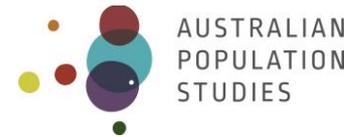

Having babies in times of uncertainty: first results of the impact of COVID-19 on the number of babies born in Australia



Edith Gray* The Australian National University

Ann Evans The Australian National University

Anna Reimondos The Australian National University

*Corresponding author. Email: Edith.Gray@anu.edu.au. Address: School of Demography, Research School of Social Sciences, The Australian National University, ACT 2601.

Paper received 29 March 2022; accepted 9 July 2022; published 25 July 2022

Abstract

Background

There has been considerable speculation on whether the COVID-19 pandemic had an effect on childbearing behaviour. Based on the experience of other social and economic disruptions, many researchers suggested that births would decline, while others argued that there could be a positive effect.

Aims

This paper considers the uncertainties associated with the impacts of COVID-19, particularly the relationship between the timing of COVID-19 events and subsequent births.

Data and methods

Publicly available birth data from birth registers, perinatal databases, and public hospital data were compiled and analysed to document changes in numbers and patterns of recorded births during 2020 and 2021.

Results

Births declined in 2020 but then rebounded in 2021. Quarterly birth data from New South Wales and Western Australia suggest that the sharpest drop in conceptions occurred in the January-March 2020 quarter. This coincided with the period when the pandemic was first taking off and when uncertainty about the future was at its highest.

Conclusions

The uncertainty associated with the onset of the COVID-19 pandemic had a noticeable impact on births in 2020. It also shows, where data is available, that this impact was relatively short-lived, and births rebounded in 2021. We note that data is still sparse for Victoria, a state which was substantially more affected by lockdowns.

Key words

Fertility; births; COVID-19; Australia.

1. Introduction

In early 2020 when news of the COVID-19 pandemic began spreading around the world there was a general consensus among demographers that this was going to have a major impact on childbearing behaviour. For people of childbearing age, COVID-19 would be the first time they would have experienced a global pandemic that caused widespread social and economic disruption. It is well known that during periods of high uncertainty and disruption, people will avoid making major life-changing decisions such as having a child (Comolli & Vignoli 2021). However, the exact nature of the impact on childbearing behaviour would remain a matter of speculation until birth data became available.

Compiling the evidence to demonstrate what effect the pandemic would have on births takes time. A recorded birth involves, an average pregnancy of 40 weeks between conception and birth, then several months or sometimes years, before birth records data are collated and distributed to statistical agencies. This translates to a lag of at least a year before being able to observe the impact of the pandemic on the number of births.

Before birth data were available, researchers tried novel ways to predict the impact of the pandemic on births, including analysing Google search trends for terms related to pregnancies and newborns (Wilde et al. 2020). More traditional methods such as asking people directly about their future fertility intentions, and if they had changed their fertility intentions because of the pandemic, were also employed (Emery & Koops 2022; Luppi et al. 2020; Naya et al. 2022; Qu 2021). In Australia, there were also early attempts to predict births based on claim data for items on the Medicare Benefits Schedule (MBS) related to antenatal visits (Moaven & Brown 2021).

Birth record data from 2020, and for some states and territories for 2021, is now becoming available in Australia. According to the Australian Bureau of Statistics *Births, Australia* report (2021) in 2020 there were 294,369 registered births, representing a 3.7% decline from 2019. This represents a record low total fertility rate of 1.58 for 2020 (ABS 2021). While most of these births would have been conceived before the pandemic, births in the later part of 2020 would have been conceived during the early stages of the pandemic. The lower number of registered births in 2020 has been attributed to the effect of the pandemic on the number of births themselves, but also on delays in birth registration (ABS 2021).

In this paper, we use recorded births from states and territories from 2018 to 2021 to analyse the early impact of COVID-19 on the pattern of births. We argue that the impact of the pandemic on childbearing decisions and on subsequent number of births, can be divided into two periods. The first period occurred during the early part of 2020 and represented the period of highest uncertainty when knowledge about the pandemic was still very limited. This period should have seen a universal fall in conceptions. The second period was marked by more diverse experiences at both the individual and state level. Depending on one's own work and family circumstances, as well as geographical location there could have been both upwards and downwards pressures on fertility, which are harder to predict.

2. Covid-19 and fertility

2.1 First stage of the pandemic: high uncertainty

The early stages of the COVID-19 pandemic led to an unprecedented level of uncertainty for much of the population in Australia, as well as around the world. Uncertainty is a ‘forward looking notion’ (Guetto et al. 2022) characterised by a lack of information regarding the future. While everything about the future is uncertain, people will generally use past experiences as well as engage in knowledge seeking to help them plan and formulate decisions. As Vignoli et al. (2020a) note in terms of decisions, the decision to have a child is one of the most important decisions people make in their lives and one that is always accompanied by a degree of fundamental uncertainty. Childless people experience the most uncertainty, or lack of information about how their future with children will be; however, parents also face uncertainty when deciding to have another child because no two children are the same (Vignoli et al. 2020b).

In periods of uncertainty, people will tend to defer making major life choices which involve long-term commitments, such as starting a family or having more children (Vignoli et al. 2020a). Increased uncertainty of daily life and lack of job security has been posited as a reason for falling fertility rates in many high-income countries in recent years (Comolli & Vignoli 2021). Additionally, there are many specific historical examples of birth rates falling in times characterised by a high level of uncertainty such as global economic recessions (Sobotka et al. 2011; Matysiak et al. 2020).

