Original Contribution

Advanced Maternal Age and the Risk of Low Birth Weight and Preterm Delivery: a Within-Family Analysis Using Finnish Population Registers

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Advanced maternal age at birth is considered a major risk factor for birth outcomes. It is unclear to what extent this association is confounded by maternal characteristics. To test whether advanced maternal age at birth independently increases the risk of low birth weight (<2,500 g) and preterm birth (<37 weeks' gestation), we compared between-family models (children born to different mothers at different ages) with within-family models (children born to the same mother at different ages). The latter procedure reduces confounding by unobserved parental characteristics that are shared by siblings. We used Finnish population registers, including 124,098 children born during 1987–2000. When compared with maternal ages 25–29 years in between-family models, maternal ages of 35–39 years and ≥40 years were associated with percentage increases of 1.1 points (95% confidence intervals: 0.8, 1.4) and 2.2 points (95% confidence intervals: 1.4, 2.9), respectively, in the probability of low birth weight. The associations are similar for the risk of preterm delivery. In within-family models, the relationship between advanced maternal age and low birth weight or preterm birth is statistically and substantively negligible. In Finland, advanced maternal age is not independently associated with the risk of low birth weight or preterm delivery among mothers who have had at least 2 live births.

low birth weight; maternal age; preterm delivery

Abbreviations: CI, confidence intervals; LBW, low birth weight.

Advanced maternal age, defined as the mother being aged 35 years or above at the time of birth, is considered a major risk factor for negative pregnancy and perinatal outcomes in both low- and high-income countries (1–3). In particular, advanced maternal age is associated with increased risk of low birth weight (LBW) and preterm delivery (4–13) among both primigravidas (14) and multiparas (15–17). LBW children have more respiratory, cognitive, and neurological problems than those born with normal birth weight (18–21). Preterm babies have higher risks of heart defects, lung disorders, cerebral palsy, and delayed development (22, 23).

Although most research documents a positive association between advanced maternal age and the risk of LBW or preterm delivery, even after adjustment for parental characteristics (4–13), a subset of studies suggests that the association may be confounded by preexisting medical conditions, obstetrical history, and maternal social characteristics (24–28). This evidence raises the question of whether advanced maternal age

at birth is an independent determinant of birth outcomes, and it suggests that children born to older mothers might face higher risks due to parental characteristics that are unobservable in the data. This might occur because maternal age at birth potentially reflects multiple biological, health, and social processes (29). To our knowledge, no study has considered whether advanced maternal age at birth is independently associated with birth outcomes after adjustment for parental characteristics that are unobserved in the data. Given current trends in delayed fertility, this is an important question to address (30).

Using data from Finnish population registers, we tested whether the association between advanced maternal age and risk of LBW or preterm delivery is directly attributable to maternal age or to other confounding factors. We were interested in the combined biological, health, and social processes that maternal age at birth potentially reflects; we were not conceptualizing advanced maternal age as a proxy for any particular process. We compared the association between advanced maternal

age and the risk of LBW or preterm delivery using two alternative approaches. First, we used the standard approach that compares children born to different mothers at different ages, while controlling for observed maternal characteristics. Second, we compared children born to the same mother at different ages, adjusting for all factors shared by the siblings. This latter approach, which has not, to our knowledge, been previously used to analyze the association between (advanced) maternal age and birth outcomes but has been used to study its association with other outcomes such as IQ (31), enabled us to remove confounding by unobserved parental characteristics that are shared by siblings.

METHODS

Data

Our study used data from the Finnish population and other administrative registers. The base data were from a 20% random sample of households with at least 1 child aged 0–14 years at the end of 2000, with individual-level information on all household members (n = 415,000). Therefore, the data cover children who were born between the years 1987 and 2000 (births that occurred after 2000 were not included in this sample). The individual-level linkages between different registers, maintained by Statistics Finland, Finland's National Institute for Health and Welfare, and the Social Insurance Institution of Finland, were carried out by Statistics Finland using the unique personal identification numbers given to residents of Finland.

