



Unplanned births and their effects on maternal Health: Findings from the Constances Cohort

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ABSTRACT

Unplanned births remain relatively common, even in regions with high contraceptive prevalence and accessible abortion services, such as contemporary France. Previous studies have shown that unplanned births can have numerous negative consequences for the well-being of mothers and children, including poorer maternal health behaviors, delayed and insufficient prenatal care, and depression during or immediately after pregnancy. However, these studies do not provide conclusive evidence on whether the observed outcomes are a consequence of unplanned births or of the conditions in which they likely occur. Furthermore, scant attention has been given to other dimensions of maternal well-being, such as physical health.

This study uses longitudinal data from the French Constances Cohort and applies fixed-effects event study models to examine how women's self-rated general health and risk of depressive symptoms are affected in the years following an unplanned birth. Results show that women who had an unplanned birth reported a sudden, significant drop in their general health in the year following the birth, particularly among the youngest, while health outcomes following planned births showed a gradual, slight decrease over the time-period considered. The risk of depressive symptoms increased similarly after birth for both unplanned and planned births. This study contributes to the literature by using a longitudinally constructed measure of unplanned births based on pre-birth fertility intentions, rather than commonly used retrospective measures prone to ex post rationalization. It also distinguishes between unwanted and mistimed births while further examining their consequences on medium-term maternal health.

1. Introduction

Despite a decrease in recent decades, rates of unplanned births remain surprisingly high in many developing and developed countries, estimated at around 23% worldwide (Hayford and Guzzo, 2016; Singh et al., 2010). Unplanned births have been linked to numerous negative outcomes for mothers (Brown and Eisenberg, 1995; Gipson et al., 2008; Kavanaugh et al., 2017), such as unhealthier behaviors during pregnancy (Joyce et al., 2000; Hellerstedt et al., 1998) and delayed, sub-optimal antenatal care (Joyce and Grossman, 1990; Carlander et al., 2023; Blondel et al., 2023). Additionally, unplanned births can increase the risk of depression during (Goossens et al., 2016) and after pregnancy (Barber et al., 1999), and they decrease maternal happiness (Su, 2012) compared to planned births.

However, scant evidence exists regarding health following an unintended birth (Brown and Eisenberg, 1995; Su, 2012; Yeatman and

Smith-Greenaway, 2021), and what has been reported is primarily based on studies conducted in Anglo-Saxon countries. In these contexts, unplanned births often affect teenagers from disadvantaged backgrounds, and health coverage is less extensive than in continental Europe (Singh et al., 2010). Given the increasing age at childbearing in Europe, the number of unplanned births occurring at more advanced ages is similarly rising (Bajos et al., 2014). These later births may entail different consequences for women's health.

Existing studies often fail to establish causal effects of unplanned births, due to their cross-sectional design and the challenge of accounting for unobserved characteristics associated with unplanned births and the absence of pre-birth information (Gipson et al., 2008; Yeatman and Smith-Greenaway, 2021). A critical question remains: Do the observed negative outcomes stem from unplanned births themselves, or are they linked to the likely circumstances surrounding these births (i. e., occurring among younger, single, economically disadvantaged

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women)? (Gipson et al., 2008; Blondel et al., 2023; Carlander et al., 2023). Moreover, the literature employs diverse and inconsistent definitions for unplanned births, relying primarily on retrospective assessments of mothers' feelings and intentions during pregnancy (Brown and Eisenberg, 1995; Singh et al., 2010). These assessments are susceptible to low retrospective accuracy due to ex post rationalization (Koenig et al., 2006). Additionally, most previous studies have relied on observation points close to the time of birth.

This study aims to fill these gaps in the literature by using recent data to examine the dynamic effects of unplanned births on self-rated health and risk of depressive symptoms in France. Previous longitudinal studies on the consequences of childbearing for maternal health have generally found slightly decreased levels of physical and mental health in the years following birth (Saurel-Cubizolles et al., 2000; Schytt et al., 2005). These effects are heterogeneous and depend on parental characteristics (Evenson and Simon, 2005; Carlson, 2011). However, the role of pregnancy intentions has usually not been considered.

We hypothesize that unplanned births might negatively affect maternal health more than planned births, independently of social factors. Unhealthy behaviors and delayed access to antenatal care may exacerbate health during and after pregnancy, thereby increasing the risk of complications. Moreover, heightened exposure to stress during and after unintended pregnancies might adversely affect maternal mental health.

Using data from the nine available waves of the French Constances Cohort study (2012–2020), we examined patterns of maternal self-rated health and the likelihood of depressive symptoms following planned and unplanned births. By leveraging the panel structure of our data for longitudinal analysis, we identified unplanned pregnancies based on declared fertility intentions before pregnancy detection. Employing event study models with individual fixed effects, we assessed whether unplanned births result in changes in health levels up to several years post-birth compared to pre-birth, while controlling for unobserved maternal characteristics. We also compared these changes with those following planned births. Our robustness checks distinguished between unwanted and mistimed births, two categories that are often grouped together in the literature as unplanned births despite representing vastly different experiences with potentially distinct consequences for maternal well-being (Pulley et al., 2002; D'Angelo et al., 2004). Finally, we explored whether general health changes following birth varied by maternal age.

2. Background and hypotheses

2.1. Childbearing and health

Having children represents a life-changing experience that entails biological and social changes with notable health consequences for mothers (Hank, 2010; Nomaguchi and Milkie, 2020; Simon and Caputo, 2019). Studies examining longitudinal changes in health around childbirth usually find decreases in mental and physical health levels in the years following a birth. Shortly after birth, many women begin reporting symptoms such as headaches, back pain, and lack of sleep, which can persist for a few years and lead to lower levels of general self-rated health (Schytt et al., 2005; Saurel-Cubizolles et al., 2000; Grice et al., 2007). Women also experience variations in mental health levels in the years following childbearing, with increases in depressive symptoms and stress, but also feelings of happiness and fulfillment (Ruppner et al., 2019; Metzger and Gracia, 2023). The health effects of childbearing depend on many factors, including women's characteristics (single vs. partnered, working vs. non-working) (Evenson and Simon, 2005) and the circumstances of childbearing (Hank, 2010; McLanahan and Adams, 1987).

