# Changes in Canadian fertility patterns during the COVID-19 pandemic

By

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*We acknowledge and respect the Lək̓ʷəŋən (Songhees and Xʷsepsəm/Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.*

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# Abstract

This paper examines how fertility patterns in Canada changed during the COVID-19 pandemic, focusing on both fertility behaviour and the composition of births. Using the universe of births from the Canada Vital Statistics – Birth Database (CVSB) from 2016 to 2024, combined with Census-based population estimates, I construct age-specific fertility rates at the provincial level. The empirical approach combines descriptive analyses of fertility trends and birth outcome trends with panel regressions of age-specific fertility rates and individual-level regressions of birth weight and gestational age.

The results indicate that fertility responses to the pandemic are heterogeneous across age groups. Pre-pandemic trends continue for most cohorts, but the temporary suspension of medically assisted reproduction services during the initial lockdown leads to a sharp decline in fertility among women over 35, followed by a rebound in 2021 that is largest in provinces with publicly funded Medically Assisted Reproduction (MAR) programs. Panel regressions using provincial policy stringency measures suggest that fertility among women aged 25 to 34 is positively associated with pandemic measures relative to the historical trend, while older and younger age groups show smaller and less consistent responses. Birth outcomes shift across the two phases of the pandemic: births during the lockdown period are heavier and more likely to be large-for-gestational-age, while post-lockdown births are lighter and more likely to be small-for-gestational-age, with low birth weight rising and high birth weight declining. Early-term births rise and remain elevated, while true preterm births, those below 37 weeks, show no comparable increase, pointing to a shift in the timing of scheduled deliveries rather than a rise in preterm risk. The composition of births also shifts by partnership context: out-of-relation first births decline among younger women but rise

markedly among women over 40. Adolescent fertility continues its long-term decline, with only a temporary increase following the reopening of schools.

Overall, the findings indicate that the pandemic affects not only the level and timing of fertility, but also who has children, with potential implications for long-term socioeconomic outcomes.

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感恩于 陈文深和 李毅 的无尽耐心、鼓励与支持。伤感于 李辉生 不能在人间见证这一天。

# Dedication

凯风自南，吹彼棘心。棘心夭夭，母氏劬劳。

凯风自南，吹彼棘薪。母氏圣善，我无令人。

爰有寒泉？在浚之下。有子七人，母氏劳苦。

睍睆黄鸟，载好其音。有子七人，莫慰母心。

——《国风・邶风・凯风》

# INTRODUCTION

At the onset of the COVID-19 pandemic in 2020, many in the media predicted a “baby boom” as the lockdown and quarantine measures are implemented across Canada. They argue that lockdowns will increase time spent together and raise fertility. However, despite the initial boom period shortly after the implementation of the lockdown, most of the OECD countries demonstrate a boom-bust cycle throughout 2021 and 2022 as birth numbers and fertility rates resume their pre-pandemic decline (Kearney & Levine, 2022; Mooi-Reci et al., 2024; Sobotka et al., 2024; Ullah et al., 2020). A 2021 Statistics Canada survey also indicates that fertility intentions change during the pandemic, with 10.9% surveyed saying they want fewer children than previously planned and 14.3% saying they want to delay their pregnancy. In comparison, only 2% and 3.4% said they wanted to have more children and earlier, respectively (Fostik & Galbraith, 2021). By contrast, a more recent comparison shows intentions recovering. Using the 2021 and 2024 Canadian Social Survey, Jordan and Sinha (2026) find that the share of people aged 15 to 49 who intended to have a first or additional biological child rose from 41% to 46%, suggesting that more Canadians wanted children as the pandemic eased.

School and hotel closures and social-distancing rules may have impacted sexual behaviours, with the largest decline in casual sex and hookups (Delcea et al., 2021). A large proportion of people ceased to engage in casual sex completely after the start of the pandemic (Gleason et al., 2021). Adolescent pregnancy rates and visits for STI treatments during the pandemic also see a significant decrease in Ontario (Vandermorris et al., 2024).

COVID-19 travel restrictions reduce the number of people entering Canada and the United States. The decline includes fewer international students, foreign workers, and prospective mothers who intend to give birth in Canada. This contributes to a sharp decline in births across North America. Canada experiences a 3.2% decline in all births, which translates to approximately 8,700 fewer-than-expected births in 2020, and 800 fewer monthly births in 2021 (Sawant & Stensrud, 2025). One report estimates that non-resident births, or birth tourism, dropped to about 2,400 births in 2020 from its peak of 5,700 before the pandemic (Griffith, 2023).

The COVID-19 pandemic and pandemic measures lead to a disruption in reproductive healthcare services, including contraceptive shortage and reduced access to abortion services. Multiple reports from different international organizations estimate that there will be an increase in unplanned pregnancies across the globe (IPPF, 2020; UNFPA, 2020). In Canada, the reduction in adolescent pregnancies is smaller among families with lower socio-economic status (Metcalfe et al., 2016; Nethery et al., 2019; Vandermorris et al., 2024).

My paper examines how fertility patterns in Canada change during the COVID-19 pandemic using the universe of births recorded in the Canadian Vital Statistics – Birth Database (CVSB) from 2016 to 2024. I investigate whether the pandemic and the public health measures alter both the level and the composition of fertility. I analyze four related outcomes: (1) differences in fertility behaviour across age groups in response to public health measures; (2) changes in overall birth outcomes such as birth weight and gestational length following the implementation of public health orders, including the changes in the incidence of adverse birth outcomes; (3) shifts in the composition of births by partnership context; and (4) trends in adolescent fertility during the observation period. I combine birth records with monthly population data derived from the Census of Population and estimate panel regressions of age-specific fertility rates in response to pandemic policy stringency.

Both the number and the composition of births matter for a range of economic outcomes. Studies have found that children born into families from a more privileged socioeconomic background tend to fare better as adults themselves regarding health, earnings, and academic achievements (Case et al., 2002; Currie, 2009; M. Marmot, 2017; M. G. Marmot et al., 1991). Cohort size also affects long-run economic outcomes, as illustrated by the differences between large cohorts such as the baby boom generation and smaller cohorts born in subsequent periods. In addition, whether a birth is planned or unplanned may influence parental investment and early childhood development outcomes (Arteaga et al., 2019). Understanding who had children during the pandemic provides insight into the potential long-term socioeconomic consequences of fertility behaviour during periods of large economic and social disruption.

I find several notable changes in fertility patterns during the pandemic. First, the age-specific fertility regressions show that public health measures act unevenly across age groups. Women aged 25 to 34 respond most to pandemic policy relative to the historical trend. Advanced age women respond less, and their responses are less consistent. The vaccination sub-index shows no significant link to fertility, and its limited variation makes any effect difficult to detect.

Second, the birth outcome trends split by timing. Early in the pandemic, early-term births rise within a few months of the first restrictions, and high-birth-weight births begin to fall about nine months after the first public health orders. Later in the pandemic, low-birth-weight births rise gradually, while early-term births stay elevated through the rest of the observation window.

Third, the composition of first births shifts by age. Out-of-relation first births fall among younger first-time mothers during the pandemic[1] and rise among advanced age first-time mothers.

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[1] I define the lockdown period as April 2020 to August 2022. April 2020 marks the first national public health orders. August 2022 marks the end of the main lockdown measures. The data chapter sets out the precise construction, including how I date exposure by conception.

Fourth, adolescent fertility holds to its long decline through the onset of the pandemic. About nine months after schools first close, adolescent births rise briefly. They then plateau in 2022.

Finally, a supplementary descriptive analysis uses the mother's marital status at birth as a proxy for partnership context. Adverse birth outcomes stay higher for out-of-relation births early in the pandemic, and the gap changes little later on.

# DATA AND METHODOLOGY

## Data

### Canadian Vital Statistics – Birth Dataset

The main data source for this study is the Canadian Vital Statistics – Birth Database (CVSB), which contains the universe of registered live births in Canada. Under provincial and territorial Vital Statistics Acts or equivalent legislation, live births are registered with the jurisdiction in which they occur, and the resulting records are transmitted by provincial and territorial vital statistics registries to Statistics Canada. The CVSB includes information on:

- the date and place of birth,
- infant sex,
- birth weight,
- gestational age,
- parental age,
- parental marital status and birthplace,
- the mother's usual place of residence,
- plurality (the number of live births from a single pregnancy), and
- parity (the number of times a female has given birth including the current one) (Government of Canada, 2023).

For this study, I use birth records from the CVSB across two samples. The age-specific fertility rate analysis uses births from 2016 to 2023. The birth-outcome analysis uses births from 2017 to 2024. The analytic sample is narrowed down to include only live births to mothers aged 15 to 49 years. I exclude Yukon because birth records are missing for 2017–2022. I also exclude Nunavut and the Northwest Territories from the main analysis because their relatively small populations generate highly volatile monthly birth counts and fertility rates. After these restrictions, the analytic sample contains 2,928,634 live births. I use the CVSB at two levels. For the fertility analysis, I use the mother's usual place of residence to aggregate births into monthly counts by province and maternal age group. For the birth-outcome regressions, I use the individual birth records, which lets me control for maternal and birth characteristics at the level of each birth. I also construct descriptive regional measures such as mean maternal age and the share of first births.

## Census of Population

The 2016 and 2021 Census of Population provides the basis to estimate monthly female population of different age groups across different provinces. Monthly population in Canada fluctuates due to many factors, such as the seasonality of birth and death, the arrival of temporary workers and international students, and internal migration between provinces (Bégin et al., 2025; Immigration Refugees and Citizenship Canada, 2025; Shariff et al., 2021; Werschler & Halli, 1992).I linearly interpolate monthly population between the Census years. Linear interpolation assumes smooth population change; sudden pandemic-related migration shifts may introduce minor measurement error, but this is unlikely to bias fertility rate comparisons systematically.

## Pandemic response and policy measures

To capture variation in provincial pandemic responses, I use the COVID-19 Stringency Index developed by Breton et al. (2022), which follows the Oxford COVID-19 Government Response Tracker framework. The overall index measures the stringency of provincial public health responses, primarily through containment and closure policies. In addition to the overall index, the data provide policy-specific sub-indices. In the age-specific fertility analysis, I use the overall stringency index as well as sub-indices capturing public health restrictions and vaccination requirements to assess whether different types of pandemic policies are associated with fertility behaviour across age groups.

The overall index and its sub-indices are available daily from March 2020 to August 2022 (Breton et al., 2022), which I aggregate to monthly provincial values. Months outside this window are assigned a stringency of zero, since no pandemic measures were in place before March 2020 or after their removal in mid-2022.

I refer to the window from April 2020 to August 2022 as the lockdown period. April 2020 marks the first national public health orders. August 2022 marks the removal of the main measures, which also closes the stringency series. The series itself begins one month earlier, in March 2020, when the first provincial measures appear.

A birth reflects a conception about nine months earlier, so I date pandemic exposure by conception rather than by the birth month. The fertility models apply this by lagging each policy index nine months. The birth-outcome models apply it by measuring the share of each pregnancy that overlaps the lockdown period. Both choices line up pandemic conditions with the pregnancy, not the delivery.

## Data linkage

The CVSB and Census-based population estimate are linked geographically using the mother's usual place of residence. The analysis is conducted at the provincial level. While linkage at the forward sortation area (FSA) level would allow for more granular analysis, it results in substantial sparsity in monthly birth counts and a concentration of observations in highly populated regions, limiting its suitability for panel estimation.

## Supplementary measures

The CVSB does not directly record whether a birth is intentional or unintentional. Birth intention is known to be associated with adverse birth outcomes such as low birth weight and preterm birth (Shah et al., 2011). Literature also shows unintended pregnancy increases the risk of psychosocial problems in young children (Beumer et al., 2024). This is why I wish to estimate birth intention in the study. Where relevant, I use maternal marital status in the birth dataset as the basis for a birth intention proxy that classifies births into two categories. It is not a definitive classification on whether a live birth is intentional or unintentional, as couples could have unintended pregnancies while single women might intentionally seek motherhood.

In my analysis, births to mothers recorded as married or in a common-law proxy category are classified as in-relation births, which are more likely to be intended births. Births to mothers recorded as single, divorced, widowed, or separated are classified as out-of-relation births, and those births are more likely to be unintended. This classification should be interpreted cautiously, as common-law unions are not recorded consistently across provinces. In some jurisdictions, common-law status is captured under “Unknown,” whereas in others it may be recorded as “Single”. As a result, measures based on marital status are not fully comparable across provinces and should not be interpreted as direct measures of intended versus unintended fertility, as relationship status is an imperfect proxy for pregnancy intention.

The mother’s relationship status can be distorted by the pandemic and its subsequent public health measures. Pandemic closure makes it more costly to both get married and divorced, which could artificially suppress the number of in-relation births. The overall negative outlook of the economy at the onset of the pandemic makes people want to delay their divorce (Ambrosino, 2014; Fischer & Liefbroer, 2006).

*Table 1: Descriptive statistics*

Panel A. Birth-level sample (used for the birth-outcome analysis, Tables 5 and 6)

| **Statistic** | **Value** |
|---|---|
| Births, analysis sample | 2,926,458 |
| Period (birth months) | January 2017 to December 2024 |
| Provinces | 10 (territories excluded) |
| Maternal age, years | 31.0 (5.15) |
| Birth weight, g | 3,308 (572) |
| Gestational age, weeks | 38.6 (1.96) |
| Low birth weight, below 2,500g, % | 6.81 |
| High birth weight, above 4,500, % | 1.20 |
| Out-of-relation, % | 29.7 |
| Advanced maternal age, % | 25.0 |
| First birth, % | 43.1 |
| Multiple birth, % | 3.09 |
| Lockdown period, pre/during/post, % | 42.4/28.0/29.6 |
| Sex ratio (boys per 100 girls), national monthly mean | 105.4 |

*Panel A: Continuous variables show mean and standard deviation in parentheses. The full sample is 2,928,634 births; the analysis sample drops records with missing birth weight. The three territories are excluded.*

Panel B. Age-specific fertility rate panel (used for the ASFR analysis, Tables 2 to 4)

| **Age group** | **Mean monthly ASFR, per 1,000** |
|---|---|
| 15 to 19 | 0.73 |
| 20 to 24 | 3.44 |
| 25 to 29 | 7.68 |
| 30 to 34 | 8.77 |
| 35 to 39 | 4.45 |
| 40 to 44 | 0.89 |
| 45 to 49 | 0.09 |

*Panel B: A province by age by month panel, January 2016 to December 2023, 10 provinces, 960 province-months per age group. Rates are monthly births per 1,000 women. The ASFR regressions in Tables 2 to 4 retain Northwest Territories and Nunavut, 12 province fixed effects, and exclude only Yukon for data availability.*

## Methodology

This paper uses multiple empirical approaches to examine changes in Canadian fertility patterns during the COVID-19 pandemic. Because the outcomes of interest differ in both definition and level of aggregation, the empirical strategy is organized around the paper's four main research questions. First, I estimate age-specific fertility rate models to assess whether fertility behaviour across age groups was associated with pandemic-related public health measures and socioeconomic conditions. Second, I document changes in overall birth outcomes, including birth weight and gestational length, and the incidence of adverse birth outcomes such as low birth weight and early-term birth, then estimate individual-level regressions of these outcomes. Third, I examine changes in the composition of births using marital status at birth as a proxy for partnership context, to assess whether the pandemic altered who had children. Fourth, I analyze trends in adolescent fertility during the observation period.

## Outcome measures

I examine several outcomes related to birth composition and fertility behaviour. For the fertility analyses, the primary outcome is the age-specific fertility rate (ASFR). The ASFR for age group $\alpha$, geographic unit $g$, and month $t$ is defined as the number of live births to women in age group $\alpha$ in month $t$, divided by the corresponding female population in the same age group and geographic unit, multiplied by 1,000. ASFR is preferred to crude birth counts because it adjusts for differences in the size of the underlying female population and facilitates comparisons across age groups, time periods, and geographic areas. Female population denominators are constructed using age-specific female population counts from the 2016 and 2021 Census of Population. For each geographic unit, I calculate the female population in each age group in both census years and assume a linear population trend between the two observations. Monthly age-specific population estimates are then obtained by interpolation between census years and by extrapolation beyond 2021 using the same age-group-specific trend.