Birth outcomes

Information on birth outcomes was extracted from the birth register. We used 2 dependent variables: whether the child was born with LBW (less than 2,500 g at birth) and whether the child was delivered preterm (at less than 37 weeks of gestation).

Maternal age at birth

The key explanatory variable was maternal age at the birth of the child, which was also extracted from the birth register. We divided it into the following categories, in years: <20, 20–24, 25–29, 30–34, 35–39, and ≥40. We use the age group 25–29 years as the reference category, because this was the most common age range. We defined mothers who gave birth at an advanced age as those who gave birth at age 35 years or older.

Control variables

We considered a range of child and family characteristics that might be associated with both maternal age at birth and with the risk of giving birth to a baby with LBW or who was preterm. The control variables were grouped according to whether they referred to the child, the sociodemographic and behavioral characteristics of the family, or the health of the mother. The child characteristics were sex, birth order (1, 2, 3, 4, or higher), and birth year (individual-year dummy variables), which were all extracted from the birth register.

The sociodemographic and behavioral characteristics were deciles of family income (continuous), highest level of education in the household (basic, secondary, lower tertiary, higher

tertiary), and whether the mother smoked during pregnancy. Income and smoking in the family during pregnancy varied between siblings. Income, extracted from the Tax Administration's database, was measured for the year of each child's birth and varied between siblings. Education, extracted from Statistics Finland's Register of Completed Education and Degrees, was measured for the year of the first child's birth, because there was little variation between siblings. Smoking during pregnancy was taken from the birth register and could vary between siblings.

The health characteristics of the mother were divided into two groups. The first group was the mother's obstetrical history: the number of previous miscarriages (a continuous variable) and whether she had any previous stillbirths. The second group of variables measured her health during pregnancy and delivery: whether she experienced high blood pressure during pregnancy and whether the child was born in a cesarean delivery. Information on the mother's health characteristics was taken from the birth register and varied between siblings. Indirectly, these variables partially capture the mother's preexisting medical conditions and her underlying health before the pregnancy. For example, we expect that a mother with poorer health before the pregnancy is more likely to have experienced repeated miscarriages and to have developed gestational hypertension (32). Data on maternal health prior to the pregnancy were not otherwise available.

Statistical analyses

We compared the association between advanced maternal age and birth outcomes using two approaches. The standard approach used in the literature consists of analyzing the association between maternal age and the risk of LBW or preterm delivery by comparing children born to different mothers. In order to account for potential confounders, these models include controls for observable parental characteristics. We refer to these models as "between-family" models because they compare children born to different mothers.

The alternative approach was based on a comparison of siblings who were born to the same mother at different ages, and we refer to this model as the "within-family" model. The within-family model, also known as the sibling fixed-effects model, includes an indicator for each sibling group and identifies the association between maternal age and the risk of LBW/preterm birth from variation between siblings (33). The main advantage of the within-family model over the between-family model is that unobserved maternal characteristics that are shared by siblings are fully accounted for. These unobserved characteristics may, for example, include the social backgrounds of the parents, health behaviors during pregnancy, the height of the mother, and genetic factors and health characteristics that are associated with difficulty conceiving—leading to births occurring at a later age—as well as the risk of LBW or preterm delivery. Observable child characteristics that were not shared by siblings—such as sex of the child, birth order, and birth year—were adjusted for as in standard regression analysis. Parental characteristics that might vary between siblings—such as family income, smoking during pregnancy, gestational hypertension, type of delivery, number of previous miscarriages and having

Table 1. Descriptive Statistics by Maternal Age for Children With Siblings Born in Finland During 1987–2000