Early maternal ages, often defined as teen births, are linked to higher maternal mortality (Barclay et al., 2016) and an increased risk of disability, long-term illness, and poorer self-reported health in mid-to

later life (Sironi et al., 2020; Grundy and Read, 2015; Henretta, 2007). This association may stem from factors such as selection, socio-economic disadvantages, and limited resources among very young mothers (Falci et al., 2010). Conversely, advanced age at childbearing, typically defined as older than 35, has historically been viewed as a major risk factor for pregnancy and birth complications. However, this association has become negligible because older mothers have a better socioeconomic status than before (Goisis et al., 2018). Evidence also points toward a U-shape relationship between a mother's age at first birth and depressive symptoms across the lifespan (Mirowsky and Ross, 2002; Umberson et al., 2010). This is partly explained by deviations from one's expected age at birth (Carlson, 2011).

2.2. Consequences of unplanned births

A rich body of literature has examined the consequences of unplanned births, suggesting they can adversely affect mothers' well-being in various ways. First, women experiencing an unplanned pregnancy are more likely than those with planned pregnancies to receive late (Joyce and Grossman, 1990) and, in some cases, suboptimal antenatal care, even in European countries with comprehensive healthcare systems (Carlander et al., 2023 in Sweden; Goossens et al., 2016 in Belgium; Blondel et al., 2023 in France). Second, several studies have found that women with unplanned pregnancies tend to experience higher levels of stress (Goossens et al., 2016) and report poorer psychological health, including depressive symptoms (McCrory and McNally, 2013) and, in some cases, psychiatric conditions during pregnancy (Carlander et al., 2023). These studies also indicate that women with unplanned pregnancies are more likely to engage in unhealthy behaviors during pregnancy, such as smoking, drinking alcohol, and caffeine consumption (Joyce et al., 2000; Hellerstedt et al., 1998; Goossens et al., 2016). However, other studies have found no or mixed effects on prenatal behaviors, especially after controlling for maternal characteristics (Gipson et al., 2008).

Despite the lower quality antenatal care and unhealthy behaviors during unplanned versus pregnancies, most studies from the US and Europe have not identified a significantly increased risk of poor health outcomes at birth for either the child or the mother, once maternal characteristics are taken into account (for a review, see Gipson et al., 2008).

Most studies have focused on the effects of unplanned live births in the months following delivery, revealing increased risks of postpartum depressive symptoms (Najman et al., 1991; Karaçam et al., 2011). Only a few studies have extended their investigation to years after the birth. These studies show that unplanned births are associated with reduced maternal happiness, even after adjusting for pre-birth levels (Su, 2012), and poorer mental health outcomes later in life (Herd et al., 2016), which could negatively affect the mother-child relationship (Barber et al., 1999). However, other studies found no significant association with psychological distress (Maximova and Quesnel-Vallée, 2009). Evidence regarding other aspects of health following unplanned births in developed countries is limited, and no association between experiencing an unwanted birth and overall physical health has been identified (Barber et al., 1999).

2.3. The French context

France offers extensive healthcare coverage grounded in principles of universalism and equality. The healthcare system is reasonably priced and heavily subsidized, yet social inequalities in health persist (Nay et al., 2016). Reproductive health services are well developed, with pregnancies regularly monitored and most examinations and support services covered by state health insurance.

An estimated one-third of pregnancies in France were unintended in 2010, and 12% of live births were classified as unwanted (Moreau et al., 2014; Bajos et al., 2014). Despite a steady 40-year decline, rates of

unintended births showed a slight uptick between 2000 and 2010, due to a rise among women aged 30 years and older (Bajos et al., 2014). Contraceptive failure was identified as the primary cause, despite the widespread use of contraception in the country (Bonnet et al., 2021). By 2016, 72% of sexually active women who did not wish to conceive relied on medical contraceptives. Since 2010, a trend has shifted away from oral contraceptives toward intrauterine devices (IUDs) and condoms (Le Guen et al., 2020), with natural methods remaining less commonly used.

Bearak et al. (2022) estimated that half of unintended births end in abortion in France, a rate higher than the combined median for both Europe and North America. Abortion is legal in France and fully reimbursed by state health insurance. In 2019, one abortion occurred for every three births. Since 2000, abortion rates have increased, particularly among individuals aged 25 to 39, while rates have steadily declined among teenagers.

2.4. Hypotheses

The decrease in health often associated with childbirth may be more pronounced in the case of unplanned births, where women face higher levels of stress during pregnancy and after birth (Su, 2012; Carlson, 2011) and have fewer mental and material resources to cope with these consequences (Elder Jr and Shanahan, 2007; Kavanaugh et al., 2017; de La Rochebrochard and Joshi, 2013). Therefore, we hypothesize that in the years following the birth, women experiencing an unplanned birth will show a greater decrease in general self-rated health (H1) and a greater increase in the risk of depressive symptoms (H2) compared to women with planned births, after accounting for pre-birth maternal characteristics.

The consequences of unplanned births might differ by maternal age. Younger mothers may have better overall health and more physical resources to cope with a young child, potentially reducing negative impacts. However, due to fewer economic resources and parental experience, an unplanned birth could be more destabilizing for their lives. The literature generally suggests that the latter mechanism tends to prevail, with more negative health effects of childbirth occurring at younger maternal ages (Grundy and Read, 2015; Sironi et al., 2020). Therefore, we hypothesize stronger negative health effects of unplanned births on younger mothers (30 years or less) compared to older ones (more than 30) (H3).

3. Data and methods

We used data from the nine available waves of the French Constances cohort study (Zins et al., 2015; Goldberg et al., 2017). The Constances cohort includes a representative sample of French individuals aged 18–69, randomly selected from adults covered by the French General Health Insurance Fund (CNAM), which represents around 85% of the French population. Recruitment for the cohort started in 2012 and, to

Table 1a
Variables, waves, and sample size for each outcome.

