The continuing decline in cohort fertility and mixed evidence of narrowing educational differences
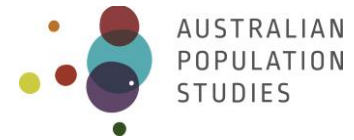
AUSTRALIAN
POPULATION
STUDIES

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Abstract

Background

Typically, women with higher levels of education have had fewer children and were more likely to be childless compared to those with lower levels of education. However, in recent years, there has been a trend of fertility convergence between education levels in several high-income countries, including Australia. New data are needed to determine whether this trend has continued and fertility remains educationally stratified among Australian women.

Aims

Using the latest available data from the 2021 Australian Census, the aim of this study is to compare the average completed fertility and number of children ever born of women born between 1952 and 1981, with a specific focus on how these metrics vary by education level.

Data and methods

Data on the number of children ever born are sourced from the 2021 Australian Census to compute population statistics (completed cohort fertility, proportion of women by parity, and parity progression ratios) for six educational categories (postgraduate, graduate, bachelor, diploma, year 12, year 11 and below) and six cohort groups (1952-56, 1957-61, 1962-66, 1967-71, 1972-76, 1977-81). These statistics are used to describe trends in fertility patterns over time and by education.

Results

Completed cohort fertility has continued to decline slowly, from 2.22 for the1952-56 birth cohorts to 1.89 for the 1977-81 birth cohorts, mostly due to an increase in childlessness and a decrease in larger families with more than two children. There has been more divergence than convergence by education level, with those with bachelor's or diploma qualifications experiencing greater declines in fertility than any other education group. Although childlessness rates by education level have converged, women with lower education have also become increasingly likely to have larger families.

Conclusions

While there is evidence of convergence in childlessness rates across different levels of education, the gap in fertility rates between education groups continue to increase in Australia.

Key words

Completed cohort fertility, fertility decline, education differentials.

1. Introduction

Australia's total fertility rate (TFR), a measure of fertility in a given year, fell to its lowest point of 1.59 in 2020 (ABS 2021), followed by a small upturn to 1.70 in 2021 (ABS 2022), and in 2022 returned to the downward trend observed prior to COVID-19, with a TFR of 1.63 (2023). Since the early 1960s (Figure 1), the TFR has shown long periods of decline, followed by shorter periods of upturns. The last peak of 2.02 was recorded in 2008. Although a widely used measure, the TFR has some limitations (Bongaarts & Feeney, 1998), as observed declines may be due to a change in the timing of having children (tempo effect) or an overall decline in the number of children born (quantum effect), or both. In Australia, like other high-income countries, there has been an increasing trend of women delaying having children to older ages, which has a negative impact on the TFR (Carmichael and McDonald 2003). When those births are realised at later ages, this can appear as an increase in the TFR.
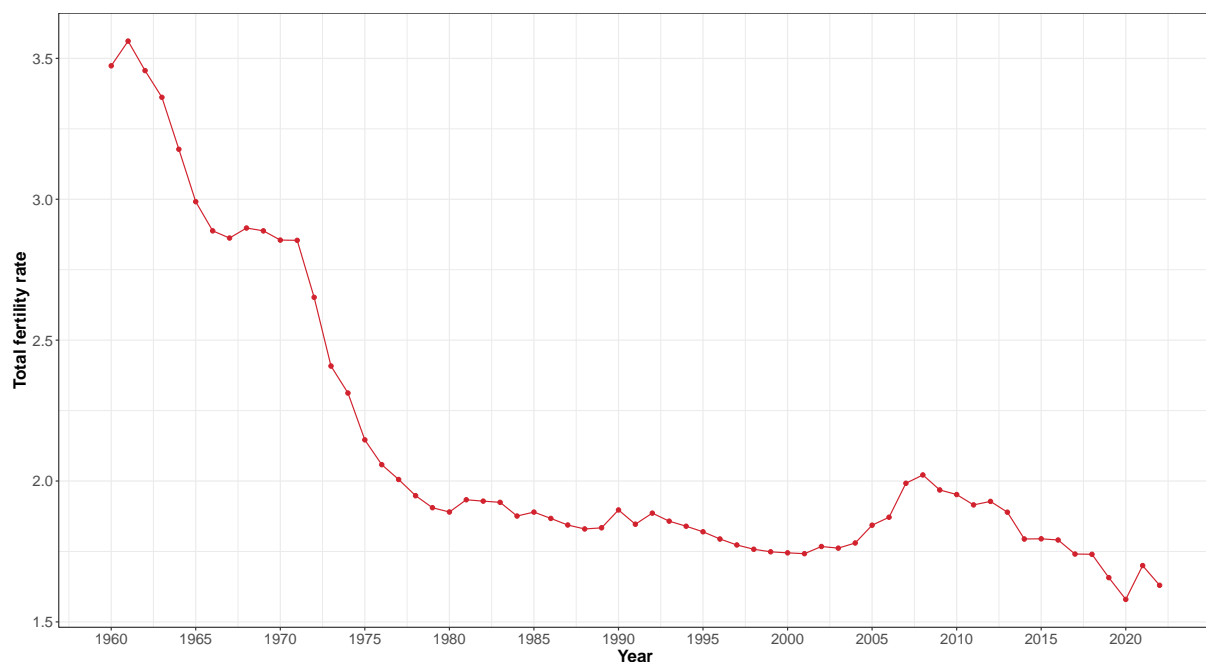

Figure 1: Total Fertility Rate, Australia, 1960-2021
Source: ABS (2022).