During the early months of 2020 there was limited understanding about the virus and how it was spread. People felt a lack of control of the situation and their own lives, and there was also a real fear for the future and a sense of threat for the well-being of oneself and one’s family (Maison, et al 2021). As more information was accumulated about the virus and public health safety measures started being imposed, the level of uncertainty decreased. Uncertainty is commonly associated with anxiety, worry, and psychological distress (Afifi et al. 2012; Sweeny et al. 2015). Repeated cross-sectional as well as longitudinal studies from overseas that tracked mental health during the different stages of the pandemic confirm that poor mental health and anxiety was highest in the first few months of March and April but then, on average recovered (Aknin et al. 2021; Daly & Robinson 2021, 2022). In Australia, a longitudinal survey of mental health conducted during three periods between May and October 2020 also found that anxiety and depressive symptoms were highest in the earliest period of May 2020 (O’Donnell et al. 2022).

2.2 Second stage of the pandemic: adaptation and diverse experiences

The timeline in Table 1 shows that the first few months of 2020 were the ones where uncertainty was at its highest. This uncertainty would have impacted most of the population, although the impact is correlated to personality traits and level of media consumption (Mertens et al. 2020). As the pandemic progressed, people’s experiences became more diverse and would have varied based on their geographic location, due to different state restrictions, and their personal situations. Some people may have decided that prolonged delays or reductions in their childbearing plans were unsustainable or unnecessary (Lindberg et al. 2021, p. 8). For some, the pandemic meant the loss of a job or reduced work hours, whereas for others their work hours may have increased. Large parts of the workforce were able to transition to working from home, whereas this was not possible in all

sectors. Working from home may have been a positive experience increasing work-life balance for some, or it may have been a stressful experience (Yerkes et al. 2020). Similarly, depending on the age and number of children at home, some parents had to navigate home schooling. This diversity of experience makes it particularly difficult to ascribe definitive ‘effects’ of the pandemic.

Table 1: Timeline of COVID-19 related events, January 2020 to March 2021

Period	Dates	Events
Jan-Mar 2020	January 11	China reports first death
	January 13	Thailand reports first case outside China
	January 23	Lockdown of Wuhan
	January 24	First European case confirmed in France
	January 25	First confirmed case in Australia
	Feb 11	Officially named coronavirus disease 2019 or COVID-19 by WHO
	March 1	First COVID-19 death in Australia
	March 2	First case of community transmission in Australia
	March 8	Italy placed under quarantine measures
	March 11	WHO declares a pandemic
	March 10	Australia records its hundredth case
	March 12	Prime Minister announces first economic stimulus package
	March 15	NSW Government cancels events of more than 500 people
	March 18	Federal government announced several measures such as social distancing (1.5 meters) and limitation on size of gatherings to be implemented by state governments.
	March 19	Australian borders closed to non-residents/citizens
Apr-Jun 2020	March 23	National cabinet agrees pubs, gyms, cinemas, restaurants and cafes to close (except for delivery)
	March 27	All returning residents required to spend two weeks in supervised quarantine
	April 15	JobKeeper payment legislation to support out-of-work Australians is passed
	April 26	COVIDSafe app, designed to help with contact tracing, is released by the Federal Government
	April 20	Peak of first wave
	May 10	NSW government announces easing of some restrictions
Jul-Sep 2020	May 11	Victoria Government announces easing of some restrictions
	June 30	Victoria announces lockdown in several postcodes
	July 7	Victoria in lockdown
Oct-Dec 2020	July 10	Victoria suggests people wear masks outside (not mandated)
	August 16	Victoria announces new lockdown measures including overnight curfew
Jan-Mar 2021	October 26	Victoria’s second lockdown ends
	December 19	NSW imposes lockdown order in Northern beaches
Jan-Mar 2021	January 9	Lockdown ends for Sydney northern beaches
	February 12-18	Victoria goes into snap lockdown.
	February 22	Phase 1a vaccination rollout targeting 678,000 aged care and frontline health workers.
	March 22	Phase 1b vaccination rollout targeting 6 million Australians.

Table 2 outlines a number of potential upwards and downwards pressures on childbearing that the COVID-19 outbreak could have had in high-income countries. An increase in births could result from a variety of reasons including more shared time at home and reassessment of priorities. For example, working from home could encourage a re-evaluation of work-life balance and reduce postponement of having a child, or partners could have more opportunities for intimacy and sexual relations. On the other hand, increased relationship conflict and fewer opportunities to socialise outside the home could reduce sexual intercourse. Economic changes could also impact on childbearing decisions. For example, some families may have been able to increase their savings, whereas others suffered a loss of income. Reduced access to contraception and abortion services may lead to increased conceptions, whereas reduced access to assisted reproductive technology (ART) during lockdowns would decrease births.

Table 2: Potential upwards and downwards pressures on fertility due to the pandemic

Influence	Effect on fertility
Job loss and reduced work hours leading to lower opportunity cost of having children	Positive
Less access to contraceptives and abortion clinics	Positive
More time spent at home with partners leading to a strengthening of relationships and increased intimacy and frequency of sexual intercourse	Positive
Increased gender equity in the home as men become more involved in household tasks	Positive
Working from home increasing work-life balance	Positive
Re-evaluation of life priorities and reduction in postponement	Positive
Job losses and reduced working hours leading to loss of income and less ability to afford children	Negative
More time spent at home with partners leading to higher relationship tension or domestic violence	Negative
Decreased access to assisted-reproduction technology	Negative
Reduced ability to socialise outside the home leading to lower levels of dating or new relationship formation	Negative
Lockdowns and travel restrictions reducing ability to access informal childcare and social support	Negative
Increased stress due to home-schooling or home-childcare	Negative
Health concerns about COVID-19 and pregnancy as well as visitation restrictions in hospitals	Negative
Uncertainty about economic and societal future	Negative
Worsening mental health	Negative

Source: Adapted from Berrington et al. (2020) and Aasve et al. (2021)

3. Data and methods

3.1 Data

Birth record data is now available in Australia for 2020 and 2021, allowing us to see what impact the early stages of the pandemic had on the number of births. For each state and territory we sourced publicly available data from birth registers, public health departments, as well as using data prepared by the Australian Institute for Health and Welfare (AIHW) and Australian Bureau of Statistics (ABS). There are three main sources of birth data: (1) registered births as counted by each state/territory's registrar of Births, Deaths and Marriages, (2) births recorded in each state/territory's perinatal data collection, (3) health department data on births in the public health system. Each source of data is briefly outlined below.

