

The contribution of infertility, miscarriage and abortion to the individual fertility gap among women in Germany

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Introduction

Most people desire to have children. Despite declining fertility rates across Europe, the average number of desired children remains close to the replacement level (Friedrich/Bujard 2025; Sobotka/Beaujouan 2014). However, fertility goals cannot always be reached. Realized fertility often remains below expectations in the long-term (e.g. Beaujouan & Berghammer 2019; Gietel-Basten et al. 2024). The difference between the hypothetical and realized number of children is called the fertility gap (Philipov/Bernadi 2012). The contribution of social and economic factors to the fertility gap have been extensively studied. Despite the fact that many women experience adverse reproductive events in their reproductive life courses, little is known about their contribution to the fertility gap.

With women's increasing age at starting a family the risk of experiencing infertility increases. This often implies longer times of trying to achieve a pregnancy and medical help-seeking, which may or may not lead to a pregnancy and ultimately in having the desired child. Higher age of women is also associated with higher risk of pregnancy loss. Induced abortion does not have much of an age gradient. It is more about limiting the number of children or impacting the timing and/ or spacing of births or in the case of medically- induced abortions about averting harm from the fetus and the mother. A shared feature of all three types of experiences is that they do have an impact on the women or couple and they are often invisible to others. And they often do not show up in statistics or survey questionnaires due to their sensitive nature.

This study aims at a better understanding the role of adverse reproductive experiences in shaping fertility outcomes of women. Specifically, we investigate whether and to what extend infertility, miscarriage, and abortion contribute to women's personal fertility gap. We compare women aged 15-17, 25-27, and 35-37 at first observation and follow them for a decade, thus covering almost the full reproductive life span of women from 15 to 47 years.

Our contribution to the state of research is threefold. Firstly, in this study we build on the concept of "reproductive careers" introduced by Johnson et al. (2018; 2023), which highlights the interconnectedness of various types of reproductive experiences, attitudes, and behaviors across women's reproductive life courses. Reproductive experiences include not only successful transitions between life stages such as births, but also "non-transitional" experiences including infertility, miscarriage, and induced abortions. Scattered evidence suggests, that such non-transitional reproductive experiences are potentially associated with the number of births (Greil et al. 2024) and attitudes towards future family building or extension (Beringer/Milewski 2024). To our knowledge, our study is the first to consider multiple adverse reproductive experiences and how they relate to realizing a personal fertility ideal.

Secondly, the life course perspective and its application to fertility emphasize that past transitions and experiences shape current and future attitudes and behavior (Huinink/Kohli 2014). The value of children approach suggests, that many utilities of children can be realized with just one child. Therefore, we argue that the differentiation between childless women and mothers is particularly relevant. Both groups differ in both their past experiences and in their perspectives on future

childbearing. As such, we pay particular attention to different age-parenthood constellations at the start of our observation window.

Thirdly, a proper life course analysis of personal fertility gap requires appropriate individual-level longitudinal data such as that from the German family panel pairfam. Rather than assessing both fertility ideals and outcomes at the end of the observation window (Casterline & Han 2017; Channon & Harper 2019; de Carvalho et al. 2016) we compare the fertility desire at first participation, the realized number of children ten years later, and the type of adverse reproductive events women experienced.

Data and methods

We use data from the German family panel pairfam, release 12.0 (Huinink et al. 2011; Brüderl et al. 2020). The survey started in 2008/09 with a nation-wide representative sample of 12,402 women and men from three age groups 15-17, 25-27 and 35-37 years, who are 25-27, 35-37 and 45-47 ten waves later. We further employ data from DemoDiff, a complementary panel survey of 1,489 East Germans from the two older age groups. We compare desired fertility, reproductive experiences of women over a ten-year observation window. Therefore, we include only those women who participated in eleven waves. The analytical sample consists of 1,862 women from three age groups.

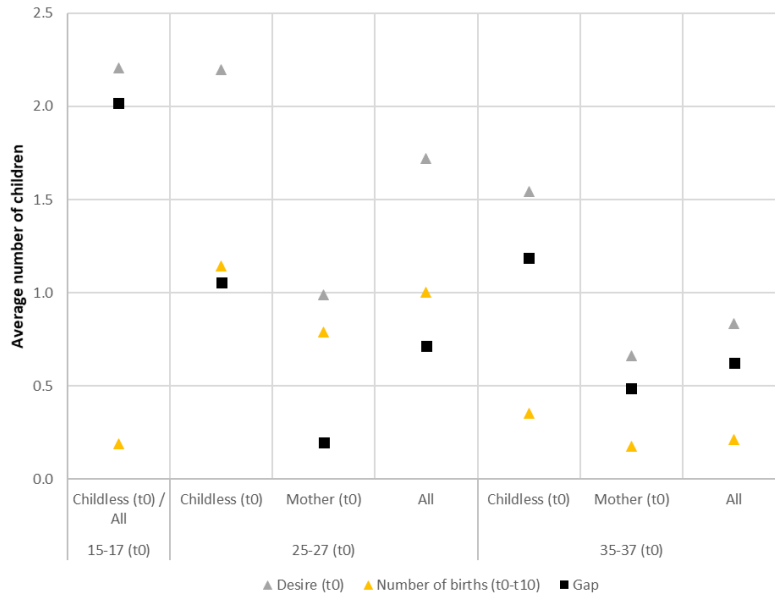
The measure of fertility desire in pairfam is based on a question on desired family size under ideal circumstances measured at first observation (t_0). From that we subtract the number of biological children at t_0 . Desire for (additional) children varies between 0 and 8 children. To investigate the fertility gap, we compare the desired number of children with the number of children born until last observation (t_{10}). We differentiate between women with a gap between desired and realized number of children and women who have the number of children they desired.