There are alternative measures which are useful for observing fertility delay and overall fertility, especially those that examine cohort change in the number of children born (Frejka and Calot, 2001; Wood et al. 2014). For example, completed cohort fertility (CCF) provides the distribution in the number of children born at the end of a woman's reproductive lifespan. This information can be used to assess childbearing decline (or increase) over time. Parity progression, a related method which uses the number of children born to women, assesses progression from one parity to the next, i.e., from no children to one child, from one child to two, etc. If assessed by age, a delay in childbearing can be observed between cohorts. Jain and McDonald (1997) used cohort measures to effectively show the change in fertility of Australian women born in 1932-1936 through to 1948-1952. They observed a decline in completed fertility (from 3.14 to 2.27), and the increase in having smaller numbers of children, or no children, for each successful cohort. Changes in parity have also been

discussed by Carmichael and McDonald (2003), who noted the noticeable decline in women with three, or four or more children.

Childbearing patterns are usually quite different for women with higher education in high-income countries, with fewer children born to women at higher education levels (D'Addio and D'Ercole, 2005). Using a highly disaggregated measure of education by level, Carmichael and McDonald (2003) demonstrated the negative relationship between average children ever born and education: those with no, or the lowest levels of education had the highest average number of children, and those with the highest levels of education had the fewest. As explained by Gray and Evans "women with higher levels of education tend to start childbearing later, have fewer children overall and are more likely to be childless" (2019, p.2). Higher education is associated with childbearing delay because of the time spent in education, and a prioritisation of careers and financial security following education (Ni Bhrolchain & Beaujouan, 2012). This societal expectation for women to delay starting families until after completing education has become commonplace (Blossfeld & Huinink, 1991). As a result, there is a reduced window available for having children following education and obtaining workplace experience. As reproductive capacity declines with age, delaying parenthood can contribute to having a smaller family than planned (Schmidt, et al. 2012).

Studies on women's timing of childbearing in Australia confirm that those with higher education start childbearing at later ages (Miranti, et al. 2009; Lazzari 2019; Lazzari 2021a). Further, education is also associated with completed family size. Gray and Evans (2019) showed that the widespread increase in educational attainment was strongly associated with a corresponding decrease in completed fertility. They found that completed fertility was a result of a general decline in fertility among women regardless of education, for those born between 1940 and 1965. But for women born in the late 1960s and 1970s, reductions in fertility were primarily a result of the increasing proportion of women with higher education, a finding supported by Lazzari et al. (2021a).

Despite this difference by education, a fertility convergence between education levels has recently been observed in a number of high-income countries (Adserà 2017). In the Nordic countries of Denmark, Norway and Sweden, childlessness, which was previously highest among highly-educated women (Andersson, et al. 2009), is now higher among the least-educated (Sobotka, et al. 2017; Jalovaara, et al. 2019), and differences in the educational gradient in completed fertility have 'vanished', with higher socioeconomic status being increasingly linked to higher fertility (Jalovaara et al. 2019; Kolk 2023). The generally low differences by education in the Nordic countries has typically been explained by the welfare policies that have assisted families to balance work and family (Ronsen and Skrede, 2010), but the recent increases in childlessness for the least-educated may be explained by inequality (Jalovaara, et al. 2019).

Adserà (2017) explores why inequality may be associated with low fertility among the least-educated, writing that periods of economic uncertainty in recent times are associated with a greater need for households to have two incomes. Specifically, she noted that "across the OECD countries, fertility has decreased the most among those population groups who were hit hardest by the Great Recession: namely, young adults, people with low levels of education, and migrants" (Adserà, 2017, p.71). A narrowing of educational differences in levels of childlessness over time have been also observed in the United States and Germany (Kreyenfeld and Konietzka 2017; Rybińska 2020).

It is also important to consider the number of children born by education (see Jain and McDonald 1997, Wood et al. 2014 and Brzozowska et al. 2022). In Australia, Lazzari (2021b) examined changes in fertility by education and found a convergence in childlessness by education and a widening in average completed fertility and in parity progression to three or more children. Further, Lazzari et al. (2021a) decomposed the overall change in completed cohort fertility into educational composition and education-specific fertility by the number of children for six countries. The research showed that for recent cohorts, changes to overall fertility was driven by a decline in higher-order births (three children or more) for women with the highest level of education, while there was less change by education for those with two children or fewer.

In this paper we investigate the most recently available data to compare average completed fertility and number of children born by education of the mother. We compare cohorts born from 1952 through to 1981, allowing us to determine whether completed fertility has continued to decline, and examine changes in parity distributions by education level.

2. Data and methods

The study uses 2021 Australian Census microdata obtained from TableBuilder Pro (ABS 2021) on the number of children ever born, and the educational level, of six cohorts of women born between 1952 and 1981. The cohorts were aged from 40-44 (cohort born 1977-1981) up to 65-69 (cohort born 1952-1956).

The Census asks the number of children ever born of Australians identifying as female who are aged 15 years and over. In this analysis, the information is used to calculate the following cohort measures of lifetime fertility: the completed average number of children ever born, the proportion of childless women, and the parity progression ratios to first and higher-order births.