Birth registrations

The registration of a birth in Australia follows a two-step process involving notification by a hospital, followed by registration by the parent(s). Each state and territory in Australia has legislation requiring the responsible person, usually the chief executive of a hospital, a doctor or midwife, to notify the Registrar of Births, Deaths and Marriages of the birth of a child within a certain time frame. The time frame varies by jurisdiction. For example, in New South Wales it is within 21 days after the birth, whereas in Queensland it is after two working days (Victorian Law Reform Commission 2013). The parents are then provided with a birth registration form which must be signed and submitted to the Registrar within a certain time period. In most jurisdictions, the parent(s) have 60 days to register the birth, except the ACT where they have 6 months (ACT Legislation Register 2014).

Data on number of births sourced from the state and territory registers are subject to delays which impacts on its usefulness in assessing trends over short periods of time. These delays may be due to parents not registering births within the required time frame, as well as processing delays by the Registrar offices. For example, the ABS (2021) notes that processing delays following the second COVID-19 wave in Victoria led to lower numbers of birth registrations being processed and reported in December 2020. Similarly, in NSW a backlog of birth registrations was processed in 2018 leading to an unusually high number of births being reported for 2018 compared to 2017 and 2019 (ABS 2021).

Perinatal data

The other major source of data on births in Australia is the perinatal data collection. When a birth occurs, a midwife or attending health professional collects information about the maternal characteristics, birth and neonatal outcomes and forwards this to the relevant health department and this forms the basis of the state/territory's perinatal dataset. Perinatal data is usually collected and reported for the purpose of monitoring public health rather than measuring fertility (Wilson 2017).

Public hospital data

In an effort to provide greater accountability on the performance of their public hospitals, a number of states and territories also publish regular reports outlining key metrics on the quality and effectiveness of their public health systems, including measures such as average waiting times at

Emergency Departments. In some cases, the number of babies born in public hospitals is also reported. In Australia, 96.7% of women give birth in hospitals, and most of those do so in public hospitals (AIHW 2022a), so data on births in public hospitals encompasses a large proportion of all births. For example, in New South Wales in 2019, 73% of all women giving birth did so in a public hospital, and in 2020 this was largely unchanged at 74% (AIHW 2022a).

Individual state/territory data and national datasets

While each state/territory has its own vital statistics registrar, and its own perinatal data collection, they vary in their approach to making this data publicly available. For example, every month the Registry of Births Deaths and Marriages Victoria publishes how many births were registered in the previous month. In some other states no such data is published in a timely manner.

However, for both registry and perinatal data all states/territories forward this to the Australian Bureau of Statistics (ABS) and the Australian Institute of Health and Welfare (AIHW), respectively. These organisations then collate the data into national datasets. Each state and territory registrar provides birth register data electronically to the ABS on a monthly basis. The ABS then publishes these data on a preliminary basis five to six months after the reference period in its National, State and Territory Population report, and publishes a revised version 21 months after the end of the financial year (ABS 2021). Registered birth data are also published around a year after the reference year in the Births, Australia publication which is the main source also of fertility estimates such as the Total Fertility Rate.

Similarly, perinatal data from each state/territory is collated into the National Perinatal Data Collection by the AIHW (AIHW 2022b). These data are published in the AIHW Mothers and Babies report two years after the reference period. For example, the *Mothers and Babies* report published in 2022 refers to births that occurred in 2020.

2.2 Methods

For each state and territory we compiled annual data on number of births recorded from 2018-2021, or the latest available year, using this time-series to examine the impact of COVID-19. We then used quarterly data from New South Wales and Western Australia, as these are available up to and including the first quarter of 2022, to examine in more detail how the number of conceptions and subsequent births changed during the early stages of the pandemic. It is important to note that these data relate to live births but they contain no information on the characteristics of mothers. It is therefore not possible to calculate additional indicators such as age-specific fertility rates or the total fertility rate.

3. Results

Table 3 shows the number of births reported in 2018 to 2021 or the latest available year for each state/territory based on different sources. For each source of data the table indicates whether the information is from perinatal data or public hospital data (based on year of occurrence), or registry data (based on year of registration).

