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Mother's age at delivery and daughters' risk of preeclampsia

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Abstract

Background.—Some cardiovascular disease risk factors are associated with both risk of preeclampsia and having been born to a younger or older mother. We examined whether mother's age at delivery predicts a primiparous daughter's risk of preeclampsia.

Methods.—The analysis included 39,803 Sister Study participants (designated as “daughters”) born between 1930 and 1974. Using log-binomial regression, we estimated relative risks (RR) of preeclampsia in the 1st pregnancy ending in birth (“primiparous preeclampsia”) associated with mother's age at the daughters' birth. Models included: number of older full and maternal half siblings, income level growing up, daughter's age at delivery, race/ethnicity, and 5-year birth cohort. We examined self-reported relative weight at age 10 (heavier than peers versus not) as a potential effect measure modifier.

Results.—Overall, 6.2% of daughters reported preeclampsia. Compared with those who had been born to 20–24-year old mothers, daughters of teenage mothers had a relative risk of 1.20 (95% confidence interval (CI) 1.01, 1.43) and daughters of mothers ≥25 had a ~10% lower risk. Relative weight at age 10 modified the association, with an inverse association between mother's age at delivery and preeclampsia seen only among daughters with low/normal childhood relative weight. In this subset, results were consistent across strata of daughter's age at menarche and age at first birth.

Conclusions.—These findings, based on self-reported data, require replication. Nevertheless, as women increasingly delay childbearing, they provide some reassurance that having been born to an older mother is not, *per se*, a risk factor for primiparous preeclampsia.

Keywords

preeclampsia; delayed childbirth; maternal age; parental age

Introduction

Preeclampsia is a relatively common pregnancy complication, particularly among primiparas. Although the definition of preeclampsia has changed over time, its features typically include hypertension and proteinuria after 20 weeks of gestation.¹ Women who have experienced preeclampsia (or other hypertensive disorders of pregnancy) have a higher incidence of subsequent cardiovascular disease.^{2–6} Preeclampsia and cardiovascular disease share numerous risk factors, including some that originate in early-life, such as low birth weight,^{7, 8} childhood overweight,^{7, 9} short stature,^{10–13} and early age at menarche.^{14, 15}

With age at childbearing increasing in many countries,^{16, 17} ascertaining whether delayed childbearing may negatively influence offspring health is a priority; yet, research in this area is comparatively scarce. Compelling -albeit limited- evidence for a possible sex-specific effect of advanced maternal age on offspring body weight, glucose metabolism, and blood pressure comes from a mouse study in which pups conceived by young and old dams were transferred into young surrogate mothers at the blastocyst stage.¹⁸

In humans, it is reasonably well established that offspring of older mothers tend to be taller^{19–21} and have a slightly higher risk of childhood type 1 diabetes (5% per 5-year increase of mother's age, according to a meta-analysis of 30 studies).²² However, the evidence linking mother's age at delivery with offspring blood pressure,^{19, 23–26} glucose metabolism^{20, 27, 28} and, especially, body mass index (BMI)^{19–21, 29–34} is mixed.

In this study, we examined whether mother's age at childbirth predicted daughter's subsequent risk of preeclampsia in her first pregnancy leading to birth.

Methods

Study population

The Sister Study is a cohort study of 50,884 women enrolled from the US and Puerto Rico between 2003 and 2009 (two of whom withdrew their data, leaving 50,882). Women were eligible if they were between 35 and 74 years old and had at least one half or full sister with breast cancer (but had never themselves had breast cancer before enrolment). After providing informed consent, the women answered questions through computer-assisted interviews and self-administered questionnaires, including modules about family history, selected exposures, reproductive history, and other domains. More details on the Sister Study are provided elsewhere.³⁵ Women were eligible for the current analysis if they had given birth at least once prior to enrolment, had been born between 1930 and 1974, and did not report having been adopted (n=41,039). We further excluded 634 women who had not answered the questionnaire on family history, and 602 because of missing or unreliable data on other key variables (Figure S1). The analysis sample consisted of 39,803 women (97% of eligible), 96% of whom were 40 years or older at enrolment.

We focused on the outcome of the 1st pregnancy ending in a still- or live birth (which was not necessarily the 1st pregnancy). Women were classified as having had “primiparous preeclampsia” if they answered yes to having had preeclampsia/toxaemia or eclampsia (asked in a separate question) in the first eligible pregnancy. As preeclampsia is rarely diagnosed early, we excluded 21 women who reported a pregnancy lasting <22 weeks (information on length of gestation was missing for 567, who were retained in the analysis).