Maternal Age Group, Years	No. of Births	%	LBW, %	Preterm, %	Birth Year (mean)	Birth Order (mean)	Household Income Decile (mean)	Mother Smoked During Pregnancy, %	Household High Education, %	Mean No. of Miscarriages	Any Previous Stillbirth, %	Cesarean Delivery, %	High Blood Pressure, %
All	124,098[a]		2.2	3.7	1993.0	2.1	5.6	12.7	14.1	0.2	0.9	13.2	2.5
10–19	2,183	1.8	3.1	4.2	1992.2	1.2	2.9	37.3	0.2	0.1	0.2	9.2	2.4
20–24	20,562	16.6	2.6	4.0	1992.4	1.5	4.2	20.2	2.0	0.1	0.4	10.3	2.2
25–29	45,946	37.0	1.9	3.3	1992.7	1.9	5.5	11.4	12.7	0.2	0.7	12.1	2.3
30–34	37,580	30.3	2.0	3.3	1993.4	2.3	6.2	10.2	20.3	0.3	1.1	14.4	2.4
35–39	14,924	12.0	2.7	4.4	1993.9	2.7	6.3	10.0	20.5	0.4	1.8	17.0	3.1
≥40	2,903	2.3	3.6	5.9	1994.0	3.6	6.3	8.1	19.2	0.7	2.8	19.4	4.9

Abbreviation: LBW, low birth weight.
[a] Total number of births in analytical sample.

experienced a stillbirth—were also adjusted for as in standard regression analysis.

We estimated 4 regression models using both the between- and within-family approaches. We estimated linear probability models, such that the coefficients of the models are directly interpretable as marginal effects, and to enable comparability across the within and between-family models (33). Model 1, in both the within- and between-family models, documents the descriptive association between advanced maternal age and LBW/preterm birth, and included a control only for the child's sex. Subsequent between- and within-family models progressively included adjustments for child and then parental characteristics. Model 2 introduced controls for the child's birth order and birth year. Model 3 introduced controls for parents' sociodemographic and behavioral characteristics. Model 4 introduced a control for maternal health characteristics.

Inclusion and exclusion criteria

The data covered a sample of 170,621 children born during 1987–2000. Multiple births were excluded from the analyses (3%), because the children are more likely to be LBW/born preterm and to be born to an older mother. Observations that had a missing value on any of the variables used in the analyses were also excluded (7% of the total sample; see Web Table 1, available at https://academic.oup.com/aje/). The prevalence of missing data ranged from 0.3% (education) to 5% (smoking during pregnancy). Each sibling group was based upon siblings sharing a mother and father; we therefore focus on full siblings. Because the sibling fixed-effect model is estimated using variation between siblings, it was necessary to exclude singletons (22%). The resulting sample size for the sibling analytical sample was 124,098 children and 63,407 mothers. On average, there were slightly fewer than 2 children per mother, because we kept in the sample children who had siblings who were born before 1987 and for whom we did not have information about birth outcomes. We used this study population for both the between-family and within-family comparative analyses.

RESULTS

Descriptive analyses

Table 1 shows the descriptive characteristics of the analytical sample. The prevalences of LBW, 2.2%, and preterm delivery, 3.7%, in our analytical sample are lower than those among the general population of Finland (34, 35) because our sample excluded families with single children and multiple births, and both of those types of birth are more likely to be LBW/preterm. The most common maternal age group was 25–29 years (37%). LBW and preterm births showed a U-shaped association with maternal age. Mothers aged 40 years or older had the highest prevalence of LBW and preterm delivery.

Mothers who give birth from age 30 years onward appeared similar in terms of socioeconomic status. Household income and education both increased with maternal age up to ages 30–34 years and then stabilized. Rates of smoking during pregnancy decreased with maternal age but varied relatively little after age 30 years. Pregnancy complications and health issues increased with maternal age. Although these results

Table 2. Between-Family and Within-Family Fixed-Effects Models[a] for Low Birth Weight for Siblings (Number of Births = 124,098; Number of Sibling Groups = 63,407) Born in Finland During 1987–2000