	N	Births (no. of events)	Kind of birth			Health outcomes	
			Unplanned births (no. of events)		Planned births	Self-rated health (1–8 scale)	Depressive symptoms (1/0)
			Unwanted births	Mistimed births			
Inclusion	24,340					23,656	23,800
Wave 1	24,340	1018	114	143	761	24,052	8197
Wave 2	24,340	1813	148	151	1514	24,034	6239
Wave 3	16,469	1106				16,273	3879
Wave 4	10,934	596				10,777	2179
Wave 5	7058	428				6967	1556
Wave 6	4029	178				3971	558
Wave 7	1967	77				1940	
Wave 8	484	18				480	
Total	113,961	5236	262	294	2275	112,150	46,608

date, 220,000 volunteers have been included. Upon inclusion, respondents completed a series of questionnaires and underwent a comprehensive health examination at a health screening center. The participation rate at inclusion was approximately 7.3 %.

In addition, women completed an additional questionnaire on reproductive health, including fertility intentions and timing. Follow-up paper questionnaires, conducted annually (with the latest available in 2020), gathered information about personal events from the previous 12 months. The annual follow-up survey participation rates were consistently higher than 80%. As respondents were included in different years, the number of available waves per respondent varied (see Table 1).

We selected women younger than 45 at the time of their inclusion in the survey, who were not pregnant, had valid information about fertility intentions, and were followed for at least waves 1 and 2. This resulted in a sample of N = 46,608 women, each with information from at least three points in time, totaling 113,961 observations (see Table 1 for sample size at each wave, outcomes, and explanatory variables). The main analyses focused on the subset of women who reported the arrival of a child at either wave 1 or 2 (N = 2831 women, with 11,625 observations).

3.1. Concepts and variables

3.1.1. Unplanned births

Measuring pregnancy intentions is complex and can be approached in various ways (Mumford et al., 2016, see Online Appendix). We followed the common convention of defining planned pregnancies as those occurring when they were wanted or later; while unplanned pregnancies are those not wanted at the time of conception. Unplanned pregnancies are further divided into unwanted and mistimed pregnancies. Unwanted pregnancies occur to women who did not want (more) children at all. Mistimed pregnancies occur to women who did want either a first or another child, but their pregnancy occurred sooner than desired (Gipson et al., 2008). Due to sample size limitations, our main analysis combined unwanted and mistimed births, as most studies do (Pulley et al., 2002; D'Angelo et al., 2004). We distinguished them in a robustness analysis comparing unwanted and planned births.

Most studies retrospectively measure unintended births based on mothers' declarations and sometimes previous contraceptive use, which

Table 1b
Sample sizes for births and totals used in different models.

	Whole sample	With self-rated health response	With depressive symptoms response
Unplanned births	556	489	496
Planned births	2275	1939	1942
All births in waves 1 & 2	2831	2428	2438

raises concerns about reporting biases due to the sensitive nature of declaring a birth as unexpected. To mitigate these biases, our measures leveraged the longitudinal aspect of the survey. We compared fertility intentions declared at cohort inclusion (wave 0) with their subsequent realization. Fertility intentions were assessed through the question: “Would you say that you intend to become pregnant?” Responses were categorized as follows: 1 = “yes, in the next 6 months”; 2 = “yes, in between 6 months and 1 year”; 3 = “yes, in between 1 and 2 years”; 4 = “yes, in more than 2 years”; 5 = “don’t want any (more) children”; 6 = “cannot have (more) children”. At each wave, respondents reported events occurring since the previous wave and up to the time of the interview. Among all possible events having occurred, we were interested in the “arrival of a child”. Given that fertility intentions can change over time (Väisänen and Jones, 2015; Trinitapoli and Yeatman, 2018), we restricted our analysis to births occurring within the first two waves; births occurring after wave 2 were not included in our analysis.

We identified the following categories of births in our study. **Unplanned births** ($n = 556$) occurred at either wave 1 or 2 to women who declared at cohort inclusion that they did not intend to have a child within that time span. These births are divided into the following two subcategories. **Mistimed births** ($n = 294$) occurred to women who initially intended to have a child in more than 2 years and declared the arrival of a child at wave 1 or 2, and to those declaring they intended to have a child in more than 1 year and declared the arrival of a child at wave 1. **Unwanted births** ($n = 262$) occurred to women who declared at inclusion that they did not want any (more) children and subsequently declared the arrival of a child at wave 1 or wave 2.

We considered **planned births** ($N = 2275$) as those occurring at wave 1 or 2 to women who had declared at inclusion that they wished to become pregnant within 2 years. Unplanned births represent around 20% of all births in our sample (25.9% at wave 1 and 15.9% at wave 2). This percentage is consistently higher than figures based on retrospective information (Bonnet et al., 2021), suggesting that ex post rationalization might lead to underestimating the rates of unplanned births.

3.1.2. Outcome variables

General health was self-rated at each wave of the Constances study, measured on a 1–8 scale, which we recoded to range from 1 = very poor health to 8 = very good health. Self-rated health is a holistic measure correlating with different indicators of physical, mental, and functional health, and has good predictive validity for mortality and illness prevalence (Wu et al., 2013).

Women’s mental health was measured using the CES-D scale, a short self-reported scale designed to measure depressive symptoms in the general population. The 20-item scale considers symptoms associated with depression, similar to those used in longer validated scales. The scale was tested in household interviews and in psychiatric settings, demonstrating high internal consistency and test-retest repeatability (Radloff, 1977). For each item, responses ranged from 0 to 4. We considered a dichotomized variable equal to 1 if the woman experienced depressive symptoms during the previous 4 weeks, and 0 otherwise, based on the commonly used cut-point of 23. CES-D mental health scale questions were asked upon survey inclusion and in some follow-up interviews (in 2015 and 2018), resulting in fewer observations over time compared to self-rated health (Table 1).

3.1.3. Controls

We included several control variables, measuring both time-invariant (at inclusion in the survey) and time-varying characteristics, which we expected could be related to the experience of an unplanned birth and to health levels. The time-invariant variables are: educational level (tertiary education, secondary education, lower education); parity at inclusion; and the birth of subsequent children. The time-varying variables are: age, partnership status (whether the woman was in a cohabiting relationship), and employment status (whether the woman was employed).