Education is classified by the ABS using the Australian Standard Classification of Education (ASCED), which is similar, but not perfectly aligned with the International Standard Classification of Education (ISCED) (ABS 2001). The standard has eight categories as follows:

1. Year 10 or lower

2. Vocational education and training: Certificate III and IV

3. Year 11

4. Year 12

5. Vocational education and training: Diploma

6. University: Bachelor (3–4 years)

7. University: Graduate (0.5–1 year)

8. University: Postgraduate (1–5 years)

There are benefits to using a more detailed measure of education when considering changes to fertility (Gray and Evans 2019; Lazzari 2021b). For this reason, we use the education measure with a

small modification, combining categories 1 and 3 to one category of year 11 and below. This category represents a measure of incomplete high school with no other qualification obtained. Figure 2 provides the percentage distribution of education categories by birth cohort.

Women's education has seen dramatic change over the cohorts under observation. The largest change is evident for year 11 and below: in the first cohort of 1952-56, over 40% had incomplete high school education, which had reduced to 10% for the 1977-1981 cohort. The categories which increased the most over time are bachelor's degree (15% to 31%) and postgraduate degree (5% to 12%).

The following methods are applied to understand the overall decline, or otherwise, in fertility over the cohorts, followed by an analysis of fertility change by education.

1.   Comparison of average completed cohort fertility

2.   Average completed cohort fertility by education level

3.   Analysis of distribution of number of children born by education level

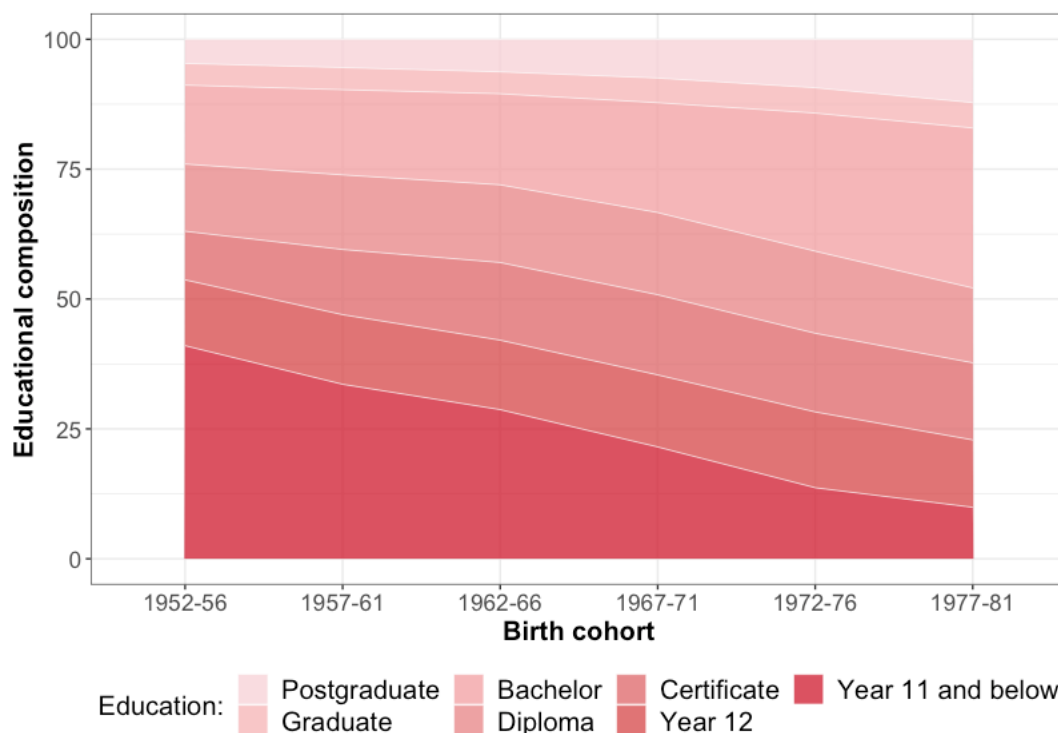4.   Parity progression ratios by education level.

Figure 2: Percentage distribution of completed education level, Australia, cohorts born 1952 to 1981
Source: authors' calculations based on 2021 Australian Census data retrieved from TableBuilder Pro.

