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Job loss and fetal growth restriction: identification of critical trimesters of exposure

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Abstract

Purpose: Previous research suggests that job loss in a household during pregnancy may perturb fetal growth. However, this work often cannot rule out unmeasured confounding due to selection into job loss. Recent work using data on exogenous job loss (due to a plant closure) finds that a father's unexpected job loss during his spouse's pregnancy increases the risk of a low weight birth. Using a unique set of linked registries in Denmark, we build on this work and examine whether associations between a father's unexpected job loss and low birthweight differ by trimester of *in utero* exposure. We additionally examine trimester-specific associations of job loss with small-for-gestational-age, a proxy for restricted fetal growth, which may cause low birthweight.

Methods: We apply a sibling control design to over 1.4 million live births in Denmark, 1980 to 2017, to examine whether this plausibly exogenous form of job loss corresponds with increased risk of low weight or small-for-gestational-age births, depending on the timing of displacement in the first, second, or third trimester.

Results: Results indicate an elevated risk of low birthweight (OR = 1.80, 95% CI: 1.24, 2.62) and small-for-gestational-age (OR = 1.40, 95% CI: 1.02, 1.93) among gestations exposed to job loss in the second trimester of pregnancy. Sensitivity analyses using continuous outcome measures (e.g., birthweight in grams, birthweight for gestational age percentile) and maternal fixed effects analyses produce substantively similar inference.

Conclusions: Findings support the notion that unexpected job loss may affect fetal growth and that the second trimester in particular appears sensitive to this external stressor.

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Supplementary materials
Additional supporting information may be found in the online version of this article.
TableS1–S4.
Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.annepidem.2022.05.003.

Keywords

Job loss; Unemployment; Birth outcomes; Fetal growth; Sibling comparison designs

Introduction

Fetal growth restriction (FGR), which often results in low birthweight (LBW, <2,500 gms) or small-for-gestational-age (SGA) delivery, raises the risk of infant morbidity and mortality, child developmental delays, and chronic disease later in life [1]. Much literature reports socioeconomic disparities in LBW and SGA such that mothers of lower socioeconomic status (SES) disproportionately deliver these higher risk infants [2,3]. SES disparities in LBW and SGA, which are widespread, persistent, and robust, have led to much research attempting to identify underlying causes [4].

Job loss in the household serves as one unambiguous stressor which disproportionately occurs among lower SES groups [5]. Sudden unemployment not only induces long-term adverse financial consequences on the family but also health sequelae. Persons who lose jobs experience reductions in both short- and long-term earnings [6], an elevated risk of subsequent job loss [7], relatively more adverse life events (e.g., divorce) [8], and an increased risk of mortality [9].

The events of the Great Recession and the sudden rise in unemployment during the COVID-19 pandemic have renewed interest in the health consequences of unemployment and financial strain, including among pregnant women [10]. Scholars have previously examined potential relations between individual-level job loss and birth outcomes [11–13]. Some (but not all) of this work reports that unemployment varies positively with adverse birth outcomes [14–16]. However, a key challenge to inferring a causal relation between job loss and birth outcomes involves confounding by a common cause.

This type of confounding, which is not unique to social epidemiology, occurs due to the non-random nature of exposure to social and economic stressors. As it relates to job loss and birth outcomes, unmeasured factors (e.g., poor maternal health) that precede both self-reported job loss as well as the infant's adverse birth outcome (e.g., LBW) may induce strong confounding bias. Evidence that persons who self-report recent job loss show a greater prevalence of health problems *before* unemployment relative to those who stay employed renders this "common cause" confounding a potentially important type of bias [17–21].

In a recent analysis, our team used high-quality individual-level data from Denmark to examine a quasi-randomized form of job loss [22]. Using a set of employment, income, and birth registers, we identified a plausibly exogenous shock—a father's job displacement due to a plant closure—and linked this information to the cohabiting spouse's birth outcome. We used a sibling comparison design, moreover, to control for unmeasured confounding of time-stable maternal characteristics by adjusting for the birth outcome of the matched infant sibling. Results show an increased risk of LBW, but not preterm birth (PTB), among gestations *in utero* when the father suddenly and unexpectedly lost his job.