Model and Maternal Age Group, Years	Model 1[b]		Model 2[c]		Model 3[d]		Model 4[e]	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Between-family model[f]								
10–19	1.2	0.5, 2.0	0.7	−0.1, 1.5	0.2	−0.6, 1.0	0.4	−0.4, 1.2
20–24	0.7	0.5, 1.0	0.5	0.3, 0.8	0.3	0.1, 0.6	0.5	0.2, 0.8
25–29	0.0	Referent	0.0	Referent	0.0	Referent	0.0	Referent
30–34	0.2	0.0, 0.4	0.4	0.2, 0.6	0.5	0.3, 0.7	0.2	0.0, 0.4
35–39	0.8	0.5, 1.1	1.1	0.8, 1.4	1.2	0.9, 1.5	0.6	0.3, 0.9
≥40	1.8	1.1, 2.5	2.2	1.4, 2.9	2.3	1.5, 3.0	1.2	0.5, 1.9
Within-family model[f]								
10–19	2.0	1.1, 2.8	0.9	−0.1, 2.0	0.9	−0.1, 2.0	0.9	−0.1, 1.9
20–24	0.8	0.5, 1.2	0.5	0.0, 0.9	0.5	0.0, 0.9	0.5	0.0, 0.9
25–29	0.0	Referent	0.0	Referent	0.0	Referent	0.0	Referent
30–34	−0.4	−0.7, −0.1	−0.2	−0.6, 0.2	−0.2	−0.7, 0.2	−0.2	−0.6, 0.2
35–39	−0.1	−0.6, 0.3	−0.1	−0.8, 0.7	−0.1	−0.8, 0.7	−0.2	−0.9, 0.6
≥40	−0.3	−1.2, 0.7	−0.4	−1.8, 0.9	−0.4	−1.8, 0.9	−0.9	−2.2, 0.5

Abbreviation: CI, confidence intervals.
[a] Coefficients denote percentage-point changes in probability of low birth weight.
[b] Model 1: no adjustment.
[c] Model 2 adjusted for birth order and birth year.
[d] Model 3 adjusted for the variables in model 2 with the addition of sociodemographic variables: household income decile, mother's smoking during pregnancy, and, in the between-family analyses, household level of education.
[e] Model 4 adjusted for the variables in model 3 with the addition of health variables: number of previous miscarriages, any previous stillbirth, high blood pressure, and cesarean delivery. In the between-family analyses, standard errors were clustered at the family level.
[f] Analytical sample included only families with at least 2 children.

suggest that older mothers are at greater risk of poorer birth outcomes, they also indicate that older mothers faced more health problems before and during pregnancy. This highlights the importance of accounting for parental characteristics, some of which may be unobservable in the data when analyzing the association between advanced maternal age and birth outcomes.

Regression analyses

Tables 2 and 3 show the maternal age coefficients for the between- and within-family models using, respectively, LBW and preterm as outcome variables. Coefficients for the control variables included in the different model specifications are presented in Web Tables 2–5.

Table 2 shows that the between-family comparative models indicated a clear association between advanced maternal age and the risk of LBW, which is consistent with previous research findings. For example, in model 2, where we adjusted for birth order and birth year, maternal age 35–39 years was associated with a 1.1-percentage-point increase in the probability of LBW (95% confidence interval (CI): 0.8, 1.4), and the age group 40 years or older with a 2.2-percentage-point increase in probability (95% CI: 1.4, 2.9). The overall prevalence of LBW in our sample was 2.2%, so the associations corresponded to approximately 50% and 100% increases in the risk of LBW, respectively. Adjustment for observed maternal socioeconomic

and health characteristics in models 3 and 4 reduced the magnitude of the coefficients by approximately half.

By using a within-family comparative model, we were further able to adjust for maternal characteristics shared by siblings that are unmeasured in the data. The results from these within-family comparisons, also presented in Table 2, showed that there was no substantive, or statistically significant, relationship between maternal age and the risk of LBW even at the oldest maternal ages in models 1 and 2, which included adjustment only for the child's birth year and birth order. The results remained essentially unchanged when including adjustments for maternal characteristics (model 3 for socioeconomic characteristics and smoking during pregnancy; model 4 for maternal health characteristics). Figure 1 illustrates the results from model 2 for both the between-family and within-family models, showing the percentage changes in the probability of LBW from the baseline probability in maternal age group 25–29 years.

