(0.014)	(0.019)	(0.016)	(0.023)	(0.015)	(0.021)	(0.015)	(0.021)	(0.014)	(0.020)	(0.017)	(0.025)	(0.012)	(0.017)	(0.016)	(0.023)
0.5	-0.027**	-0.017	-0.010	-0.003	-0.006	0.002	0.013	0.003	0.021	0.016	0.006	-0.040*	0.009	0.012	-0.002	0.023
	(0.013)	(0.018)	(0.016)	(0.022)	(0.015)	(0.021)	(0.015)	(0.021)	(0.013)	(0.020)	(0.016)	(0.023)	(0.012)	(0.016)	(0.016)	(0.023)
1	-0.009	0.012	-0.021	-0.006	0.005	0.028	0.021	-0.006	0.009	-0.021	-0.012	-0.049**	0.017	0.020	0.002	0.057**
	(0.013)	(0.018)	(0.016)	(0.021)	(0.015)	(0.021)	(0.015)	(0.020)	(0.013)	(0.019)	(0.017)	(0.024)	(0.012)	(0.016)	(0.016)	(0.023)
1.5	-0.003	0.025	-0.002	0.017	-0.002	0.016	0.011	-0.001	0.006	-0.017	0.009	-0.023	-0.008	-0.006	-0.009	0.021
	(0.013)	(0.019)	(0.016)	(0.021)	(0.015)	(0.021)	(0.015)	(0.021)	(0.013)	(0.020)	(0.017)	(0.025)	(0.013)	(0.017)	(0.016)	(0.022)
2	-0.008	0.029	-0.031**	-0.029	0.002	0.008	0.009	-0.006	0.004	-0.026	-0.002	-0.052**	-0.014	-0.017	-0.012	0.038
	(0.014)	(0.019)	(0.016)	(0.022)	(0.015)	(0.021)	(0.016)	(0.021)	(0.014)	(0.020)	(0.017)	(0.024)	(0.012)	(0.016)	(0.016)	(0.024)

Source: Own calculations from data in Stats NZ's IDI.

7.3 Summary

There is some trivial indication to suggest the gender of the child could further influence a father's likelihood to become injured. Having a son versus a daughter appears to have a short-lived reducing effect on young European father's propensity to make a sport-injury claim; there is also a potentially long-term reducing effect on older fathers' propensity to make a sport-injury claim, although a longer-time horizon in the post-childbirth period would have to be analysed to make this conclusion.

Generally, there is no convincing evidence that the gender of the child further influences a father's propensity to make economically or statistically significant changes to their injury incidence.

8 Conclusion

There is an abundance of literature that examine changes in risk behaviour and other wellbeing outcomes after fatherhood. I seek to identify the causal effect of having a child on a father's risk behaviour using quantitative, population-wide, linked administrative data on injury claims from Stats NZ. The underlying assumption is that risk-seeking individuals are more likely to be put themselves in injury-prone circumstances.

Using the identification strategy outlined by Fadlon and Nielsen (2019), I identify a treatment group of fathers who experience childbirth, and a control group of fathers who experience the childbirth at a later date. Using a quasi-experimental research design, I find that men are less likely to make non-work-related injury claims, which remains persistent for up to two-years after childbirth. However, there are differences in how fathers react depending on the type of injury in question, and the relationship between a father's ethnicity and age.

Older fathers and younger non-European fathers are immediately less likely to make a sport-injury claim after childbirth, and this remains true for up to two-years post-childbirth. Younger European fathers on the other hand are less likely to make sport-related injury claims in the first six months after childbirth, but injury incidence bounces back in subsequent observation windows, indicating a more short-lived effect. The effect of fatherhood on sport-injury claims for all groups of fathers is further amplified when the father has made any non-work-related injury claim in the period prior to conception.

There is no convincing evidence to suggest that fatherhood leads to a change in the probability of making household-related injuries. However, assuming that fathers spend more time at home after having a child, this could indicate a reduction in household injury claims as a proportion of the time spent at home, reflecting the desire to be a responsible, engaging and physically present parent. This may especially be true for older non-European fathers who exhibit pockets of statistically significant increased likelihoods of making household-injury claims in the post-childbirth period. However, understanding how fathers spend their time after having a child is unfeasible with the data, making it difficult to conclude this with confidence. Furthermore, fathers with a pre-conception non-work-related injury may reduce their household injury propensity even prior to childbirth, but these results are not robust.

Finally, I test the extent to which the gender of the child can further amplify or moderate the degree of a father's risk tolerance after childbirth. There may exist further short-lived reductions in sport-related injuries for younger European fathers of sons with a pre-conception injury, and more delayed reductions in sport-related injuries for older European fathers of sons with a pre-conception injury. However, I conclude that the

gender of the child does not have an additional effect on most fathers' risk-taking behaviour surrounding physical injuries.

There are a number of limitations to my study. First, given that the strongest effects are seen to be with sport-injuries, it is impossible to determine how much of the effect is attributable to more responsible behaviour versus abstaining from sports due to time-constraints. However, I do not believe that time-constraints and risk behaviour are necessarily mutually exclusive factors. A father is still confronted with the decision to abstain from playing sport and this could reflect his desire to be physically present and engaging with his child. Second, the sample size in my secondary analysis - particularly fathers who have a pre-conception injury – is small, making it difficult to ascertain valid estimates of the child gender effect on risk behaviour for this group of men. Third is the validity of using injury data as a proxy for risk behaviour. There are many external factors that can increase an individual's propensity to become injured that are not related to risk behaviour. Overall, I am the least sceptical of sport injuries as a proxy for risk, as this is a factor that an individual is most in control of.

On that front, it would be useful for future iterations of this research to understand which sports compose a father's sport injury incidence before and after childbirth as some sports are arguably riskier than others. It may also be beneficial to undertake qualitative mixed-methods approaches to understand the thought processes that men may exhibit surrounding family-formation events and their effect on risk behaviour.

References

Accident Compensation Act 2001 (N.Z.) https://www.legislation.govt.nz/act/public/2001/0049/latest/DLM100100.html

Accident Compensation Corporation. (2021a) *ACC's delivery to priority populations: Part 2 – Māori* [Aide Memoire]

Accident Compensation Corporation. (2021b) *ACC's delivery to priority populations: Part 2 – Pāsifika peoples* [Aide Memoire]

Accident Compensation Corporation. (2022a) *Annual Report 2022. https://www.acc.co.nz/assets/corporate-documents/acc8430-acc-annual-report-2022.pdf*

Accident Compensation Corporation. (2022b) *Te Tū o te Taha Pūtea Financial Condition Report 2022* .https://www.acc.co.nz/assets/corporate-documents/acc-financial-condition-report-2022.pdf

Accident Compensation Corporation. (2023) *Resources.* https://www.acc.co.nz/resources/#/

Allender, S., Hutchinson, L., & Foster, C. (2008). Life-change events and participation in physical activity: a systematic review. *Health promotion international*, *23*(2), 160-172.

Angrist, J. D., & Pischke, J. S. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.

Begg, D. J., Langley, J. D., & Williams, S. M. (1999). A longitudinal study of lifestyle factors as predictors of injuries and crashes among young adults. *Accident Analysis & Prevention*, *31*(1-2), 1-11.

Booth, A. L., & Nolen, P. (2012). Gender differences in risk behaviour: does nurture matter?. *The economic journal*, *122*(558), F56-F78.