3. Results

3.1. Comparison of completed cohort fertility

As shown in Figure 1, there has been a substantial decline in the period fertility measure of TFR, more than halving over the period from 1960 to 2021. However, when we examine completed fertility (Figure 3), the decline appears to be much smaller, indicating that declines in fertility are gradual, although they clearly trend downwards.
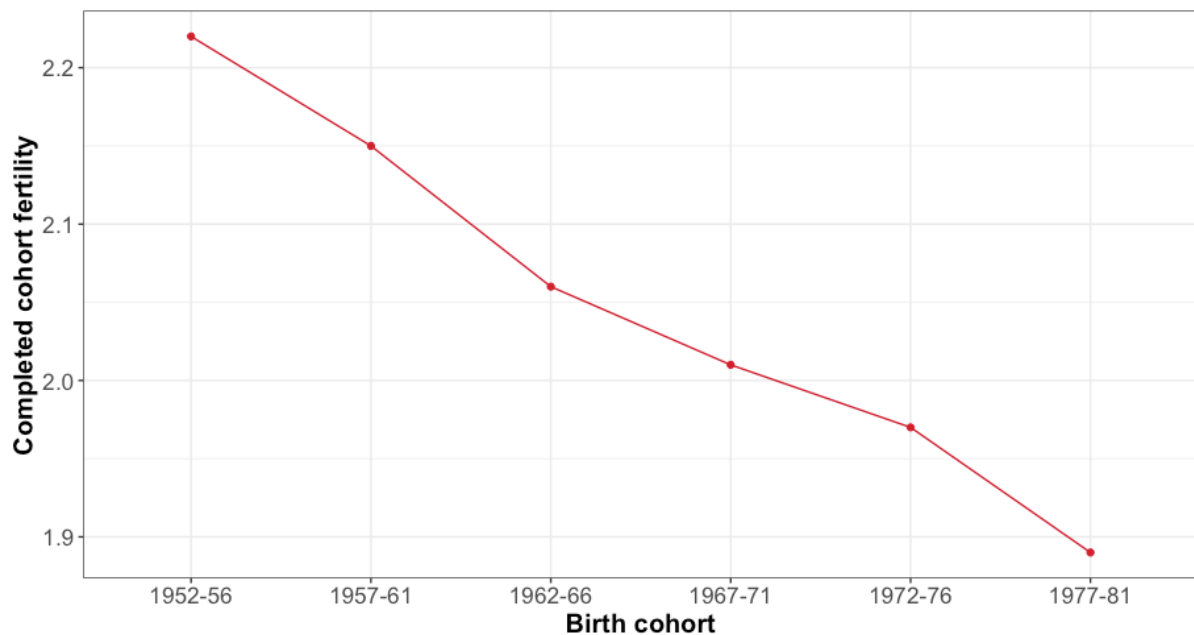

Figure 3: Average completed cohort fertility, cohorts born 1952 to 1981

Source: authors' calculations based on 2021 Australian Census data retrieved from TableBuilder Pro. *Note*: Average completed fertility figures available in Figure 5, Total column.

Completed fertility can be separated to show the distribution in number of children born by cohort. This provides more information on whether the decline in how many children women have is due to an increase in childlessness, or a decrease in larger families, or both. Figure 4 presents information on the number of children born by each cohort. In every cohort, the most common number of children is two, and this has barely changed over the generations. For the 1952-56 cohort, 39% had two children. It has hovered around that level for each generation, dropping slowly over time to just under 38% for the 1966-81 cohort (Figure 4). However, over time, there has been a shift in the number of children women are having. Specifically, the proportion of women who have no children or one child has been increasing, while the proportion of women who have three children or four or more children has been decreasing. These changes have been consistent across birth cohorts, with more women having two or fewer children and fewer women having more than two children as time goes on.

The 1952-56 cohort had a completed fertility of 2.2 children per woman, the highest of all cohorts (Figure 3). Twelve per cent of women in this cohort had no children, and a further 12% had one child (Figure 4). The cohort also had the largest percentages of three children (24%), or four or more children (14%). In comparison, the most recent cohort born in 1977-81 had a completed

fertility of 1.89 children per woman. Those with no children increased to 18%, while those with one child increased to 16%. Those with three (18%) or four or more children (9%) correspondingly declined. In sum, both increases in permanent childlessness and declines in having large families of three or more children have led to the decline in overall completed fertility by cohort.
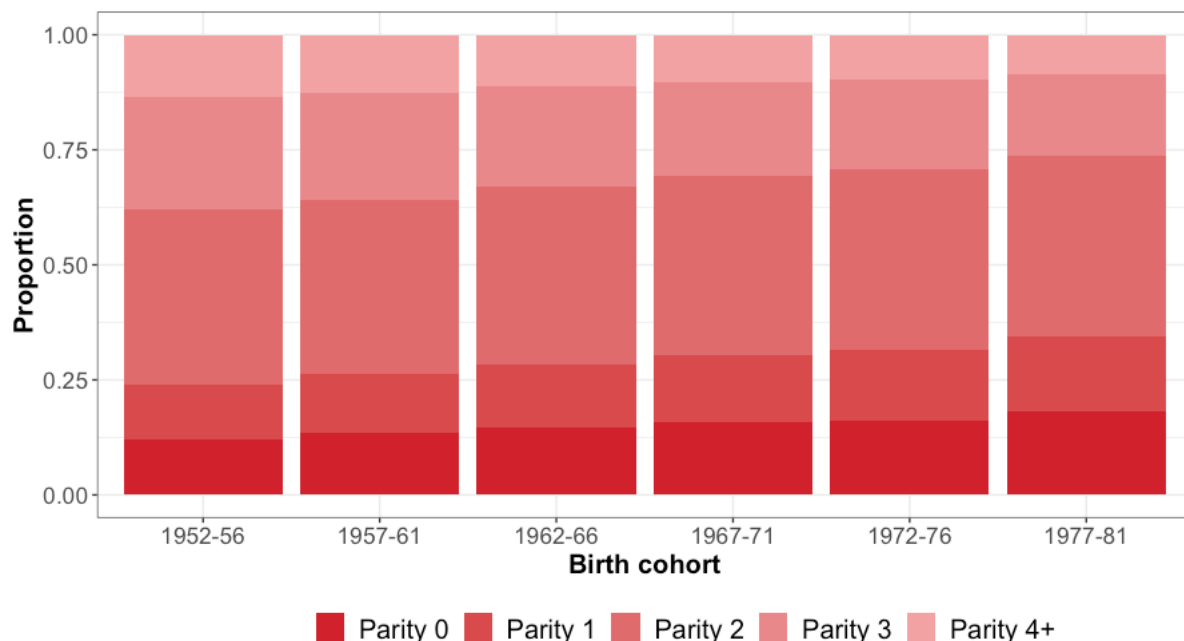

Figure 4: Percentage distribution of children ever born, cohorts born 1952 to 1981
Source: authors' calculations based on 2021 Australian Census data retrieved from TableBuilder Pro.