4. Methods

We began by detailing the demographic and socioeconomic characteristics of women included in the study who experienced planned, unwanted, or mistimed births. Additionally, we analyzed the distribution of these births across age groups, as age strongly influences both health patterns and reproductive behavior (see Fig. A1 in the Online Appendix for health patterns by age). We also analyzed the birth distribution based on the parity and educational attainment of the women upon their inclusion in the survey.

To investigate the impact of unplanned and planned births on maternal health (H1), we conducted fixed-effects event studies. Health outcomes were regressed on a set of time dummies $S_{it} = t - r_j$, where r represents the relative time before and after the birth event (s), interacted by a variable indicating whether the pregnancy was unplanned, as indicated in the following:

$$\text{Health}_{it} = \sum_s \gamma_s * 1(S_{it} = s) * \text{unplanned birth} + X_{it}'\alpha + \eta_i + \nu_t + \varepsilon_{it}$$

where γ are coefficients for the time relative to the event (birth), which occurs at $s = 0$. For $s < 0$, they represent pre-event trends. For $s \geq 0$, they capture the effective treatment effects, that is, the dynamic impact of the event on the outcome. X includes age and other individual controls; ν_t and η_i are time and individual fixed effects; $t - 1$, the omitted category, serves as the reference point.

The reference health level was established as that before the arrival of the child (as in Kleven et al., 2019). The time of the event was defined as the wave when the woman reported the arrival of a child in the past 12 months—designated as time 0 in our models. This means that time 0 could vary from 0 to 11 months after the occurrence of the event. The reference level $t - 1$ could similarly vary from 0 to 11 months before the arrival of the child. At $t - 1$, some women could already be pregnant (with or without being aware). Since births in our study could occur at wave 1 or wave 2, and women were observed up to seven years after birth, observation could range potentially from $t - 2$ to $t + 7$. However, due to limited observations across all waves for some women, we aggregated health observations from $t + 3$ to $t + 7$ to present the results. We ran linear models for self-rated general health and linear probability models for the probability of experiencing depressive symptoms. All models controlled for time-varying partnerships and employment status. The primary models grouped unwanted and mistimed births together and compared them against planned births. Note that the mother’s age at wave t is not perfectly collinear with time since we employ a discrete age variable (in brackets) and regroup observations from $t + 3$ to $t + 7$ post-inclusion.

To examine whether the effects of having and unplanned birth versus a planned birth varied by maternal age, we conducted the same analysis on the sample stratified by age group (30 years or younger vs. older than 30 years).

4.1. Robustness checks

In additional models we excluded mistimed births, thereby comparing planned and unwanted births. Mistimed and unwanted births may occur in distinct life-circumstances, thus representing different life experiences with potentially varying consequences for maternal well-being (Brown and Eisenberg, 1995; Hayford and Guzzo, 2016).

Following Kleven et al. (2019), we implemented an alternative model specification. To create a control group, individuals who did not experience childbirth were included and assigned a placebo birth, thus establishing a time-to-event set of variables based on the age distribution at childbirth of those who did have children during the study period. This approach allowed us to assess whether the observed health patterns were attributable to childbirth by comparing both planned and unplanned births to the health trends of those who did not have any children. In these models, fixed effects were excluded and we instead

incorporated controls for both time-invariant and time-varying individual characteristics. The results are shown in the Online Appendix (Figs. A2 and A3).

Lastly, in another specification (not shown), the models were run on balanced panels to address the issue of changing sample composition, which is handled by individual fixed effects in unbalanced panels. Additionally, we explored other measures of unplanned pregnancy, including more restrictive (only considering births at wave 1) and broader definitions (including births at later waves), all yielding similar results. We also conducted additional models where general health was operationalized as a dichotomous variable (optimal vs. non-optimal health), and mental health as a continuous version of the CES-D scale. Finally, specifications of the models on the dichotomized CES-D category were conducted using logistic models instead of linear probability, with consistent results across all analyses. Given the potential impact of relatively small sample size on the analysis of depressive symptoms, we employed an alternative measure of symptoms to ensure our results remained unaffected by the lack of statistical power. For waves without CES-D scale data, we used respondents' self-reported feelings (whether they felt depressed). Results from these analyses were consistent with those from the main specifications (see Table 1b).

5. Results

5.1. Women experiencing unplanned births are initially more socioeconomically disadvantaged

Women experiencing unplanned births exhibit notably distinct demographic and socioeconomic characteristics from those with planned births (see Table 2). On average, women with unplanned births are one

Table 2

Characteristics of the sub-sample of women who had a child at wave 1 or 2, by kind of birth.

	Type of birth			
	Unwanted	Mistimed	Planned	Total
<i>Age</i>	36.09	29.97	31.54	31.80
<i>sd</i>	(5.02)	(3.87)	(4.04)	(4.38)
<i>Age groups</i>				
18–24	1.26%	8.00%	3.13%	3.49%
25–29	10.08%	38.91%	32.04%	30.70%
30–34	28.15%	42.18%	43.29%	41.72%
35–39	35.29%	9.82%	18.62%	19.24%
40–44	25.21%	1.09%	2.93%	4.85%
<i>Number of children</i>	1.63	0.69	0.57	0.69
<i>sd</i>	(0.99)	(0.81)	(0.71)	(0.81)
<i>Number of children</i>				
0	18.49%	50.91%	54.44%	50.62%
1	18.49%	30.91%	34.91%	32.91%
2	44.12%	16.36%	9.59%	13.63%
3	18.91%	1.82%	1.06%	2.85%
<i>Cohabiting</i>	77.54%	76.30%	93.79%	90.32%
<i>sd</i>	(0.42)	(0.43)	(0.24)	(0.30)
<i>Educational level</i>				
Secondary or lower	27.43%	17.04%	14.27%	15.84%
<i>sd</i>	(0.45)	(0.38)	(0.35)	(0.37)
Tertiary	41.35%	37.78%	41.08%	40.75%
<i>sd</i>	(0.49)	(0.49)	(0.49)	(0.49)
Higher education	31.22%	45.19%	44.65%	43.42%
<i>sd</i>	(0.46)	(0.50)	(0.50)	(0.50)
<i>Employed</i>	85.29%	84.73%	91.47%	90.14%
<i>sd</i>	(0.35)	(0.36)	(0.28)	(0.30)
<i>General health</i>	6.56	6.63	6.63	6.63
<i>sd</i>	(1.17)	(1.07)	(1.03)	(1.05)
<i>Depressive symptoms</i>	24.03%	22.43%	19.00%	19.85%
<i>sd</i>	(0.43)	(0.42)	(0.39)	(0.40)
<i>N</i>	262	294	2275	2831