Infertility, miscarriage, and abortion are considered as adverse reproductive experiences. Information on abortion and miscarriage is based on two questions inquiring whether each was experienced in the time since last interview. Perception of infertility is based on two questions where the respondent was asked to assess one's own and - if the person has a partner - the partners' "ability to conceive" (women) or "procreate naturally" (men). Information on the women's infertility and the infertility of her partner (if existing) was combined to a couple indicator. Infertility (1) was assigned if infertility was perceived for at least one partner, fertility (0) was assigned if the women or both partners were perceived as fertile. In all three variables, women who replied with "don't know" or "I don't want to answer that" have been coded as not experiencing the event. Thus, our measures are conservative.

Results

Figure 1 shows the average number of additionally desired children at t_0 , the average number children born (t_0 - t_{10}) and the gap between both by initial age group and parity. The average fertility gap declines with age: 2.02 in the youngest age group, 0.72 in the middle age group, and 0.52 in oldest age group. The number of children women desire strongly depends on whether they already have children or not. The gap is on average larger among women without children and much smaller among parents.

Figure 1: Fertility gap after 10 years by age (t_0) and parity (t_0)



Of the three types of adverse reproductive experiences abortions are the least common. The prevalence of any abortion in our sample is 5.3%, for any miscarriage 8.9%, and for any infertility 27.9%. In our sample, only the risk of infertility increases with age, which is in line with established knowledge. Miscarriages and abortions are most common in the middle age group, representing the prime reproductive years, where also by far the most births occur.

Table 1 shows important age and parenthood differences with regard to the contribution of types of adverse experiences to having or not having a fertility gap. For childless women aged 25-27 and 35-37 at first observation, those who remain below their desired fertility have a slightly higher risk to experience infertility (18.2 vs. 21.2%, and 49.2 vs. 53.2%). In contrast, among mothers those who reached their goal are more likely to experience infertility. For miscarriages the pattern is different. The contribution of miscarriages to having the desired number of children is higher than to having a fertility gap among women in the two younger age groups. Only among women 35-37 at first observation the contribution of miscarriage is larger for those with a fertility gap than for those who had the number of children they desired. For abortions there is no clear pattern. Notable differences in the contribution of abortions occur only in two groups. Firstly, among women aged 15-17 at first observation the contribution of abortions is six percentage points higher among those who had the number of children they desired. Secondly, among mothers in the middle age group the prevalence of abortion experience is considerably higher among women with a fertility gap (17.6%) than among women without (7.1%).

The contribution of experiencing infertility, miscarriage, and abortion to the fertility gap is also assessed in a multivariable context. For this purpose, we estimated separate models for each age-parenthood constellation and each adverse experience (5 x 3= 15 models), controlling for partnership status (t0), level of education (t0), and migration background. Table 2 shows statistically significant associations mostly for mothers. Among mothers 25-27 years at first observation, any infertility is associated with a lower risk of a fertility gap, while any abortion is associated with a higher risk of a fertility gap. Among mothers age 35-37 any miscarriage contributes to higher odds of a gap between fertility desires and number of children born.

Table 1: Contribution of types of adverse reproductive experiences to the individual fertility gap

Age (t0)	Parity (t0)	Fertility gap (t0-t10)	Any infertile (t0-t10)	Any miscarriage (t0-t10)	Any abortion (t0-t10)	Total
15-17	0	no	3 (5.2%)	6 (10.3%)	6 (10.3%)	58 (12.1%)
		yes	33 (7.8%)	28 (6.7%)	18 (4.3%)	421 (87.9%)
25-27	0	no	25 (18.2%)	28 (20.4%)	7 (5.1%)	137 (36.2%)
		yes	51 (21.2%)	37 (15.4%)	15 (6.2%)	241 (63.8%)
	1+	no	56 (33.1%)	12 (7.1%)	12 (7.1%)	169 (69.5%)
		yes	14 (18.9%)	4 (5.4%)	13 (17.6%)	74 (30.5%)
35-37	0	no	29 (49.2%)	4 (6.8%)	2 (3.4%)	59 (38.6%)
		yes	50 (53.2%)	12 (12.8%)	2 (2.1%)	94 (61.4%)
	1+	no	165 (43.9%)	16 (4.3%)	13 (3.5%)	376 (61.7%)
		yes	93 (39.9%)	19 (8.2%)	10 (4.3%)	233 (38.3%)

Table 2: Summary of results from logistic regressions on the risk of an individual fertility gap by miscarriage, infertility, and abortion (separate models for each type (3x) and age-parenthood constellation 5x)

Age (t0)	Parity (t0)	Any infertile (t0-t10)	Any miscarriage (t0-t10)	Any abortion (t0-t10)	N
		OR	OR	OR	OR
15-27	0	1.673	0.623	0.386 *	354
25-27	0	1.359	0.835	1.025	374
	1+	0.442 **	0.753	2.603 **	239
35-37	0	1.352	2.604	1.170	152
	1+	0.913	2.001 *	1.066	602

Notes: * 0.10, ** 0.05, *** 0.01. OR = Odds ratios. All 15 models control for partnership status (t0), level of education (t0), migration background

Conclusion and next steps

Our analyses show that the individual contributions of infertility, miscarriages, and abortions to the individual fertility gap vary depending on women's life stage as reflected by the combination of age and parenthood. To date, we have only considered whether each type of adverse experience occurred in the window of observation. However, women differ in the frequency of each type of adverse event and also in the risk of experiencing multiple types of events. The contribution of adverse reproductive experiences to the fertility gap may therefore vary significantly based on these factors. As a next step, we plan to conduct further analyses to explore these issues in more detail.