For birth-weight analyses, I examine descriptive trends in mean birth weight as well as the incidence of low-birth-weight and high-birth-weight births. Low birth weight (LBW) is defined as birth weight below 2,500 grams, while high birth weight (HBW) is defined as birth weight above 4,500 grams. Studies have shown high birth weight is associated with elevated risks for certain health and behavioural issues in childhood, including breast cancer, several psychiatric disorders, hypertension in childhood, and type 1 and 2 diabetes (Magnusson et al., 2021). High birth weight is also associated with overweight and obesity in adulthood (Schellong et al., 2012). On the other hand, low birth weight is also associated with various adverse health, developmental, and behavioural outcomes. Some studies attribute low birth weight to worsened academic achievement (Amadou et al., 2025; Chatterji et al., 2014; Jamaluddine et al., 2023; Jańczewska et al., 2023). Low birth weight infants have a much higher chance of developing complications and resulting in fatal outcomes after birth compared to normal weight babies (Wardlaw, 2004) and are often more vulnerable to various risk factors, such as cognitive deficit and other health and psychological problems (Fan et al., 2013; Fitzgibbons et al., 2009; Mathewson et al., 2017).

The American College of Obstetricians and Gynecologists Committee on Obstetric Practice and the Society for Maternal-Fetal Medicine define five gestational categories (ACOG, 2025). A preterm birth has a gestation under 37 weeks. An early-term birth falls between 37 0/7 and 38 6/7 weeks, and a full-term birth between 39 0/7 and 40 6/7 weeks. A late-term birth falls between 41 0/7 and 41 6/7 weeks. A post-term birth is 42 0/7 weeks or more. For the gestational-age analyses, I assign each birth to one of these categories by its completed gestational weeks.

Adolescent births are defined as births to mothers aged 15 to 19 years. Similar to birth weight, both preterm and post-term births are associated with adverse birth and developmental outcomes (El Marroun et al., 2012).

## Age-specific fertility rate analysis

To examine fertility behaviour across age groups, I estimate panel models of age-specific fertility rates using monthly data. The unit of observation is a province-age group-month cell, and the models are estimated separately for each maternal age group to allow fertility responses to vary across the reproductive life course.

The fertility panel runs monthly from January 2016 to December 2023, the span of the available monthly birth data.

The empirical specification is:

$$ASFR_{a,p,t} = \beta_0 + \beta_1 Trend_t + \beta_2 Policy_{p,t-9} + \beta_3 (Trend_t \times Policy_{p,t-9}) + \mu_p + \epsilon_{a,p,t}$$

Where $ASFR_{a,p,t}$ is the age-specific fertility rate for age group $a$ in province $p$ and month $t$; $Trend_t$ is a linear time trend; $Policy_{p,t-9}$ is the relevant pandemic policy measure lagged by nine months; and $\mu_p$ denotes province fixed effects. I use a linear time trend because it approximates the long-run movement in fertility well.

The nine-month lag is used to align policy conditions more closely with the likely timing of conception rather than birth. In the baseline specification, the policy variable is the overall COVID-19 Stringency Index. In alternative specifications, I replace the overall index with sub-indices capturing public health restrictions and vaccination requirements. Estimating these parallel models allows me to assess whether different dimensions of pandemic policy were differentially associated with fertility behaviour across age groups.

The models are estimated separately by age group rather than pooled across all reproductive ages because the timing and determinants of fertility differ substantially across the life course. Separate estimation allows the association between pandemic conditions and fertility to vary flexibly across adolescent, young adult, prime-age, and older reproductive ages.

Standard errors are clustered at the provincial level. Inference with few clusters can be prone to downward bias in standard errors; results should be interpreted with this limitation in mind.

The ASFR regression results are interpreted as conditional associations rather than causal effects. Pandemic-related public health measures were not randomly assigned, and provincial policy stringency may reflect broader epidemiological, institutional, and economic conditions that also influenced fertility decisions. The estimated coefficients should be understood as describing differences in fertility patterns associated with the pandemic policy environment, rather than as causal effects of specific policy measures.

## Descriptive analysis of birth outcomes

To address the research questions on the two adverse birth outcomes: anomalous birth weights and birth terms, I construct monthly descriptive series for mean birth weight, the incidence of low-birth-weight and high-birth-weight births, and the incidence of early-term, late-term, and post-term births using the full set of live births in the analytic sample. These outcomes are summarized at the national level and, where appropriate, by region. I compare patterns observed after the onset of the pandemic in March 2020 with pre-pandemic trends from 2016 to early 2020 to assess whether the pandemic coincided with changes in the composition of births.

This part of the analysis is descriptive rather than causal. Its purpose is to document whether birth outcomes changed during and after the lockdown period, and whether those changes appeared temporary or persistent over time.

## Regression analysis of birth outcomes

The descriptive series show how birth outcomes move over the pandemic. To hold the composition of births constant, I also estimate individual-level regressions on the full sample of live births. These models ask whether outcomes during and after the lockdown differ from the pre-lockdown baseline, once I control for maternal and birth characteristics.

The unit of observation is a single live birth. I study two groups of outcomes. The first group concerns birth weight: the log of birth weight, birth weight in grams, and a birth weight z-score. The second group concerns gestational length and size for gestational age: gestational age in weeks, the log of gestational age, and indicators for small-for-gestational-age (SGA) and large-for-gestational-age (LGA) births. I construct the z-score, SGA, and LGA within gestational-age strata. SGA and LGA mark births below the tenth percentile and above the ninetieth percentile of birth weight for a given gestational length. By construction, these three outcomes already net out gestational length.

The baseline specification for a continuous outcome is:

$$\begin{aligned} Y_i = \beta_0 + \beta_1 Lockdown_i + \beta_2 Post_i + \beta_3 Share_i + \beta_4 (Age_i \times Lockdown_i) + \beta_5 (Age_i \times Post_i) \\ + \beta_6 (Out_i \times Lockdown_i) + \beta_7 (Out_i \times Post_i) + \delta Trend_t + \mathrm{X}_i \gamma + \mu_p + \tau_m + \epsilon_i \end{aligned}$$

where $Y_i$ is the outcome for birth $i$. $Lockdown_i$ and $Post_i$ indicate births that occur during the lockdown period (April 2020 to August 2022) and after it. $Share_i$ is the share of the pregnancy that overlaps the lockdown period, measured from the estimated month of conception to the month of birth. $Age_i$ is the mother's age, and $Out_i$ marks out-of-relation births. $\mathrm{X}_i$ is a vector of controls: the mother's age and its square, birth parity, birth plurality, and relationship status. $\mu_p$ denotes province fixed effects, $\tau_m$ denotes birth-month fixed effects, and $Trend_t$ is a linear time trend measured in months since January 2016.

The lockdown and post-lockdown indicators capture period shifts in outcomes by date of birth. The pregnancy-share variable captures the dose of in-utero exposure to the lockdown environment, since two births in the same month can differ in how much of gestation falls inside the window. The interaction terms let these shifts vary with the mother's age and with relationship status. Birth-month fixed effects absorb seasonality, province fixed effects absorb fixed provincial differences, and the linear trend absorbs the long-run drift in outcomes over the sample. The reference birth is a first birth to a mother in British Columbia, in-relation, before the lockdown.

I estimate the birth weight and gestational age models by ordinary least squares. I estimate the SGA and LGA models by logistic regression, so their coefficients are log-odds. For the birth weight outcomes, I report a second specification that adds gestational age in weeks to the controls. Comparing the two specifications shows how much of any birth weight change works through gestational length rather than through fetal growth.

I report conventional standard errors for these models. Clustering by province and year-month leaves the standard errors undefined for many coefficients because both dimensions are absorbed as fixed effects, and the province dimension has only ten clusters, too few for reliable cluster-robust inference. Where the clustered standard errors are defined, the during-lockdown increases in birth weight and large-for-gestational-age odds and the post-lockdown rise in small-for-gestational-age odds all remain significant. The post-lockdown declines in mean birth weight and the share-of-pregnancy associations lose significance under clustering, so I read them with caution.

These regressions describe conditional associations rather than causal effects. The lockdown was not assigned at random, and every province faces the pandemic at once, so the models lack an untreated comparison group. The estimates report differences in birth outcomes associated with the lockdown period, holding the measured characteristics constant.

## Descriptive analysis by in-relation vs out-of-relation births

To further examine whether changes in birth outcomes differed by family context at birth, I conduct supplementary descriptive analyses stratified by the birth intention proxy. Because the CVSB does not directly record pregnancy intention, this classification is based on maternal marital status in the birth dataset and is intended to capture differences in partnership context at birth rather than a direct measure of planned or unplanned pregnancy. I compare time trends in selected adverse birth outcomes, including low birth weight across the two categories.

I also examine these patterns separately for first births, since first births may be more sensitive to changes in partnership formation and fertility timing during the pandemic.

The proxy does not directly observe pregnancy intention, and the recording of common-law unions differs across provinces. As a result, differences across the birth-intention proxy categories should be understood as suggestive patterns rather than definitive evidence about intended versus unintended fertility.

## Adolescent fertility analysis

Adolescent fertility is analyzed separately due to its sensitivity to institutional disruption such as school closures. To examine adolescent fertility, I track births to mothers aged 15 to 19 over time using monthly birth counts and age-specific fertility rates. This analysis is motivated by the possibility that school closures, reduced in-person social interaction, and changes in access to reproductive health services affected adolescent fertility differently from fertility at older ages. I examine whether adolescent fertility continued its pre-existing downward trend during the pandemic and whether any short-run deviations occurred following school closures or subsequent reopenings.

When relevant, I compare the timing of changes in adolescent fertility with the school-closure component of the provincial COVID-19 Stringency Index. This part of the analysis is primarily descriptive. The results are interpreted as temporal patterns rather than as estimates of a causal school-closure effect.

Taken together, the descriptive and regression-based components of the analysis allow me to distinguish between changes in the composition of births and changes in fertility behaviour. The descriptive analyses document whether the characteristics of births changed during the lockdown period, while the ASFR models assess whether age-specific childbearing patterns were associated with pandemic-related public health measures across provinces and age groups.

# RESULTS

## Fertility trend

### National

Like many high-income economies, Canada's fertility rate has been in decline since the turn of this century (Bloom et al., 2024). The decline is largely driven by women under the age of 30. Using the CVSB data, I demonstrate the changes in age-specific fertility rate over time.  In the observed period, fertility rates among individual age groups continued their pre-pandemic trend. Women under the age of 30 continue to decline, while the fertility rates among the 30 to 34, and the 35 to 39 cohorts remained relatively stable. The fertility rates for advanced-age mothers (40-44 and 45-49) show a slow increase over the observation period.

Across age groups, seasonality is the strongest among the 25 to 29, the 30 to 34, and the 35 to 39 age group. Seasonal variations are minimal among the 15 to 19, the 40 to 44 and the 45 to 49 age groups.

Fertility rates among women over 35 deviate from their pre-pandemic trend during the lockdown period, as shown in Figure 1.

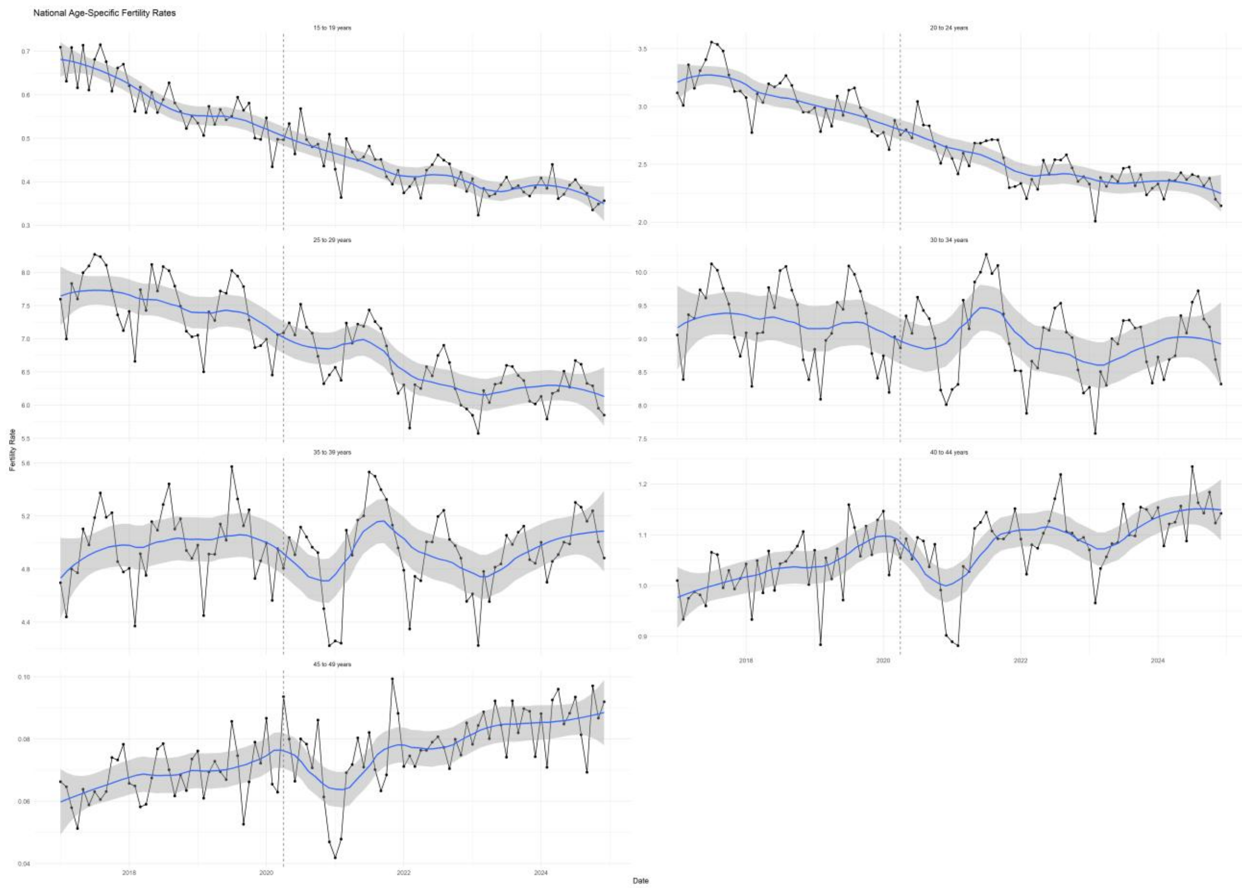


*Figure 1: National age-specific fertility rates by age group, between 2017 and 2024. Territories excluded. The vertical dashed line marks the onset of the lockdown, April 2020.*

## Provincial

Medically assisted reproduction support programs and their availability vary province to province. In 2015, Ontario introduced the Ontario Fertility Program, which covers various MAR procedures such as IVF and intrauterine insemination (IUI). Quebec temporarily delisted IVF treatment from its provincial healthcare program RAMQ in 2015 to reduce healthcare spending. A subsequent government reinstated the coverage in 2021 (CBC, 2020; Simone, 2019). British Columbia did not have a publicly funded IVF program until 2025 (Whitehead et al., 2024).

On top of the federal Canada Child Benefit program, different provinces offer separate incentives to families with children. BC Family Benefit and Ontario Child Benefit programs both offer an annual tax-free payment of approximately $1700 to families with children. Quebec's Family Allowance offers up to $3000 annual payment to families in the same situation. However, these incentive programs are in place before the year 2000 and none of them had changed during the COVID-19 pandemic. The effect of these incentives is observed through the overall fertility rates, but not through short-term changes in fertility rates.

The difference in coverage provides a great opportunity to observe the fertility outcome of the initial COVID-19 public health order (PHO). Women over the age of 35 are of advanced maternal age (AMA). Across all provinces, fertility rates among the 35 and above cohort experienced a significant drop 9-month after the initial PHO. For the 35 to 39 age group, all three provinces see a drop that significantly deviates from their seasonal low. For the 40 to 44 age group, I observe a similar persistent drop in fertility in Ontario and Quebec, but not as much in British Columbia. Ontario and Quebec both experience a more significant drop in fertility rates, while British Columbia's drop is more moderate and in line with seasonal variance.

Figures 2 to 4 show a similar pattern across the province. Among the 35 to 39 and the 40 to 44 age groups, all provinces saw a significant uptick in fertility rates in 2021 from the previous years. In Ontario, where a publicly funded medically assisted reproduction program is available, the increase in fertility rate among women in the 35 to 39 age cohort is the most significant compared to provinces that did not have such a program at the time.