This study builds on our recent findings in two ways. First, we explore which specific trimesters of pregnancy appear sensitive to job loss. Identification of these sensitive windows may assist with understanding etiological mechanisms which connect sudden economic stress to FGR. Previous literature in this area shows counter-vailing responses depending on whether the economic stressor occurred in the first or second trimester [13,23]. That work, however, relies on ecological macroeconomic fluctuations and therefore cannot isolate specific pregnancies for which the father suddenly lost a job. Second, we move beyond examination of LBW by additionally assessing indicators of FGR, including SGA and birthweight for gestational age percentiles (BWGA). These measures separate the role of early parturition from FGR, which is thought to have a distinct etiology (i.e., from PTB). Past evidence of null relations between a father's job loss and PTB indicate that restricted fetal growth may underlie the previously observed association of job loss with LBW.

Methods

Variables and data

We conducted our study in Denmark because, unlike most countries (e.g., the US), their national registers include unique personal identification numbers that allow individual-level linkages across datasets. We retrieved data on our key birth outcome variables, including birthweight and gestational age, from the Medical Birth Register (MFR). The MFR permits linkage of the mother to the birth as well as to the spouse at the time of the birth. We linked the MFR to the Integrated Database for Labor Market Research (IDA, described below), the Education Register, and the Population Register to access data on parents' income and employment, educational attainment, and sociodemographic characteristics (e.g., citizenship, immigration status). We used 1980 as the start date for our analyses given that information on the job loss variable (available from IDA) begins in this year. We retrieved data through 2017, the last date available to us at the time of our tests.

We retrieved our exposure variable – a spouse's job loss due to a plant closure – from IDA. IDA provides multilevel data on individual employment, plants, and firms operating in Denmark. We identified fathers in the MFR who experienced job loss due to the closure of a single-plant firm in the private sector. This form of displacement appears plausibly exogenous as plant closures occur primarily due to firm-level factors, rather than individual performance. A more detailed description of our definition of involuntary job loss due to a plant closure, exposure classification, and sensitivity checks appear elsewhere [22].

The MFR includes 2,282,144 live singleton births between 1980 and 2017. We excluded live births missing maternal or paternal identifiers or gestational age (n = 80,596), and with implausible birthweight-gestational age combinations (n = 8806). We defined biological plausibility using the Alexander method [24] for infants delivered between 22 and 45 weeks' gestational age, where cut-points for plausible birthweight differ by gestational week. For example, we excluded infants delivered at 35 weeks' gestational age weighing less than 750 or more than 4500 grams.

Next, we restricted our sample to first, second, and third order siblings — in other words, excluding live births to mothers who had less than two or more than three births during the study period — resulting in 1,722,057 total live births. From this pool, we then identified 743,574 sibling comparison pairs. Our identification strategy sought to maximize the number of sibling pairs in which the later born sibling was exposed *in utero* to a father's involuntary job loss. We included first and second born siblings in comparison pairs if neither birth was exposed to job loss (i.e., exposure concordant pairs) (n = 741,238). For exposure discordant siblings (n = 2336), we included pairs in which the second born sibling was exposed to job loss, but not the first (n = 1838), as well as pairs in which the third born sibling was exposed to job loss, but not the second (n = 498).

Among exposure discordant pairs, we further classified trimester-specific exposure to a job loss using the estimated date of conception (i.e., date of birth minus gestational age [in weeks] at birth plus 2 weeks) and the estimated date of job loss. We defined infants as exposed in the first, second, or third trimester if job loss occurred after the estimated date of conception and before 98 days of gestation (<12 weeks), between 98 and 188 days of gestation (12–24 weeks), or after 188 days of gestation and before the date of birth (>24 weeks), respectively.

Building on previous research which finds an elevated risk of LBW among gestations exposed to a father's unexpected job loss during pregnancy [22], we began our trimester-specific exploration with LBW as the main outcome variable. We then further examine SGA, which gauges severe growth restriction while adjusting for timing of parturition, and corresponds with an increased risk of infant morbidity, developmental delays in childhood, and chronic disease in adulthood [25]. To derive SGA, we first calculated a birthweight percentile measure that captures size for the infant's gestational age at birth. The MFR, which has less than 0.5% of values with missing or implausible information on birthweight and gestational age, contains the population base of all birthweight values for births in Denmark. To assign birthweight percentiles, we therefore derived sex-specific BWGA tables using the birthweight distributions in the MFR 1980–2017. Consistent with the literature, we then defined SGA infants as those with weight for gestational age less than the 10th percentile (i.e., using the Danish population-based reference chart) [26].