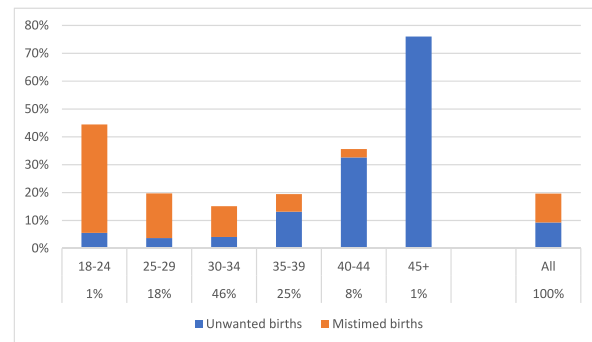
Note: All variables pertain to time of inclusion in the survey (wave 0), thus to pre-birth levels. Women who experienced childbirth after wave 2 were excluded from the sample.

year older (32.8 vs. 31.5 years), had more children (1.15 vs. 0.57), and are more often without a cohabiting partner (24% vs. 6%). Specifically, women with unwanted births are older (average 36.1 years) compared to those with planned births (average 31.6 years), while those with mistimed births are consistently younger than both groups (29.0 years).

The proportion of unplanned births is highest at the two extremes of fertile life (Fig. 1a), with nearly half of unplanned births occurring between ages 18 and 24, and significant percentages after age 40 (36% for ages 40–44 and 70% for age 45 and older). However, births at these ages are rare and represent less than 10% of all births. Additionally, unplanned births, particularly unwanted births, are more common among mothers with at least 2 children compared to childless women or mothers with only one child (Fig. 1b).

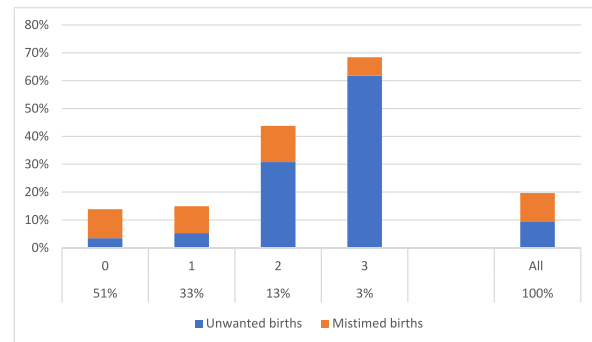
A clear educational gradient is also observed in the prevalence of unplanned births (Fig. 1c): The proportion of unplanned births decreases

a. % of unplanned births by mother's age



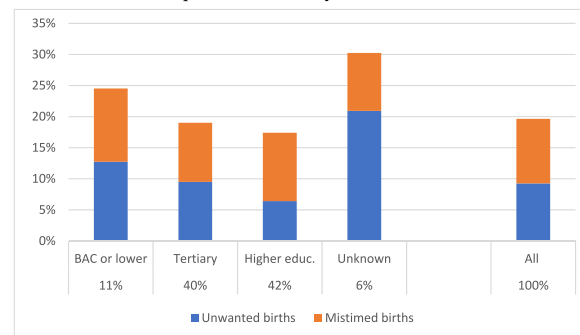
Note: The percentages under the age categories indicate the distribution of total births by age.

b. % of unplanned births by parity



Note: The percentages under the birth number categories indicate the distribution of total births by parity.

c. % of unplanned births by mother's education



Note: The percentages under the educational categories indicate the distribution of total births by education level.

Fig. 1. Characteristics of women experiencing planned and unplanned births.

with a woman’s educational level, as unwanted births are particularly less frequent among highly educated women. Women having unplanned births are also less often employed compared to women having planned births (Table 2). Thus, women having unplanned births are more disadvantaged across different life domains.

Looking at health levels, compared to women with planned births, women who experienced unplanned births reported lower self-rated health at inclusion in the cohort (prior to the birth). However, this is true only for unwanted births, while no difference is reported among mistimed births. Additionally, both unwanted and mistimed births reported more frequent depressive symptoms.

5.2. Health following planned and unplanned births

Results from the first fixed-effects event study show that women experience an overall decrease in general self-rated health in the years following a birth (both planned and unplanned). However, the health trajectories following planned and unplanned births differ significantly (see Fig. 2). Women who had an unplanned birth consistently report lower levels of health throughout the whole observation period, including before the arrival of the child. Among women who experienced a planned birth, a slight, gradual decrease in health is observed, leading to significantly lower levels of health compared to pre-birth levels approximately two years after the arrival of the child. In contrast, unplanned births are followed by a sharp decrease in health in the year following birth, with health levels dropping substantially immediately after birth and stabilizing thereafter. This decrease in health is notably greater than that experienced by women who had a planned birth (approximately 0.2, double the standard deviation (SD) of $p < 0.001$, compared to around 0.08, $p > 0.5$), thereby confirming our main hypothesis (H1).