3.2. Completed cohort fertility by education level

As discussed, there has been a noticeable negative education gradient in completed fertility evident in Australia, where those with less education having higher fertility, and those with more education having lower fertility. But in other countries, this generally observed education gradient has disappeared, or is reducing. In recent years, these differences by education have mainly been driven by declines in fertility at lower education levels.

The results from the completed cohort fertility by highest level of educational attainment in 2021 do not show any convincing evidence of a convergence in fertility by education in Australia. In fact, we see small continuing declines for all education levels except for those with year 11 and below education, which declined for cohorts born 1962-66 and 1967-71, but has since rebounded for later cohorts (Figure 5).

In all cohorts, women with a post-graduate degree have the lowest completed fertility, and those with year 11 and below report the highest completed fertility. As a percentage change, the largest cohort fertility decline is 13.9% for those with a Diploma, followed by a decline of 13.7% for those with a bachelor's degree (see Appendix Table A1).
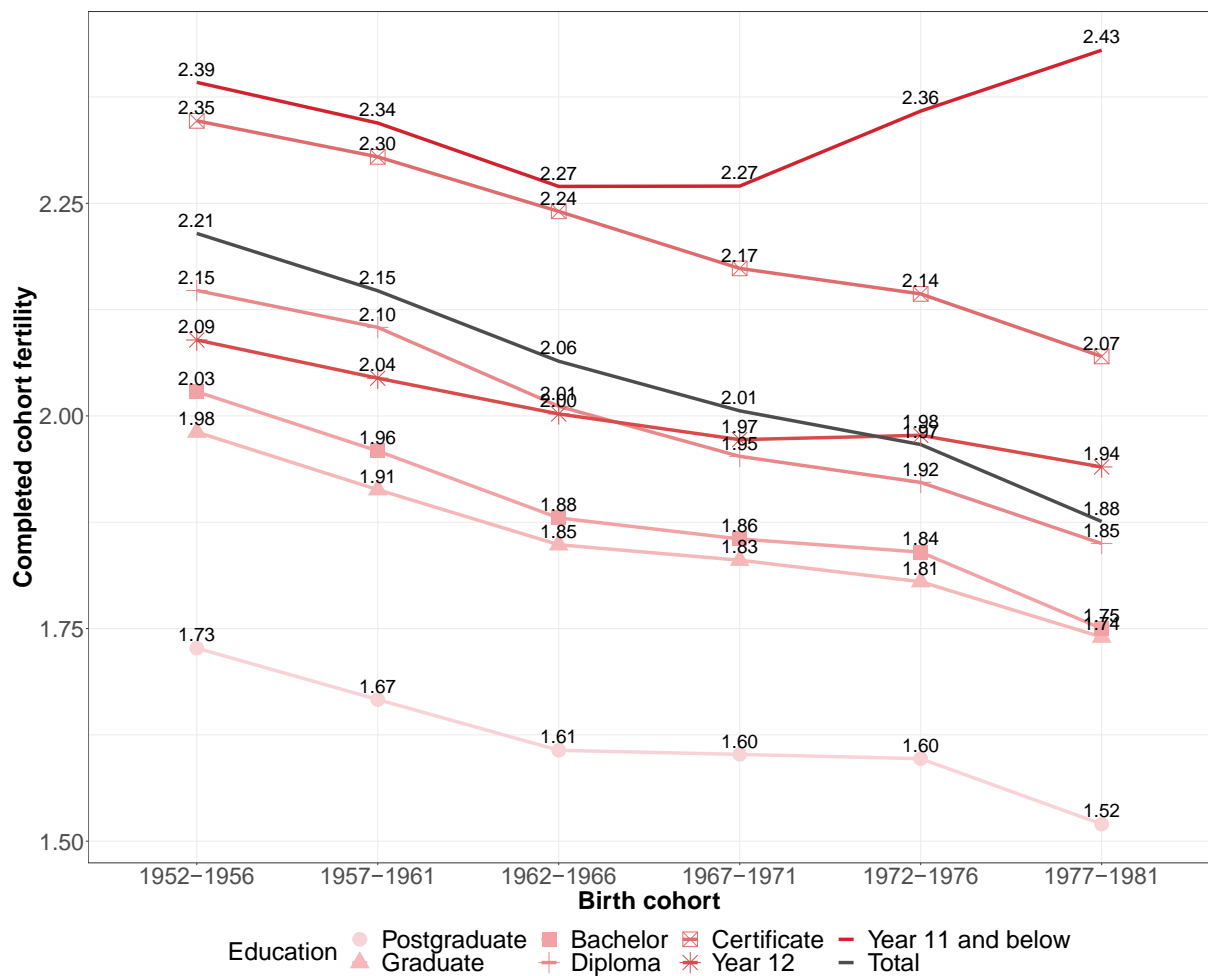
Figure 5: Average completed cohort fertility by highest level of educational attainment, Australia, cohorts 1952 to 1981

Source: authors' calculations based on 2021 Australian Census data retrieved from TableBuilder Pro. *Note*: The cohort born 1977-81 completed fertility is likely to increase slightly in the 2026 round of Census data collection as this cohort was aged 40-44 at the 2021 Census, and hence their fertility is incomplete.