The results for preterm births, shown in Table 3, were qualitatively similar to those for LBW. The between-family analyses showed that there was a statistically significant association between advanced maternal age and the probability of preterm delivery. For example, model 2 showed that giving birth in the age range 35–39 years was associated with a 1.4-percentage-point increase in the probability of preterm delivery (95% CI: 1.0, 1.8). In the age group 40 years or older, the increase was 3.1 percentage points (95% CI: 2.1, 4.0). The sizes of these

Table 3. Between-Family and Within-Family Fixed-Effects Models[a] for Preterm Delivery for Siblings (Number of Births = 124,098; Number of Sibling Groups = 63,407) Born in Finland During 1987–2000

Model and Maternal Age Group, Years	Model 1[b]		Model 2[c]		Model 3[d]		Model 4[e]	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Between-family model[f]								
10–19	0.9	0.0, 1.8	0.3	−0.6, 1.2	−0.2	−1.1, 0.7	0.3	−0.7, 1.2
20–24	0.6	0.3, 1.0	0.4	0.1, 0.7	0.2	−0.2, 0.5	0.4	0.1, 0.8
25–29	0.0	Referent	0.0	Referent	0.0	Referent	0.0	Referent
30–34	0.0	−0.2, 0.3	0.3	0.0, 0.5	0.3	0.1, 0.6	0.0	−0.2, 0.3
35–39	1.1	0.7, 1.4	1.4	1.0, 1.8	1.5	1.1, 1.9	0.9	0.5, 1.3
≥40	2.6	1.7, 3.5	3.1	2.1, 4.0	3.1	2.2, 4.0	2.0	1.1, 2.9
Within-family model[f]								
10–19	1.9	0.8, 3.1	0.6	−0.7, 2.0	0.7	−0.6, 2.0	0.7	−0.6, 2.0
20–24	1.0	0.6, 1.5	0.5	0.0, 1.1	0.6	0.0, 1.1	0.6	0.0, 1.1
25–29	0.0	Referent	0.0	Referent	0.0	Referent	0.0	Referent
30–34	−0.7	−1.0, −0.3	−0.4	−0.9, 0.2	−0.4	−0.9, 0.1	−0.4	−0.9, 0.1
35–39	−0.1	−0.7, 0.5	0.2	−0.7, 1.2	0.2	−0.7, 1.2	0.2	−0.8, 1.1
≥40	−0.2	−1.5, 1.0	0.0	−1.7, 1.8	0.1	−1.6, 1.8	−0.3	−2.0, 1.4

Abbreviation: CI, confidence intervals.

[a] Coefficients denote percentage point changes in probability of preterm birth.

[b] Model 1: no adjustment.

[c] Model 2 adjusted for birth order and birth year.

[d] Model 3 adjusted for the variables in model 2 with the addition of sociodemographic variables: household income decile, mother's smoking during pregnancy, and, in the between-family analyses, household level of education.

[e] Model 4 adjusted for the variables in model 3 with the addition of health variables: number of previous miscarriages, any previous stillbirth, high blood pressure, and cesarean delivery. In the between-family analyses, standard errors were clustered at the family level.