The patterns differ for mental health (Fig. 3). Women who experienced an unplanned birth show markedly higher risks of depressive symptoms before the arrival of the child. However, no additional increase in risk emerges after the birth. In contrast, the arrival of a planned child is followed by a significant increase in the risk of depression, which remains elevated compared to pre-birth levels until the end of our observations, eventually converging to levels similar to those experienced by women who had an unplanned birth. Contrary to our second hypothesis (H2), this suggests that mental health is not more adversely

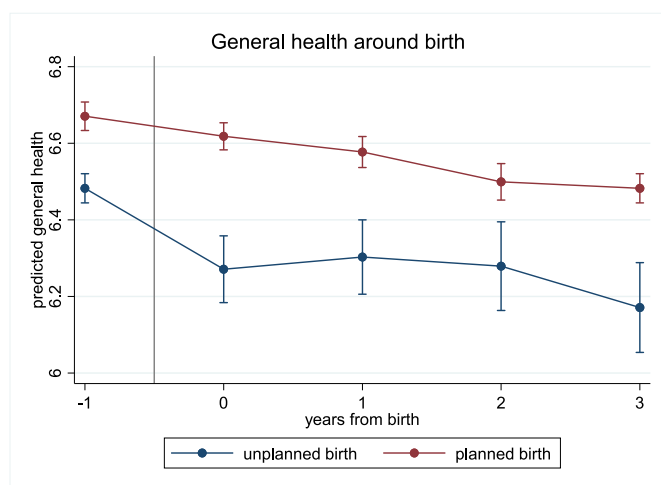


Fig. 2. Predicted self-rated health around planned and unplanned births, results from fixed-effects event study

Notes: N = 11,184 observations for 2428 women who had a planned or unplanned birth and provided valid information on general health (1939 women with planned, 489 women with unplanned births). The models control for time-varying partnership and employment status. Health at $t - 1$ is the reference point.

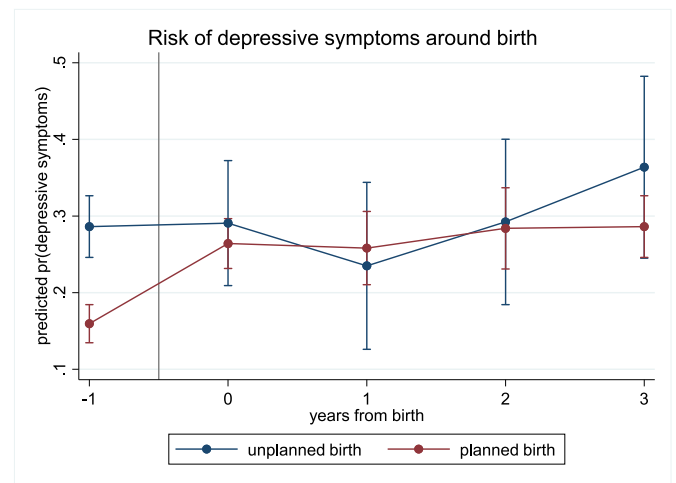


Fig. 3. Predicted risk of depressive symptoms around planned and unplanned births, results from fixed-effects models

Notes: N = 4763 observations for 2438 women who had a planned or unplanned birth and valid information on depressive symptoms (1942 with planned, 496 with unplanned birth). The models control for time varying partnership and employment status. Health at $t - 1$ is the reference point.

affected by an unplanned birth compared to a planned birth.

5.3. Heterogeneous effects by maternal age

General health follows a decreasing trend after birth for both mothers aged under 30 years and those aged 30 and older (Fig. 4). While the sharp decline in the year following the arrival of the child is of similar magnitude and statistically significant for both groups, the health levels continue to decline in the subsequent year for younger women before returning to levels similar to pre-birth. In contrast, the decline for older women stops at $t + 1$, but their health levels never return to pre-birth ones.

5.4. Additional results

When we consider only unwanted births among unplanned births, women who experienced an unwanted birth show an even more pronounced drop in general health following the birth compared to those with planned births (Fig. 5). Additionally, they exhibit a marked increase in the risk of depressive symptoms (Fig. 6). However, this increase does not differ from the risk experienced by mothers after a planned birth.

6. Conclusion

Despite the high rates of unplanned births still observed in many countries, little is known about maternal health following such births. Due to data structure and study designs, previous literature has often failed to clarify whether unplanned births directly impact women’s well-being or if the observed outcomes are instead related to socioeconomic disadvantages among women likely to experience these births (Gipson et al., 2008). In this study, we examined the annual changes in self-rated health and the risk of depressive symptoms following unplanned and planned births. Using fixed-effects models on longitudinal data, we accounted for maternal characteristics and health levels before pregnancy.

Our findings align with previous observations in the literature, indicating that women who experienced an unplanned birth tended to come from more disadvantaged backgrounds compared to those who had planned births. Net of the characteristics captured by the individual fixed effects and time-varying variables, our hypothesis was confirmed:

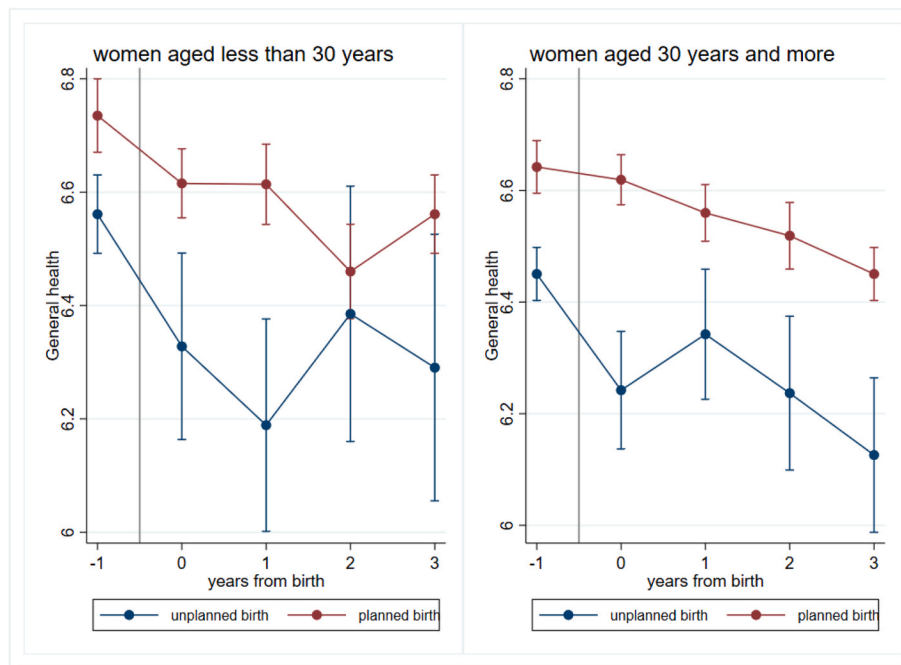


Fig. 4. Predicted self-rated health around planned and unplanned births, by maternal age group
 Notes: N = 11,184 observations for 2428 women who had a planned or unplanned birth and provided valid information on general health (853 women aged less than 30; 1642 women aged more than 30). The models control for time-varying partnership and employment status. Health at $t - 1$ is the reference point.

