Women's Physical Health Around Live and Non-Live Births

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Introduction

Several physiological characteristics of women, such as maternal smoking, obesity, advanced maternal age, low socioeconomic status, and pre-existing medical conditions (e.g., hypertension and diabetes), have been identified as predictors of physical health during and after pregnancy (Guelinckx et al., 2008; Heazell et al., 2016; Lee and Rowlands, 2015; Morin et al., 2017; Okoth et al., 2022). Additionally, the type of pregnancy outcome—whether a live birth or a non-live birth (miscarriage or stillbirth)—has been shown to be a significant determinant of women's physical health. Evidence suggests that women who experience miscarriage or stillbirth are at a higher risk of poorer health outcomes, such as cardiovascular diseases, metabolic disorders, and chronic pain conditions, compared to those who experience live births (Kyriacou et al., 2022; Muehlschlegel et al., 2020). However, there is a gap in understanding whether these associations originate before conception, during gestation, or persist long after pregnancy. This study aims to address these gaps by examining the unadjusted and adjusted associations between pregnancy outcomes and women's health before, during, and after their first gestation.

Objectives

The primary objectives of this study are threefold:

1. To document the association between pregnancy outcomes ("live birth" or "non-live birth", which includes miscarriage and stillbirth) and women's health before, during, and after their first gestation to determine if women who experience non-live births were already in poorer physical health before conception.

2. To analyze the trajectory of women's physical health post-pregnancy to understand whether, and to what extent, those experiencing miscarriage or stillbirth fare worse compared to their counterparts who have live births.

3. To explore potential drivers of these associations by examining how the unadjusted relationships change when adjusting for maternal characteristics (e.g., age, socioeconomic status, pre-existing conditions) across various time periods.

Methods

This study uses data from the Understanding Society Survey (UKHLS), a longitudinal panel survey that is representative of the British population. The data, collected from 2009 to 2023, includes 2,386 pregnancies of women who were childless at the time and reported a pregnancy for the first time. The key explanatory variable is the outcome of the first pregnancy, categorized as either a live birth or a non-live birth, which includes miscarriage and stillbirth. Voluntary terminations (abortions) are excluded from the analysis.

The primary dependent variable is the Physical Component Summary (PCS) of the SF-12 questionnaire, which measures physical functioning, bodily pain, general health perceptions, and role limitations due to physical health problems. The PCS is standardized with a mean of 0 and a standard deviation of 1, allowing for comparisons across populations and time periods. An additional indicator of cardiovascular problems is included due to its prevalence in the data and its relevance in the literature (not displayed in this extended abstract). The main explanatory variables are a set of dummy variables indicating the time (in months) before and after the end of pregnancy for the two groups of women (reporting a live or a non-live birth). The two groups are mutually exclusive. The control variables include women's age, partnership status (cohabiting, married, single), educational attainment, 5-category job class (NSSEC scale), mental health (measured using

the Mental Component Summary (MCS) of the SF-12, which assesses emotional well-being, vitality, and social functioning), post-pregnancy transition to a(nother) motherhood.

Statistical Analysis
Five linear probability models are estimated to understand the association between pregnancy outcomes and women's physical health. These models allow the coefficients to be interpreted as marginal effects, representing percentage differences in health outcomes relative to the average level in the sample. The analysis begins with an unadjusted model (Model 1), which examines the association between pregnancy outcomes and women's health before and after pregnancy. Subsequent models incrementally introduce additional covariates, such as maternal demographic characteristics (Model 2), socioeconomic characteristics (Model 3), and mental health (Model 4), culminating in a fully adjusted model (Model 5) that includes the transition to a(nother) child (a second child for women in the “live birth” group, a first child for women experiencing in the “non-live birth” group). This approach helps to determine whether the trajectories of physical health differ systematically before conception and how these trajectories evolve post-pregnancy.

Results
Descriptive analyses (Table 1 and Figure 1) indicate that, prior to pregnancy, physical health (PCS scores) and the prevalence of cardiovascular disease are comparable between women who have a live birth and those who do not. In the period closer to pregnancy (24-13 months before), the "live birth" group shows a significantly lower PCS score (51.84) compared to the "non-live birth" group (54.58). This decline is likely due to negative physical experiences related to gestation reported by some women in the "live birth" group, whereas no women in the "non-live birth" group are pregnant during this period since miscarriages or stillbirths occur within nine months of conception. Post-pregnancy, PCS scores improve for both groups, but women with non-live births consistently report lower PCS scores than those with live births. The prevalence of cardiovascular disease remains higher in the non-live birth group, suggesting a persistent disparity in health outcomes based on pregnancy outcome.