Bourke, J. A., Owen, H. E., Derrett, S., & Wyeth, E. H. (2023). Disrupted mana and systemic abdication: Māori qualitative experiences accessing healthcare in the 12 years post-injury. *BMC health services research*, *23*(1), 1-9.

Camerer, C. F., & Hogarth, R. M. (1999). The effects of financial incentives in experiments: A review and capital-labor-production framework. *Journal of risk and uncertainty*, *19*, 7-42.

Cooney, T. M., Pedersen, F. A., Indelicato, S., & Palkovitz, R. (1993). Timing of fatherhood: Is" on-time" optimal?. *Journal of Marriage and the Family*, 205-215.

Crichton, S., Stillman, S., & Hyslop, D. (2005). Returning to Work from Injury: longitudinal evidence on employment and earnings (update). *Statistics New Zealand, Wellington*.

Cunningham, S. (2021). *Causal inference: The mixtape*. Yale university press.

Dahl, G. B., & Moretti, E. (2008). The demand for sons. The review of economic studies, 75(4), 1085-1120.

Dasgupta, K., Diegmann, A., Kirchmaier, T., & Plum, A. (2022). The gender reveal: The effect of sons on young fathers' criminal behavior and labor market activities. *Labour Economics*, *78*, 102224.

de Looze, M., Pickett, W., Raaijmakers, Q., Kuntsche, E., Hublet, A., Nic Gabhainn, S., ... & ter Bogt, T. (2012). Early risk behaviors and adolescent injury in 25 European and North American countries: A cross-national consistent relationship. *The Journal of Early Adolescence*, *32*(1), 104-125.

Demmler, J. C., Hill, R. A., Rahman, M. A., Bandyopadhyay, A., Healy, M. A., Paranjothy, S., ... & Brophy, S. T. (2017). Educational attainment at age 10–11 years predicts health risk behaviors and injury risk during adolescence. *Journal of Adolescent Health*, *61*(2), 212-218.

Denny, V. C., Cassese, J. S., & Jacobsen, K. H. (2016). Nonfatal injury incidence and risk factors among middle school students from four Polynesian countries: The Cook Islands, Niue, Samoa, and Tonga. *Injury*, *47*(5), 1135-1142.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the european economic association*, *9*(3), 522-550.

Dustmann, C., & Landersø, R. (2021). Child's gender, young fathers' crime, and spillover effects in criminal behavior. *Journal of Political Economy*, *129*(12), 3261-3301.

Einiö, E., Goisis, A., & Myrskylä, M. (2019). Is the relationship between men's age at first birth and midlife health changing? Evidence from two British cohorts. *SSM-Population Health*, *8*, 100458.

Fadlon, I., & Nielsen, T. H. (2019). Family health behaviors. *American Economic Review*, 109(9), 3162-3191.

Fergusson, D., Swain-Campbell, N., & Horwood, J. (2003). Risky driving behaviour in young people: prevalence, personal characteristics and traffic accidents. *Australian and New Zealand journal of public health*, *27*(3), 337-342.

Ferreira, A. I., Martínez, L. F., & Guisande, M. A. (2009). Risky behavior, personality traits and road accidents among university students. *European Journal of Education and Psychology*, *2*(2), 79-98.

Fryt, J., Szczygieł, M., & Duell, N. (2021). Positive and negative risk taking in adolescence: Age patterns and relations to social environment. *New directions for child and adolescent development*, *2021*(179), 127-146.

Görlitz, K., & Tamm, M. (2020). Parenthood, risk attitudes and risky behavior. *Journal of Economic Psychology*, *79*, 102189.

Hadley, R., & Hanley, T. (2011). Involuntarily childless men and the desire for fatherhood. *Journal of reproductive and infant psychology*, *29*(1), 56-68.

Hennecke, J., Meehan, L., Pacheco, G. & Turcu, A. (2022) Fathers' household and childcare involvement in New Zealand: A snapshot, determinants and consequences. NZ Work Research Institute. Auckland, NZ.

Jafari, M. J., Saghi, F., Alizadeh, E., & Zayeri, F. (2019). Relationship between risk perception and occupational accidents: a study among foundry workers. *Journal of the Egyptian Public Health Association*, *94*, 1-5.

Jakob, A., Craig, J. L., & Fisher, G. (2006). Transport cost analysis: a case study of the total costs of private and public transport in Auckland. *Environmental Science & Policy*, *9*(1), 55-66.

Josef, A. K., Richter, D., Samanez-Larkin, G. R., Wagner, G. G., Hertwig, R., & Mata, R. (2016). Stability and change in risk-taking propensity across the adult life span. *Journal of Personality and Social Psychology, 111*(3), 430–450. https://doi.org/10.1037/pspp0000090

Kalmijn, M. (1999). Father involvement in childrearing and the perceived stability of marriage. *Journal of Marriage and the Family*, 409-421.

Knight, F. H. (1921). *Risk, uncertainty and profit* (Vol. 31). Houghton Mifflin.

Kontos, A. P. (2004). Perceived risk, risk taking, estimation of ability and injury among adolescent sport participants. *Journal of pediatric psychology*, *29*(6), 447-455.

Lamb, M. E. (Ed.). (2004). *The role of the father in child development*. John Wiley & Sons.

Lamb, M. E., Pleck, J. H., Charnov, E. L., & Levine, J. A. (1985). Paternal behavior in humans. *American zoologist*, 883-894.

Leigh, J. P., Markowitz, S. B., Fahs, M., Shin, C., & Landrigan, P. J. (1997). Occupational injury and illness in the United States: estimates of costs, morbidity, and mortality. *Archives of internal medicine*, *157*(14), 1557-1568.

Lewycka, S., Dasgupta, K., Plum, A., Clark, T., Hedges, M., & Pacheco, G. (2023). Determinants of ethnic differences in the uptake of child healthcare services in New Zealand: a decomposition analysis. International Journal for Equity in Health, 22(1), 1-15.

Lundberg, S., & Rose, E. (2002). The effects of sons and daughters on men's labor supply and wages. Review of Economics and Statistics, 84(2), 251-268.

Lytton, H., & Romney, D. M. (1991). Parents' differential socialization of boys and girls: A meta-analysis. *Psychological bulletin*, *109*(2), 267.

Mamerow, L., Frey, R., & Mata, R. (2016). Risk taking across the life span: A comparison of self-report and behavioral measures of risk taking. *Psychology and aging*, *31*(7), 711.

Massenkoff, M. N., & Rose, E. K. (2022). *Family formation and crime* (No. w30385). National Bureau of Economic Research.

Mascaro, J. S., Rentscher, K. E., Hackett, P. D., Mehl, M. R., & Rilling, J. K. (2017). Child gender influences paternal behavior, language, and brain function. *Behavioral neuroscience*, *131*(3), 262.

Mata, R., Josef, A. K., & Hertwig, R. (2016). Propensity for risk taking across the life span and around the globe. *Psychological science*, *27*(2), 231-243.

Ministry of Health. (2016) *Twins, triplets or more.* https://www.health.govt.nz/your-health/pregnancy-and-kids/pregnancy/helpful-advice-during-pregnancy/twins-triplets-or-more

Ministry of Health. (2019). Annual update of key results 2018/19: New Zealand health survey.

Ministry of Transport. (2021). Social cost of road crashes and injuries - June 2020 update. Wellington: Ministry of Transport.