3.3. Number of children born by education level

As shown previously, over time there has been a shift in the number of children women are having, where the proportion of women who have no children or one child has increased, while the proportion of women who have three children, or four or more children, has declined. Here we investigate these changes to see if there are differences by education level (Table 1).

Overall, the percentage of women with no children has been increasing. This is true for all levels of education except for those with post-graduate degrees, but the growth in having no children is stronger for those without university qualifications, which were coming off a lower starting point. For those with a certificate we see an increase from 9% to 15%, similar to those with year 11 and below increasing from 9% to 14%. For those with year 12 education, having no children increased from 13% to 18%. The only education category that has seen a decline in childlessness is those with a post-graduate qualification, which has declined from 25% for the oldest cohort, to 22% for the youngest cohort. For the oldest cohort, there was a very large gap in the percentage of women who had no children when comparing those with a post-graduate degree and those with other

education levels; a gap which has declined over time. This can be seen as a convergence in having no children by education.

Table 1: Percentage distribution of children ever born by education level, Australia, cohorts 1952-56 to 1972-76

Birth cohort	Post-graduate	Graduate	Bachelor	Diploma	Certificate	Year 12	Year 11 and below	Total
No children								
1952-56	25	18	16	13	9	13	9	12
1957-61	25	20	17	14	10	14	10	14
1962-66	25	20	18	15	9	15	12	15
1967-71	24	19	17	16	12	16	13	16
1972-76	22	19	17	16	13	17	13	16
1977-81	22	20	19	18	15	18	14	18
One child								
1952-56	14	12	14	13	11	17	10	12
1957-61	16	12	14	14	11	17	11	13
1962-66	17	14	15	14	12	16	12	14
1967-71	18	15	15	15	13	15	13	15
1972-76	19	15	15	16	14	15	14	15
1977-81	21	15	16	17	14	16	14	16
Two children								
1952-56	35	37	37	38	39	38	39	38
1957-61	35	37	38	38	38	38	38	38
1962-66	37	39	39	39	39	39	37	38
1967-71	38	41	41	40	39	39	36	39
1972-76	41	41	42	40	38	38	32	40
1977-81	42	41	43	39	38	36	29	39
Three children								
1952-56	18	23	23	24	26	21	27	24
1957-61	17	22	22	23	26	21	26	23
1962-66	16	20	20	21	24	20	24	22
1967-71	15	19	19	20	23	20	23	20
1972-76	14	18	19	19	22	19	22	20
1977-81	12	18	17	18	22	19	21	18
Four or more children								
1952-56	8	10	11	12	15	12	16	13
1957-61	7	9	9	11	15	11	16	13
1962-66	5	8	8	10	14	10	15	11
1967-71	5	7	7	9	13	10	16	10
1972-76	4	6	6	9	13	10	19	10
1977-81	3	5	5	8	12	11	22	9

Source: authors' calculations based on 2021 Australian Census data retrieved from TableBuilder Pro.

Having one child has also increased over time, but there is more variation by education level. Those with a post-graduate qualification had the biggest increase (14% to 21%), but smaller increases are also evident for those with a graduate degree, diploma, certificate, and year 11 and below to varying degrees. Those with a bachelor's qualification showed a very small increase over time, and of those with year 12, the percentage having one child hardly changed.

Having two children has always been the most common response over the cohorts, indicating the continued acceptance of the two-child family norm in Australia. In particular, there have been more women with university qualifications having two children over time. Those having two children with a post-graduate degree increased from 35% to 42%, similar to those with graduate degrees (37% to 43%), and those with bachelor's degrees (37% to 43%). The education category that saw a large decline in the percentage of women with two children was those with year 11 and below education, which declined from 39% to 29%.

Having three children has declined for all education categories over time, with the lowest percentage found among the youngest cohort of women with a postgraduate degree (12%), and the highest percentages found among those with a certificate qualification (22%), or year 11 and below (21%). For the highest parity of four or more children, most educational categories saw declines over time, except women with year 12, or year 11 or below. The most dramatic change is evident for women with year 11 or below, where the percentage with four or more children increased from 16% to 22% over the cohorts. This is evidence of growing divergence rather than convergence.

3.4. Parity progression ratios by education level

The results of the distributions of children ever born over time showed that there had been some convergence in having no children by education level, with the percentage not having children ranging between 14% and 22% for the youngest cohort. We now consider, of those women who have at least one child, what percentage go on to have higher-order births by cohort. This highlights the pattern of divergence in higher-order parities by education levels seen in the distribution of children ever born.

In terms of progression to a second birth, most women who have one child progress to a second child, regardless of education level (Figure 6), although we see the usual education gradient with women with higher education having slightly less progression to a second child. For most education categories, in almost all years, the percentage progressing to a second child is 80% or higher. Notably, progression to a second child for those women with a postgraduate degree is between 72% and 80% for all but the oldest cohort.