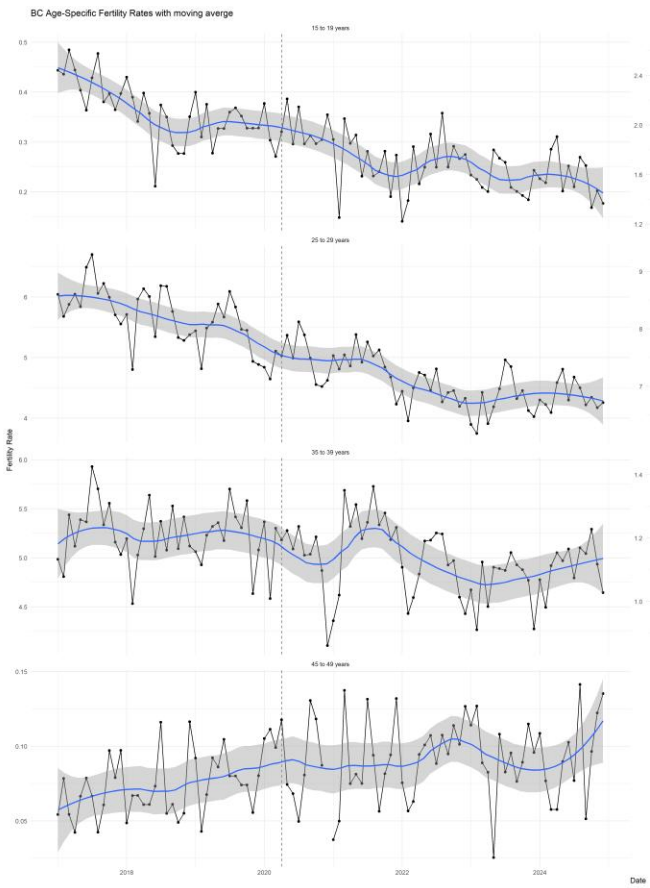


*Figure 2: Age-specific fertility rates, British Columbia. The vertical dashed line marks the onset of the lockdown, April 2020. Between 2017 and 2024. Territories excluded.*

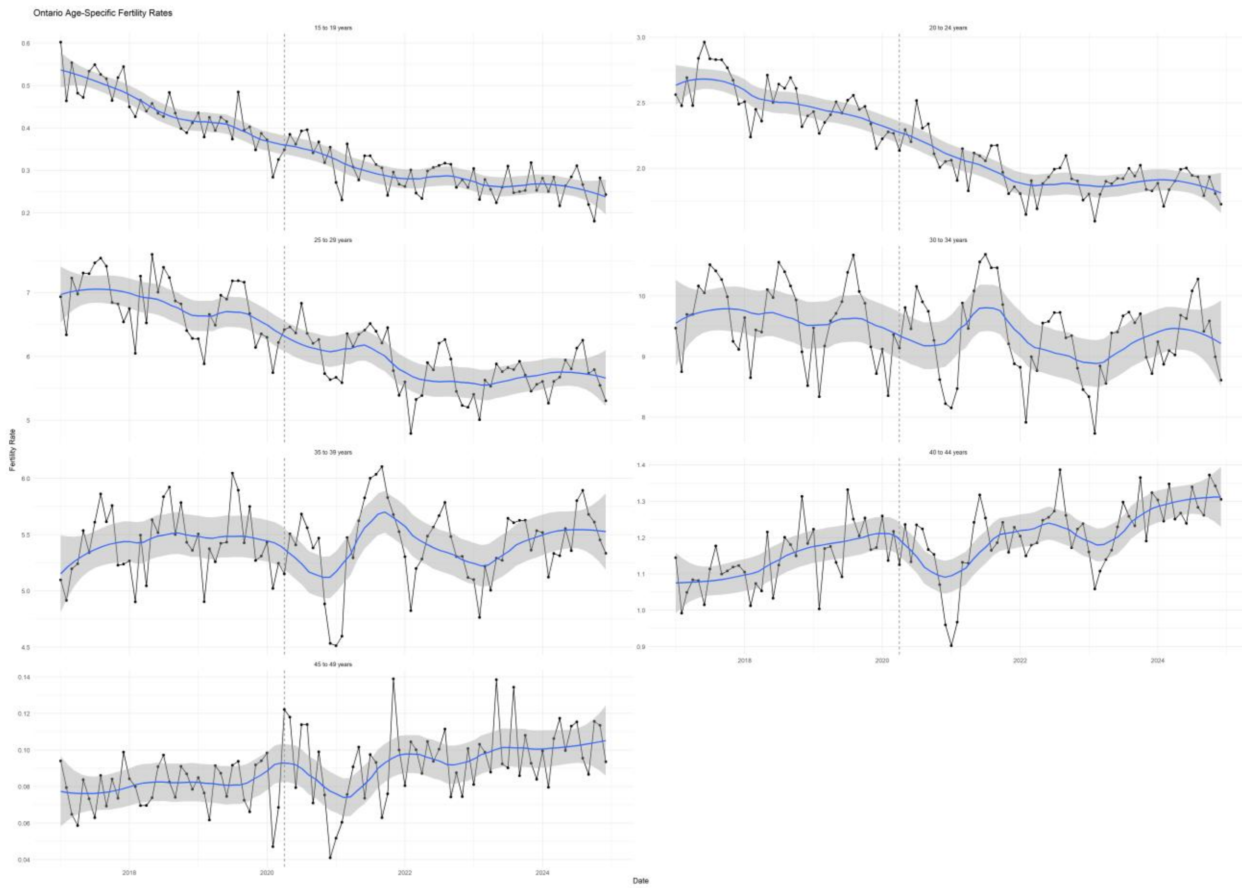


*Figure 3: Age-specific fertility rates, Ontario. The vertical dashed line marks the onset of the lockdown, April 2020. Between 2017 and 2024. Territories excluded.*

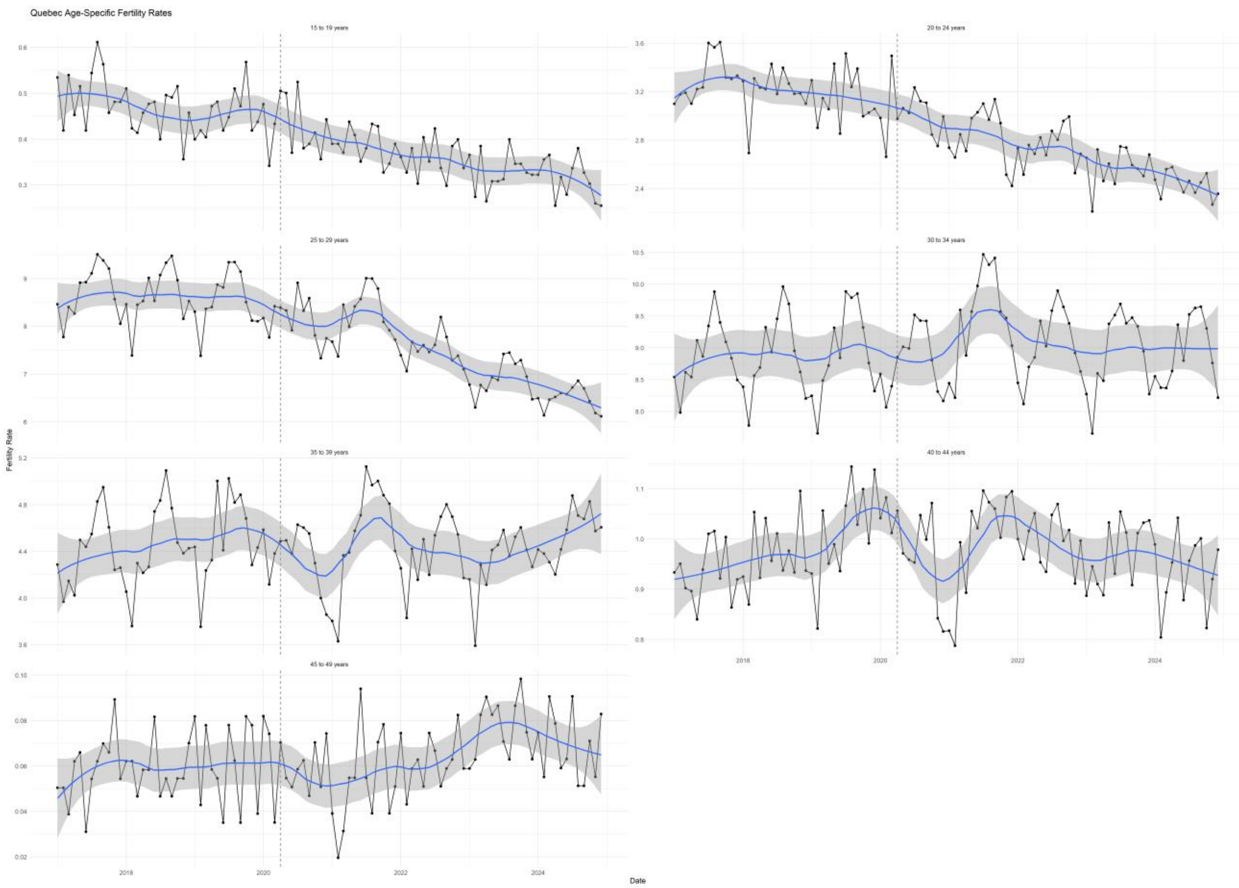


*Figure 4: Age-specific fertility rates, Quebec. The vertical dashed line marks the onset of the lockdown, April 2020. Between 2017 and 2024. Territories excluded.*

## Fertility impact of Public Health Orders

I estimate the age-specific fertility rate models described in the Methodology section separately for each maternal age group using three policy measures: the overall COVID-19 Stringency Index, the public health measure sub-index, and the vaccination requirement sub-index. The results are reported below.

## Overall COVID-19 measures

*Table 2: Age-Specific Fertility Rate Regressions: Overall COVID-19 Stringency Index (CSI)*

| Age group | 15-19 yrs | 20-24 yrs | 25-29 yrs | 30-34 yrs | 35-39 yrs | 40-44 yrs | 45-49 yrs |
|---|---|---|---|---|---|---|---|
| | Dependent variable: ASFR (births per 1,000 women) | | | | | | |
| Time Trend | -0.0069** | -0.0186*** | -0.0214*** | -0.0137*** | -0.0013 | 0.0013*** | 0.0002** |
| | (0.0019) | (0.0017) | (0.0015) | (0.0028) | (0.0021) | (0.0002) | (0.0001) |
| CSI (9-mo. Lag) | 0.0050 | 0.0209 | 0.0803** | 0.0534** | 0.0162 | -0.0062* | -0.0010* |
| | (0.0075) | (0.0149) | (0.0241) | (0.0130) | (0.0115) | (0.0027) | (0.0004) |
| CSI x Trend | -0.0001 | -0.0003 | -0.0011** | -0.0007** | -0.0002 | 0.0001† | 0.0000† |
| | (0.0001) | (0.0002) | (0.0004) | (0.0002) | (0.0002) | (0.0000) | (0.0000) |
| Province FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Birth month FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1,142 | 1,152 | 1,152 | 1,152 | 1,150 | 1,073 | 681 |
| Adj. $R^2$ | 0.7294 | 0.7409 | 0.6844 | 0.6528 | 0.5426 | 0.4771 | 0.9446 |
| Within $R^2$ | 0.0765 | 0.1836 | 0.2375 | 0.0935 | 0.0039 | 0.0158 | 0.0384 |

**** p<0.001 ** p<0.01 * p<0.05 † p<0.10. Clustered standard errors (by province) in parentheses. Unit of observation: province × age group × month, 2016–2023. All models include province and birth-month fixed effects (12 levels each). Policy variable lagged 9 months to align with conception timing. Standard errors rounded to 4 decimal places; several 45–49 coefficients and their standard errors are smaller than 0.0001 in magnitude and display as 0.0000; exact values are in the regression output. Within $R^2$ reflects variation explained after absorbing fixed effects.*

The estimated time trend differs across age groups. Fertility rates decline significantly for every group under age 35, that is, the 15 to 19 through 30 to 34 groups. The 35 to 39 group also trends downward, but the trend is not statistically significant. In contrast, the 40 to 44 and 45 to 49 groups show a small but significant upward trend. Turning to the policy association, the overall COVID-19 Stringency Index is positively associated with fertility rates among women aged 25 to 34. For women aged 40 to 49, the association is negative and significant but very small in magnitude (a one-point increase in the stringency index is associated with a decrease of 0.006 births per 1,000 women aged 40-44), and it does not disrupt the historical upward trend in these advanced age groups. For the younger age groups (15-19 and 20-24), the coefficients for pandemic measures and the interaction term are not statistically significant, implying that adolescent and young adult fertility decisions are less responsive to pandemic policy conditions.

## Public health measures only

*Table 3: Age-Specific Fertility Rate Regressions: Public Health Measure Sub-index (CSI-PHM)*

| | 15-19 yrs | 20-24 yrs | 25-29 yrs | 30-34 yrs | 35-39 yrs | 40-44 yrs | 45-49 yrs |
|---|---|---|---|---|---|---|---|
| Age group | Dependent variable: ASFR (births per 1,000 women) | | | | | | |
| Time Trend | -0.0070** | -0.0186*** | -0.0216*** | -0.0137*** | -0.0013 | 0.0013*** | 0.0002* |
| | (0.0019) | (0.0017) | (0.0015) | (0.0027) | (0.0021) | (0.0002) | (0.0001) |
| PHM (9-mo. Lag) | 0.0068 | 0.0226 | 0.0857** | 0.0567** | 0.0159 | -0.0056 | -0.0011* |
| | (0.0074) | (0.0169) | (0.0270) | (0.0160) | (0.0144) | (0.0034) | (0.0005) |
| PHM x Trend | -0.0001 | -0.0003 | -0.0012* | -0.0007** | -0.0002 | 0.0001 | 0.0000† |
| | (0.0001) | (0.0002) | (0.0004) | (0.0002) | (0.0002) | (0.0000) | (0.0000) |
| Province FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Birth month FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1,142 | 1,152 | 1,152 | 1,152 | 1,150 | 1,073 | 681 |
| Adj. $R^2$ | 0.7295 | 0.7409 | 0.6848 | 0.6528 | 0.5426 | 0.4770 | 0.9447 |
| Within $R^2$ | 0.0768 | 0.1837 | 0.2385 | 0.0936 | 0.0038 | 0.0156 | 0.0390 |

**** p<0.001 ** p<0.01 * p<0.05 † p<0.10. Clustered standard errors (by province) in parentheses. Unit of observation: province × age group × month, 2016–2023. All models include province and birth-month fixed effects (12 levels each). Policy variable lagged 9 months to align with conception timing. Standard errors rounded to 4 decimal places; several 45–49 coefficients and their standard errors are smaller than 0.0001 in magnitude and display as 0.0000; exact values are in the regression output. Within $R^2$ reflects variation explained after absorbing fixed effects.*

The OLS results using only the public health measure sub-index (Table 3) tell a similar story to the overall stringency index. Fertility among women aged 25–34 shows a positive and statistically significant association with public health measures, while only the oldest group (45-49) shows a small but significant negative association. For adolescents and young adults (ages 15-24), the coefficients are not statistically significant, indicating less responsiveness to public health measures.

## Vaccination requirements only

Replacing the pandemic measures with the vaccination requirement sub-index (Table 4) yields null results. No vaccination requirement coefficient is statistically significant in any age group. The estimate closest to conventional significance is for the 40 to 44 group (-0.0187, p=0.19), and even it falls short of the five-percent threshold. Overall, there is little evidence that vaccination requirements are associated with fertility behaviour in any age group.