Mintz, S. (1998). From patriarchy to androgyny and other myths: Placing men's family roles in historical perspective. In A. Booth & A. C. Crouter (Eds.), *Men in families: When do they get involved? What difference does it make?* (pp. 3–30). Lawrence Erlbaum Associates Publishers.

Morrongiello, B. A., & Rennie, H. (1998). Why do boys engage in more risk taking than girls? The role of attributions, beliefs, and risk appraisals. *Journal of pediatric psychology*, *23*(1), 33-43.

Nattiv, A., Puffer, J. C., & Green, G. A. (1997). Lifestyles and health risks of collegiate athletes: a multi-center study. *Clinical Journal of Sport Medicine*, *7*(4), 262-272.

Nicholson, N., Soane, E., Fenton-O'Creevy, M., & Willman, P. (2005). Personality and domain-specific risk taking. *Journal of Risk Research*, *8*(2), 157-176.

Norwood, M. S., Hughes, J. P., & Amico, K. R. (2016). The validity of self-reported behaviors: methods for estimating underreporting of risk behaviors. *Annals of epidemiology*, *26*(9), 612-618.

Patel, D. R., & Luckstead, E. F. (2000). Sport participation, risk taking, and health risk behaviors. *Adolescent Medicine (Philadelphia, PA.)*, *11*(1), 141-155.

Pickett, W., Garner, M. J., Boyce, W. F., & King, M. A. (2002). Gradients in risk for youth injury associated with multiple-risk behaviours: a study of 11,329 Canadian adolescents. *Social science & medicine*, *55*(6), 1055-1068.

Pleck, J. H., & Masciadrelli, B. P. (2004). Paternal involvement by US residential fathers: Levels, sources, and consequences.

Powell, J. W., & Barber-Foss, K. D. (1999). Injury patterns in selected high school sports: a review of the 1995-1997 seasons. *Journal of athletic training*, *34*(3), 277.

Reeves, J. (2006). Recklessness, rescue and responsibility: Young men tell their stories of the transition to fatherhood. *Practice, 18(2), 79-90.*

Reid, P., Paine, S. J., Te Ao, B., Willing, E. J., Wyeth, E., Vaithianathan, R., & Loring, B. (2022). Estimating the economic costs of Indigenous health inequities in New Zealand: a retrospective cohort analysis. *BMJ open, 12*(10), e065430.

Rosen, A. B., Tsai, J. S., & Downs, S. M. (2003). Variations in risk attitude across race, gender, and education. *Medical Decision Making*, *23*(6), 511-517.

Rubin, D. B. (1974). Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of educational Psychology*, *66*(5), 688.

Schytt, E., & Bergström, M. (2014). First-time fathers' expectations and experiences of childbirth in relation to age. *Midwifery*, *30*(1), 82-88.

Sartorius, G. A., & Nieschlag, E. (2010). Paternal age and reproduction. *Human reproduction update*, *16*(1), 65-79.

Schytt, E., & Bergström, M. (2014). First-time fathers' expectations and experiences of childbirth in relation to age. *Midwifery*, *30*(1), 82-88.

Scott-Parker, B., Watson, B., & King, M. J. (2009). Understanding the psychosocial factors influencing the risky behaviour of young drivers. *Transportation research part F: traffic psychology and behaviour*, *12*(6), 470-482.

Shore, J., & Janssen, I. (2020). Adolescents' engagement in multiple risk behaviours is associated with concussion. *Injury epidemiology*, *7*(1), 1-5.

Simonelli, A., Parolin, M., Sacchi, C., De Palo, F., & Vieno, A. (2016). The role of father involvement and marital satisfaction in the development of family interactive abilities: A multilevel approach. *Frontiers in psychology*, *7*, 1725.

Stats New Zealand. (2017). *Births and deaths: Year ended December 2016 and March 2017.* https://www.stats.govt.nz/information-releases/births-and-deaths-year-ended-december-2016-and-march-2017/

Stats New Zealand. (2022). *National population estimates: At 30 September 2022. https*://www.stats.govt.nz/information-releases/national-population-estimates-at-30-september-2022/

Stats New Zealand. (2022) *Data in the IDI.* https://www.stats.govt.nz/integrated-data/integrated-data-infrastructure/data-in-the-idi/

Stats New Zealand. (2023) *Population.* https://www.stats.govt.nz/topics/population

Tariq, N., & Gupta, V. (2022). High risk behaviors. In *StatPearls [Internet]*. StatPearls Publishing.

Taubman-Ben-Ari, O., & Noy, A. (2011). Does the transition to parenthood influence driving?. *Accident Analysis & Prevention*, *43*(3), 1022-1035.

Tichenor, V., McQuillan, J., Greil, A. L., Contreras, R., & Shreffler, K. M. (2011). The importance of fatherhood to US married and cohabiting men.

Tompa, E., Mofidi, A., van den Heuvel, S., van Bree, T., Michaelsen, F., Jung, Y., ... & van Emmerik, M. (2021). Economic burden of work injuries and diseases: a framework and application in five European Union countries. *BMC Public Health*, *21*(1), 1-10.

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and uncertainty*, *5*, 297-323.

Umberson, D., & Gove, W. R. (1989). Parenthood and psychological well-being: Theory, measurement, and stage in the family life course. *Journal of family issues*, *10*(4), 440-462.

Von Neumann, J., & Morgenstern, O. (2007). Theory of games and economic behavior. In *Theory of games and economic behavior*. Princeton university press.

Workers' Compensation Act 1922 (N.Z.) http://www.nzlii.org/nz/legis/hist_act/wca192213gv1922n39327/v

Wren, J. (2015a). Evidence for Māori under-Utilisation of ACC Injury Treatment and Rehabilitation Support Services: Māori Responsiveness Report 1. *ACC Research*.

Wren, J. (2015b). Barriers to Māori Utilisation of ACC Funded Services, and Evidence for Effective Interventions: Māori Responsiveness Report 2. *ACC Research*.

Yee, D. (2023). *School-age vaccinations: Changes in uptake over time and by children's characteristics.* Unpublished manuscript

Zamani-Alavijeh, F., Niknami, S., Bazargan, M., Mohammadi, E., Montazeri, A., Ahmadi, F., & Ghofranipour, F. (2009). Accident-related risk behaviors associated with motivations for motorcycle use in Iran: a country with very high traffic deaths. *Traffic injury prevention*, *10*(3), 237-242

Appendices

Appendix A. ACC Account Funding

Table A. 1. Account Fund Sources and Payments

	Account	Payment to costs associated with…	Levied from	2021/2022 Levy	2021/2022 Levy Revenue
(1)	Work Account	Work-related injuries	Employers and self-employed	0.63% of liable earnings	$921 million
(2)	Earners' Account	Non-work-related injuries to employed (excluding injuries covered by accounts (1) and (3) – (5))	Employees and self-employed (paid workers)	1.21% of liable earnings	$2,020 million
(3)	Motor vehicle account	Road injuries involving a moving vehicle	Registration fees and petrol charges	$40.59 - $436.17 per registration/renewal depending on vehicle type and fuel type. 6 cents per litre of petrol.	$460 million
(4)	Treatment Injury Account	Injuries that occur because of or during treatment	Paid workers and Government appropriation		Levies: $85 million Government: $245 million
(5)	Non-Earners' Account	Injuries to people not in employment and where injuries are not covered by accounts (1) – (4)	Government appropriation		$1,660 million

Source: Accident Compensation Corporation (2022) retrieved from acc.co.nz

Appendix B. Abortion Legislation Act 2020

This section quotes sections of the Abortion Legislation Act 2020 that restrict the ability to abort a foetus on the basis of its sex:

“ …

Section 10 Provision of abortion services to women not more than 20 weeks pregnant:

A qualified health practitioner may provide abortion services to a woman who is not more than 20 weeks pregnant.