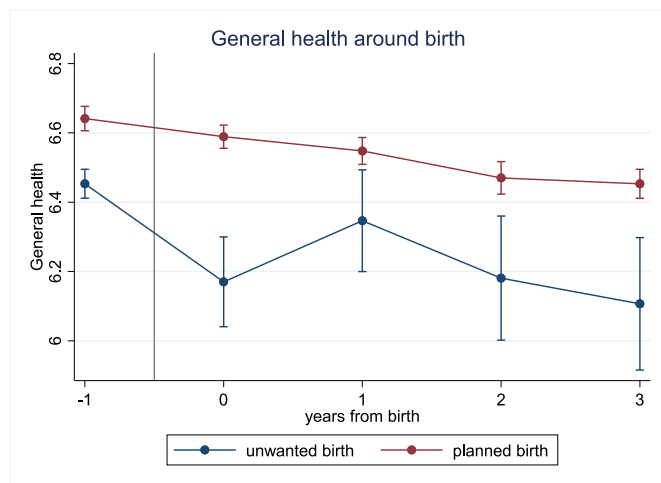


Fig. 5. Predicted self-rated health around unwanted and planned births
 Notes: N = 10,218 observations for 2168 women who had a planned or unwanted birth and valid information on health (1939 with a planned, 229 with unwanted birth). The models control for time-varying partnership and employment status. Health at $t - 1$ is the reference point.

compared to a planned birth, experiencing an unplanned birth led to a greater decline in health levels in the years following birth. Specifically, the decrease in general self-rated health was substantially and significantly greater after unplanned and especially unwanted births. Conversely, the risk of depressive symptoms did not significantly increase after unplanned births, but it did after planned births. Before birth, this risk was higher for mothers who had not planned the pregnancy, leading to a convergence in depressive symptoms after birth regardless of pregnancy intentions. This suggests, contrary to our hypothesis, that mental health is not more adversely affected by an unplanned compared to a planned birth.

Traditionally, studies on unplanned births have focused on those

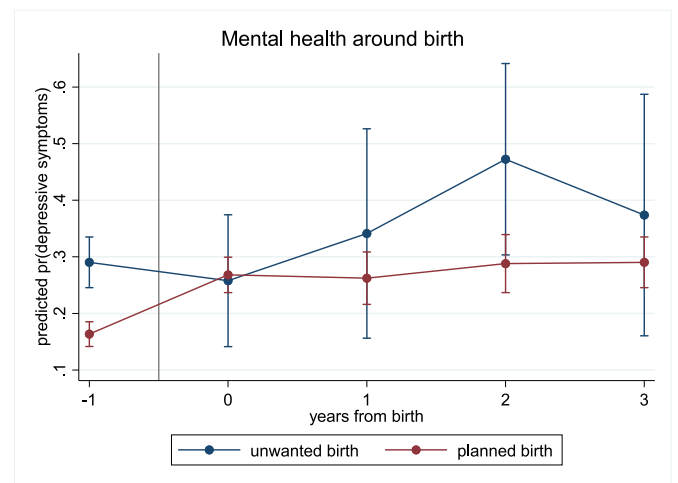


Fig. 6. Predicted risk of depressive symptoms around unwanted and planned births
 Notes: N = 2938 observations for 2175 women who had a planned or unwanted birth and provided valid information on depressive symptoms (1942 with planned, 233 with unwanted birth). The models control for time-varying partnership and employment status. Health at $t - 1$ is the reference point.

occurring at very young ages, both in the US (Gipson et al., 2008) and in European countries (Carlander et al., 2023). However, our findings indicate that many unplanned, and especially unwanted, births occurred at relatively advanced ages. This observation may partly reflect the characteristics of the Constances cohort, which comprises women aged 18 and older, but it also aligns with trends of fertility postponement. Furthermore, recent evidence from France shows that the increase in rates of unplanned births over the past decade has been primarily driven by women aged 30 and older (Bonnet et al., 2021).

Additionally, women are increasingly experiencing unplanned births at higher parities. As the profile of women experiencing unplanned births evolves due to major demographic and social trends, the

consequences of these births may also be changing. When we stratified our sample by age, we found that the decline in health was more pronounced up to two years after birth among women younger than 30 compared to older women. However, younger women experienced a quicker recovery afterward. This suggests that an unplanned birth may be more destabilizing at younger ages, but the better initial health conditions of younger women allow for a more complete and faster recovery compared to older women. Additionally, factors not accounted for in the analysis, particularly financial factors, may play a role. For example, the reduction in childcare costs when children start free nursery school at age 3 may alleviate the financial burden of having a child for young mothers.

Our results also underscore the importance of distinguishing between unwanted and mistimed births, as these experiences were associated with substantially different demographic and family profiles: Women who experienced an unwanted birth were typically older and tended to already have two or more children. This suggests that unwanted births often occurred after women had completed their desired fertility. In contrast, women who had a mistimed birth were younger and often had one child already.

Interpreting our results warrants caution due to sample size limitations. However, it appears that the negative health consequences were more pronounced in cases of unwanted births compared to mistimed births.

This study substantively advances the literature on the consequences of unplanned births. A key contribution is our ability to identify unplanned births prospectively, rather than retrospectively, using longitudinal data that provide information about fertility intentions and subsequent fertility behavior. Our findings reveal a higher proportion of unplanned births in our sample (approximately 20%) compared to prior studies relying on retrospective cross-sectional measures, which tend to underestimate these rates. However, it is crucial to note that fertility intentions can change over short periods (Trinitapoli and Yeatman, 2018). For instance, some women may have initially declared at inclusion no immediate desire for children but later changed their intentions and had a planned birth shortly thereafter, suggesting that our estimates might also overestimate unplanned birth rates. The short interval between measuring intentions and the birth event should mitigate this issue to some extent. Sensitivity analyses focusing only on births reported at wave 1 yielded the same results.