Table 3: Number of births by year, state and data source, 2019-2021

State/ Territory	Data source	Type	No. of births				Change in births (%)		
			2018	2019	2020	2021	2018-19	2019-20	2020-21
NSW	AIHW (2020,2021,2022a)	Occurrence-Perinatal	94,942	95,096	92,539		0.2	-2.7	
	ABS (2021)	Registration	105,463	96,909	93,579		-8.1	-3.4	
	ABS (2022)	Registration	98,626	98,678	94,822	101,333	0.1	-3.9	6.9
	NSW Health (2022)	Occurrence-Perinatal	95,552	95,133	92,541		-0.4	-2.8	
	NSW, Bureau of Health Information (2022)	Occurrence-Public hosp.	72,497	72,123	70,252	74,185	-0.5	-2.6	5.6
VIC	Births, Deaths and Marriages Victoria (2022)	Registration	79,726	79,597	74,620	76,410	-0.2	-6.3	2.4
	Births, Deaths and Marriages Vic (2022)*	Registration	79,726	79,597	75,018	76,822	-0.2	-5.8	2.4
	CCOPMM (2022)+	Occurrence-Perinatal	78,521	78,954	76,990		0.5	-2.5	
	AIHW (2020,2021,2022a)	Occurrence-Perinatal	78,233	79,344	77,380 ^P		1.4	-2.5	
	ABS (2021)	Registration	78,488	77,220	73,543		-1.6	-4.8	
	ABS (2022)	Registration	77,512	77,052	72,159	75,365	-0.6	-6.4	4.4
QLD	Queensland Government (2022)	Registration	62,248	62,184	59,914	64,673	-0.1	-3.7	7.9
	Queensland Health (2021)	Occurrence-Perinatal	60,503	60,443	59,603		-0.1	-1.4	
	AIHW (2020,2021,2022a)	Occurrence-Perinatal	60,120	60,431	59,584		0.5	-1.4	
	ABS (2021)	Registration	61,931	61,735	59,490		-0.3	-3.6	
	ABS (2022)	Registration	61,076	61,054	59,297	64,112	-0.03	-2.9	8.2
WA	Department of Justice (2022)	Registration	33,459	33,754	32,677	34,300	0.9	-3.2	5.0
	Department of Health (2022)	Occurrence-Perinatal	33,204	33,147	32,027	34,476	-0.2	-3.4	7.6
	AIHW (2020,2021,2022a)	Occurrence-Perinatal	33,204	33,368	32,255		0.5	-3.3	
	ABS (2021)	Registration	33,257	33,539	32,426		0.8	-3.3	
	ABS (2022)	Registration	33,442	33,427	32,563	34,039	0.0	-2.6	4.5
SA	AIHW (2020,2020,2022a)	Occurrence-Perinatal	19,199	19,173	18,738		-0.1	-2.3	
	ABS (2021)	Registration	19,113	19,490	18,526		2.0	-4.9	
	ABS (2022)	Registration	18,968	18,957	18,450	19,757	-0.1	-2.7	7.1
TAS	Tasmanian Government (2022)	Registration	5,570	5,835	5,850	6,365	4.8	0.3	8.8
	AIHW (2020,2021,2022a)	Occurrence-Perinatal	5,480	5,736	5,637		4.7	-1.7	
	ABS (2021)	Registration	5,547	5,741	5,780		3.5	0.7	
	ABS (2022)	Registration	5,412	5,648	5,606	6,044	4.4	-0.7	7.8

Table 3 continued

State/ Territory	Data source	Type	No. of births				Change in births (%)		
			2018	2019	2020	2021	2018-19	2019-20	2020-21
ACT	AIHW (2020,2021,2022a)	Occurrence- Perinatal	5,994	6,314	6,147		5.3	-2.6	
	ABS (2021)	Registration	5,374	5,520	5,368		2.7	-2.8	
	ABS (2022)	Registration	5,300	5,522	5,240	5,543	4.2	-5.1	5.8
	ACT Health (2022)	Occurrence- Public hosp.	5,055	5,151	5,110	5,293	1.9	-0.8	3.6
NT	AIHW (2020,2021,2022a)	Occurrence -Perinatal	3,730	3,592	3,688		-3.7	2.7	
	ABS (2021)	Registration	4,050	3,658	3,752		-9.7	2.6	
	ABS (2022)	Registration	3,763	3,595	3,690	3,785	-4.5	2.6	2.3

Note: + Data refer to adjusted live births and excludes terminations of pregnancy for congenital anomalies or for maternal psychosocial indications. P Data for Victoria in 2021 published by AIHW (2022a) is preliminary and may be subject to revision. * Discrepancy in Victorian registration data when registered births by month are summed compared to their data annual data.

For New South Wales (NSW), the trend for 2018-2019 differs substantially across the sources. AIHW and ABS population estimates suggest a small increase in births between 2018 and 2019, whereas ABS (2021) births data based on registered births shows a substantial decline. This is due to a substantial backlog of births being processed by the NSW register in 2018 (ABS 2021). For 2019-2020, there is a decline of between -2.6% to -3.9% in births. Both birth register data and public hospital data suggest a rebound in 2021 of 6.9 to 5.6% respectively.

For Victoria (VIC), between 2018 and 2019 according to most sources there was a small trend downwards. The drop in births in Victoria in 2020, was between -2.5% and -6.4% depending on the source. The largest drops are those recorded for registered births so this indicates that it may be due in large part to delays in registration due to the Victorian lockdowns. In 2020-2021 registered births increased between 2.4% to 4.4%.

For Queensland (QLD), again we see a small trend downwards in the number of births between 2018 and 2019, followed by a decline between 2019-2020 of between -1.4% and -3.7%. However registered births in 2021 increased by 7.9-8.2%. Western Australia (WA) data suggests that births may have been increasing already between 2018-19, but 2020 saw a decline of between -2.6% to -3.4%. Register and midwife data shows a rebound of 4.5% to 7.6% in 2021.

For South Australia (SA), the decline in 2020 is estimated at -2.7% to -4.9%, again followed by a rebound. For the smaller States and Territories, the pattern is less clear. Tasmanian (TAS) and Australian Capital Territory (ACT) both had increasing births in 2019. For Tasmania, the birth registration data as provided by the Tasmanian Government suggests that births continued to increase in 2020, however, at a slower pace. In 2021, registered births increased by 7.8-8.8%. The Australian Capital Territory registered declines of -0.5% to -5.1% in 2020, whereas in the Northern Territory (NT), births increased in 2020.

To better understand how patterns of childbearing decision making may have changed across the different stages of the pandemic, we use quarterly birth data. Figure 1 presents the actual estimated quarterly conceptions (leading to births) for NSW and WA. NSW data come from the NSW Bureau of

Health Information, which publishes quarterly data regarding babies born in NSW public hospitals using admitted patient data. The latest available quarter is January-March 2022 quarter. Western Australia data come from the Midwives Notification System as published by the Department of Health WA. The number of conceptions leading to live births are based on backdating births. For example, conceptions in January-March lead to births in October-December of that year. The data is indexed on the first quarter available for each state.

While quarterly data is also available for registered births, we prefer to use perinatal and public hospital data due to the registration delays in the register data which may lead to an inaccurate portrayal of the trends over time (Wilson 2017). With register data we are unable to tell if a decline in registered births in one quarter is due to a decline in births, or to decline in registrations (for example due to lockdowns). With the perinatal data and public hospital data which record births at time of occurrence, we have more confidence that any temporal trends observed represent actual trends in the number of births.