Section 11 Provision of abortion services to women more than 20 weeks pregnant:

(1) A qualified health practitioner may only provide abortion services to a woman who is more than 20 weeks pregnant if the health practitioner reasonably believes that the abortion is clinically appropriate in the circumstances.

(2) In considering whether the abortion is clinically appropriate in the circumstances, the qualified health practitioner must—

(a) consult at least 1 other qualified health practitioner; and

(b) have regard to—

(i) all relevant legal, professional, and ethical standards to which the qualified health practitioner is subject; and

(ii) the woman’s—

(A) physical health; and

(B) mental health; and

(C) overall well-being; and

(iii) the gestational age of the fetus.

(3) Subsection (2) does not apply in a medical emergency.

…

Section 21 Abortion for sole purpose of sex selection:

(1) This Parliament opposes the performance of abortions being sought solely because of a preference for the fetus to be of a particular sex.

(2) Not later than 5 years after the commencement of this section, and then at subsequent intervals of not more than 5 years, the Director-General must—

(a) review whether there is any evidence of abortions being sought solely because of a preference for the fetus to be of a particular sex; and

(b) report to the Minister of Health on—

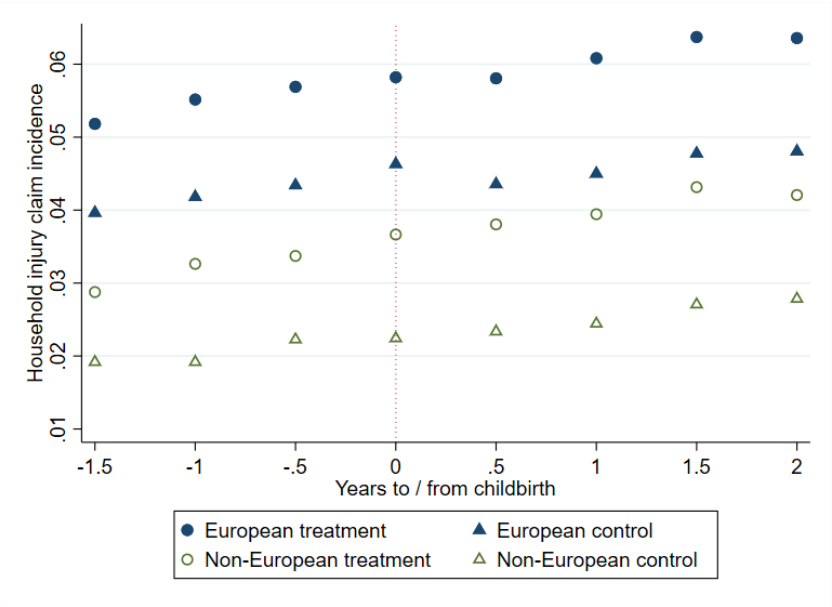
(i) the outcome of the review; and

(ii) if there is such evidence, any recommendations that the Director-General considers appropriate for preventing abortions being sought solely because of a preference for the fetus to be of a particular sex.

… ”

Appendix C. Tables and Figures

Figure C. 1. Household injury claim incidence by ethnicity and treatment status



Note: The horizontal axis measures the observation window from 0.5 years prior.

Source: Own calculations based on data in Stats NZ's IDI.

Table C. 1. T-test results for the difference in means of household injury claims

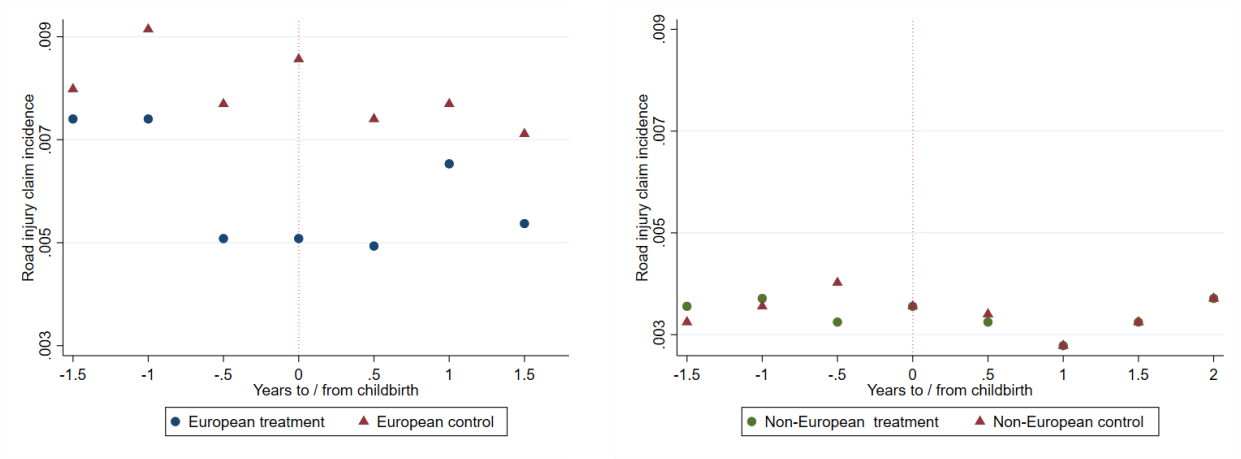
Treatment group	Treatment	Control
Pre-treatment period mean	0.045	0.032
Post-treatment period mean	0.052	0.036
Pre- minus post-treatment mean	-0.007	-0.004
t-statistic	-9.073	-6.419
p-value	~1	~1

Note: the p-value is associated with the hypothesis that the difference in means between the pre-treatment and post-treatment period is greater than 0.

Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 2. Road injury claim incidence by ethnicity and treatment status

Panel A: Europeans **Panel B: Non-Europeans**



Note: The horizontal axis measures the observation window from 0.5 years prior.

Source: Own calculations based on data in Stats NZ's IDI.

Table C. 2. T-test results for the difference means of road-related injury claims incidence in the pre- and post-treatment period

Treatment group	Treatment	Control
Pre-treatment period mean	0.0049	0.006
Post-treatment period mean	0.0045	0.0054
Pre- minus post-treatment mean	0.0004	-0.006
t-statistic	1.522	2.485
p-value	0.064	0.006

Note: the p-value is associated with the hypothesis that the difference in means between the pre-treatment and post-treatment period is greater than 0.