It is the parity progressions to third birth or fourth or higher birth where divergence by level of education is the greatest, and the difference is increasing over the cohorts rather than dissipating. Overall, we see that while those with year 11 education and below are more likely to remain childless over time, those who do go on to have children are having larger families than in the past.
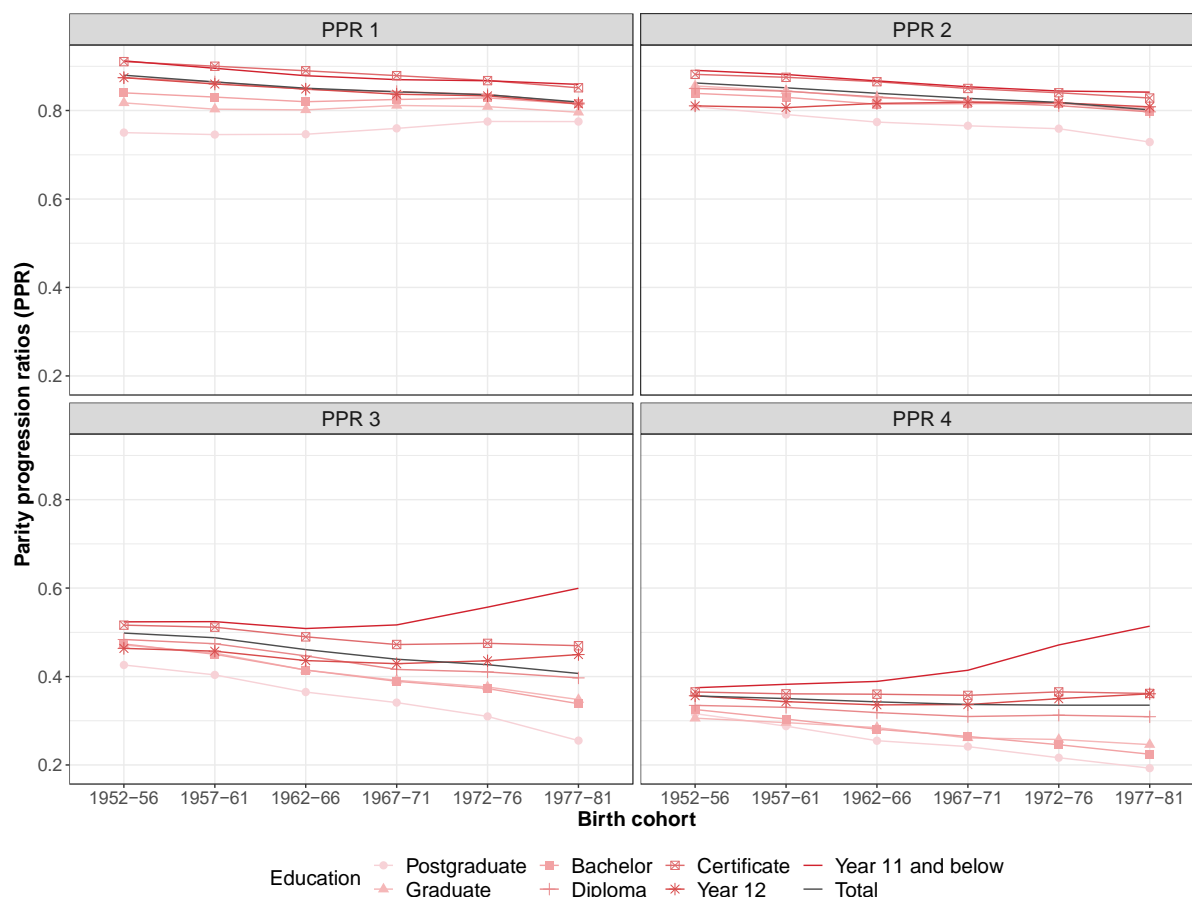
Figure 6: Progression to first, second, third, fourth or higher birth by education level (%), cohorts born 1952 to 1981

Source: authors' calculations based on 2021 Australian Census data retrieved from TableBuilder Pro.

3. Discussion

Assessing measures of fertility to understand fertility change can be problematic. The usual period measure of fertility, the total fertility rate, will appear as a decline due to quantum changes, as well as timing changes such as fertility delay (Bongaarts & Feeney, 1998). As an alternative, completed cohort fertility can be used to see if fertility has declined between birth cohorts, providing a measure of overall fertility regardless of when women have their children. The downside to using this measure is that one must wait for cohorts to reach the end of their childbearing years, usually around age 45 for women, although we note some babies are born to women above this age.

In this paper, we assess whether completed fertility has declined for recent cohorts. We then also investigate whether there has been a convergence in fertility by level of education by examining average completed fertility as well as the distribution of children ever born by education. Previous research found that women with lower levels of education had higher fertility and were less likely to be childless but, as discussed in the introduction, findings from a number of countries have shown a convergence in fertility as measured by average completed fertility and the percentage having no children (e.g. Adsera 2017, Jalovaara et al. 2019, Kolk 2023). This paper extends this to also look at differences in the distribution of number of children born.

We find that average completed cohort fertility continues to decline slowly in Australia. For our earliest cohort, born 1952 to 1956, average completed fertility was 2.22. For our last cohort, born 1977 to 1981, average completed fertility was 1.89. We note that not all individuals in this cohort have reached 45 years of age, so fertility will likely increase very slightly.