Another key contribution of our study lies in its longitudinal design, inclusion of individual fixed effects, and consideration of pre-birth health information. These aspects enable us to differentiate between the health effects of unplanned births and selection effects. Our data reveal that women who experienced an unplanned birth self-reported poorer overall health and more depressive symptoms at the initial survey wave, prior to experiencing the birth. Importantly, the health changes observed were adjusted for these pre-pregnancy levels.

However, the relatively limited post-birth timeframe in our study limits our ability to explore potential long-term health improvement trends beyond the initial post-birth health decline. Nonetheless, our study's capability to dynamically assess health changes in the years following birth constitutes a noteworthy contribution to the literature. Previous research has typically focused on outcomes over only a few points in time, often during pregnancy or immediately after birth, making our longitudinal approach particularly valuable.

Our study does have some limitations. Firstly, the enrollment rate for the Constances cohort was low because volunteers needed to visit a regional health screening center for examination. Typically, women who decline participation in health surveys tend to have lower socioeconomic status compared to those who participate. While our participation rate was comparable to other similar cohorts like the UK Biobank (5.45%, see Fry et al., 2017), we acknowledge that our results could potentially be explained by selection due to differences in participation rates between treated and control groups, even after controlling for observed characteristics. This inherent limitation in our data should be

mitigated by using individual fixed effects, which account for time-constant unobserved heterogeneity.

Secondly, despite the large sample size of the Constances Cohort Study, the number of unplanned births that we identified and followed over several years was relatively small. This could potentially lead to issues of lacking statistical significance in our analyses. This also means that our main analyses had to group unwanted and mistimed births together under the overarching category of unplanned births.

Lastly, our study exclusively focused on unplanned live births, which represent only a subset of unplanned pregnancies, as most unplanned pregnancies in France result in abortions (Bonnet et al., 2021). The absence of data on women who opt for abortion following an unplanned pregnancy means that our study sample is selective: It includes only those who choose to carry the pregnancy to term and have a live birth. Given the accessibility of abortion in France, it is plausible that most unplanned pregnancies are terminated in this manner. This selective process may partly explain the relatively older age and higher parity of the women in our sample who experienced unplanned births. Young women facing their first unwanted pregnancy, which could impact their education and career prospects, may be more inclined to choose abortion compared to older women experiencing additional unplanned births. It is also conceivable that in countries with less widespread contraceptive use and restricted access to abortion, unplanned pregnancies might have more pronounced adverse consequences than those observed in our study. Our findings may represent a conservative estimate of the impacts of unplanned births.

The high prevalence of unplanned births and their detrimental health effects highlight critical issues for public health policy. In France, unwanted pregnancies are predominantly due to incorrect use of oral contraceptives or the use of unreliable methods, such as barriers or natural methods (Diamond-Smith et al., 2014). They may also be due to a decline in the use of the pill, despite it being freely accessible, which has not been offset by an increase in the adoption of highly effective long-acting reversible contraception methods (Le Guen et al., 2020).

Women of low socioeconomic status often rely more on non-prescription contraceptive methods like withdrawal, barriers, or natural family planning (Congy et al., 2023), due to limited access to gynecologists, whose numbers are decreasing in France. They also use long-acting reversible contraception methods less frequently, primarily because they consult general practitioners more often than gynecologists (Bajos et al., 2004, 2012), who are less likely to recommend these methods (Roux et al., 2017).

Increasing the use of highly effective contraceptive methods presents a potential solution to mitigate the health disparities associated with unplanned pregnancies in France and improve women's health outcomes. Strategies to achieve this include reversing the decline in the number of gynecologists, training general practitioners in long-acting reversible contraception methods, improving women's knowledge about contraception and its anticipated effects, and, above all, developing safer methods suitable for both young and older women (Moreau et al., 2014).

Effective communication between healthcare providers and women is also crucial for optimal maternal care during pregnancy and after childbirth (Heaman et al., 2015). Empathetic, respectful, attentive, and supportive healthcare professionals have been shown to facilitate healthcare use among women (Balaam et al., 2013). Additionally, training midwives to empower socially disadvantaged women will ensure they feel heard and have a greater sense of control in their maternity care decisions (Ebert et al., 2014).

Despite the highlighted limitations, our study is one of the first to longitudinally examine the impact of unplanned births on maternal health, and it is the first to do so within the French context. Overall, our findings suggest potential adverse effects on maternal health stemming from experiencing unplanned, particularly unwanted, births that cannot be solely attributed to the disadvantaged socioeconomic conditions often associated with such pregnancies.

Interestingly, these health effects appear to be primarily related to physical rather than mental health, as the incidence of depressive symptoms was not significantly affected by unplanned births. This underscores the importance of targeted medical follow-up for these women. However, without data on antenatal care and health behaviors during pregnancy, we cannot assess whether these factors explain the observed effects. Based on the existing literature, we hypothesize that they may indeed play a role.

Moreover, our results highlight a shifting demographic profile among women experiencing unplanned births, underscoring the need for ongoing research with contemporary data across diverse contexts to enhance our understanding of this issue.

Ethics approval

All confidentiality, safety and security procedures were approved by the French legal authorities. According to the French regulations, the CONSTANCES Cohort project has obtained the authorisation of the National Data Protection Authority (Commission nationale de l'informatique et des libertés-CNIL). CNIL verified that before inclusion, clear information is provided to the eligible participants (presentation of CONSTANCES, type of data to be collected, ability to refuse to participate, informed consent, etc). In addition, CONSTANCES was approved by the National Council for Statistical Information (Conseil national de l'information statistique-CNIS), the National Medical Council (Conseil national de l'Ordre des médecins-CNOM), and the Institutional Review Board of the National Institute for Medical Research-INSERM.

CRedit authorship contribution statement

Anna Barbuscia: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Ariane Pailhé:** Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization. **Anne Solaz:** Writing – review & editing, Formal analysis, Conceptualization.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.socscimed.2024.117350>.

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