Analytic strategy

A key concern with exploring trimester-specific responses to a spouse's job loss during pregnancy involves confounding by a common cause [27]. Unmeasured characteristics of the mother or the family may precede both a spouse's job loss and the birth outcome, which may confound results. To minimize confounding by a common cause, we used as the exposure a plant closure resulting in displacement. This exposure represents a plausibly exogenous shock in that its timing is independent of common causes (e.g., pre-existing health issues) of job loss and adverse birth outcomes at the individual level.

In addition, we used a sibling comparison design to estimate "within-family" associations between job loss and birth outcomes. This approach controls for confounders shared across siblings (e.g., parental genomes), but may amplify confounding when siblings differ in common causes of exposure and outcome [28]. The use of a plausibly exogenous shock (i.e., plant closure) resulting in siblings' discordant exposure to job loss, however, minimizes bias due to unmeasured confounders not shared across siblings [29,30].

The sibling comparison design requires that we focus our tests on mothers with at least two live births over the test period. As with previous work, we compare the birth outcome of an infant exposed *in utero* to job loss to the birth outcome of an infant born to the same mother before the job loss. The sibling "match" approximates the birth outcome to that mother had the spouse's job loss not occurred (i.e., a counterfactual scenario). We focus our matched sibling analyses on pairs in which the higher birth order (i.e., target) sibling is exposed to job loss but the lower birth order (i.e., index sibling) is not because previous work indicates that the effect of job loss on fertility timing and stress can endure for several years. To avoid this potential exposure "contamination" or "carryover effect," we excluded pairs in which the index sibling is exposed to job loss [31].

We explored trimester-specific associations between job loss and birth outcomes by estimating the conditional log-odds of LBW, and, separately, SGA, as a function of a spouse's job loss during pregnancy, and adjusted for the birth outcome of the index sibling born *before* the job loss. In this specification, which controls for time-invariant confounders, we adjusted for time-varying sociodemographic characteristics including age of mother and father, highest education completed by mother and father, and parity.

Sensitivity analyses

We performed several sensitivity checks. First, we conducted sensitivity analyses predicting birthweight (in grams, in an ordinary-least-squares [OLS] regression) and BWGA (in percentiles, OLS regression) to assess the robustness of results to continuous outcome specifications. Next, given concerns about potential collider bias when controlling for a sibling's birth outcome, we repeated the matched sibling analysis but removed control for the birth outcome of the first delivery and conducted maternal fixed effects analyses by conditioning logistic regressions on the mother's unique identifier [29].

We also conducted conventional between-mother analyses to assess the external generalizability of our sibling comparison design. For these analyses, we restricted the analytic sample to outcome discordant sibling pairs, as only these pairs inform the matched sibling analyses when predicting binary outcomes (i.e., LBW, SGA). Additionally, given that our identification strategy uniquely examines job loss that occurs during the higher parity sibling's perinatal period, resulting in a strong correlation between job loss and parity, we attempt to "remove" the association of parity from models estimating SGA risk and BWGA. To this end, we reconstructed our reference charts using parity-specific birthweight percentiles to derive parity-specific SGA and BWGA outcomes.

Finally, we relaxed the sibling comparison design (which required that we restrict our sample to mothers with at least two live births) and examined relations between job loss and birth outcomes among a new sample drawn from the population of all mothers, including those with only one live birth during the study period, by conducting a propensity score matching (PSM) analysis. A plant closure represents a plausibly exogenous shock. However, fathers may nonetheless "select" into vulnerable occupations or plants susceptible to closure according to SES and/or demographic characteristics, such as low educational attainment, which may confound relations with birth outcomes.

We matched fathers of any live birth exposed to involuntary job loss due to plant closure (n = 5398) to fathers not exposed to plant closures by fitting a logistic regression model estimating the probability of job displacement during pregnancy as a function of baseline covariates. The variables that best predicted this exposure included personal income and unemployment benefits in the fiscal year preceding the year of infant birth, highest educational attainment, and age at baseline. We matched observations with a “greedy nearest neighbor” algorithm using a caliper of ±0.01 on the probability scale [32–35]. This process successfully matched all exposed fathers to unexposed fathers, yielding a dataset of 10,796 births. We then repeated regression analyses in this propensity matched sample (which differs from the sibling comparison sample). All statistical analyses were performed using SAS software version 9.3 (SAS institute, Cary, NC).