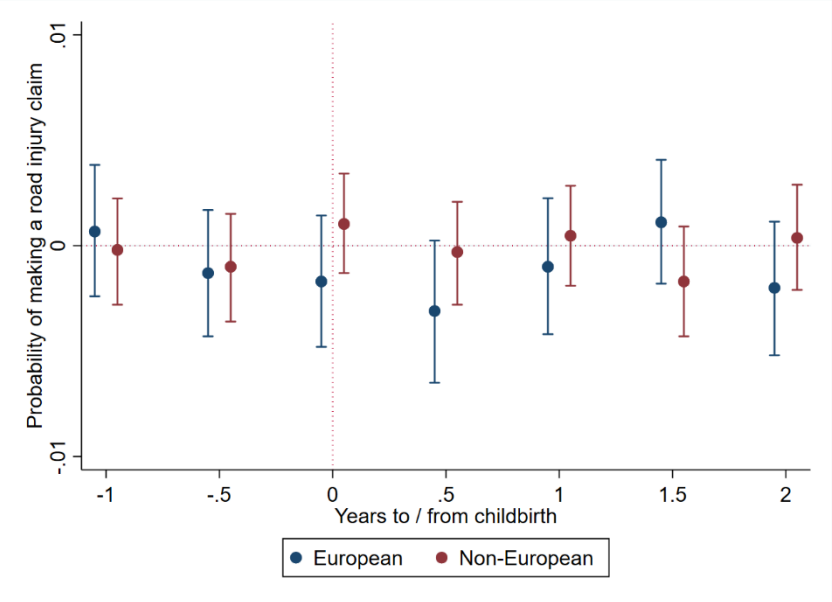
Source: Own calculations based on data in Stats NZ's IDI.

Table C. 3. F-test results of joint significance for the pre-treatment ATT of European fathers aged under 30 (household injury claims)

F-statistic	p-value
1.73	0.1582

Source: Own calculations based on data from Stats NZ's IDI

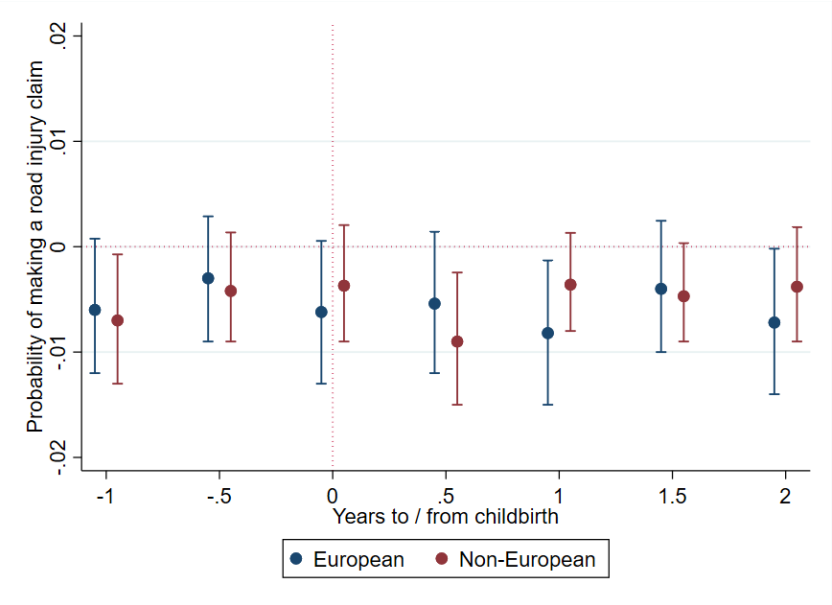
Figure C. 3. DD estimates of the fatherhood effect on the probability of making a road injury claim (fathers aged over 30)



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 4. DD estimates of the fatherhood effect on the probability of making a road injury claim (fathers aged over 30 with a pre-conception injury claim)

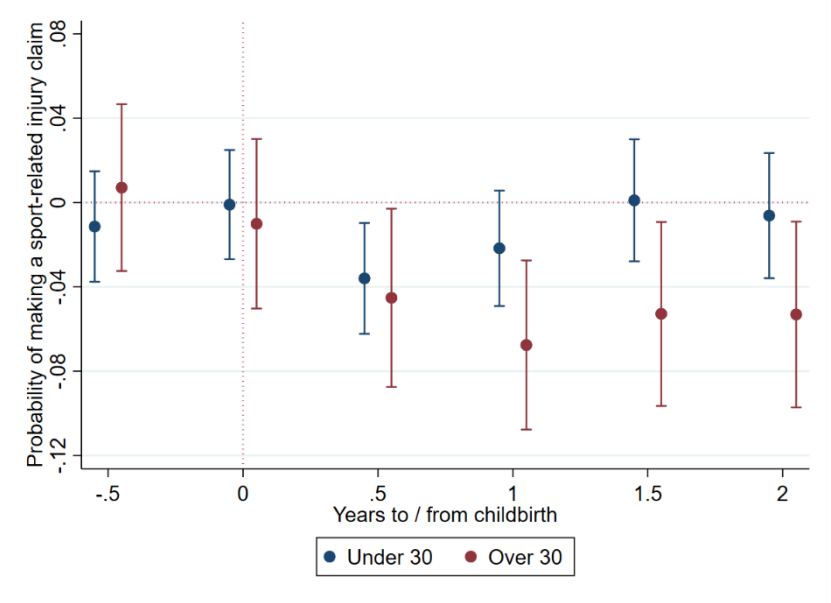


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

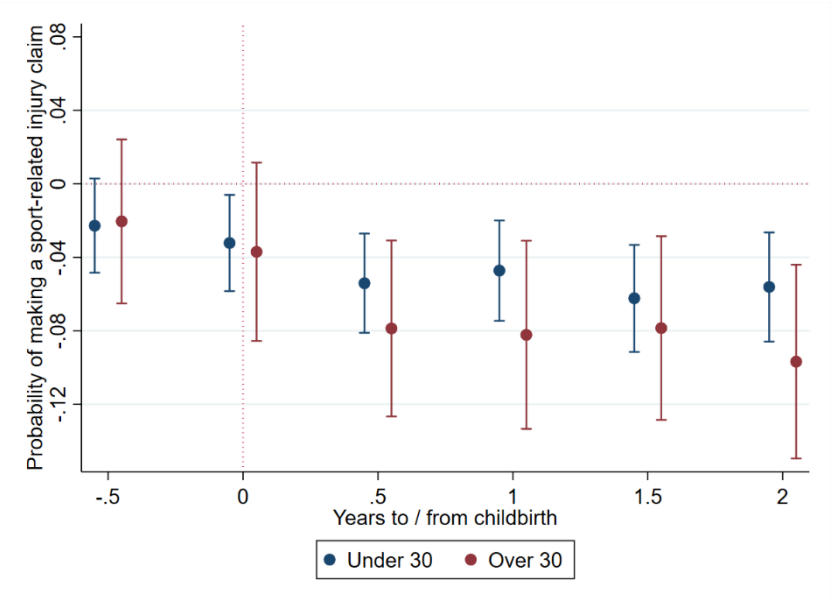
Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 5. DD estimates of the fatherhood effect on the probability of making a sport injury claim (fathers with a non-work-related injury claim prior to r = -1.5)