Both states display a similar pattern. Conceptions in 2019 were generally lower than conceptions in 2018. Due to the seasonal pattern of births in Australia, births tend to be lower in December overall (Wilson, et al. 2020). However, in both the NSW public hospital data and WA perinatal data there is a distinct sharp drop in conceptions in January-March 2020. Following this, there is an increase in conceptions.

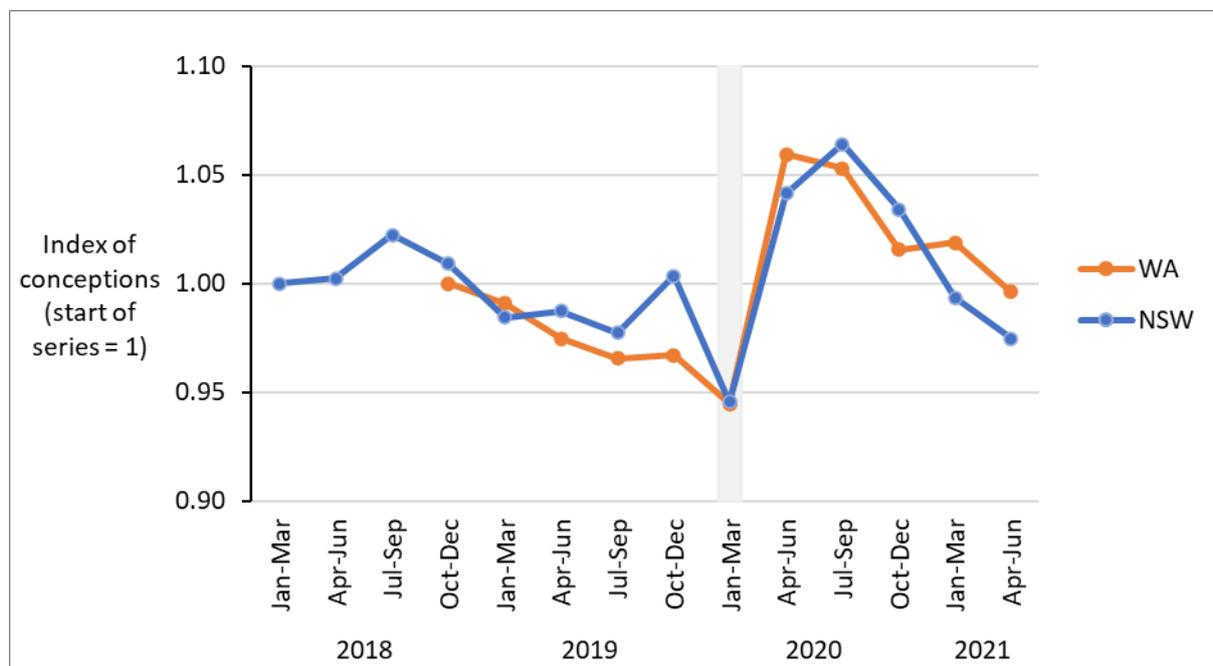


Figure 1: Conceptions by quarter, NSW and WA, 2018-2021

Source: NSW Bureau of Health Information 2022, WA Department of Health 2022

4. Discussion

In 2020, the number of babies born in Australia dropped significantly compared to 2019 in nearly every state and territory. This pattern can be seen across a number of different sources of data, including birth registrations as well as perinatal data and public hospital data. While the number of births had been trending downward in recent years, 2020 was a clear disjunction. While most of the births in 2020 would have been conceived in pre-pandemic times, babies born in the last few months of 2020 would have been conceived in the early months of 2020.

Our analysis of quarterly data available for New South Wales and Western Australia, confirms that the large drop in 2020 can be attributed in particular to a reduction of births in the last quarter of 2020. In 2021, the data indicated a significant recuperation starting as early as the first quarter of 2021. Based on the literature on uncertainty and fertility, as well as evidence from surveys tracking the pattern of mental health during the pandemic, we suggest that the drop in births in the October-December quarter of 2020, corresponding to conceptions in January-March 2020 was related to the unprecedented uncertainty about the future that people felt during this time. As more became known about the virus, the immediate level of anxiety lessened and childbearing plans were revisited again.

While we suggest that the decline in the number of births in 2020 was due to the uncertainty of the early stages of the pandemic, another possibility could be that there were fewer women to give birth in the population at that time due to a decline in immigration.

Every quarter the ABS publishes estimates of the resident population of Australia. Estimates for 2019 to 2021 have recently been rebased based on the 2021 Census of the population. At 30th June 2019, there were an estimated 6.026 million women aged 15-49 in Australia. By 30th June 2020, this had increased slightly to 6.048, and a year later it had fallen to 5.977 (ABS 2022). However, there were large differences in female population numbers by age group as well as by state. In particular, the number of women aged 20-24 age is estimated to have declined from 846,908 in 2019 to 786,274 in 2021.

The early 20s is a key age for students and travellers to migrate temporarily to Australia for study or work. While the estimated resident population numbers exclude overseas visitors who are in Australia for less than 12 months over a 16-month period, many young people on temporary visas for studying or working holidays stay for 12 months or longer. So the decline in the number of women in this age group could perhaps be explained by the travel restrictions preventing the usual temporary migration of young women. Women on temporary visas have relatively low fertility rates (McDonald 2021) therefore we do not believe that the drop in births in 2020 was due to any large degree to fewer women in the population.

While the focus on this paper has been on number of births, it is important to understand how fertility measures such as Total Fertility Rate (TFR) may have been affected by changes in the number of births as well as the number of women, or the population at risk of giving birth. The Total Fertility Rate is calculated by the Australian Bureau of Statistics and is reported by calendar year (ABS 2021) as well as by financial year (ABS 2022). The most recently published TFR of 1.58 for 2020 was calculated by the Australian Bureau of Statistics using registered births and the estimated number of

resident women projected in 2020 based on the 2016 Census. If the TFR was calculated using the same number of registered births but using the more recently available estimates of resident women rebased on 2021 Census the TFR is slightly higher at around 1.59.