Event-study analysis (Figures 1-2 and Table 2) shows that both groups maintain steady physical health profiles in the periods "25+ months before pregnancy end" and "13-24 months before pregnancy end." A significant decline in PCS is observed in the "12-1 months before pregnancy end" period, with a sharper decline among women who experience non-live births. Adjusting for maternal and socioeconomic characteristics attenuates this decline, but the differences remain statistically significant for between the “live birth” and the "non-live birth" group between 13 and 24 months after the end of pregnancy. Also, the PCS score for the women with a pregnancy loss remains steadily below the pre-conception level in the short and in the long term (61+ months after pregnancy end).

Discussion
The results provide evidence consistent with the hypothesis that an involuntary pregnancy termination is associated with worse physical health outcomes beyond just mental health effects. Women who experience miscarriage or stillbirth report consistently lower physical health scores than their counterparts who transition to motherhood in the short term. The decline in physical health is not fully explained by maternal age, socioeconomic factors, mental health or transition to motherhood. These findings suggest that pregnancy loss itself, rather than pre-existing conditions, could be an independent risk factor for poorer physical health outcomes.

This study highlights the importance of presenting both unadjusted and adjusted results when examining the impact of pregnancy outcomes on women's health. The findings suggest that miscarriage or stillbirth may independently contribute to poorer long-term physical health. Future research should further explore the mechanisms linking pregnancy loss to health outcomes and consider the role of pregnancy loss as a potential risk factor for adverse health outcomes in women.

Table 1. Descriptive statistics

	Live Birth		**Non-Live birth**	
	Mean/%	SD	Mean/%	SD
Woman's age	31,22	6,19	31,72	7,72

Degree	0,49	0,5	0,46	0,5
Other higher	0,12	0,33	0,12	0,32
A level etc.	0,22	0,41	0,27	0,45
GCSE etc.	0,13	0,34	0,12	0,32
Other qualification	0,01	0,12	0,01	0,09
No qualification/Not reported	0,02	0,13	0,02	0,15
Union duration (years)	5,49	6,96	5,09	6,46
Married	0,41	0,49	0,44	0,5
Cohabiting	0,53	0,5	0,49	0,5
Mental health (women)	46,74	10,26	46,13	10,53
Mental health (men)	49,34	8,98	48,87	8,95
GHQ (depression score, women)	11,64	5,71	11,9	5,55
GHQ (depression score, men)	10,36	4,81	10,74	4,9

Figure 1. Mean and standard deviation of PCS SF-12 (indicator of physical health) of women reporting a live or a non-live birth before their pregnancy.

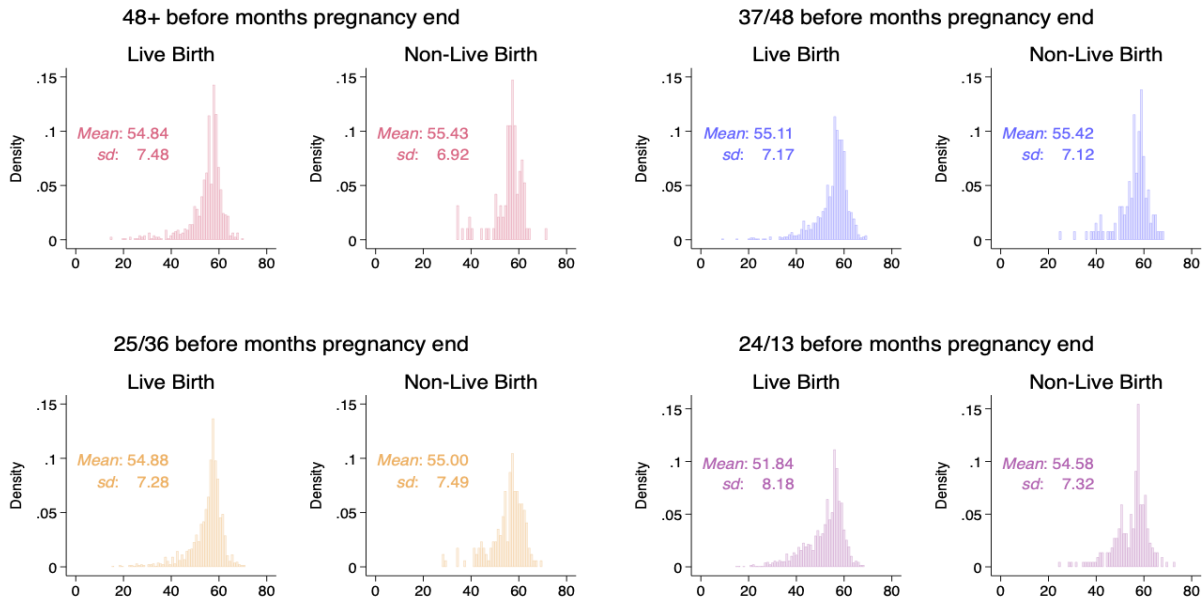


Table 2. Linear probability models. Event-study analysis of PCS SF-12 (Physical score with mean 1 and standard deviation 0) with individual fixed effect. Linear probability models.