Results

Table 1 describes the sociodemographic characteristics of the parents and live births of 743,574 sibling pairs, by sibling order and father’s job loss status, over the study period. The distribution of age, education, and immigrant status among mothers who gave birth to sibling pairs appears generally similar to those of mothers with only one live birth (available upon request). Among sibling pairs in which neither was exposed to father’s job loss, first (i.e., index) and second (i.e., target) siblings show a LBW prevalence of 4.22% and 2.70%, and SGA prevalence of 12.70% and 7.38% prevalence, respectively. A father’s unexpected job loss due to a plant closure occurred among 2336 pregnancies that resulted in a live birth (see Table 1). Among these sibling pairs, unexposed first siblings and exposed second siblings show a LBW prevalence of 3.60% and 3.55%, and SGA prevalence of 12.52% and 7.96% prevalence, respectively.

Fig. 1A and B plot the unadjusted prevalence of LBW (Fig. 1A) and SGA (Fig. 1B) by sibling order and trimester of exposure to job loss due to plant closure. For example, Fig. 1B shows that, among sibling pairs in which the second sibling was not exposed to a father’s job loss, SGA prevalence declines substantially with increasing sibling order. This decline reflects the fact that risk of SGA is greatest among first births. The slope of the decline in SGA prevalence across sibling order appears similar among never exposed second siblings and those exposed during the first or third trimester of pregnancy. By contrast, second siblings exposed during the second trimester show a persistently high prevalence of SGA which diverges from the overall pattern.

Results from the adjusted sibling comparison analysis (Table 2) cohere with unadjusted plots in that second siblings exposed to job loss during the second trimester of pregnancy show an increased risk of LBW (OR: 1.80, CI: 1.24, 2.62) and SGA (OR: 1.40, 95% CI: 1.02, 1.93). We, however, observe no difference in either LBW or SGA from expected levels among second siblings exposed in the first or third trimester. We assessed the robustness of results using binary outcomes (LBW, SGA) to various model specifications, including continuous outcomes of birthweight and BWGA percentiles. When using birthweight (continuous, in grams) as the outcome, adjusted linear regression results show a 55.24 gm reduction in birthweight among second siblings exposed to job loss in the second trimester (95% CI: −89.49, −18.98) (Table 2). In addition, exposure in the first trimester corresponds with a 44.75 gm reduction in birthweight (95% CI: −83.37, −6.13). Results using BWGA percentile (continuous, from 1 to 99) indicate substantively similar results to those of SGA, LBW, and birthweight, but do not reach conventional levels of statistical detection (Table 2). Conventional between-mother analyses restricted to discordant pairs (Appendix Table S1) and maternal fixed effects analyses (Appendix Table S2) show similar results across binary outcomes. Logistic and linear regressions estimating parity-specific SGA and BWGA (i.e., using reconstructed birthweight percentile reference charts) also produce similar results (Appendix Table S3). In contrast to our original analysis (Table 2), however, job loss in the second trimester shows a statistically detectable association with parity-specific BWGA (Appendix Table S3).

We then relaxed the sibling comparison design and conducted PSM analyses in a propensity-matched sample drawn from all live births (including non-siblings). The standardized difference in means for baseline covariates falls below the 10% threshold considered sufficient for covariate balance [35]. Table S4 in the Appendix shows the distribution of job loss by trimester and birth outcomes in the propensity matched sample. Compared to the sibling comparison results (Table 2), PSM analyses show several differences (Table 3). First, job loss in first (OR = 1.82, CI: 1.37, 2.42) and second (OR = 1.48, CI: 1.13, 1.95) trimesters corresponds with an elevated odds of LBW (rather than only the second trimester). Second, the association between second trimester job loss and SGA is no longer detectably different from the null. Third, results a statistically detectable association between second trimester job loss and BWGA (Table 3).