*Table 4: Age-Specific Fertility Rate Regressions: Vaccination Requirement Sub-index (CSI-VAX)*

| | 15-19 yrs | 20-24 yrs | 25-29 yrs | 30-34 yrs | 35-39 yrs | 40-44 yrs | 45-49 yrs |
|---|---|---|---|---|---|---|---|
| Age group | Dependent variable: ASFR (births per 1,000 women) | | | | | | |
| Time Trend | -0.0074** | -0.0182*** | -0.0212*** | -0.0116*** | -0.0009 | 0.0010** | 0.0002* |
| | (0.0021) | (0.0022) | (0.0020) | (0.0024) | (0.0025) | (0.0002) | (0.0001) |
| VAX (9-mo. Lag) | -0.0173 | -0.0143 | -0.0219 | 0.0341 | 0.0375 | -0.0187 | -0.0002 |
| | (0.0209) | (0.0354) | (0.0606) | (0.0490) | (0.0279) | (0.0134) | (0.0016) |
| VAX x Trend | 0.0002 | 0.0002 | 0.0002 | -0.0004 | -0.0005 | 0.0002 | 0.0000 |
| | (0.0003) | (0.0004) | (0.0007) | (0.0006) | (0.0003) | (0.0002) | (0.0000) |
| Province FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Birth month FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| N | 1,142 | 1,152 | 1,152 | 1,152 | 1,150 | 1,073 | 681 |
| Adj. $R^2$ | 0.7292 | 0.7403 | 0.6771 | 0.6461 | 0.5417 | 0.4754 | 0.9441 |
| Within $R^2$ | 0.0757 | 0.1817 | 0.2199 | 0.0759 | 0.0020 | 0.0127 | 0.0292 |

**** p<0.001 ** p<0.01 * p<0.05 † p<0.10. Clustered standard errors (by province) in parentheses. Unit of observation: province × age group × month, 2016–2023. All models include province and birth-month fixed effects (12 levels each). Policy variable lagged 9 months to align with conception timing. Standard errors rounded to 4 decimal places; several 45–49 coefficients and their standard errors are smaller than 0.0001 in magnitude and display as 0.0000; exact values are in the regression output. Within $R^2$ reflects variation explained after absorbing fixed effects.*

In all regressions above, I observe a mild but positive trend in fertility rates for the 40 to 44 and the 45 to 49 age groups, consistent with the pre-pandemic incline documented in public data and reports. For prime-childbearing ages (25-34), containment and closure policies are the primary pandemic measures associated with changes in fertility behaviour, while vaccination mandates show no measurable association. Although the overall stringency index is negatively associated with fertility in advanced age groups (Table 2), the magnitude is very small and does not disrupt the long-term upward trend.

## Adverse Birth Outcomes

### Birth Weight

#### Mean birth weight

At the national level, I observe a trend of declining mean birth weights over time. The same pattern can be observed across different geographic regions of the country. Despite the overall trend of decline in birth weight across Canada, the data shows there is a temporary bump in birth weights shortly after April 2020. It is more persistent in British Columbia and Ontario (Figure 5).

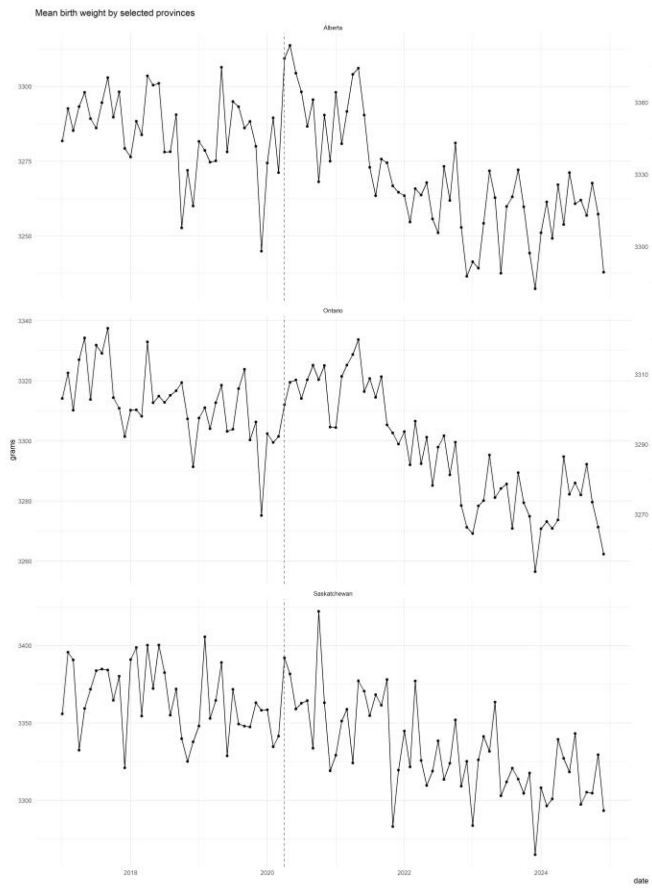


*Figure 5: Mean monthly birth weights by provinces among mothers of all age groups, between 2017 and 2024. Territories excluded. The vertical dashed line marks the onset of the lockdown, April 2020.*

## Low Birth Weight

As the mean birth weights across the country fall continuously, an increase in the incidence rates of LBW births is expected despite the COVID-19 pandemic. However, I observe that the increase in LBW incidence rates for 2022 and 2023 deviates from previous years, especially before the pandemic (Figure 6).

The incidence rate of LBW births between different years after the onset of the pandemic shows there is a meaningful increase in LBW births two years into the pandemic. The pre-COVID mean is around 67 per 1,000 births, with the lowest rate in the fall and the peak in winter. While the incidence rates for 2022 and 2023 demonstrate a similar seasonal pattern, the mean incidence rates have risen to 70 and 71 per 1,000 births, respectively. Between the pre-COVID mean and the 2023 mean, there is approximately a 9% increase.

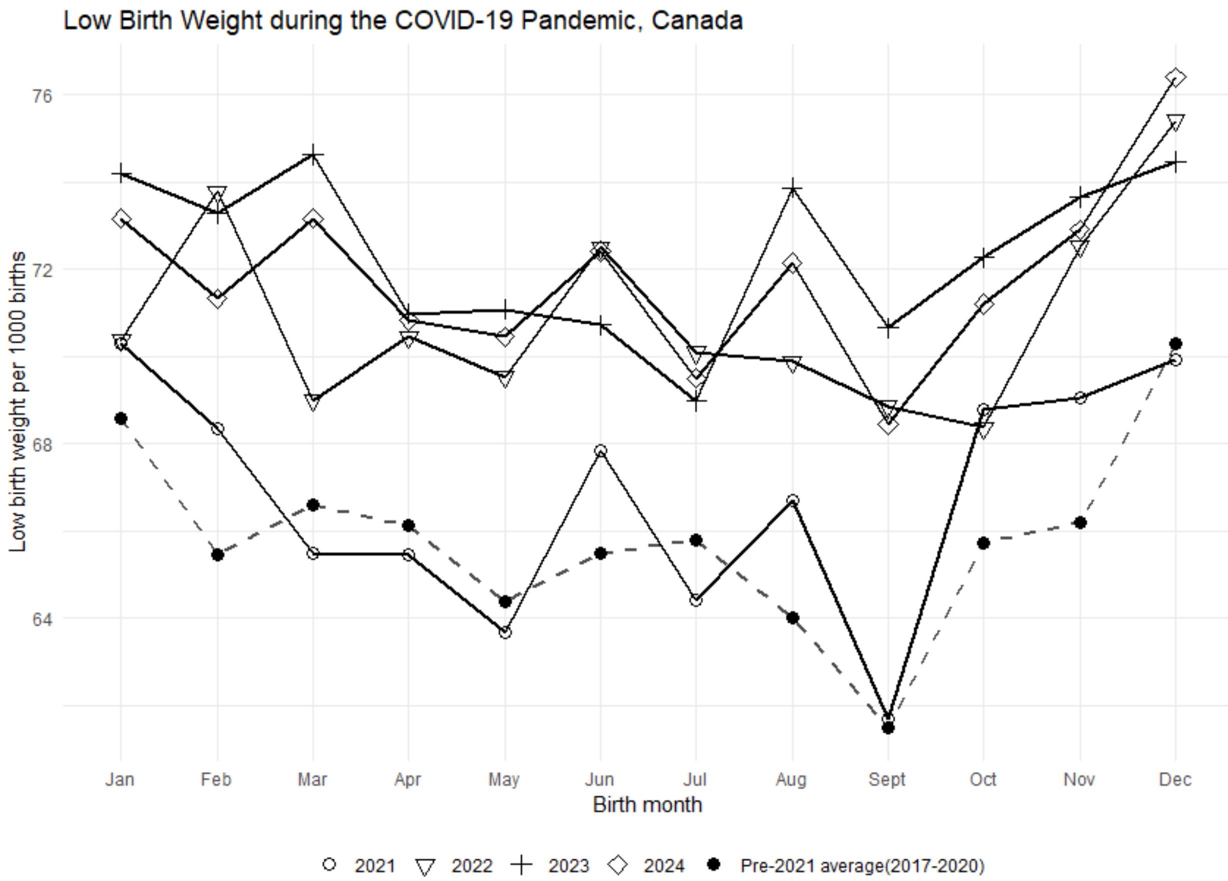


*Figure 6: Low birth weight incidence by month, national level, all age groups, compared with the pre-COVID average. The pre-COVID average pools births from January 2016 up to about nine months after the first public health measures, so it reflects pregnancies conceived before the pandemic. Territories excluded.*

## High Birth Weight

Like LBW infants, High Birth Weight (HBW) infants also carry numerous adverse outcomes. Newborns with high birth weight are at a higher risk for neonatal intensive care unit admission, respiratory distress, and neonatal metabolic abnormalities. HBW infants are at a higher risk of overweight/obesity, diabetes, and cardiovascular disease later in life (Magnusson et al., 2021; Scifres, 2021). An HBW birth is defined as a birth where the birth weight exceeds 4,500 grams.

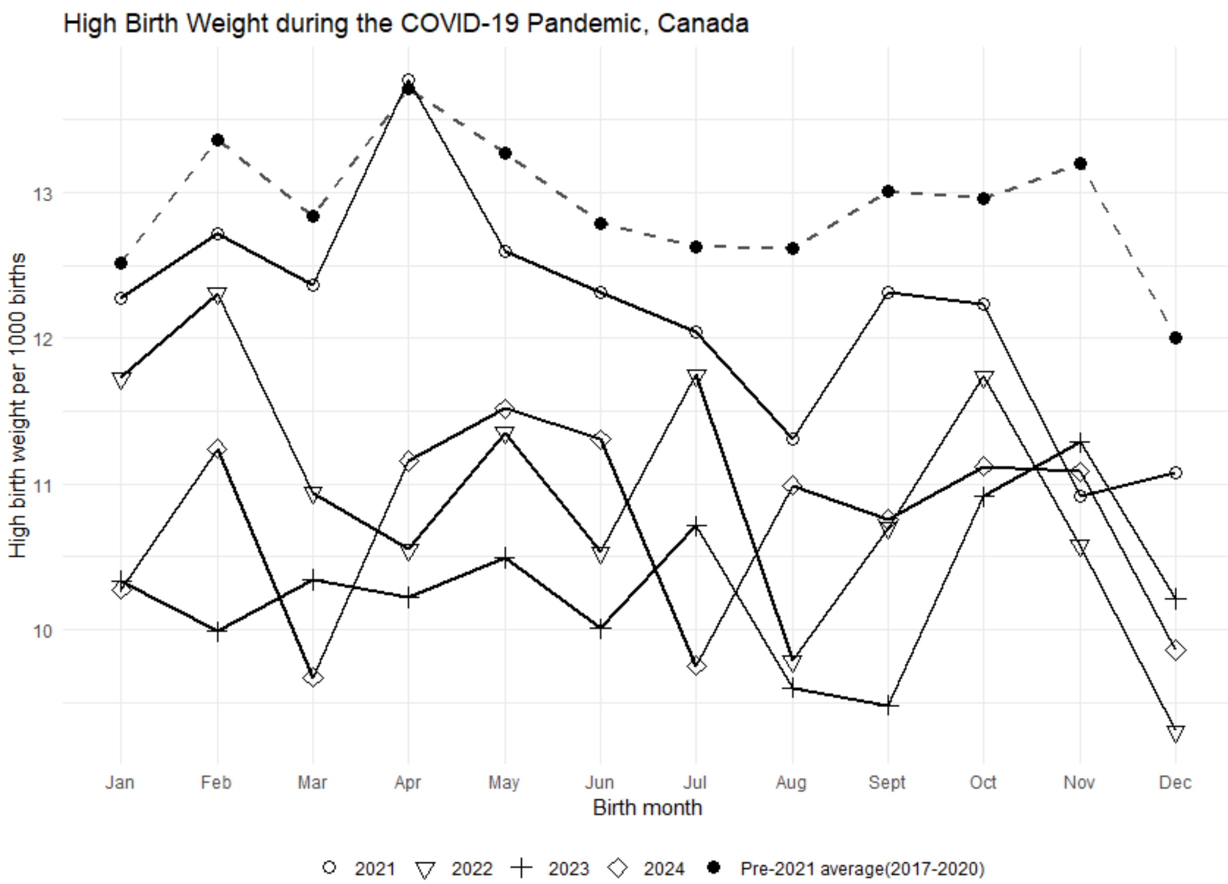


*Figure 7: High birth weight incidence by month, national level, all age groups, compared with the pre-COVID average. Territories excluded*

During the COVID-19 pandemic, I observe a significant decline in HBW incidence rates nine months after the initial Public Health Order (PHO) in March 2020. Different from the LBW incidence rates, whose elevation can only be observed two years after the onset of the pandemic, the HBW incidence rates change shortly after the PHOs, and the decline persists in 2022 and 2023. The mean HBW incidence rate pre-COVID is around 13 per 1,000 births. The incidence rate then decreases to 12 per 1,000 births in 2021, and 11 and below 10 per 1,000 births in 2022 and 2023, respectively, representing a 7%, 15%, and 23% decrease compared to the pre-COVID mean incidence rate (Figure 7).

Lastly, the incidence rates for Normal Weight Birth (NWB) remain largely the same since 2016, with the largest monthly deviation (4%) occurring in December 2021.

### Regression estimates

The patterns above are descriptive. To estimate the pandemic's effect on birth outcomes while holding other factors constant, I turn to a regression. I model each outcome on its timing relative to the lockdown and on the share of the pregnancy spent in the lockdown period, with controls for the mother's age, parity, plurality, province, birth month, and relationship status. Table 5 reports birth weight, and Table 6 reports gestational age and size-for-gestational-age.

*Table 5: Birth Weight*

| | (1)<br>Log BW<br>No gestation | (2)<br>Log BW<br>With gestation | (3)<br>BW (grams)<br>No gestation | (4)<br>BW z-score<br>No gestation |
|---|---|---|---|---|
| During lockdown | 0.0039 | 0.0055*** | 17.80*** | 0.0498*** |
| | (0.0020) | (0.0014) | (5.32) | (0.0096) |
| Post-lockdown | -0.0057** | -0.0073*** | -11.49* | -0.0344*** |
| | (0.0021) | (0.0014) | (5.44) | (0.0099) |
| Share of pregnancy in lockdown | -0.0022*** | 0.0003 | -6.34*** | -0.0015 |
| | (0.0006) | (0.0004) | (1.66) | (0.0030) |
| Mother age x lockdown | 0.0000 | -0.0001* | -0.13 | -0.0009** |
| | (0.0001) | (0.0000) | (0.16) | (0.0003) |
| Mother age x post-lockdown | 0.0001* | 0.0001** | 0.24 | 0.0005† |
| | (0.0001) | (0.0000) | (0.15) | (0.0003) |
| Out-of-relation x lockdown | 0.0017** | -0.0002 | 3.32† | -0.0005 |
| | (0.0007) | (0.0005) | (1.74) | (0.0032) |
| Out-of-relation x post-lockdown | 0.0050*** | 0.0036*** | 14.90*** | 0.0307*** |
| | (0.0007) | (0.0005) | (1.75) | (0.0032) |
| Controls | | | | |
| Mother's age (quadratic.) | Yes | Yes | Yes | Yes |
| Birth parity | Yes | Yes | Yes | Yes |
| Birth plurality | Yes | Yes | Yes | Yes |
| Province FE | Yes | Yes | Yes | Yes |
| Birth month FE | Yes | Yes | Yes | Yes |
| Relationship status | Yes | Yes | Yes | Yes |
| Linear time trend | Yes | Yes | Yes | Yes |
| Gestation weeks | No | Yes | No | No |
| N | 2,886,653 | 2,886,315 | 2,886,653 | 2,886,652 |
| $R^2$ | 0.098 | 0.571 | 0.098 | 0.032 |

**** p<0.001 ** p<0.01 * p<0.05 † p<0.10. Standard errors (unclustered) in parentheses. All four columns are estimated by OLS. Sample: live births to mothers aged 15–49 in Canadian provinces, 2017–2024; Yukon, NWT, and Nunavut excluded. The full sample contains 2,928,634 births; estimation N varies by specification due to missing values (see N row). Baseline: in-relation, pre-lockdown. Lockdown period defined as April 2020 – August 2022. August 2022 is the last month covered by the Stringency Index. All specifications include a continuous time trend (months since January 2016). The "with gestation" specification in col (2) adds gestational age in weeks; the share of pregnancy in lockdown coefficient becomes insignificant, consistent with gestational length being the primary mediating pathway. In cols (1)–(2), the mother-age interaction coefficients and their standard errors are order $10^{-5}$ and are shown at additional decimal places.*