[f] Analytical sample included only families with at least 2 children.

associations correspond to an approximately one-third to three-fourths increase in the probability of preterm delivery (because the average prevalence in our sample was 3.7%). However, the results from the within-family comparisons, which minimize residual confounding, present a very different picture. As with

Figure 1. Change in probability of low birth weight from between-family and within-family models, Finland, 1987–2000. For more detail, see results for model 2 in Table 2.

the results for LBW, we found that maternal age is neither significantly nor substantively associated with the risk of preterm delivery in both the models that included adjustment only for the child's birth order and birth year (model 1 and model 2), and also in the models that also include adjustment for the mother's characteristics (model 3 and model 4). Figure 2 illustrates these results.
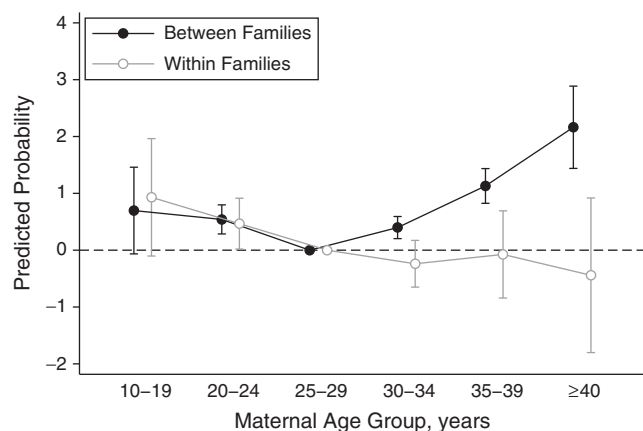
Sensitivity analyses

The analyses excluded children who did not have any siblings, because they cannot be included in the within-family analyses, and we wanted to retain comparability between the within- and between-family analytical samples. To assess how our sample selection might bias the results, Web Table 6 shows the characteristics of the excluded subsample of single-child families. The results show that the excluded subsample of mothers who have (so far) had only 1 child showed higher overall prevalence of LBW and preterm births, both of which are more likely to occur in first births. While single-child mothers were more likely to have less-favorable health (behavior) profiles, in terms of socioeconomic characteristics they were relatively similar to the sample used in the analyses. The between-family analyses were replicated on an analytical sample that included children without siblings, and the results are shown in the Web Table 7. The results for preterm births were almost identical to
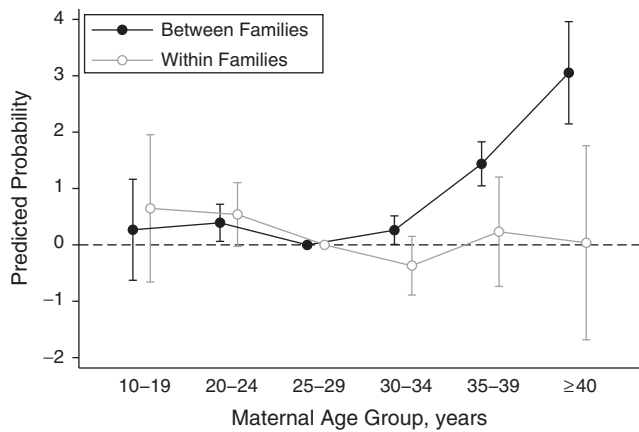
Figure 2.   Change in probability of preterm birth from between- and within-family models, Finland, 1987–2000. For more detail, see results for model 2 in Table 2.

those of the sibling sample used in the main analyses. Results for LBW were qualitatively similar, although the age gradient at advanced maternal ages was steeper. Adjustment for child and parental characteristics produced changes in the estimates that were very similar to those shown in Tables 2 and 3. These additional results suggest that the bias introduced by our sample selection is limited. As a check for robustness, we also estimated models including other variables—such as the mother's marital status and employment status and paternal age at birth—which did not change the results.

DISCUSSION

In this study, we examined whether advanced maternal age was independently associated with the probability of LBW or preterm delivery. Although our analyses replicated the pattern observed in previous research, where advanced maternal age was associated with a higher risk of LBW and preterm delivery (4–7), the analyses where we reduced the degree of confounding by maternal characteristics shared by siblings indicated that accepted knowledge on this topic must be revisited. When comparing siblings born to the same mother, an analytical approach that has not, to our knowledge, previously been applied to the associations between maternal age and birth outcomes, we found that advanced maternal age was not associated with an increased risk of LBW or preterm delivery. These results were obtained with models that controlled for birth order. Adjustment for observed maternal characteristics that vary between siblings, such as family income and smoking during pregnancy, did not change the results.