Discussion

Pregnancy represents a sensitive period in which job loss in the household likely perturbs fetal growth and development. However, observational work which relies on macroeconomic data or self-reports of job loss risks bias due to confounding on a common cause (e.g., preexisting health issues). This study builds on our recent work in Denmark [22] and explores trimester-specific responses to a sudden and unexpected stressor – a spouse's job loss due to a plant closure. Results of sibling comparison analyses indicate elevated odds of LBW and SGA of infants exposed in the second trimester of pregnancy to job loss. Additional propensity score analyses show mixed results, including some evidence of increased sensitivity of gestations to job loss in the first trimester (at least, with respect to LBW), as well as the second trimester. Results appear generally consistent across models specifying continuous measures of birthweight and BWGA, parity-specific SGA and BWGA, and maternal fixed effects analyses. Findings suggest that intervention efforts to combat the adverse effects of this stressor may want to focus on the first two trimesters of pregnancy.

Our analysis extends previous work by our team [22] by providing evidence of trimester-specific adverse effects of a spouse's job loss. The fact that we identified an increase in SGA following a spouse's job loss, combined with previous work which finds no relation with PTB or timing of parturition, suggests that a potential mechanism by which a spouse's job loss affects pregnancy may involve elevated fetal growth restriction. Within the broader literature, our work most closely resembles Lindo's [16] sibling comparison analysis of birthweight using the US Panel Study of Income Dynamics. We, however, hesitate to compare our work directly to that study given that it did not examine plausibly exogenous job loss. In addition, Lindo examined a 2-year window by which job loss could affect birthweight, which leaves open the possibility that selective fertility decisions, rather than exposure to job loss *in utero*, accounts for results. Nevertheless, the convergence of findings across these studies supports the notion that job loss in a family may perturb fetal growth, as indicated by elevated risks of LBW and SGA.

Job loss increases family strain and, across the family unit, raises the risk of maladaptive coping responses (e.g., elevated tobacco or alcohol consumption), disrupts sleep patterns [36], and increases symptoms of anxiety and depression [37]. These responses occur even in societies with generous social safety nets. Mechanistic research, moreover, finds a positive relation between stress during pregnancy and LBW [38,39]. Adaptation to stressful events, moreover, may include activation of the immune system (e.g., increased plasma circulation of IL-2, TNF-α, IL-10, and 25(OH)D) which may adversely affect fetal growth [40,41]. We encourage subsequent work which may uncover these and other mechanisms by which a father's job loss during the second trimester affects fetal growth.

Strengths and limitations

A principal strength of our study involves the use of a sibling comparison design to control for time-invariant characteristics of mothers that may affect the tendency to deliver adverse birth outcomes. For instance, the sibling comparison approach automatically adjusts for unobserved maternal characteristics, such as short maternal height and chronic hypertension, that may increase risk of delivering growth restricted infants across multiple births. Models also adjusted for sociodemographic characteristics that may vary across pregnancies, including education level. Yet, we likely do not capture all time-varying characteristics of families that may confound associations between job loss and birth outcomes, such as changes in income or adverse health events (i.e., that occur during the interpregnancy interval). The use of plant closures as an exogenous exposure, however, minimizes confounding due to time-varying characteristics, as this form of job loss appears relatively independent of common causes of displacement and adverse birth outcomes, compared, for instance, to self-reported job loss [18,20,21].

The strong internal validity of the sibling comparison design, while minimizing confounding, includes an important limitation of unknown external validity [42]. The sibling design is also susceptible to bias when the exposure of interest is heavily confounded (Frisell et al. [29]; Sjölander et al., 2021), but that is unlikely to a problem in our analysis due to the exogenous nature of plant closures. The rarity of unexpected job loss among fathers with a pregnant spouse led us to focus on less than 0.4% of second siblings in Denmark who we classified as exposed. Although our study remained sufficiently powered to detect trimester-specific effects, we caution against using our results to estimate a population-level response to broader unemployment that occurs during larger economic cycles (e.g., Great Recession).