	(1) Model 1 Baseline controls	(2) Model 2 Model 1 + Partnership status	(3) Model 3 Model 2 + socio-economic status	(4) Model 4 Model 3 + mental health	(5) Model 5 Model 4 + transition to a(nother) child
Months before/after pregnancy ending in a live birth (*Ref*: 25+ months before)					
24/13 before	-0.03	-0.03	-0.02	-0.03	-0.03
	(0.021)	(0.021)	(0.021)	(0.020)	(0.020)
12/1 before	-0.34***	-0.34***	-0.32***	-0.30***	-0.30***
	(0.025)	(0.026)	(0.026)	(0.025)	(0.025)
0/12 after	-0.19***	-0.19***	-0.15***	-0.12***	-0.12***
	(0.026)	(0.027)	(0.027)	(0.026)	(0.026)
13/24 after	-0.13***	-0.12***	-0.08***	-0.08***	-0.08**
	(0.029)	(0.030)	(0.030)	(0.030)	(0.030)
25/36 after	-0.14***	-0.14***	-0.09***	-0.10***	-0.09***
	(0.032)	(0.033)	(0.033)	(0.032)	(0.032)
37/48 after	-0.14***	-0.14***	-0.08**	-0.10***	-0.09***
	(0.035)	(0.035)	(0.036)	(0.036)	(0.036)
49/60 after	-0.13***	-0.13***	-0.07*	-0.08*	-0.07*
	(0.039)	(0.040)	(0.040)	(0.040)	(0.040)
61+ after	-0.13***	-0.13***	-0.07	-0.08*	-0.08*
	(0.043)	(0.044)	(0.044)	(0.044)	(0.044)
Months before/after pregnancy ending in a non-live birth (*Ref*: 25+ months before)					
24/13 before	-0.01	-0.01	0.00	-0.05	-0.05
	(0.054)	(0.054)	(0.054)	(0.050)	(0.050)
12/1 before	-0.04	-0.04	-0.03	-0.06	-0.06
	(0.051)	(0.051)	(0.051)	(0.049)	(0.049)
0/12 after	-0.17***	-0.17***	-0.15**	-0.24***	-0.24***
	(0.061)	(0.062)	(0.061)	(0.060)	(0.060)
13/24 after	-0.31***	-0.31***	-0.29***	-0.29***	-0.33***
	(0.061)	(0.061)	(0.061)	(0.060)	(0.072)
25/36 after	-0.26***	-0.25***	-0.22***	-0.22***	-0.30***
	(0.072)	(0.072)	(0.071)	(0.068)	(0.086)
37/48 after	-0.23***	-0.23***	-0.19**	-0.22***	-0.30***
	(0.075)	(0.075)	(0.074)	(0.072)	(0.094)
49/60 after	-0.21**	-0.21**	-0.16*	-0.19**	-0.29***
	(0.089)	(0.089)	(0.089)	(0.084)	(0.109)
61+ after	-0.23***	-0.23***	-0.18**	-0.20**	-0.30***
	(0.082)	(0.082)	(0.081)	(0.082)	(0.113)
Age linear	0.04***	0.04***	0.02**	0.03**	0.02**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Age squared	-0.00***	-0.00***	-0.00*	-0.00	-0.00
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Marital status (*Ref:* Married)					
Cohabiting		-0.01	-0.02	-0.00	-0.01