Our finding that advanced maternal age was not associated with an increase in the probability of LBW and preterm delivery suggests that there are unobserved factors that are related to both the probability of giving birth at older ages and the probability of LBW and preterm delivery. These unobservable factors may vary between women. One example may lie in unobserved maternal health characteristics that are associated both with difficulty in conceiving—leading to birth occurring

at a later age—and the risk of poor birth outcomes. Other potential variables may be the parents' social background and genetic factors. The difference could also be due to unobserved factors that vary between siblings. For example, older mothers may engage in better health behaviors (e.g., less drinking during pregnancy) that would attenuate the otherwise potentially negative biological association between advanced maternal age and birth outcomes. Older mothers might also seek antenatal care earlier in their pregnancy and have access to better care and monitoring, by which they might be able to manage the pregnancy complications associated with giving birth at an advanced maternal age (36).

This study has several strengths. First, the data set is large and allows us to compare siblings. Second, the data are not prone to self-selection because they are drawn from administrative population registers. Third, we relied on a methodological approach that enabled us to account for unobserved parental traits that are shared by siblings. To our knowledge, no previous study has analyzed the association between advanced maternal age and birth outcome using this approach.

The study also has limitations. First, the results are based upon a subset of women who had had at least 2 live births, because the sibling fixed-effect model is estimated using variation between siblings. Although the within-family approach minimized the bias in our estimates to a great extent, it did introduce a selection bias that restricted our ability to generalize the results to mothers who have given birth to only 1 child. It might also reduce the precision of the estimates, given that it reduced the sample size. Nevertheless, sibling groups with 2 or more children are more common in Finland than only children, so our results are likely to be generalizable to the majority of the population. Moreover, the results of the between-family models for the full sample suggest that the bias introduced by our sample selection was limited. A second limitation is that our analysis only considered women who successfully conceived and had at least 2 live births. Maternal age at birth is related to a woman's ability to conceive as well as to the risk of miscarriage and stillbirth. Third, we studied families in Finland, a country with a highly advanced health-care system and a world-leading low rate of infant mortality. Therefore, the results may not be generalizable to other developed contexts. Fourth, in this study we were able to establish that, in the within-family model, advanced maternal age was not associated with an increased risk of LBW/preterm birth, but were not able to establish why. This could occur because of unobserved parental characteristics of families who have children at older ages that do not vary between siblings and/or because of family characteristics that do vary between siblings. Nonetheless, when we controlled for factors that do vary between siblings (e.g., family income, smoking during pregnancy, number of previous miscarriages), the within-family results did not change. Despite these limitations, this study makes an important contribution to the literature on maternal age and birth outcomes by showing that when unobserved maternal characteristics that do not vary between siblings are accounted for, advanced maternal age is not associated with an increase in the probability of LBW or preterm delivery.

The question of whether delaying childbearing increases the risk of adverse pregnancy outcomes is important given the remarkable increase in the mean age of women at childbearing.

Knowledge about these risks is of great relevance both for women who are contemplating the postponement of childbearing and for physicians who are providing advice to patients about risks. Our results indicate that women who are pregnant at advanced ages may, in absolute terms, still be considered a group that is at risk of giving birth to a LBW or preterm child, but the results of this study indicate that this is due to factors other than their age.

Given that these findings challenge long-held conclusions about the relationship between advanced maternal age and the risk of LBW and preterm delivery, it is important that our analyses are replicated in contexts that are similar to and different from contemporary Finland. Moreover, using different data, future research should identify the unobserved confounding factors that explain the link between advanced maternal age and negative birth outcomes; this is important for the design of prevention programs designed to reduce negative birth outcomes. Furthermore, the sibling fixed-effect approach should be applied to the study of relationships between maternal age and other perinatal outcomes, which could shed light on both the costs and benefits of postponing childbearing.

ACKNOWLEDGMENTS

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