Conclusion

Findings in Denmark support that unexpected job loss may affect fetal growth, and that the second trimester in particular appears sensitive to this social and economic stressor. We note that Denmark's generous social safety net might mitigate even stronger associations that could potentially arise in other countries [43]. All Danes, whether employed or not, receive publicly funded health insurance with little to no out-of-pocket costs. In addition, recently dis-employed Danes receive generous unemployment insurance which covers, on average, 70 to 80 percent of the wages that were received while employed [43,44]. As a result, newly dis-employed persons suffer only a modest income loss and no loss of health insurance coverage. Whereas only replication attempts can determine the external validity of our results, we suspect that the relatively low unemployment compensation and attendant economic uncertainty that arises due to job loss in the US (relative to Denmark) would lead us to underestimate the job loss / FGR relation if one were to extrapolate Danish findings to the US case. Such replication attempts, however, require high-quality linked individual-level data on plausibly exogenous job loss, income, family structure, and birth outcomes, which, to our knowledge, remain unavailable in the US, but which we hope are forth-coming.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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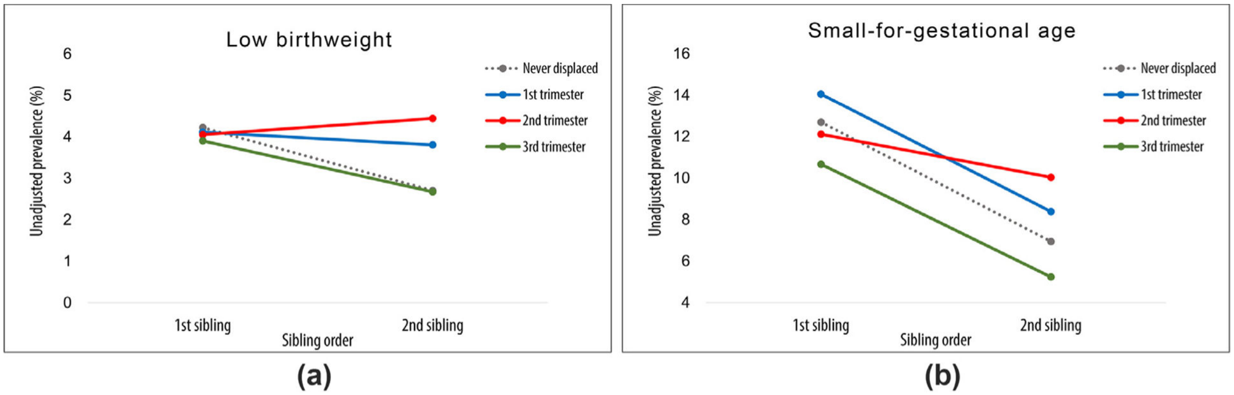

Fig. 1.

(A and B) Unadjusted prevalence (%) of (A) low birthweight and (B) small-for-gestational age[1] by sibling order and trimester of exposure to father's unexpected job loss, Denmark, 1980–2017.

[1]SGA restricted to infants born between 1997 and 2017, the time period in which sex information on the live birth is fully available (n = 362,089).

Table 1

Characteristics of parents and live births by father's job loss status among sibling pairs (n = 743,574), Denmark, 1980–2017.

	Father never lost job due to plant closure (n = 741,238)				Father lost job due to plant closure (n = 2336)			
	Index sibling		Target sibling		Index sibling		Target sibling	
	n	%	n	%	n	%	n	%
Birth characteristics								
Male *	185,558	51.46	228,071	51.30	751	50.67	853	50.68
Low weight (<2,500 g)	31,278	4.22	20,017	2.70	84	3.60	83	3.55
Small-for-gestational-age[1]	45,768	12.70	32,801	7.38	185	12.52	134	7.96
Preterm (<37 weeks)	38,295	5.17	27,422	3.70	125	5.35	97	4.15
	mean	**std**	**mean**	**std**	**mean**	**std**	**mean**	**std**
Birthweight (g)	3423.59	546.70	3574.74	547.18	3439.44	546.44	3549.58	540.26
Interpregnancy interval (days)	–	–	1055	805	–	–	1131	879
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Trimester of job loss								
First trimester	–	–	–	–	–	–	632	0.09
Second trimester	–	–	–	–	–	–	766	0.10
Third trimester	–	–	–	–	–	–	938	0.13
Mother's age, years								
<20	35,107	4.74	2759	0.37	153	6.55	7	0.30
20–24	215,856	29.12	77,449	10.45	709	30.35	285	12.20
25–29	326,415	44.04	267,787	36.13	979	41.91	796	34.08
30–34	138,252	18.65	281,328	37.95	424	18.15	873	37.37
35–39	24,279	3.28	97,553	13.16	68	2.91	343	14.68
≥40	1329	0.18	14,362	1.94	3	0.13	32	1.37
Mother's highest education								
No education reported	2148	0.29	–	–	8	0.35	–	–
Primary school	108,954	14.84	–	–	400	17.26	–	–
Upper secondary	269,727	36.73	–	–	848	36.60	–	–
Some higher education	282,696	38.50	–	–	878	37.89	–	–
BA or higher	70,812	9.64	–	–	183	7.90	–	–