In any average year, the TFR of Australia can be thought of as being slightly underestimated due to the fact that included in the denominator is young women on extended temporary visits to Australia for work or study. With some of this population removed due to the pandemic, this had a small effect on increasing the TFR. This effect can also be observed to some degree by comparing the TFR of calendar and financial years. In most years the calendar year TFR and the financial year TFR are closely aligned and in pre-pandemic years they followed the same trend. However, while the calendar year TFR for 2020 was 1.58 (ABS 2021), the TFR for 2019-20 (covering 1st July 2019 to 30th June 2020), which would include babies conceived pre-pandemic was 1.62 (ABS 2022). The TFR for 2020-21, which would be primarily babies conceived after the pandemic began, was higher at 1.63 (ABS 2022). This is likely because the 2020-21 includes both the large dip of births but then the large increase in mid-2021, and because there were fewer resident women as a result of border closures leading to a lower denominator.

5. Conclusions

Using recorded birth data from birth registers as well as perinatal and public hospital data we observe that in Australia births declined significantly in most states and territories in 2020, followed by a rebound in 2021. This pattern was found across a number of different types of birth data, and therefore not due simply to delays in registration. Analysis of public health data, and perinatal data for Western Australia and New South Wales indicates that the 2020 decline appears to have been primarily due to a significant reduction in births in the later part of the year. This corresponds to births conceived during the first stage of the pandemic. This was a period of high uncertainty when, as predicted by the literature on uncertainty and fertility, people avoided making important childbearing decisions.

As the pandemic progressed, people's experiences became more diverse and it becomes more difficult to predict the direction that fertility would take. The situation across different parts of Australia became more heterogeneous. Different states imposed lockdown orders of varying severity, and as case numbers peaked unevenly across the country, people's experiences of the pandemic, therefore, became more diverse in the later stages and depended on where they lived as well as what their job and family situation was. There are a number of possible upwards and downwards pressures that could have occurred, but based on the quarterly data available for New South Wales and Western Australia it appears that for a significant part of the population, the possible upwards pressures outweighed any negative pressures as the pandemic progressed, leading to at least a resumption in previously postponed childbearing plans.

Was the drop in births in late 2020, followed by a rebound a universal experience across Australia, as well as in other high-income countries? It is likely that the uncertainty of the first few months of the pandemic would be mediated by individual factors such as level of media consumption, personal characteristics, including traits such as intolerance of uncertainty (Mertens et al. 2020), but also by contextual factors including the response of the different state and national governments to the

pandemic. Unfortunately, apart from register data no other sources of birth record data are available yet for Victoria which arguably experienced the greatest level of disruption of all the jurisdictions as a result of the pandemic. It is possible that the pattern of conceptions and births in Victoria will reveal a different trend to that observed in New South Wales and Western Australia. For the ACT, quarterly data available up to July-September 2021 did not show a significant dip.

The pattern observed in Australia is very similar to that observed in many other countries. For example, in the United States there is a similar pattern of a sharp drop in births in late 2020, corresponding to conceptions in early 2020 (Morse 2021). Analysis of monthly birth data tracked between November 2020 and January 2021 across 22 highly developed countries by Sobotka et al. (2021) also showed a significant decline in births in most countries in the later part of 2020. However, other countries appeared not to have followed this pattern. In Europe, birth rates declined from November 2020 in Southern Europe, Austria and Belgium, but no effect was found in the Nordic countries (Aassve et al. 2021). This points to the importance of the social context in mediating the effect of pandemic uncertainty on childbearing. Countries with strong welfare systems to act as safety nets may have led to lower levels of uncertainty for their populations (Gassen et al. 2022).

While the birth data allows us to see the change in childbearing behaviour at the population level, the currently available data also does not allow us to analyse how childbearing decisions and behaviour may have changed during the pandemic for different groups of the population. We will have to wait for more data to become available, including monthly birth data, as well as survey data to understand how childbearing patterns were affected according to people's geographic location, age, parity, occupation and work experience. The current data may hide counterbalancing effects with some segments of the population more likely to have children, whereas others may have abandoned all childbearing plans.

As more data become available, it will be interesting to observe whether the widespread lockdowns experienced during the 2021 had further negative impact on births. Questions abound on whether Australia's trending decline in fertility rates will continue and how the changing nature of work, including working from home, will affect childbearing in the future.

Key messages

- Birth data from a variety of sources, including registry data, perinatal and public hospital data were analysed to see the impact of the COVID-19 on number of births.
- Births declined in 2020 but then rebounded in 2021.
- Quarterly birth data from NSW and WA suggest that January-March 2020 was the period with the sharpest drop in conceptions. This coincides with the highest period of uncertainty.

References

- Aassve, A., Cavalli, N., Mencarini, L., Plach, S., & Livi Bacci, M. (2020). The COVID-19 pandemic and human fertility. *Science*, 369(6502), 370-371. <https://doi.org/10.1126/science.abc9520>.
- Aassve, A., Cavalli, N., Mencarini, L., Plach, S., & Sanders, S. (2021). Early assessment of the relationship between the COVID-19 pandemic and births in high-income countries. *Proceedings of the National Academy of Sciences*, 118(36). <https://doi.org/10.1073/pnas.2105709118>.