*Table 6: Gestational Age and Size-for-Gestational-Age*

| | (1)<br>Gest. age<br>Weeks, OLS | (2)<br>Log gest.<br>OLS | (3)<br>SGA<br>Logit | (4)<br>LGA<br>Logit |
|---|---|---|---|---|
| During lockdown | -0.0207 | -0.0006 | -0.0108 | 0.152*** |
| | (0.0183) | (0.0005) | (0.0329) | (0.0327) |
| Post-lockdown | 0.0176 | 0.0003 | 0.166*** | 0.0130 |
| | (0.0187) | (0.0005) | (0.0330) | (0.0342) |
| Share of pregnancy in lockdown | -0.0314*** | -0.0009*** | -0.0163 | -0.0204* |
| | (0.0057) | (0.0002) | (0.0103) | (0.0103) |
| Mother age x lockdown | 0.0014** | 0.00004** | 0.0001 | -0.0025** |
| | (0.0005) | (0.00002) | (0.0010) | (0.0010) |
| Mother age x post-lockdown | 0.0003 | 0.00001 | -0.0030** | -0.0013 |
| | (0.0005) | (0.00002) | (0.0009) | (0.0010) |
| Out-of-relation x lockdown | 0.0234*** | 0.0007*** | -0.0097 | -0.0135 |
| | (0.0060) | (0.0002) | (0.0109) | (0.0107) |
| Out-of-relation x post-lockdown | 0.0170** | 0.0005** | -0.0674*** | 0.0536*** |
| | (0.0060) | (0.0002) | (0.0108) | (0.0109) |
| Controls | | | | |
| Mother's age (quadratic.) | Yes | Yes | Yes | Yes |
| Birth parity | Yes | Yes | Yes | Yes |
| Birth plurality | Yes | Yes | Yes | Yes |
| Province FE | Yes | Yes | Yes | Yes |
| Birth month FE | Yes | Yes | Yes | Yes |
| Relationship status | Yes | Yes | Yes | Yes |
| Linear time trend | Yes | Yes | Yes | Yes |
| N | 2,887,643 | 2,887,643 | 2,886,653 | 2,886,653 |
| $R^2$ | 0.105 | 0.098 | — | — |

**** p<0.001 ** p<0.01 * p<0.05 † p<0.10. Standard errors (unclustered) in parentheses. Cols (1)–(2) are OLS on gestational age in weeks and its log; cols (3)–(4) are logistic regressions where coefficients are log-odds, so SGA = small-for-gestational-age and LGA = large-for-gestational-age. $R^2$ is not defined for the logistic models and is shown as "—". Sample: live births to mothers aged 15–49 in Canadian provinces, 2017–2024; Yukon, NWT, and Nunavut excluded. Baseline: in-relation, pre-lockdown. Lockdown period defined as April 2020 – August 2022. August 2022 is the last month covered by the Stringency Index. In cols (1)–(2), the mother-age interaction coefficients and their standard errors are order $10^{-5}$ and are shown at additional decimal places.*

## Gestational Age

### Early-term Births

Early-term births carry higher risks than full-term births, though milder than those of true preterm birth. Maternal stress is a well-established risk factor for preterm birth specifically (Lilliecreutz et al., 2016), so I report preterm incidence, births under 37 completed weeks, alongside the early-term series. Figure 9 reports preterm incidence over the same period. Unlike early-term births, preterm incidence shows no sustained rise after the public health orders. It stays close to its pre-COVID average across the pandemic years.

Early-term incidence rises immediately after the public health orders. In April 2020, the rate jumps from a pre-COVID average of 275 per 1,000 births to 295 per 1,000, a 7% increase. It continues to rise slightly through the following years and stays above the pre-COVID average. In Figure 8, the 2020 line covers pregnancies conceived before the pandemic, so it captures exposure to the lockdown late in gestation. The lines from 2021 onward cover pregnancies conceived during or after the lockdown.

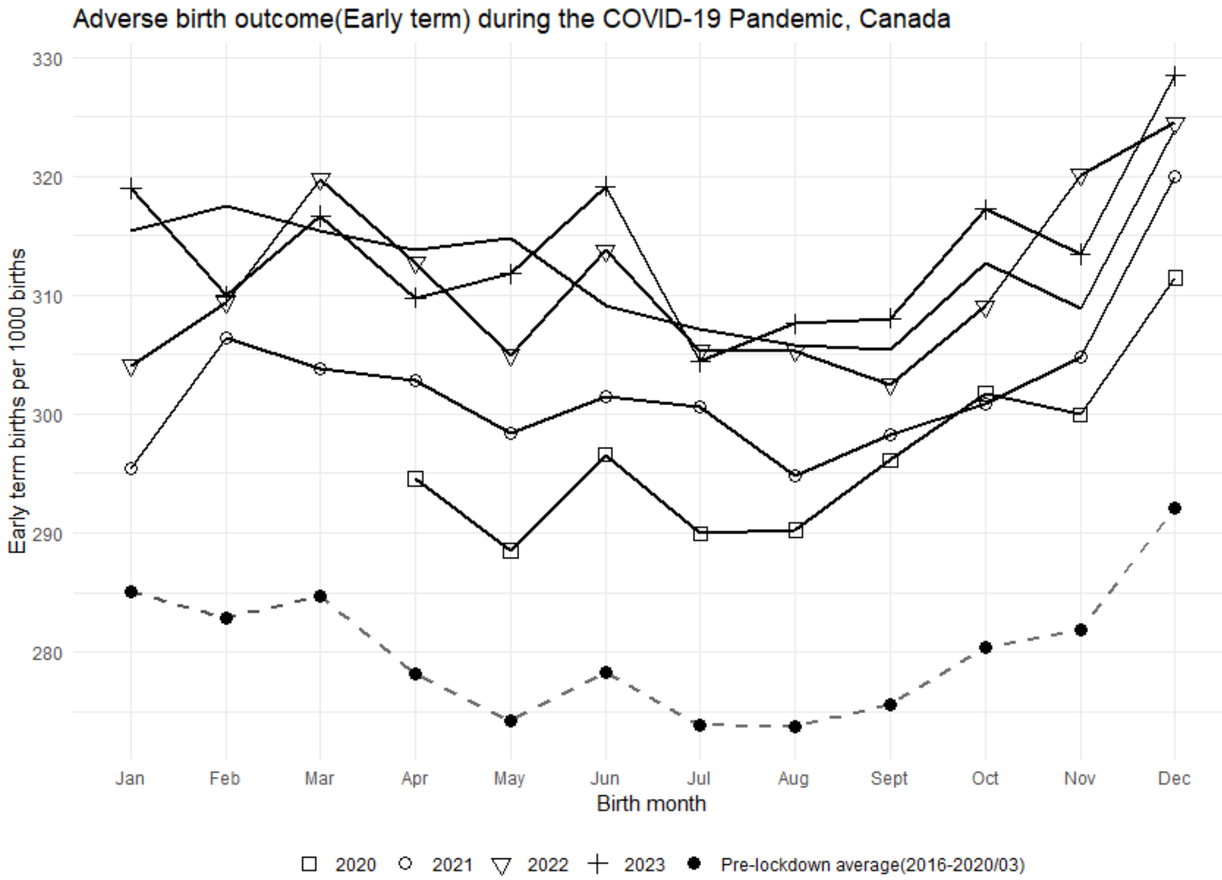


*Figure 8: Early-term birth incidence by month, national level, all age groups, compared with the pre-COVID average.*

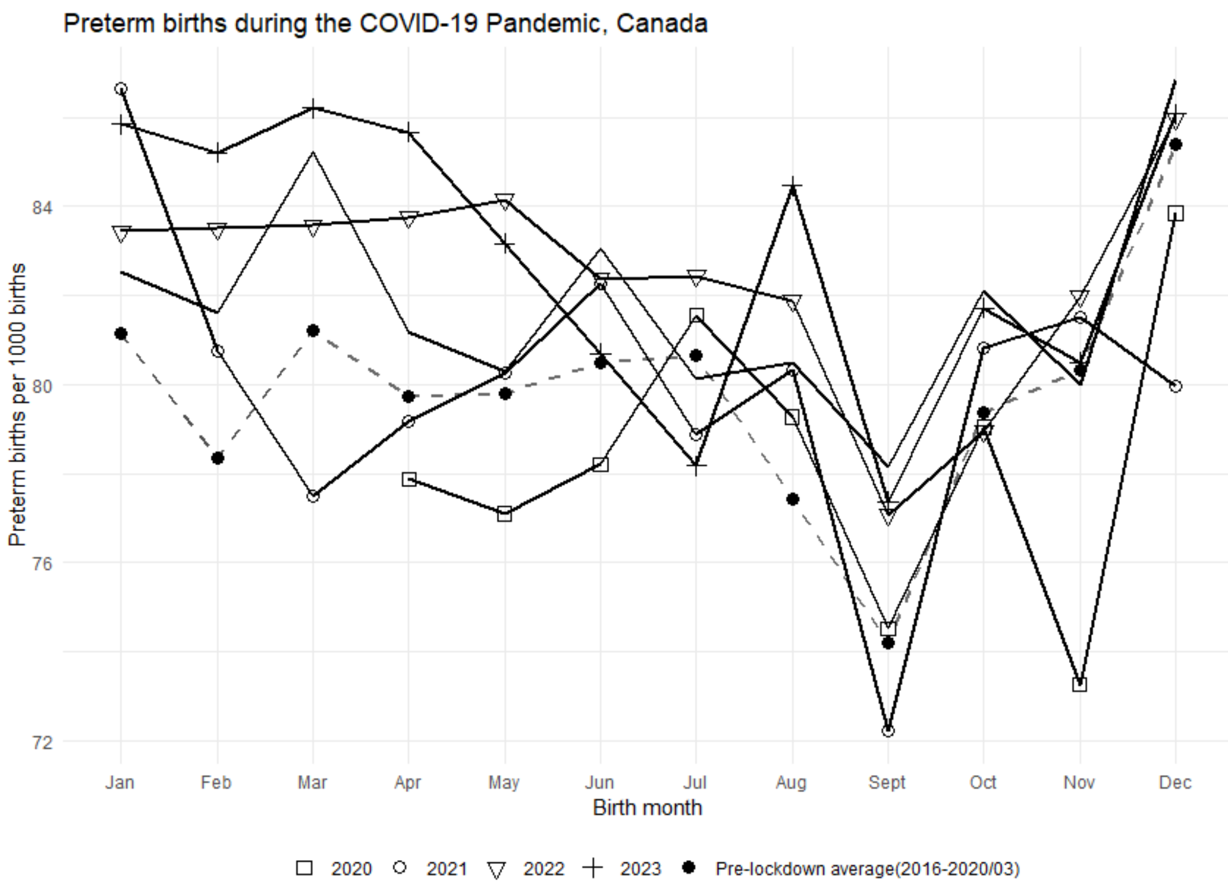


*Figure 9: Preterm birth incidence (under 37 completed weeks) by month, national level, all age groups, compared with the pre-COVID average. Territories excluded.*

## Late- and post-term births

Late-term incidence falls after the public health orders and stays below the pre-COVID average for the rest of the period. The pre-COVID average sits above 105 per 1,000 births in most months. Every pandemic year runs below it, and the gap widens over time, with 2020 closest to the baseline and 2023 the lowest. The seasonal shape is unchanged, so this is a downward shift in level rather than a change in timing (Figure 10).

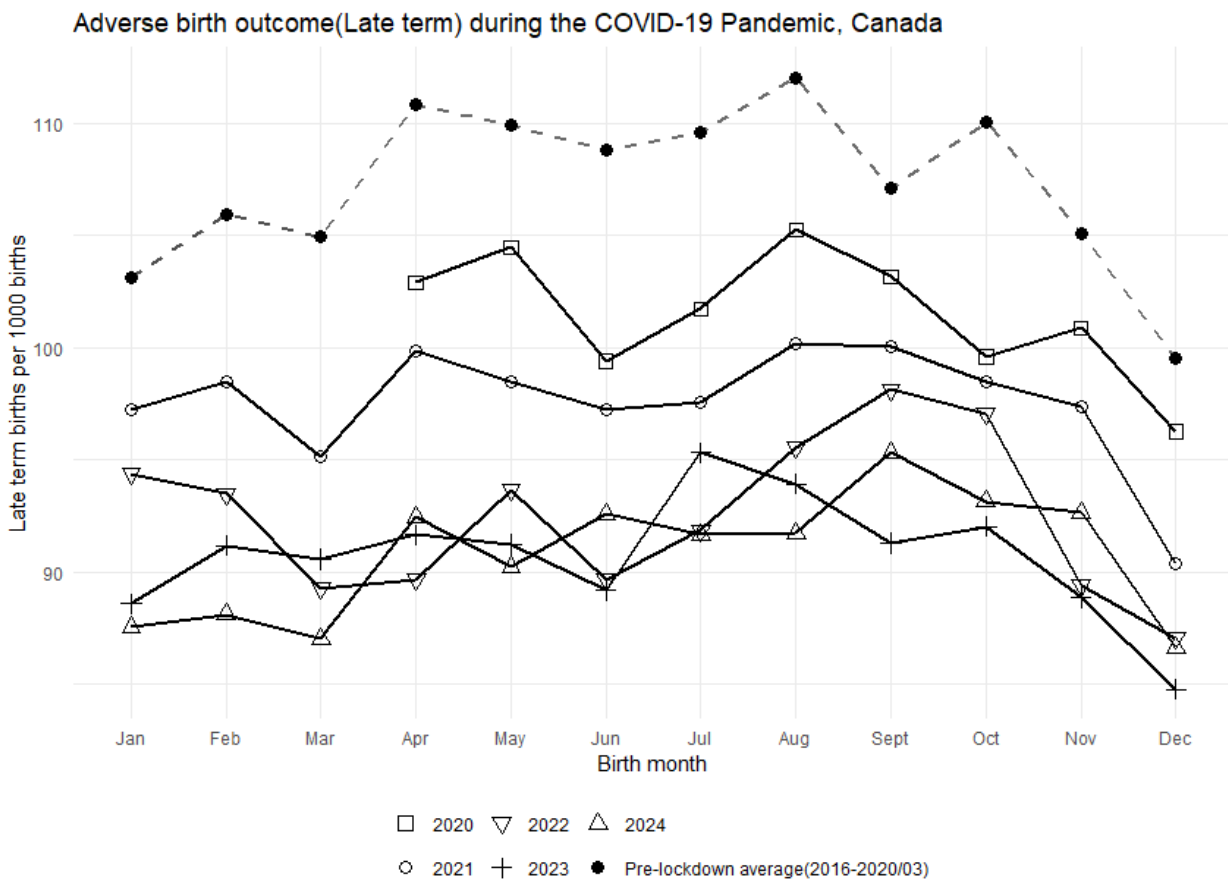


*Figure 10: Late-term birth incidence by month, national level, all age groups, compared with the pre-COVID average. Territories excluded.*

On post-term birth incidence rates during the pandemic, I observe a dichotomy (Figure 11): in the two years following the implementation of the PHOs, post-term incidence rates drop from a pre-COVID average of about 3.1 per 1,000 births to around 2.5 per 1,000 births, a decline of roughly

20%. However, in the subsequent years of 2022 and 2023, I observe a recovery in incidence rates, returning to and slightly exceeding the pre-COVID average, reaching about 3.4 per 1,000 births.