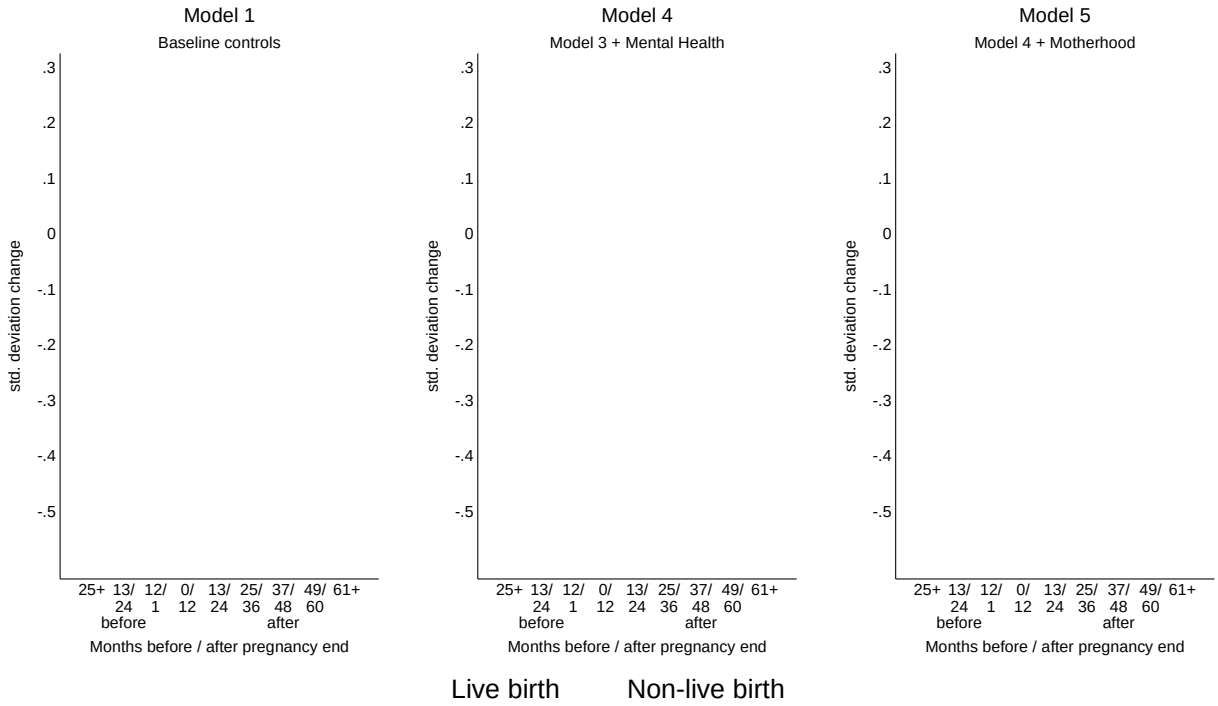
		(0.019)	(0.019)	(0.019)	(0.019)
Single		-0.01	-0.01	-0.02	-0.03
		(0.040)	(0.040)	(0.040)	(0.040)
ISEI linear			-0.00	-0.00	-0.00
			(0.002)	(0.002)	(0.002)
ISEI squared			0.00	0.00	0.00
			(0.000)	(0.000)	(0.000)
Highest qualification ever reported (*Ref*: Degree)					
Other higher			-0.14***	-0.17***	-0.17***
			(0.039)	(0.042)	(0.042)
A level etc			-0.06**	-0.07**	-0.07**
			(0.027)	(0.027)	(0.027)
GCSE etc			-0.22***	-0.26***	-0.26***
			(0.038)	(0.040)	(0.040)
Other qualification			-0.31***	-0.37***	-0.37***
			(0.109)	(0.116)	(0.116)
No qualification			-0.25**	-0.32**	-0.32**
			(0.121)	(0.129)	(0.129)
Not reported/missing			-0.33***	-0.27***	-0.27***
			(0.092)	(0.096)	(0.095)
Private sector (*Ref: Private*)					
Public sector			0.01	-0.00	-0.00
			(0.018)	(0.018)	(0.018)
None			-0.01	0.00	0.00
			(0.030)	(0.029)	(0.029)
Current job: Five Class NS-SEC (*Ref:* Managers and Professionals)					
Intermediate			-0.03	-0.02	-0.02
			(0.024)	(0.023)	(0.023)
Small employers & own account			-0.01	-0.03	-0.02
			(0.052)	(0.051)	(0.051)
Lower supervisory & technical			0.00	0.01	0.01
			(0.040)	(0.041)	(0.041)
Semi-routine & routine			-0.07**	-0.05	-0.05
			(0.030)	(0.030)	(0.030)
Unspecified paid employment			-0.06	-0.08	-0.07
			(0.071)	(0.069)	(0.069)
Unemployed			-0.10	-0.15*	-0.15*
			(0.077)	(0.075)	(0.075)
Out of Labour Force			-0.10	-0.12*	-0.12*
			(0.071)	(0.069)	(0.069)
Unspecified			0.05	0.01	0.01
			(0.093)	(0.090)	(0.090)
Partner income (GBP of 2015)			0.00	0.00	0.00
			(0.002)	(0.002)	(0.002)
SF-12 (MCS)				-0.26***	-0.26***
				(0.008)	(0.008)
A(nother) child					-0.14*
					(0.081)
Constant	-0.50***	-0.52***	-0.03	-0.06	0.08
	(0.177)	(0.178)	(0.206)	(0.209)	(0.229)

Observations	19,153	19,153	19,153	19,153	19,153
Number of individuals	2,386	2,386	2,386	2,386	2,386

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 2. Change in the PCS SF-12 (indicator of physical health) from Models 1, 4 and 5 (Table 2)



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