- ACT Health (2022). ACT Public Health Services Quarterly Performance Report. <https://health.act.gov.au/about-our-health-system/act-public-health-services-quarterly-performance-report>
- ACT Legislation Register (2014). Births, Deaths and Marriages Registration Amendment Act 2014. ACT Government. <https://www.legislation.act.gov.au/a/2014-8/>
- Afifi, W. A., Felix, E. D., & Afifi, T. D. (2012). The impact of uncertainty and communal coping on mental health following natural disasters. *Anxiety, Stress & Coping*, 25(3), 329-347. <https://doi.org/10.1080/10615806.2011.603048>
- Aknin, L. B., De Neve, J. E., Dunn, E. W., Fancourt, D. E., Goldberg, E., Helliwell, J. F., ... & Ben Amor, Y. (2021). Mental health during the first year of the COVID-19 pandemic: A review and recommendations for moving forward. *Perspectives on Psychological Science*, 17456916211029964. <https://doi.org/10.1177/17456916211029964>
- Australian Bureau of Statistics (2021). *Births, Australia 2020*. Australian Bureau of Statistics, Canberra. <https://www.abs.gov.au/statistics/people/population/births-australia/2020>.
- Australian Bureau of Statistics (2022). *National, State and Territory Population*, December 2021. Australian Bureau of Statistics, Canberra. <https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release#states-and-territories>. Accessed 29 June 2022.
- Australian Institute of Health and Welfare (2020). *Australia's Mothers and Babies 2018 – in brief*. Data tables: Australia's mothers and babies 2018- in brief supplementary tables. Table 1.1. <https://www.aihw.gov.au/reports/mothers-babies/australias-mothers-and-babies-2018-in-brief/data>
- Australian Institute of Health and Welfare (2021). *Australia's Mothers and Babies 2019*. Data tables: National Perinatal Data Collection annual update 2019. Table 1.1. <https://www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies/data>
- Australian Institute of Health and Welfare (2022a). *Australia's Mothers and Babies 2020*. Data tables: National Perinatal Data Collection annual update 2020. Table 1.1. <https://www.aihw.gov.au/reports/mothers-babies/australias-mothers-babies/data>
- Australian Institute of Health and Welfare (2022b). National Perinatal Data Collection <https://www.aihw.gov.au/about-our-data/our-data-collections/national-perinatal-data-collection>
- Berrington, A., Ellison, J., Kuang, B., Vasireddy, S., & Kulu, H. (2021). Scenario-based fertility projections incorporating impacts of COVID-19. *Population, Space and Place*, e2546. <https://doi.org/10.1002/psp.2546>.
- Berrington, A., Ellison, J., Kuang, B., Vasireddy, S., & Kulu, H. (2022). What is the likely impact of Covid-19 on fertility in the UK?. Policy Briefing 66. ESRC Centre for Population Change. https://www.cpc.ac.uk/docs/2022_PB66_What_is_the_likely_impact_of_COVID19_on_fertility_in_the_UK.pdf.
- CCOPMM (Consultative Council on Obstetric and Paediatric Mortality and Morbidity) (2021). Victoria's Mothers Babies and Children 2020 report and presentations. Supplementary Tables- Births <https://www.safercare.vic.gov.au/publications/victorias-mothers-babies-and-children-2020-report-and-presentations>. Accessed 28 June 2022
- Comolli, C. L., & Vignoli, D. (2021). Spreading uncertainty, shrinking birth rates: A natural experiment for Italy. *European Sociological Review*. <https://doi.org/10.1093/esr/jcab001>.
- Daly, M., & Robinson, E. (2021). Psychological distress and adaptation to the COVID-19 crisis in the United States. *Journal of Psychiatric Research*, 136, 603-609. <https://doi.org/10.1016/j.jpsychires.2020.10.035>.
- Daly, M., & Robinson, E. (2022). Depression and anxiety during COVID-19. *The Lancet*, 399(10324), 518. [https://doi.org/10.1016/S0140-6736\(22\)00187-8](https://doi.org/10.1016/S0140-6736(22)00187-8)

- Department of Health, Western Australia (2022). *Mothers and Babies, Western Australia*. Summary birth data: Graphs and tables for last 3 months. <https://ww2.health.wa.gov.au/Reports-and-publications/Western-Australias-Mothers-and-Babies-summary-information>. Data extracted 01 February 2022
- Department of Justice, Western Australia. Statistics - births, deaths and marriages registered 1981-2021. <https://www.wa.gov.au/organisation/department-of-justice/the-registry-of-births-deaths-and-marriages/statistics-births-deaths-and-marriages-registered#:~:text=Statistics%20%20births%2C%20deaths%20and%20marriages%20registered%20,of%20Name%2086%2C010%20%2019%20more%20rows%20>. Accessed 2 February 2022
- Emery, T., & Koops, J. C. (2022). The impact of COVID-19 on fertility behaviour and intentions in a middle income country. *Plos One*, 17(1), e0261509. <https://doi.org/10.1371/journal.pone.0261509>.
- Gassen, N.S, Jokinen, J.C and Cuadrado, A. (2022). Marriage, Divorce, and birth trends. In Norlén, G., Randall, L., Sánchez Gassen, N., Tapia, C., Bogason, Á., Cuadrado, A., Heleniak, T., Jokinen, J.C., Karlsdóttir, A., Lundgren, A. and Moodie, J. (Eds.) *State of the Nordic Region*. Nordic Council of Ministers, Nordregio. <http://doi.org/10.6027/R2022:2.1403-2503>.
- Guetto, R., Bazzani, G., & Vignoli, D. (2022). Narratives of the future and fertility decision-making in uncertain times. An application to the COVID-19 pandemic. *Vienna Yearbook of Population Research*, 20, 1-38. <https://doi.org/10.1553/populationyearbook2022.res1.6>.
- Lindberg, L. D., Mueller, J., Kirstein, M., & VandeVusse, A. (2021). *The Continuing Impacts of the COVID-19 Pandemic in the United States: Findings from the 2021 Guttmacher Survey of Reproductive Health Experiences*. New York: Guttmacher Institute. <https://www.guttmacher.org/report/continuing-impacts-covid-19-pandemic-findings-2021-guttmacher-survey-reproductive-health>.
- Luppi, F., Arpino, B., & Rosina, A. (2020). The impact of COVID-19 on fertility plans in Italy, Germany, France, Spain, and the United Kingdom. *Demographic Research*, 43, 1399-1412. <https://doi.org/10.4054/DemRes.2020.43.47>.
- Maison, D., Jaworska, D., Adamczyk, D., & Affeltowicz, D. (2021). The challenges arising from the COVID-19 pandemic and the way people deal with them. A qualitative longitudinal study. *Plos One*, 16(10), e0258133. <https://doi.org/10.1371/journal.pone.0258133>.
- Matysiak, A., Sobotka, T., & Vignoli, D. (2020). The great recession and fertility in Europe: A sub-national analysis. *European Journal of Population*. <https://doi.org/10.1007/s10680-020-09556-y>.
- McDonald, P. (2020). A projection of Australia's future fertility rates. Centre for Population Research Paper. Canberra: Australian Government. <https://population.gov.au/research/research-fertility>.
- Mertens, G., Gerritsen, L., Duijndam, S., Saleminck, E., & Engelhard, I. M. (2020). Fear of the coronavirus (COVID-19): Predictors in an online study conducted in March 2020. *Journal of Anxiety Disorders*, 74, 102258. <https://doi.org/10.1016/j.janxdis.2020.102258>.
- Moaven, L., & Brown, J. (2021). COVID-19 "baby boom". *The Medical Journal of Australia*, 214(8), 386-386. <https://doi.org/10.5694/mja2.51010>.
- Morse, A. (2021). Fewer babies born in December and January but number started to rise in March. United States Census Bureau. <https://www.census.gov/library/stories/2021/09/united-states-births-declined-during-the-pandemic.html>
- Naya, C. H., Saxbe, D. E., & Dunton, G. F. (2021). Early effects of the COVID-19 pandemic on fertility preferences in the United States: an exploratory study. *Fertility and sterility*, 116(4), 1128-1138. <https://doi.org/10.1016/j.fertnstert.2021.05.092>.
- NSW Health (2022). *Mothers and Babies 2020*. <https://www.health.nsw.gov.au/hsnsw/Pages/mothers-and-babies-2020.aspx>. Accessed 28 June 2022
- O'Donnell, J., Cárdenas, D., Orazani, N., Evans, A., & Reynolds, K. J. (2022). The longitudinal effect of COVID-19 infections and lockdown on mental health and the protective effect of neighbourhood