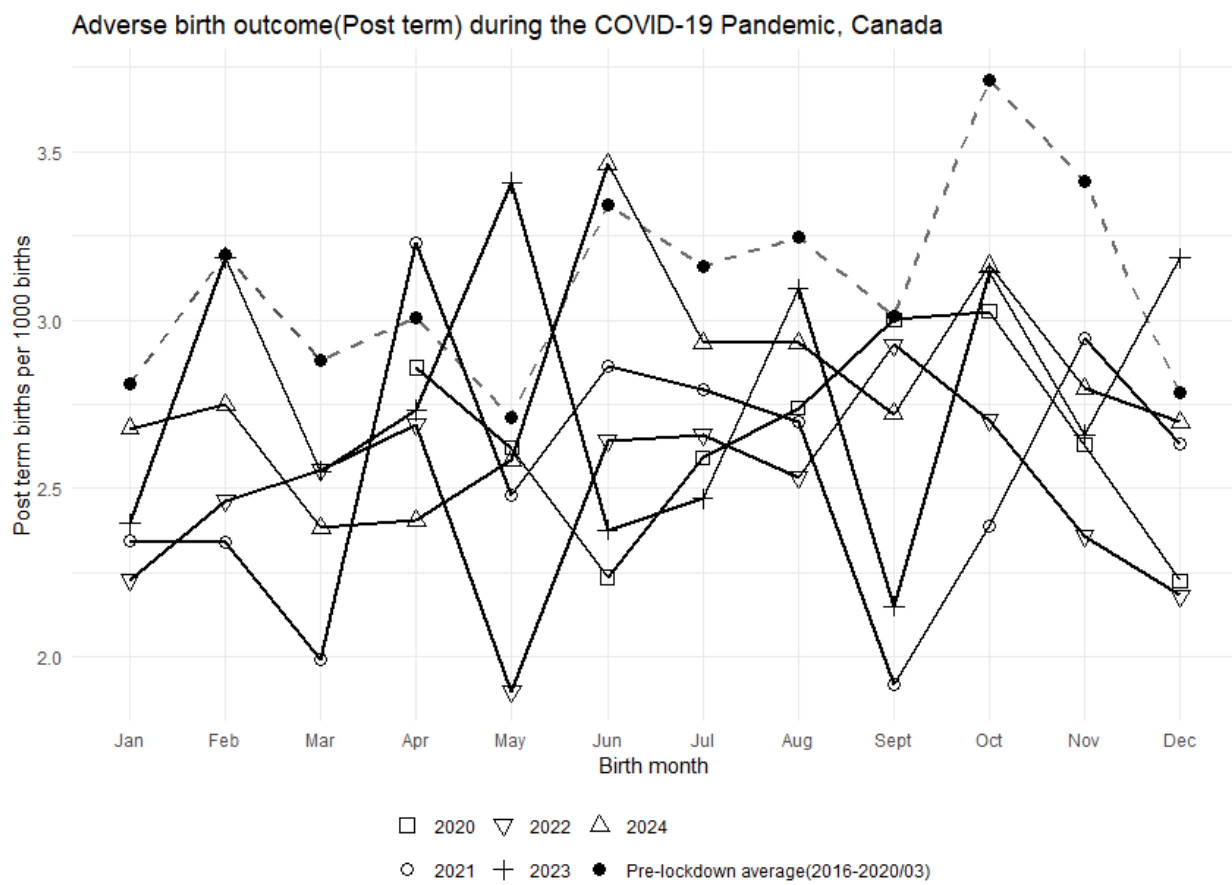


*Figure 11: Post-term birth incidence by month, national level, all age groups, compared with the pre-COVID average. Territories excluded.*

## Birth outcomes by birth intention proxy

This section examines birth outcomes stratified by the birth intention proxy in the Data section. Births are classified as in-relation (mothers recorded as married or in a common-law proxy category) or out-of-relation (mothers recorded as single, divorced, widowed, or separated). I first describe overall trends in out-of-relation births, then examine patterns for first births specifically, and finally compare adverse birth outcomes across the two categories.

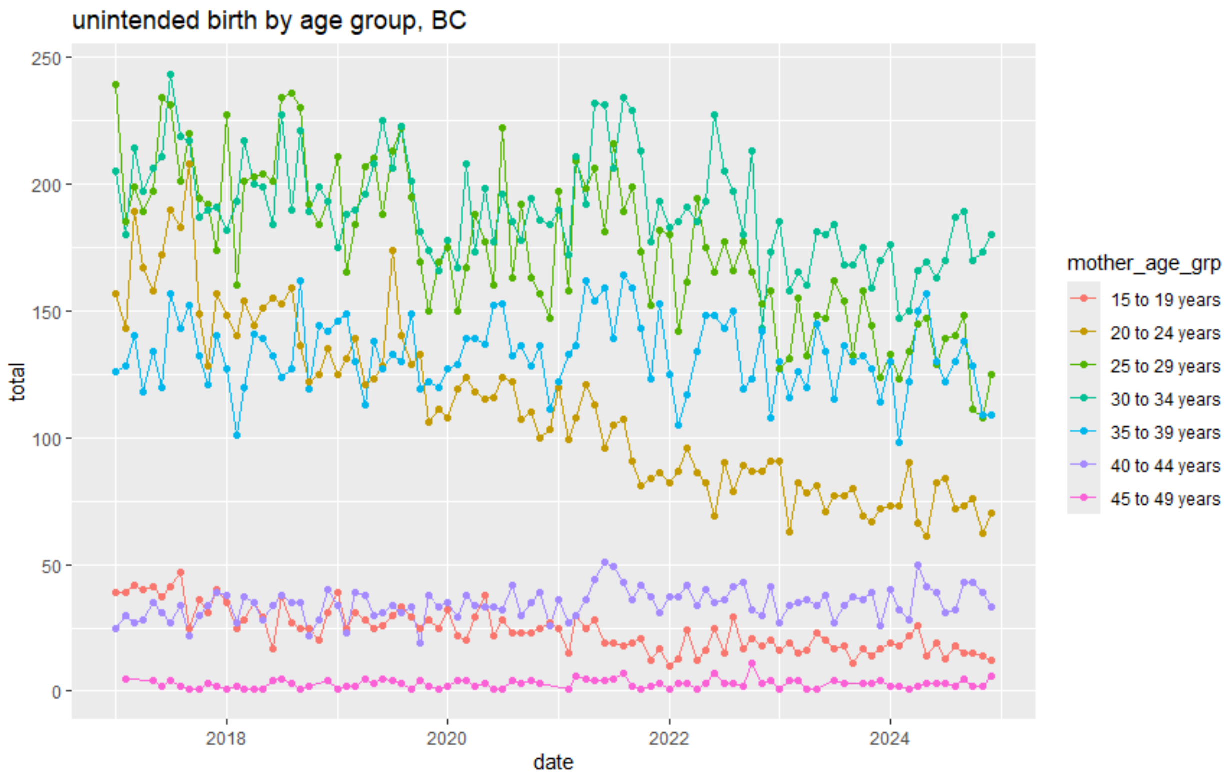


*Figure 12: Out-of-relation births by mother's age group at the BC level, between 2017 and 2024.*

Figure 12 shows the time trends for monthly out-of-relation birth events in the observed period for the province of British Columbia. For adolescents, the monthly births were low and stable before the pandemic. I observe an acceleration in further decline in monthly births in this cohort starting in mid-2021.

Among younger mothers in the 20 to 24 years age group, out-of-relation births continue to decline over time, dropping from on average 150 births per month in 2017 to below 75 births per month by the end of 2024. Despite consistently trending downwards, I observe a temporary bump in the first half of 2021, which coincides with the closure and re-opening period in 2020. Another significant age group is the 40 to 44 years group. The out-of-relation births among this cohort are usually stable around 20 to 30 births per month. However, I observe an almost 100% increase in monthly births in the first half of 2021, reaching its peak of over 50 births per month in the second quarter of 2021. The bump persists and the monthly births remain above pre-COVID level for the remainder of the observation period.

Other younger age groups, specifically the 25 to 29 years, the 30 to 34 years, and the 35 to 39 years groups, all have an observable increase in monthly births in 2021. The oldest age group, the 45 to 49 years group, shows a minor and temporary increase in 2021.

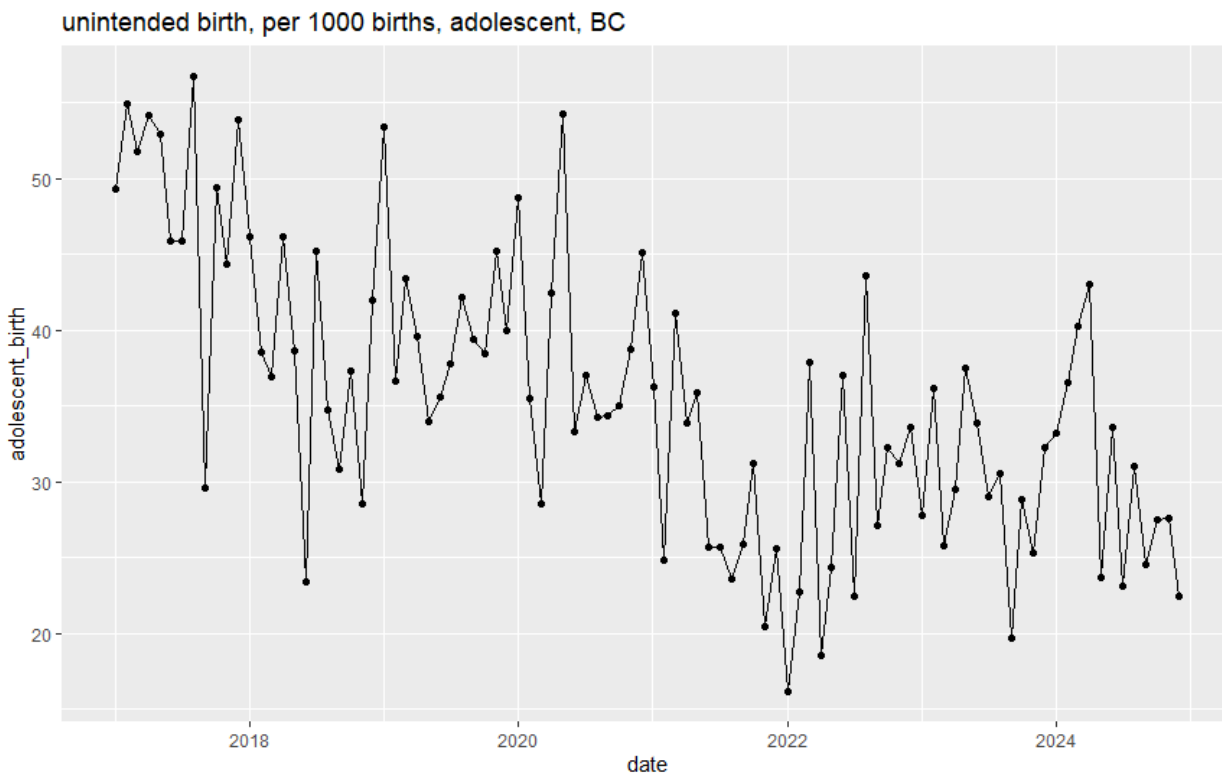


*Figure 13: Out-of-relation birth rates among adolescent mothers in BC, between 2017 and 2024.*

Among adolescent mothers across British Columbia, Ontario, and Quebec, I observe a decline in out-of-relation birth rates over the observation period (Figure 13). The levels differ across provinces. Ontario sits highest, British Columbia in the middle, and Quebec the lowest throughout. The decline is most pronounced in British Columbia, where the rate roughly halves. Ontario and Quebec fall by less. The decline slows toward the end of the period in all three.

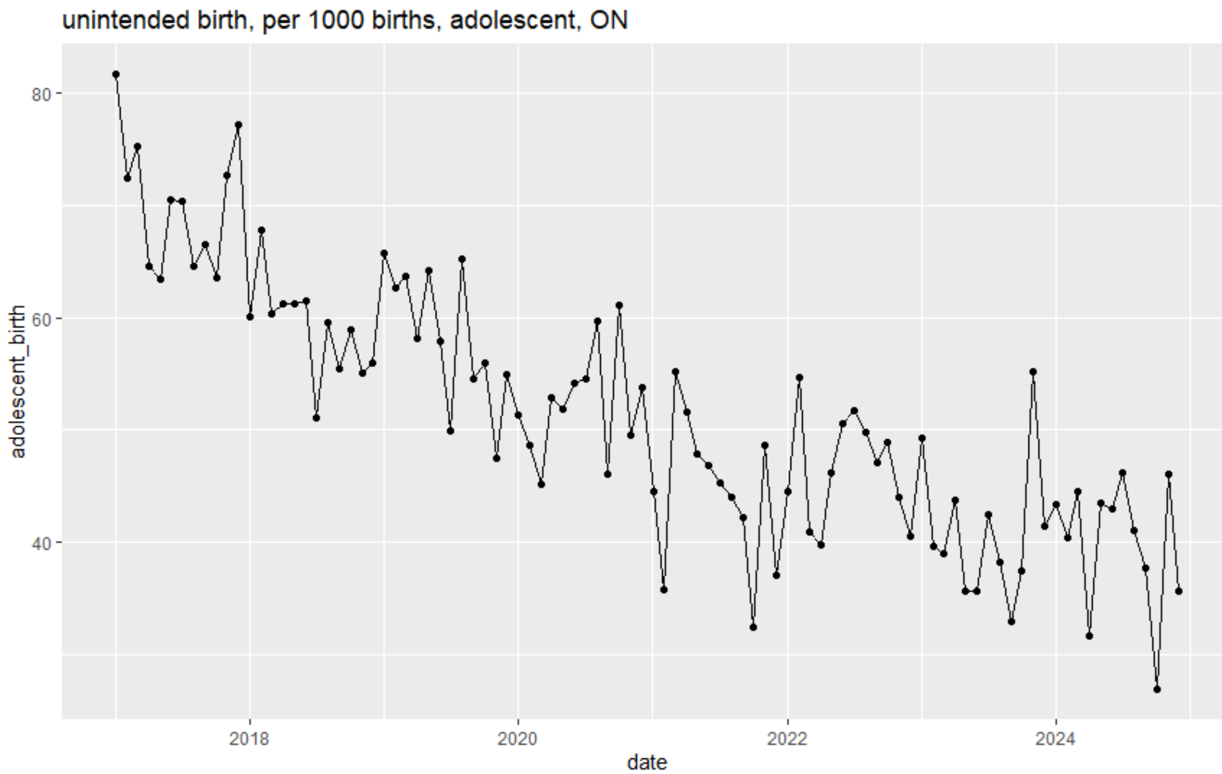


*Figure 14: Out-of-relation birth rates among adolescent mothers in Ontario, between 2017 and 2024.*

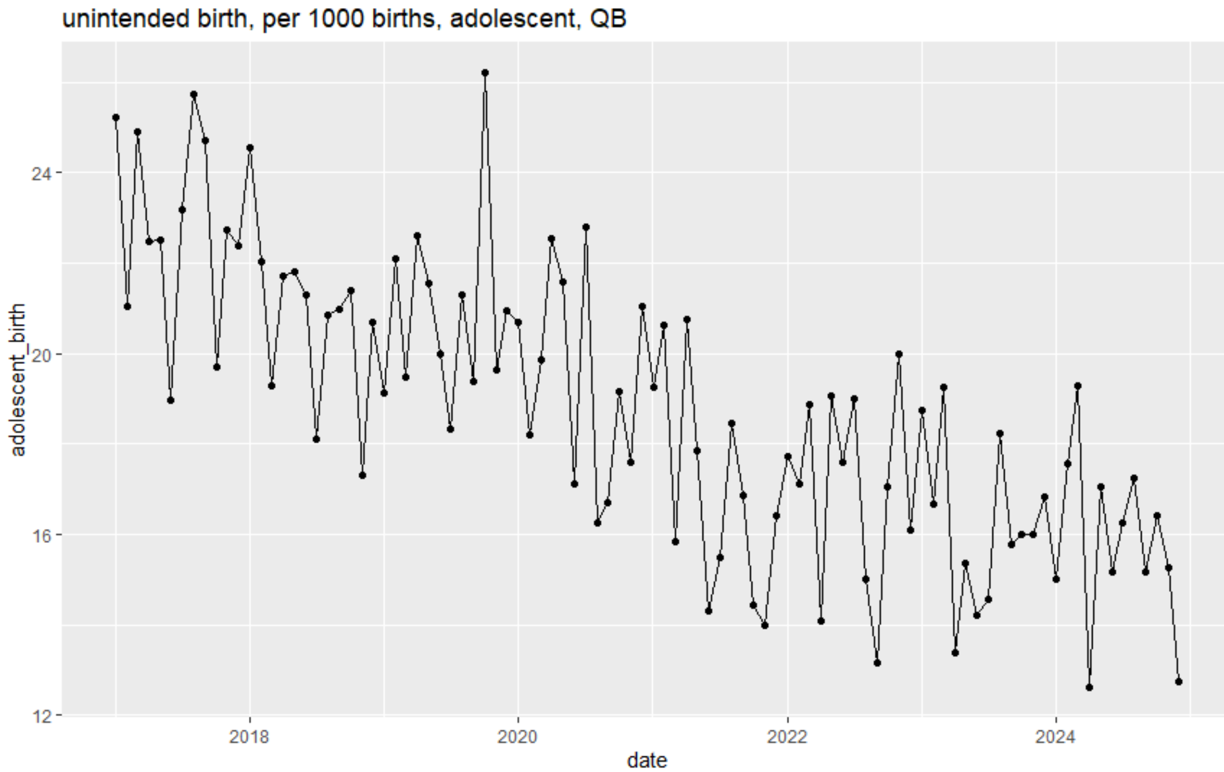


*Figure 15: Out-of-relation birth rates among adolescent mothers in Quebec, between 2017 and 2024.*

## First births by in-relation vs out-of-relation

I examine first births separately because they may be more sensitive to changes in partnership formation and fertility timing during the pandemic. Figure 16 shows trends in first births classified as out-of-relation by maternal age group.