When examining the results by education level, we see that average completed cohort fertility remains lowest for those with the highest education, and there have been greater declines for those with bachelor's or diploma qualifications. For those whose education was year 11 or below we see an increase, not a decrease in completed cohort fertility for recent cohorts. These results do not provide evidence of a convergence in fertility levels; in fact, they suggest the opposite.

Unpacking this, we investigate differences in the number of children ever born by education. Here we see some very interesting results. First, we see a decline in the percentage with no children for those with postgraduate qualifications, and a slight increase in those with no children for women with a graduate or bachelor's qualification. We see larger increases in having no children for all other education categories, leading to somewhat of a convergence in the percentage of childless women by education level. There are also increases in the percentage having one child for almost all education categories. But this is where any convergence ends. Women with high levels of education see increases in the percentage having two children, but having two children declines for women with the least education, creating a large gap between the highest and lowest education groups. For women having the largest number of children, i.e., three, or four or more children, we see considerable increases for those with year 11 or below education. These results suggest that there is divergence by education level.

4.   Conclusions

Taken together, these results suggest that there is mixed evidence for convergence in the Australian setting: the gap in average completed fertility is widening between women with the lowest and highest levels of education, yet the percentage of women with no children is narrowing. There is also a narrowing by education level for the percentages who have two children, but not at the higher parities, leading to an increase in the gap by education levels.

Why do we see these changes in number of children born, particularly for those with low levels of education? For women with year 11 or lower education, we see large changes in both directions: greater percentages of women with this level of education that have no children or one child, but those who have children are more likely to have larger families in recent cohorts. The second area of research is about understanding the characteristics of women by education level for the different cohorts. It may be that women with year 11 or below education are increasingly selective of women from particular backgrounds, and that this selection has narrowed over time, as this education category has reduced. With only around 10% of women having this level of education, we suggest that they hold characteristics which lead them to have larger numbers of children, if they become mothers.

One explanation for differences between cohorts relates to changes in the proportion of women who have migrated to Australia, and their country of origin. Australia has a longstanding history of selective skilled immigration, leading to a notable influx of highly educated individuals. The countries

contributing immigrants have also shifted over time, leading to changes in the nation's overall demographic makeup. While the United Kingdom historically dominated as a source of permanent migration to Australia, this role has now been assumed by India and China (Department of Home Affairs, 2023). This has led to changes in the relative share of births by country of origin (Baffour et al. 2023).

Australian research highlights substantial diversity in fertility among immigrant groups (Abbasi-Shavazi and McDonald 2000, Baffour et al. 2023). Research in Europe has also revealed that these differences persist in subsequent generations due to ongoing influences from minority subcultures on fertility behaviours (Kulu et al. 2019). Hence, the changes that we observed in our analysis in cohort fertility based on education are likely influenced by shifts in the immigrant composition. Despite the considerable and increasing proportion of immigrants in Australia, there has been limited research focusing on the topic of migrant fertility, with scant knowledge about fertility trends in successive generations (see Carmichael and McDonald 2003). Future research should address this research gap, given its importance to better understand the country's fertility patterns.

The fertility patterns of women by education provide information to better understand overall changes in fertility levels. Despite evidence indicating that only a minority of highly educated women express a definite preference for remaining childless (Holton et al. 2011; Beaujouan and Berghammer 2019), delayed family formation among this group has historically resulted in a higher likelihood of experiencing infertility and remaining childless. However, this study reveals a recent decrease in childlessness rates among highly educated women in Australia, potentially indicating that these women have recognised the issues associated with delayed childbearing, or they may have been able to achieve pregnancy through the use of assisted reproductive technology, which is increasingly being used in recent years (Lazzari et al. 2021b). As educational attainment continues to expand, the fertility decisions of highly educated women will significantly influence future fertility rates (Adserà 2017). Therefore, it is crucial that future demographic research focuses on understanding the underlying factors driving these changing fertility patterns to comprehend future fertility trends.

Key messages

- Completed cohort fertility continues to slowly decline in Australia, mostly due to an increase in childlessness and a decrease in large families with more than two children.
- Having two children remains the most common response over the cohorts, demonstrating a continued desire for the two-child family norm in Australia.
- A decline in childlessness is only observed in post-graduates, while all other levels of education, particularly those without university qualifications, have seen an increase in childlessness, indicating a growing convergence by education.
- The trend of forming large families with more than two children has declined in all education categories, except for those with a year 11 or lower qualification, indicating a growing divergence by education.
- These opposing trends provide mixed evidence of convergence of fertility by education in the Australian setting.

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Appendix

Table A1: Percentage change in cohort fertility between cohorts by education level, 1952-56 to 1977-81.

	Post-graduate	Graduate	Bachelor	Diploma	Certificate	Year 12	Year 11 and below	Total
Cohort 1952-56	1.73	1.98	2.03	2.15	2.35	2.09	2.39	2.21
Cohort 1977-81	1.52	1.74	1.75	1.85	2.07	1.94	2.43	1.88
Percentage change	-12.0%	-12.2%	-13.7%	-13.9%	-11.8%	-7.15%	1.58%	-15.3%

Source: authors' calculations based on 2021 Australian Census data retrieved from TableBuilder Pro.