Mother's immigrant status								
Danish	540,071	89.69	622,039	89.71	1777	87.24	1981	87.50
Immigrant	55,756	9.26	64,774	9.34	224	11.00	246	10.87
Descendant	6345	1.05	6609	0.95	36	1.77	37	1.63
Parity								
First birth	682,334	93.05	0	0	1727	74.92	0	0
Second birth	37,744	5.15	660,968	89.36	521	22.60	1676	71.96
Third birth or more	13,193	1.80	56,083	7.58	57	2.47	585	25.12

Abbreviations: BA = bachelor of arts; g = grams.

* Data on infant sex are available 1997–2017 (n = 362,089).

Table 2

Results of four models[*] estimating (1) LBW, (2) SGA,[†] (3) BWT (grams), and (4) BWGA (percentiles),[†] as a function of father's job loss due to plant closure by trimester of exposure, sibling matched sample (n = 743,574 sibling pairs), Denmark, 1980–2017.

Outcomes	First trimester			Second trimester			Third trimester		
Binary	**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**	
(1) LBW	1.28	0.80,	2.04	1.80	1.24,	2.62	1.07	0.69,	1.67
(2) SGA	1.03	0.71,	1.49	1.40	1.02,	1.93	0.78	0.53,	1.15
Continuous	**Coef.**	**95% CI**		**Coef.**	**95% CI**		**Coef.**	**95% CI**	
(3) BWT	−44.75	−83.37,	−6.13	−55.24	−89.49,	−18.98	20.16	−12.12,	52.43
(4) BWGA	−1.38	−3.67,	0.89	−2.00	−4.17,	0.17	0.39	−1.64,	2.42

Abbreviations: BWGA = birthweight for gestational age; BWT = birthweight; CI = confidence interval; Coef. = coefficient; LBW = low birthweight; OR = odds ratio; SGA = small-for-gestational age.

[*] All models adjusted for the birth outcome of the first sibling, year of birth of the second sibling, and time-varying sociodemographic characteristics (maternal and paternal age, education, immigrant status, and parity).

[†] SGA and BWGA analyses restricted to sibling pairs born between 1997 and 2017, the time period in which sex information on the live birth is fully available (n = 362,089).

Table 3

Results of models* estimating (1) LBW, (2) SGA,† (3) BWT (grams), and (4) BWGA (percentiles),† as a function of father's job loss due to plant closure by trimester of exposure, propensity score matched sample (*N* = 10,796), Denmark, 1980–2017.

Outcomes	First trimester			Second trimester			Third trimester		
Binary	**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**	
(1) LBW	1.82	1.37,	2.42	1.48	1.13,	1.95	0.91	0.68,	1.24
(2) SGA	1.01	0.81,	1.27	1.00	0.80,	1.23	0.89	0.70,	1.07
Continuous	**Coef.**	**95% CI**		**Coef.**	**95% CI**		**Coef.**	**95% CI**	
(3) BWT	−67.29	−107.06,	−27.52	−58.52	−94.56,	−22.48	31.80	−1.86,	65.48
(4) BWGA	−0.55	−2.58,	1.48	−1.64	−3.52,	−0.23	0.10	−1.70,	1.89

Abbreviations: BWGA = birthweight for gestational age; BWT = birthweight; CI = confidence interval; coef. = coefficient; LBW = low birthweight; OR = odds ratio; SGA = small-for-gestational age.

*All models adjusted for year of birth, maternal age, education, immigrant status, and parity.

†SGA and BWGA analyses are restricted to infants born between 1997 and 2017, the time period in which sex information on the live birth is fully available (*n* = 6848 in sample matched on job loss).