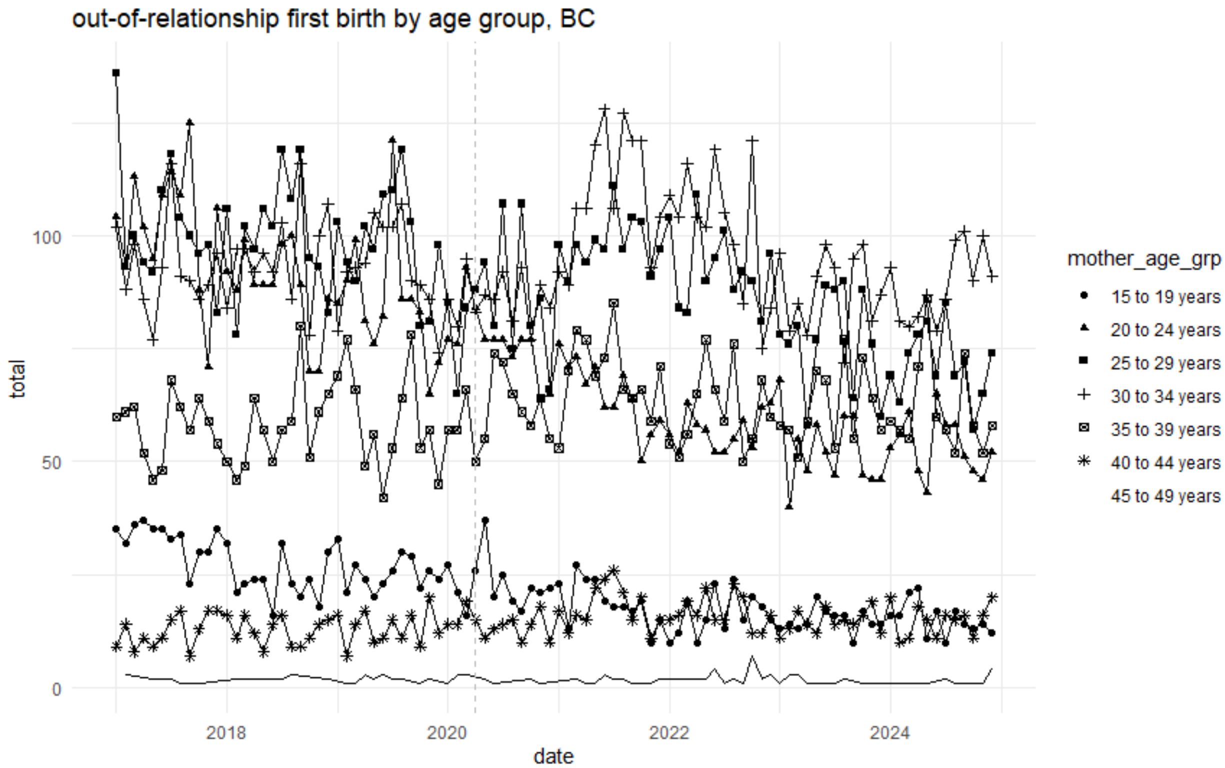


*Figure 16: Out-of-relation first birth by mother's age groups in BC, between 2017 and 2024.*

## Comparison across BC, Ontario, and Quebec

First births follow the same cross-province pattern as out-of-relation births overall. Out-of-relation first-birth rates fall in all 3 provinces over the period. Quebec continues to decline, while British Columbia and Ontario level off after 2022.

### Adverse outcome by relation status

The descriptive series do not show a clear adverse-outcome pattern among out-of-relation first births. I test birth weight and gestational age by relation status in the regression analysis, which provides the controlled comparison.

## Adolescent Births

An adolescent birth is a birth given by a mother whose age ranges between 15 and 19. During the COVID-19 pandemic, I do not observe any significant deviation from the norms in terms of adverse birth outcomes. Specifically, the incidence rates for LBW and HBW births did not change at the national level, despite larger incidence rates among adolescent births compared to the national mean. The mean incidence rate of LBW and HBW births among adolescent mothers is 16% (90 vs 77 per 1,000 births) and 30% (17 vs 13 per 1,000 births) higher than the national mean, respectively.

However, the provincial means indicate that the mean weight of adolescent births in British Columbia sees a larger decline over the observation time frame compared to other provinces (Figure 17).

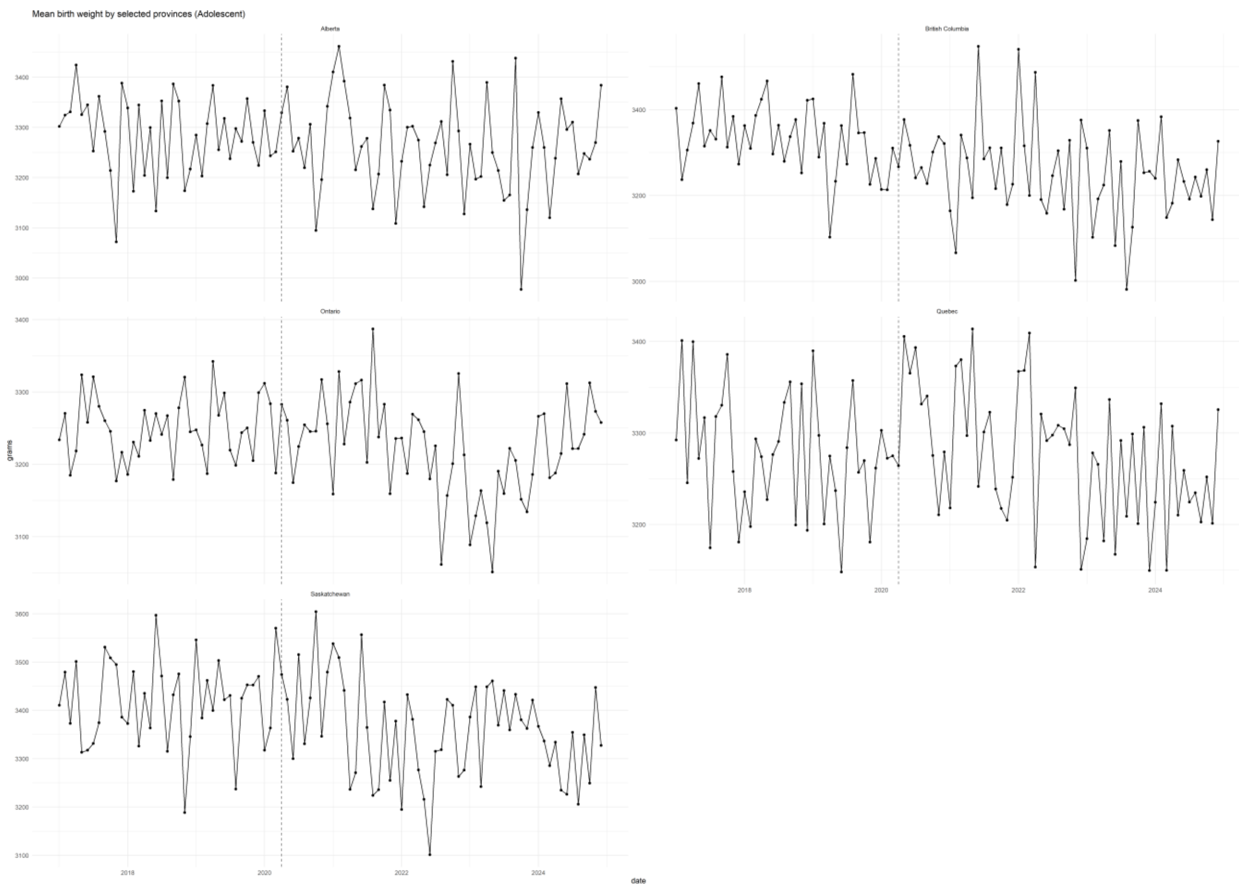


*Figure 17: Mean monthly birth weights by selected provinces among adolescent mothers, between 2017 and 2024. Territories excluded.*

The adolescent birth incidence rate has been on decline over the years (Figure 18). In the CVSB data, I observe both the historical trend of decline since the beginning of my observation window and the temporary jump in December 2020. I also find that the historical trend reaches a plateau stage beginning in 2022, with the monthly incidence rates staying at 12.5 per 1,000 births.

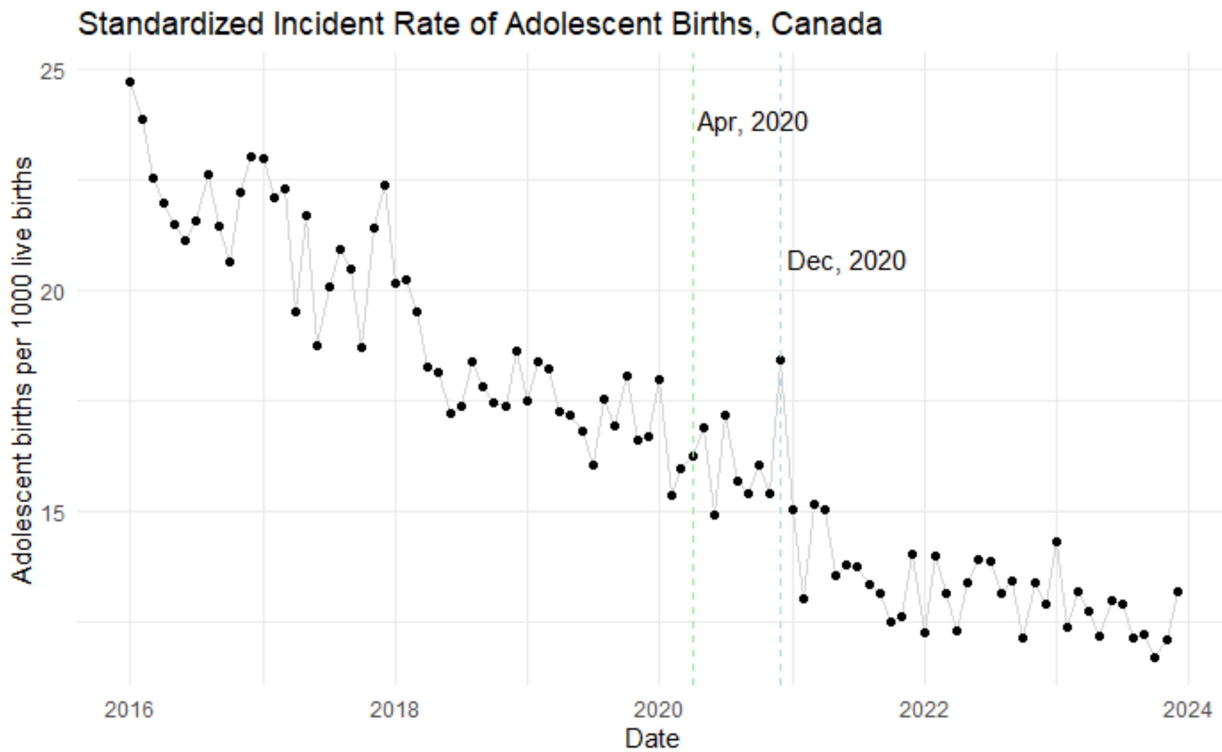


*Figure 18: Adolescent birth rates at the national level, between 2017 and 2024. Territories excluded.*

# DISCUSSION

This paper documents several changes in Canadian fertility patterns during the COVID-19 pandemic using the universe of births from 2016 to 2024. The findings contribute to the growing literature on fertility responses to the pandemic by examining not only changes in fertility levels but also shifts in the composition of births, such as who had children, under what circumstances, and with what birth outcomes. Several themes emerge from the results that merit further discussions.

## Access to medically assisted reproduction (MAR) for advanced age mothers

The descriptive results reveal a sharp decline in fertility among women over 35 approximately nine months after the initial public health order in March 2020, followed by a pronounced rebound in 2021. This pattern is consistent with the temporary suspension of medically assisted reproduction (MAR) services during the first wave of the pandemic. Lam et al. (2022) also observe an uptick in MAR attainment in 2021, and the present findings extend this observation to population-level fertility outcomes. The rebound is largest in Ontario, where a publicly funded MAR program is available, and more muted in British Columbia, which did not have such a program during the observation period. This provincial variation suggests that publicly funded fertility care may moderate the impact of health-system disruptions on fertility timing among advanced age groups.

These findings also align with the broader literature on access to medically assisted reproduction care during the pandemic (Lam et al., 2022). The near-complete suspension of IVF and related services in early 2020 created a supply-side constraint on fertility that is distinctive from the demand-side mechanisms emphasized in much of the pandemic fertility literature. For women approaching the upper age limits of publicly funded programs, typically age 44, even a temporary disruption may have had permanent consequences for lifetime fertility. The differential provincial responses suggest that the design of public MAR coverage has implications for fertility resilience during health-system shocks.

## Age-specific responses to pandemic policy

The panel regression results indicate that fertility among women aged 25 to 34 is positively associated with the overall COVID-19 Stringency Index and the public health measures sub-index relative to the historical downward trend. In contrast, fertility among women aged 15 to 19 and 20 to 24 shows no statistically significant association with pandemic measures. One possible explanation is that fertility at younger ages is more often unplanned and therefore less responsive to deliberate fertility decisions shaped by policy conditions. Another is that younger women face offsetting forces during the pandemic: reduced in-person social interaction may lower conception risk, while reduced access to contraceptive services may increase it.

The descriptive trends reinforce this age gradient. Seasonal variation also appears most pronounced among women aged 25 to 39, a pattern consistent with research linking stronger fertility seasonality to higher socio-economic status, more education, stable relationships, and higher parity (Bobak & Gjonca, 2001; Dahlberg & Andersson, 2018).

For women aged 40 to 49, I observe a mild but positive trend in fertility rates across all regressions specifications. This aligns with the previously observed incline in public data and reports. This pattern is consistent with several possible explanations, including better access to artificial insemination technologies in the observation period (Austin & Apold, 2023), more stable career and income among advanced age mothers (Salonen et al., 2024), and pandemic-induced shifts in fertility intentions (Golovina et al., 2025; Gordon, 2021). These advanced age fertility increases, while small in absolute magnitude, contribute to the ongoing shift in the age distribution of fertility toward later ages, a trend that the pandemic appears to accelerate rather than reverse.

Vaccination requirements, in contrast, show no measurable association with fertility across any age group. This null result is noteworthy given public discourse linking vaccines to fertility concerns and suggests that such concerns do not translate into detectable changes in aggregate fertility behaviour. Still, the vaccination sub-index carries little variation independent of the broader stringency measures, so this null reflects limited identifying power rather than evidence of no effect.

## Adverse birth outcomes

The early-term birth rate rises about 7% above its pre-COVID average in the months after the public health orders. This shift sits in the early-term window, 37 to 38 completed weeks, not below 37 weeks. Figure 9 shows that preterm incidence, births under 37 completed weeks, has no sustained rise over the same period. It stays close to its pre-COVID average across the pandemic years. The gestational shift is therefore concentrated in the early-term window and is not a rise in true preterm birth. The pattern points to the health system rather than to maternal stress. As I discuss below, a shift toward earlier scheduled delivery during the pandemic moves births into the early-term window. Maternal stress is a well-established risk factor for true preterm birth (Lilliecreutz et al., 2016). The absence of any sustained rise in preterm incidence is consistent with a delivery-timing mechanism rather than a stress-driven increase in preterm birth.

The decline in late-term births after the implementation of public health orders presents an apparent paradox. Maternal stress has been linked to longer gestation and a higher risk of post-term birth (Margerison-Zilko et al., 2015), so a population-level stressor might be expected to push gestations longer, not shorter. One possible explanation is that an increased number of mothers choose C-section and labour induction during the pandemic to avoid prolonged exposure to a risky healthcare environment and to secure access to limited healthcare resources (Public Health Agency of Canada, 2025). This interpretation is consistent with the documented peak in both C-sections and inductions in the March 2021 to February 2022 period, followed by a return toward pre-pandemic levels.

The post-term birth pattern shows a temporary decline followed by a recovery. In the two years following the implementation of the public health orders, post-term incidence rates drop from about 3.1 to roughly 2.5 per 1,000 births, a decline of about 20%, likely reflecting the same shift toward scheduled deliveries. However, in 2022 and 2023, post-term rates recover to about 3.4 per 1,000 births, slightly exceeding pre-pandemic levels.