Panel A. Europeans



Panel B. Non-Europeans

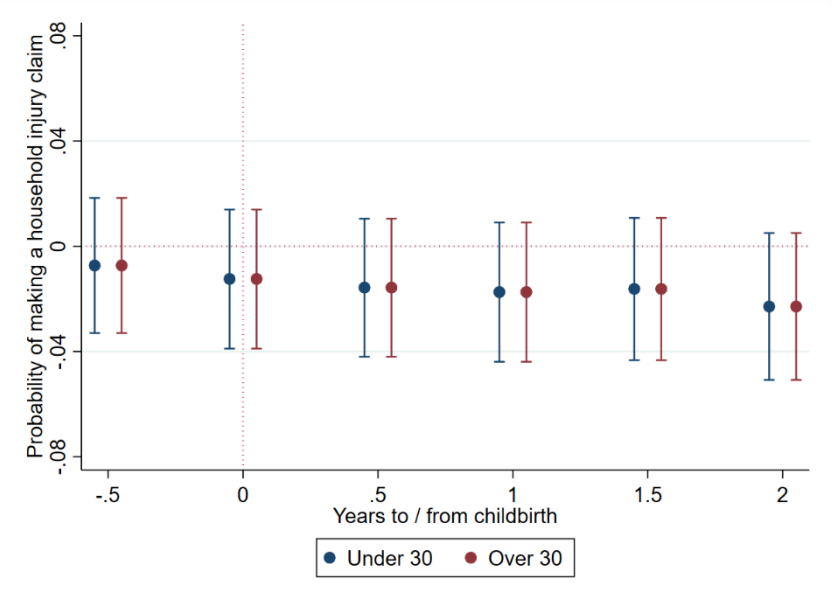


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 2-to-1.5-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

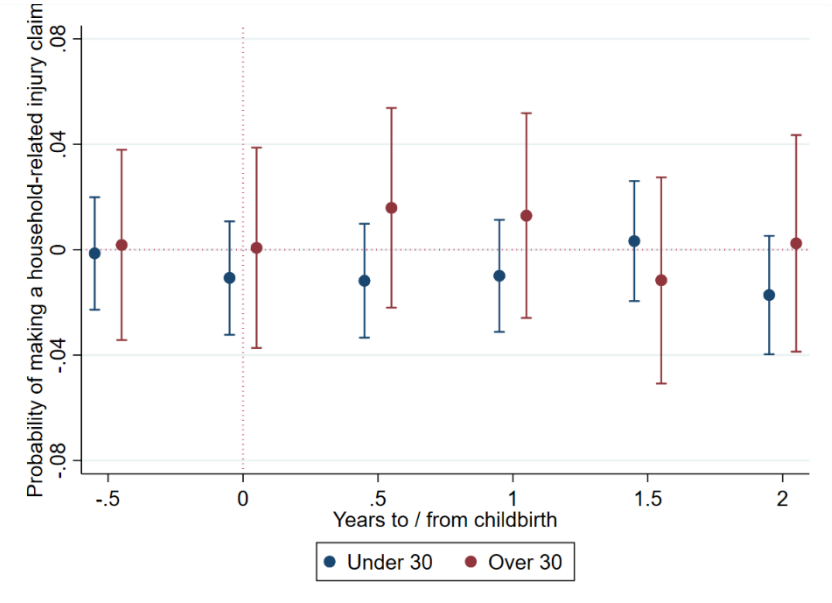
Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 6. DD estimates of the fatherhood effect on the probability of making a household injury claim (fathers with a non-work-related injury claim prior to r = -1.5)

Panel A. Europeans



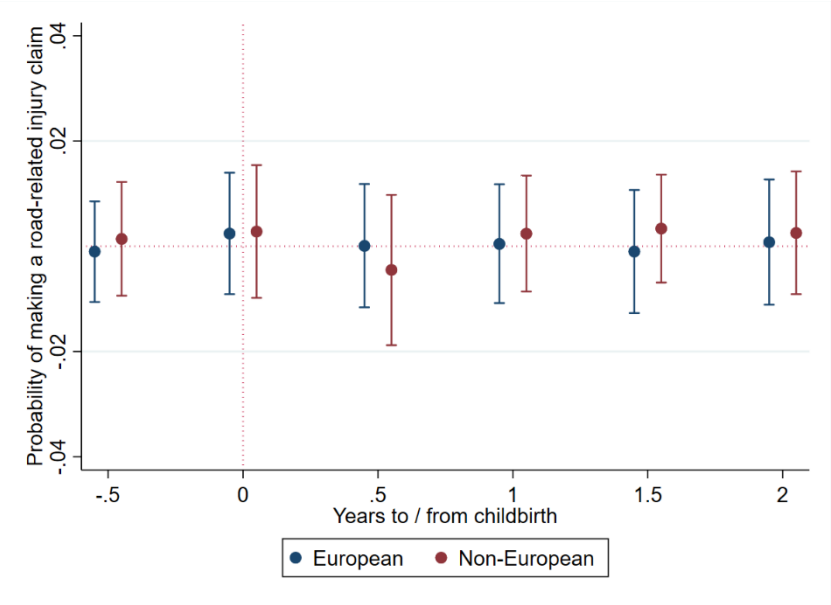
Panel B. Non-Europeans



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 1.5-to-1-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

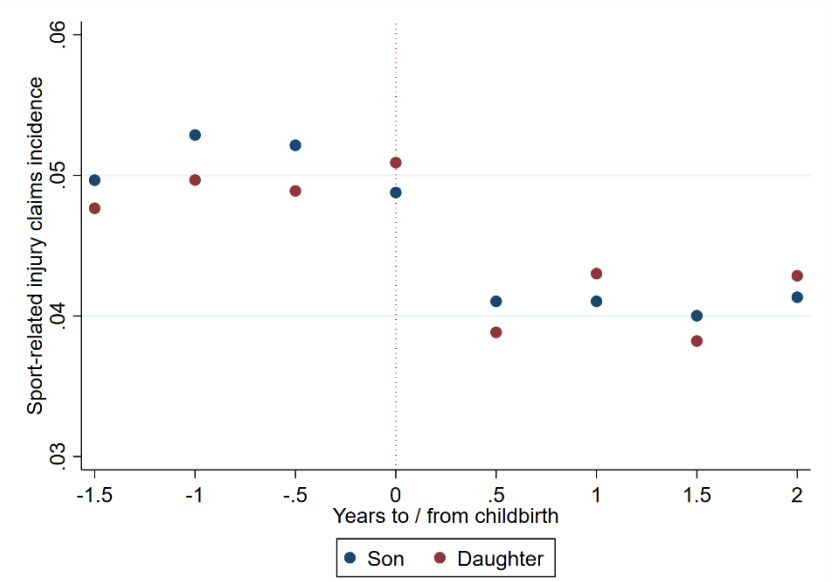
Figure C. 7. DD estimates of the fatherhood effect on the probability of making a road injury claim (fathers over 30 with a non-work-related injury claim prior to r = -1.5)



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 1.5-to-1-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.

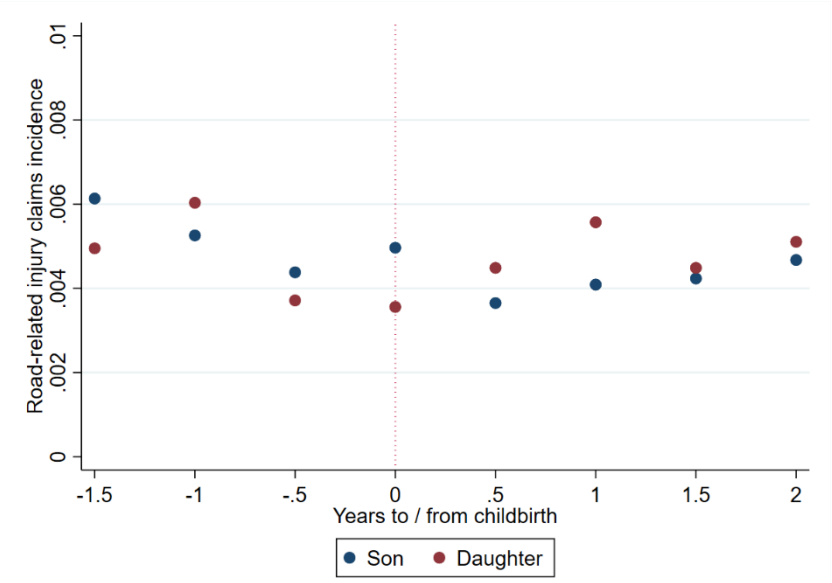
Figure C. 8. Sport-related injury claim incidence by child gender



Note: The horizontal axis measures the observation window from 0.5 years prior.

Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 9. Road injury claim incidence by child gender

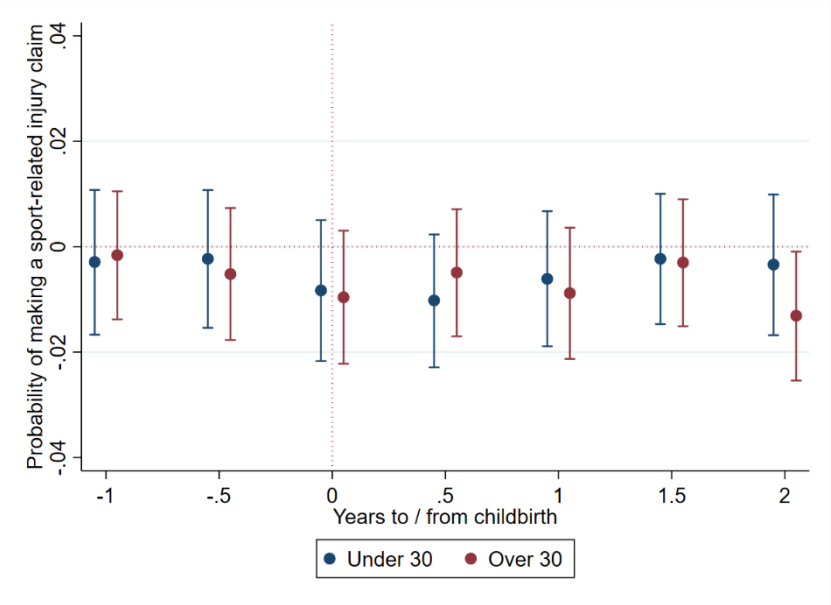


Note: The horizontal axis measures the observation window from 0.5 years prior.

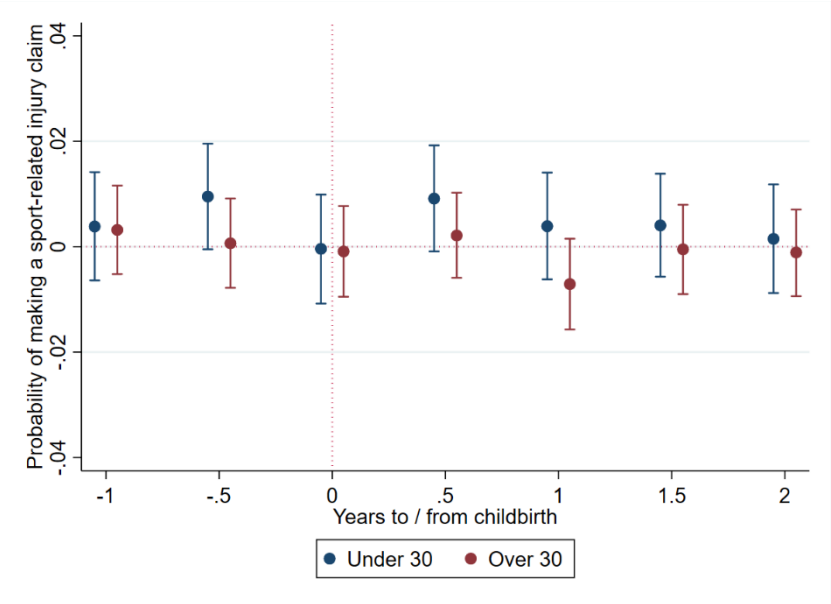
Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 10. The gender effect on sport-related injury claims

Panel A. Europeans



Panel B. Non-Europeans

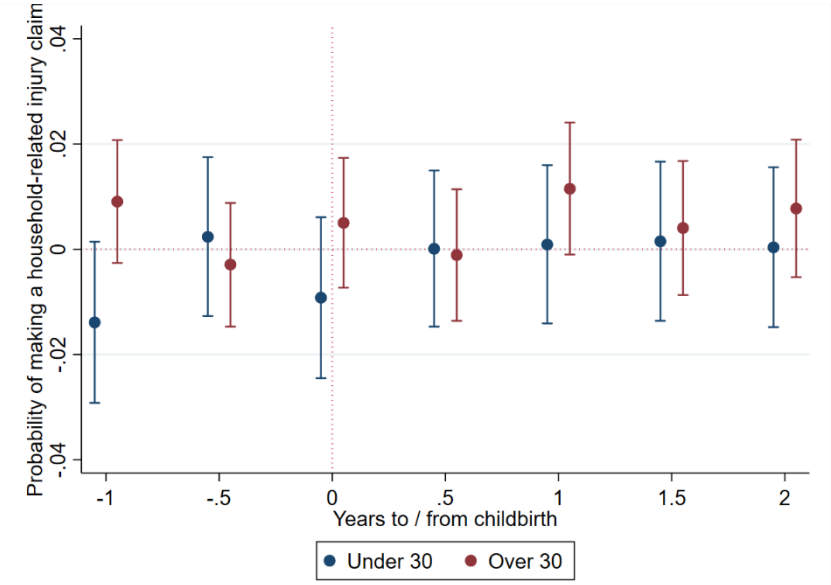


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 1.5-to-1-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

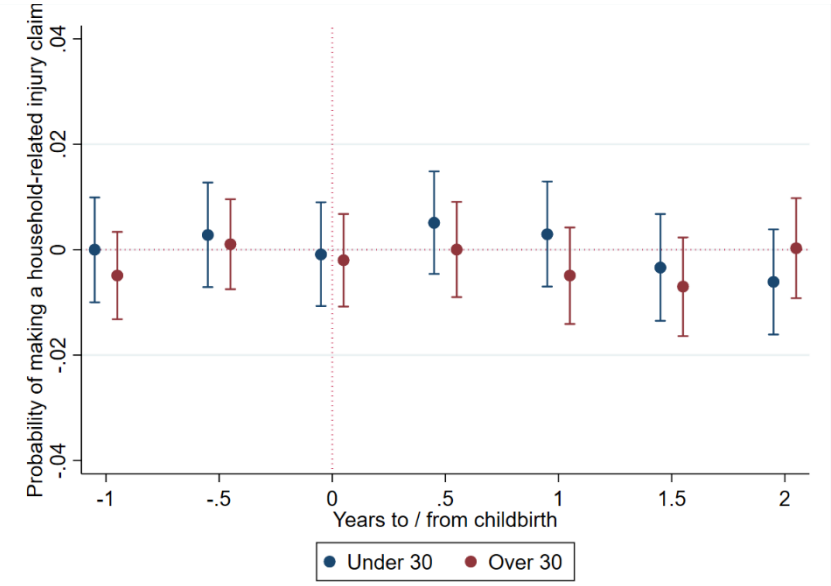
Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 11. The gender effect on household-related injury claims