- social relations. *Social Science & Medicine*, 297, 114821. <https://doi.org/10.1016/j.socscimed.2022.114821>.
- Qu, L. (2021). Report No. 4: Impacts of COVID-19 on pregnancy and fertility intentions. Australian Institute of Family Studies. <https://aifs.gov.au/publications/impacts-covid-19-pregnancy-and-fertility-intentions>.
- Queensland Government (2022). Life event Statistics. <https://www.qld.gov.au/law/births-deaths-marriages-and-divorces/data/life-event-statistics>
- Queensland Health (2021). Queensland Perinatal Statistics 2020. https://www.health.qld.gov.au/hsu/peri/peri_2020/queensland-perinatal-statistics-2020
- Satici, B., Saricali, M., Satici, S. A., & Griffiths, M. D. (2020). Intolerance of uncertainty and mental wellbeing: Serial mediation by rumination and fear of COVID-19. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-020-00305-0>
- Sobotka, T., Jasilioniene, A., Galarza, A. A., Zeman, K., Nemeth, L., & Jdanov, D. (2021). Baby bust in the wake of the COVID-19 pandemic? First results from the new STFF data series. <https://osf.io/preprints/socarxiv/mvy62/>
- Sobotka, T., Skirbekk, V., & Philipov, D. (2011). Economic recession and fertility in the developed world. *Population and Development Review*, 37(2), 267–306. <https://doi.org/10.1111/j.1728-4457.2011.00411.x>.
- Sweeny, K., Andrews, S. E., Nelson, S. K., & Robbins, M. L. (2015). Waiting for a baby: Navigating uncertainty in recollections of trying to conceive. *Social Science & Medicine*, 141, 123-132. <https://doi.org/10.1016/j.socscimed.2015.07.031>.
- Tasmanian Government (2022). Births, Deaths, and Marriage. <https://www.justice.tas.gov.au/bdm/statistics>. Retrieved 16 March 2022
- Vignoli, D., Bazzani, G., Guetto, R., Minello, A., & Pirani, E. (2020a). Uncertainty and narratives of the future: A theoretical framework for contemporary fertility. In Schoen, R (Ed.) *Analyzing Contemporary Fertility* (pp. 25-47). Springer, Cham. https://doi.org/10.1007/978-3-030-48519-1_3.
- Vignoli, D., Guetto, R., Bazzani, G., Pirani, E., & Minello, A. (2020b). A reflection on economic uncertainty and fertility in Europe: The Narrative Framework. *Genus*, 76(1), 1-27. <https://doi.org/10.1186/s41118-020-00094-3>.
- Wilde, J., Chen, W., & Lohmann, S. (2020). COVID-19 and the future of US fertility: what can we learn from Google? IZA DP No. 13776 <https://www.iza.org/publications/dp/13776/covid-19-and-the-future-of-us-fertility-what-can-we-learn-from-google>
- Wilson, T. (2017). Comparing alternative statistics on recent fertility trends in Australia. *Journal of Population Research*, 34(2), 119-133. <https://doi.org/10.1007/s12546-016-9176-x>.
- Wilson, T., McDonald, P., & Temple, J. (2020). The geographical patterns of birth seasonality in Australia. *Demographic Research*, 43, 1185-1198. <https://doi.org/10.4054/DemRes.2020.43.40>.
- Yerkes, M. A., André, S. C., Besamusca, J. W., Kruijven, P. M., Remery, C. L., van der Zwan, R., ... & Geurts, S. A. (2020). 'Intelligent' lockdown, intelligent effects? Results from a survey on gender (in)equality in paid work, the division of childcare and household work, and quality of life among parents in the Netherlands during the Covid-19 lockdown. *PloS One*, 15(11), e0242249. <https://doi.org/10.1371/journal.pone.0242249>.