One candidate explanation for the later recovery is economic stress. Worsening economic conditions, such as higher inflation, stagnating real wages, and the persistent housing crisis, do not disappear along with the public health orders. The termination of federal pandemic income support programs in May 2022 may have compounded these pressures, particularly for lower-income households that had relied on these transfers as a financial buffer. If such pressures raised maternal stress, the stress-gestation link would predict a rise in post-term births. The data offer only weak support for this channel. The overshoot in 2022 and 2023 is small, and the recovery is also consistent with a simpler account, in which the health-system factors that suppress post-term births in 2020 and 2021 recede and rates return toward their pre-pandemic baseline. I therefore treat the economic-stress pathway as a possibility that the descriptive evidence does not clearly distinguish from this baseline return.

## Birth weight and fetal growth

The birth weight results point to a broad downward shift in the birth weight distribution over the pandemic. Low birth weight incidence rises by approximately 9% by 2023, high birth weight incidence falls by 7%, 15%, and 23% across 2021 to 2023, and normal weight births remain largely unchanged, while mean birth weight declines across regions. Rather than a change concentrated in a single tail, these patterns together suggest a gradual compression and leftward movement of the distribution, with fewer of the heaviest newborns and more of the lightest.

The regression results in Table 5 help clarify the likely pathway. The share of a pregnancy spent under lockdown conditions is negatively associated with birth weight, but this association becomes statistically insignificant once gestational age is included as a control (column 2). A parallel pattern appears in Table 6, where a longer share of pregnancy spent in lockdown is associated with shorter gestational length. Read together, these results are consistent with the interpretation that lockdown exposure lowers birth weight primarily by shortening gestation, rather than by restricting intrauterine growth at a given gestational age. This points to gestational length as the channel, consistent with the shift in delivery timing discussed above.

The results also reveal a reversal between the lockdown and post-lockdown periods. Births occurring during the lockdown period are, on average, heavier and more likely to be large-for-gestational-age (LGA), whereas births in the post-lockdown period are lighter and more likely to be small-for-gestational-age (SGA) (Tables 5 and 6). One possible explanation is that the condition of lockdown, including more time at home and altered diet and activity, increased gestational weight gain and thereby favoured higher birth weight. This is consistent with evidence that lockdown raised maternal antenatal weight gain and neonatal macrosomia (Raischer et al., 2023) and with the increase in mean birth weight observed internationally during the pandemic (Yao et al., 2023). The lighter and more growth-restricted profile that follows reflects the accumulation of economic pressure, sustained stress, and disrupted prenatal care as the lockdown period lengthened.

Finally, the birth weight patterns connect to the compositional changes documented in the next section. Out-of-relation births in the post-lockdown period are significantly heavier and more likely to be large-for-gestational-age (Tables 5 and 6), even though out-of-relation births are otherwise associated with less favourable outcomes. This apparent tension is consistent with the shift in the composition of out-of-relation births toward advanced age mothers, whose pregnancies carry a higher risk of large-for-gestational-age outcomes (Huang et al., 2025; Kenny et al., 2013). In this sense, part of the measured birth weight response to the pandemic may reflect not a change in outcomes for a fixed population, but a change in who is giving birth outside of a recorded partnership.

This compositional interpretation is consistent with evidence that maternal-age gradients in birth outcomes partly reflect the characteristics of women who delay childbearing rather than age alone (Goisis et al., 2017).

Overall, the birth outcome findings suggest three overlapping pathways. First, a health-system pathway shifts the timing of deliveries through induction and scheduled C-section. This raises early-term incidence and lowers late-term incidence. Second, a stress and economic pathway may shorten gestation and contribute to the lighter, more growth-restricted profile in the post-lockdown period. The link between maternal stress and true preterm birth is well established in the literature, though the descriptive evidence in Figure 9 shows no rise in preterm incidence. Third, a compositional pathway reshapes the observed distribution of outcomes as the mix of women giving birth changes.

## Changing composition of births

The analysis of births by partnership context reveals significant shifts in who has children during the pandemic. Among first-time mothers, out-of-relation births decline among younger age groups, consistent with the broader decline in casual sexual activity documented during the pandemic (Delcea et al., 2021; Gleason et al., 2021), while out-of-relation first births among women over 40 increase substantially, in some cases nearly doubling relative to pre-pandemic levels.

The adolescent patterns are particularly informative. Out-of-relation birth rates among adolescents halve during the pandemic and plateau at low levels. The temporary increase in December 2020 places these conceptions around the onset of the first school closures in spring 2020, not a later reopening. The overall decline aligns broadly with Vandermorris et al. (2024), who document a decline in adolescent pregnancy rates in Ontario during the pandemic, and with Gleason et al. (2021), who find that casual sexual activity declines sharply after the onset of the pandemic. The fact that adolescent birth rates do not return to their pre-pandemic trajectory even after schools fully reopen suggests a more persistent shift in adolescent fertility behaviour, possibly reflecting lasting changes in school interaction patterns or contraceptive use.

Taken together, these findings suggest that the pandemic affects Canadian fertility through multiple overlapping channels rather than through any single dominant effect. Supply-side disruptions to reproductive healthcare, demand-side shifts in fertility intentions, and compositional changes in who has children each leave a distinct mark on the data. The same pressures extend to infant health, through a stress pathway that shortens gestation and lowers birth weight, as well as a health-system pathway that reshapes the timing of delivery. The heterogeneity of these responses across age groups, partnership contexts, and provinces underscores the importance of institutional context, including the design of publicly funded fertility care, in shaping fertility resilience during large-scale health and economic shocks.

# LIMITATIONS AND FUTURE RESEARCH

This study has several limitations. First, the CVSB does not directly record pregnancy intention, and marital status in the birth dataset is only an imperfect proxy for partnership context at birth. Because reporting practices for common-law unions differ across provinces, measures based on marital status are not fully comparable across jurisdictions and should not be interpreted as direct measures of intended versus unintended fertility.

Second, age-specific fertility rates are constructed using monthly female population denominators derived from 2016 and 2021 Census counts. These denominators are obtained by linear interpolation between census years and linear extrapolation beyond 2021 using the same age-group-specific trend. If actual population dynamics differed from this assumption, the resulting fertility rates may be measured with error.

Third, the regression analysis is observational and should not be interpreted as establishing definitive causal effects of pandemic policies on fertility behaviour. Provincial policy stringency may reflect broader epidemiological, institutional, and economic conditions that also influenced fertility decisions.

Fourth, the birth weight analysis treats the lockdown period as a single national window, from April 2020 to August 2022, rather than through the monthly COVID-19 Stringency Index used in the fertility models. This binary definition captures the broad before, during, and after shift. But it assigns every province the same timing and intensity, when provincial responses varied a great deal. Linking the monthly index to each birth, weighted over the relevant gestation window, would allow a dose-response estimate in place of an on-and-off indicator. I expect the refinement to be modest, given the small magnitude of the estimated birth weight effects and the inclusion of a control for the share of each pregnancy that overlapped with the lockdown period, but I was not able to test this directly within the scope of the current study.

In addition, the analysis is conducted at the provincial level, which provides stable monthly birth counts but may mask within-province heterogeneity in fertility patterns. The exclusion of Yukon, Nunavut, and the Northwest Territories further means that the findings apply primarily to the provinces.

Future research could strengthen this analysis by linking birth records to individual-level administrative data on income, employment, and healthcare use, which would allow a more direct assessment of socioeconomic selection into fertility during the pandemic. Additional work could also examine whether the observed changes in fertility patterns and birth composition had longer-term consequences for maternal and child outcomes.

# CONCLUSION

This paper documents how Canadian fertility changed during the COVID-19 pandemic, across both the number of births and the characteristics of the children born. Taken together, the results point away from the simple baby boom or bust that early commentary anticipated. The pandemic instead operates through several overlapping channels. Disruptions to medically assisted reproduction first depress births among advanced age women and then give way to a rebound, concentrated where fertility care is publicly funded. Shifts in the conditions of pregnancy and mounting economic pressure reshape infant health, raising birth weight during lockdown, lowering it afterward, and leaving early-term birth elevated. Changes in who gives birth, by age and by partnership context, alter the composition of the birth cohort itself.

The common thread is heterogeneity. Responses vary across age groups, partnership contexts, and provinces, which means aggregate fertility figures conceal offsetting movements beneath them. The pattern also points to the role of institutional context. That the advanced age mother rebound concentrates in provinces with publicly funded fertility care suggests policy design shapes how households can act on their intentions once services resume. For a cohort whose size and composition are both reshaped by the pandemic, these differences carry forward into the long-term socioeconomic profile of the children born in this period, and they offer a guide to where fertility proves most and least resilient when the next large-scale shock arrives.

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# APPENDIX

## Birth Weight Robustness Checks

The individual-level birth weight results in Tables 5 and 6 rely on two modelling choices worth probing: a single national time trend, and a particular set of maternal and birth controls. This section reports robustness checks on both. The estimates of interest, the during-lockdown and post-lockdown coefficients, are stable across every specification, which suggests the main findings are not artefacts of these choices.

Table A1 addresses the trend assumption. The baseline models in Table 5 include one national linear trend, which assumes provinces share a common underlying path in birth weight over the sample period. Because birth weight trends may differ across provinces, I re-estimate the log birth weight models with province-specific linear trends, interacting the month-since-start variable with province. Columns 1 and 3 reproduce the Table 5 specifications, and columns 2 and 4 add the province-specific trends. The lockdown coefficients change little in either the base or the gestation-controlled models. The during-lockdown estimate moves from 0.0039 to 0.0044 in the base specification, and the post-lockdown estimate from negative 0.0057 to negative 0.0050, with no change in sign or significance. I therefore retain the more parsimonious national trend in the main text.

*Table A1: Birth Weight: Robustness to Province-Specific Trends*

| | (1)<br>Log BW<br>base | (2)<br>Log BW<br>+ prov.trend | (3)<br>Log BW<br>+ gestation | (4)<br>Log BW<br>+ gest. & prov.trend |
|---|---|---|---|---|
| During lockdown | 0.0039 † | 0.0044* | 0.0055*** | 0.0051*** |
| | (0.0020) | (0.0020) | (0.0014) | (0.0014) |
| Post-lockdown | -0.0057** | -0.0050* | -0.0073*** | -0.0079*** |
| | (0.0021) | (0.0021) | (0.0014) | (0.0014) |

| | | | | |
|---|---|---|---|---|
| Share of pregnancy in lockdown | -0.0022*** | -0.0022** | 0.0003 | 0.0003 |
| | (0.0006) | (0.0006) | (0.0004) | (0.0004) |
| Out-of-relation x lockdown | 0.0017** | 0.0016* | -0.0002 | 0.0001 |
| | (0.0007) | (0.0007) | (0.0005) | (0.0005) |
| Out-of-relation x post-lockdown | 0.0050*** | 0.0048*** | 0.0036*** | 0.0042*** |
| | (0.0007) | (0.0007) | (0.0005) | (0.0005) |
| Control | | | | |
| Mother age, parity, plurality | Yes | Yes | Yes | Yes |
| Relationship status | Yes | Yes | Yes | Yes |
| Province & birth-month FE | Yes | Yes | Yes | Yes |
| National linear trend | Yes | Yes | Yes | Yes |
| Province-specific trends | No | Yes | No | Yes |
| Gestational duration | No | No | Yes | Yes |
| N | 2,886,653 | 2,886,653 | 2,886,315 | 2,886,315 |
| $R^2$ | 0.098 | 0.099 | 0.571 | 0.571 |

*Notes: All columns include mother's age (quadratic), parity, plurality, relationship status, province and birth-month fixed effects, and a national linear trend. *** p<0.001, ** p<0.01, * p<0.05, † p<0.10. Unclustered SEs. Sample 2017–2024.*

Table A2 examines whether the results depend on the set of controls or on the composition of births. Column 1 repeats the Table 5 baseline. Column 2 adds an indicator for infant sex, which raises the model fit, as expected given that male infants are heavier on average, but leaves the lockdown coefficients essentially unchanged. Columns 3 and 4 allow the maternal and partnership effects to vary more flexibly. Column 3 adds an interaction between birth parity and mother's age, which lets the birth weight gap between first and later births differ across the maternal age distribution. Column 4 adds further interactions of relationship status with both mother's age and birth parity. These richer specifications do not change the lockdown estimates: the during-lockdown coefficient stays near 0.0035 to 0.0039, and the post-lockdown coefficient near negative 0.0068 to negative 0.0075, in line with the baseline.

*Table A2: Birth Weight: Composition and Sensitivity*

| | (1)<br>Log BW<br>Baseline | (2)<br>Log BW<br>+ infant sex | (3)<br>Log BW<br>+ parity x age | (4)<br>Log BW<br>+ parity & rel. interactions |
|---|---|---|---|---|
| During lockdown | 0.0039 † | 0.0040* | 0.0035† | 0.0038† |
| | (0.0020) | (0.0020) | (0.0020) | (0.0020) |
| Post-lockdown | -0.0057** | -0.0057** | -0.0075*** | -0.0068*** |
| | (0.0021) | (0.0020) | (0.0021) | (0.0021) |

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Share of pregnancy in lockdown | -0.0022*** | -0.0022*** | -0.0022*** | -0.0022*** |
| | (0.0006) | (0.0006) | (0.0006) | (0.0006) |
| Out-of-relation x lockdown | 0.0017** | 0.0017* | 0.0018** | 0.0015* |
| | (0.0007) | (0.0007) | (0.0007) | (0.0007) |
| Out-of-relation x post-lockdown | 0.0050*** | 0.0050*** | 0.0050*** | 0.0045*** |
| | (0.0007) | (0.0007) | (0.0007) | (0.0007) |
| Control | | | | |
| Mother age, parity, plurality | Yes | Yes | Yes | Yes |
| Relationship status | Yes | Yes | Yes | Yes |
| Province & birth-month FE | Yes | Yes | Yes | Yes |
| National linear trend | Yes | Yes | Yes | Yes |
| Infant sex | No | Yes | No | No |
| Parity x age interaction | No | No | Yes | Yes |
| Relationship interactions | No | No | No | Yes |
| N | 2,886,653 | 2,886,653 | 2,886,653 | 2,886,653 |
| $R^2$ | 0.098 | 0.104 | 0.099 | 0.099 |

**** p<0.001 ** p<0.01 * p<0.05 † p<0.10. Standard errors (unclustered) in parentheses. Col (1) reproduces the Table 5 baseline. Col (2) adds an infant-sex control. Col (3) adds an interaction of birth parity with mother's age; col (4) adds further interactions of relationship status with mother's age and with birth parity. All models use the full sample; none restricts to first births. The during- and post-lockdown coefficients are stable across all specifications. Sample: live births to mothers aged 15–49 in Canadian provinces, 2017–2024; Yukon, NWT, and Nunavut excluded. Baseline: in-relation, pre-lockdown. Mother-age interaction rows omitted for space; they are order $10^{-5}$ and unchanged across columns.*

## Birth Tourism

### Data

For the supplementary analysis of birth tourism, I use the mother's place of birth and usual place of residence to construct a narrow proxy for births to non-resident foreign-born mothers. Specifically, I classify a birth as potentially associated with birth tourism when the mother's usual place of residence is outside Canada and her place of birth is also outside Canada. This measure likely understates the true incidence of birth tourism and may also include some Canadian citizens living abroad who return to Canada to give birth. The latter overstates the number of tourism births because the children are entitled to Canadian citizenship regardless of the place of birth, but the births are included in the birth tourism category. The measure should be interpreted cautiously.

## Methodology

I conduct a supplementary descriptive analysis of birth tourism using the proxy measure defined in the data section. Births are classified as potentially associated with birth tourism when the mother's usual place of residence is outside Canada and her place of birth is also outside Canada.

I use this proxy to describe changes in the frequency of births potentially associated with birth tourism over time, comparing pre-pandemic and lockdown-period patterns descriptively.

## Results

The descriptive analysis of births captured by the birth tourism proxy shows a sharp decline at the onset of the pandemic. The decline coincides with the implementation of international travel restrictions in March 2020, which reduced the volume of air travel by 98% (International Air Transport Association, 2020). After 2021, the number of births captured by the proxy begins to recover but remains below pre-pandemic level throughout the observation period.

The patterns are broadly consistent with Griffith (2023), who reports that non-resident births fell from a pre-pandemic peak of approximately 5,700 to about 2,400 in 2020 using a different definition of birth tourism. The findings here should be interpreted cautiously given the narrowness of the proxy and the measurement issues noted above.