Panel A. Europeans



Panel B. Non-Europeans

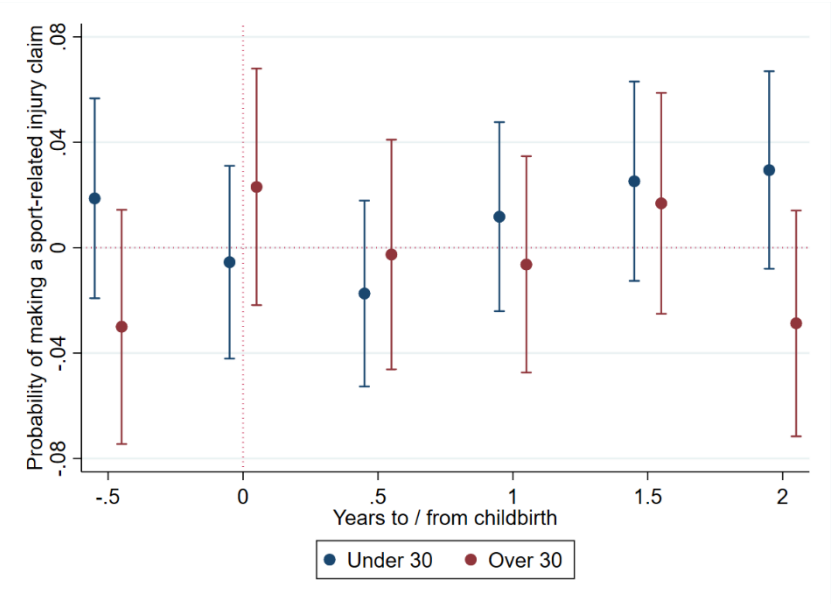


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 1.5-to-1-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

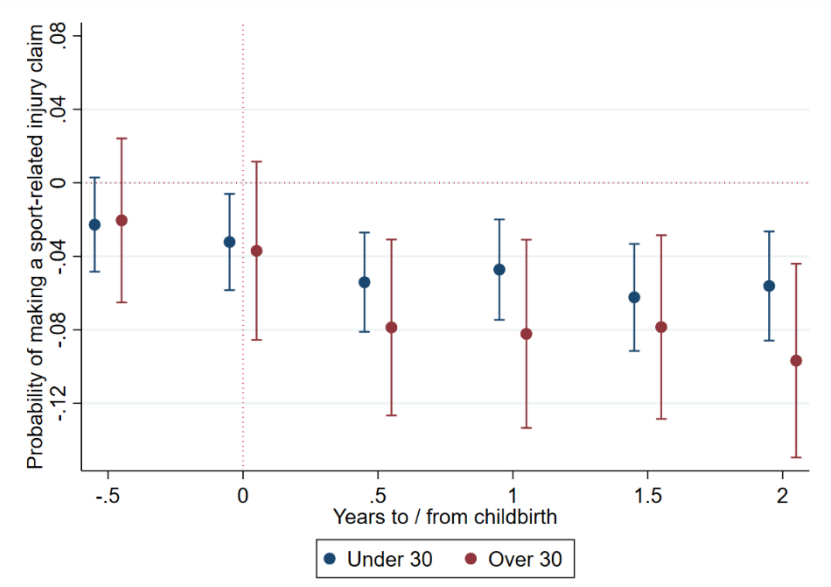
Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 12. The gender effect on sport-related injury claims (fathers with a non-work-related injury claim prior to r = -1.5)

Panel A. Europeans



Panel B. Non-Europeans

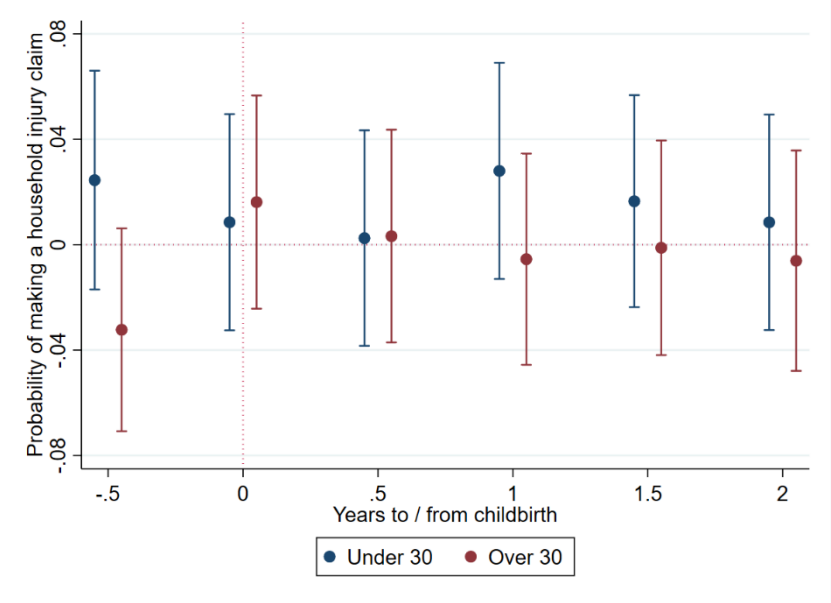


Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 1.5-to-1-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

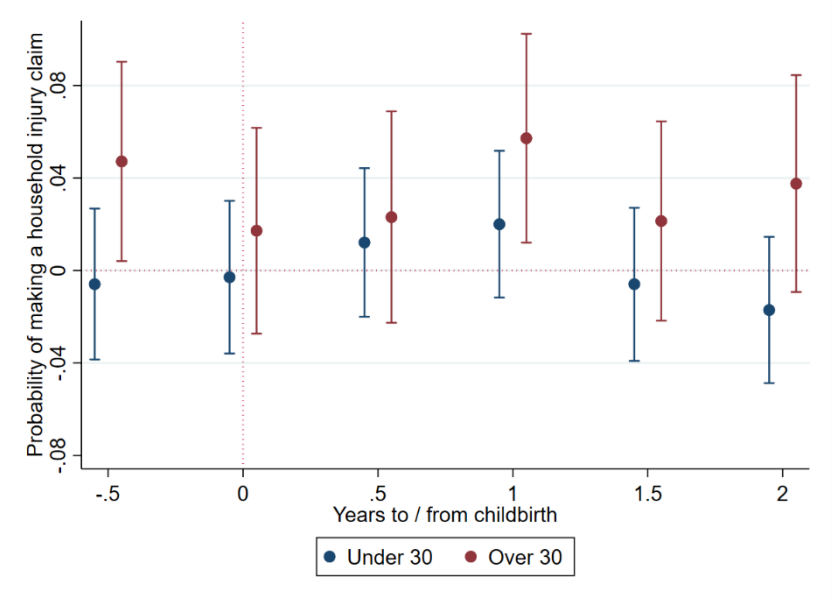
Source: Own calculations based on data in Stats NZ's IDI.

Figure C. 13. The gender effect on household-related injury claims (fathers with a non-work-related injury claim prior to r = -1.5)

Panel A. Europeans



Panel B. Non-Europeans



Notes: The event timeline is measured across the horizontal axis from the 2 years prior to childbirth, and the 2 years post childbirth. The figures along the horizontal axis measure the observation window spanning the six-month period prior, with childbirth occurring at event time $r = 0$ indicated by the vertical dotted line. The point estimates are represented by the points, while the vertical blue lines represent the 95 percent confidence interval. The reference period is the 1.5-to-1-year observation window prior to childbirth (r = -1.5), and thus is not presented on the axes.

Source: Own calculations based on data in Stats NZ's IDI.