The women (from hereon termed “daughters” for clarity of presentation) reported their mothers’ age in years at their birth. For 7.9% (3,129) of daughters, mother’s age was imputed based on either (i) the daughter’s report of one of eight 5-year categories or (ii) the difference between the mother’s age at the time of the daughter’s interview (or the age at which she died) and the estimated year of birth. When both were available and fell in discordant 5-year categories (n=652), we used the latter, except for 35 instances in which the former was deemed more plausible.

The Sister Study was approved by the Institutional Review Boards (IRB) of the National Institute of Environmental Health Sciences and the Copernicus Group. The IRB of the McGill University Health Centre approved the current project.

Statistical analysis

We estimated relative risks (RR) and 95% confidence intervals (CI) of preeclampsia in daughters at categories of mother’s age (<20, 25–29, 30–34, and 35, with 20–24 years as the reference), using multivariable log-binomial regression. As 2,959 families contributed more than one sister (for a total of 6,448 women), we used a robust variance estimator to account for possible statistical dependencies. As covariates, we included factors that may have influenced the participant’s prenatal environment and early development: number of older full or half siblings born to the same mother (0, 1, 2), self-reported income level growing up (well off, middle income, low income, and poor), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), and 5-year birth cohort. We additionally accounted for the daughter’s age when she gave birth (modeled as a restricted cubic spline with three knots).

We examined self-reported relative weight at age 10 (heavier than peers versus lighter or same weight) as a potential separate early-life pathway to preeclampsia. (The question about childhood relative weight referred to age 10 as a time before puberty that women were reasonably likely to remember).

We restricted all subsequent analyses to daughters who had not been relatively heavy as children. First, we stratified the analyses by their age at menarche (<12 years, 12–14, and 15) and the age at which they had given birth (<25 years, 25–29, and 30). We further checked the robustness of our findings by accounting for (i) father’s age at the daughter’s birth, (ii) prenatal exposure to maternal smoking, and (iii) prenatal exposure to maternal smoking and maternal preeclampsia together. As information on maternal smoking and maternal preeclampsia was missing for 4.8% and 14.9% of daughters, respectively, we generated 40 datasets using multiple imputation by chained equation (MICE) in Stata.

We further checked whether estimates changed when stratifying by the participants' birth cohort (1930–1944, 1945–1959, and 1960–1974) and race/ethnicity (non-Hispanic white, non-Hispanic-black, and Hispanic). In all analyses (except in the main model, where we report observed counts and percentages), we estimated the predicted marginal probability³⁶ of preeclampsia in each stratum of mother's age, using the *margins* command in Stata.

Finally, we indirectly explored whether, in the subset of daughters who had not been overweight as children, adult body composition (self-reported, as maximum height and BMI in the 4th decade of life and categorized as <25 and ≥25 kg/m²) may have partially mediated the association between mother's age at delivery and preeclampsia. We modeled height with linear regression and overweight with Poisson regression (as log-binomial regression failed to converge). In the latter analysis, we accounted for the number of births before age 30.

All analyses were carried out with Stata 14.2 (College Station, TX, USA).

Results

The characteristics of the study population are shown in Table 1. The proportion of daughters reporting a higher relative weight in childhood increased as the mother's age at delivery increased. A lower income growing up was more frequently reported by daughters of both the youngest and oldest mothers. Having been born to a teenage mother predicted early menarche, a first birth before age 20, and primiparous preeclampsia.

Overall, 6.2% of daughters reported having had preeclampsia associated with their first birth (n=2,484, including 359 with eclampsia). Women with preeclampsia were more likely to have been heavier than peers at age 10 and to have had earlier menarche. Additionally, they were less likely to go on to have another child. As expected, the proportion of multiples, stillbirths, and preterm births was higher in preeclamptic pregnancies (Table 2).

Table 3 shows estimates from the multivariable model. Birth to a teenage mother was associated with a 20% higher risk of preeclampsia, compared with having been born when the mother was between 20–24 years old; daughters of mothers ≥25 years had an approximately 10% lower preeclampsia risk. The prevalence of preeclampsia increased in successive birth cohorts, beginning in the 1945–1949 cohort.

The daughter's birth cohort and age at 1st birth (the latter entered as a restricted cubic spline) were the only predictors -besides mother's age at delivery- that significantly improved the model's fit; we nevertheless retained all covariates in the subsequent analyses. Removing the terms for daughter's age at 1st birth resulted in the estimated relative risks for mother's age at delivery changing by 2%.

The probability of being relatively heavier than peers at age 10 increased with increasing mother's age at delivery. Compared with daughters born when their mother was 20–24 years old, the RR of being heavier (adjusted for the same predictors listed in the body of table 3) was 0.90 (95% CI 0.80, 1.02) among daughters of teenage mothers, and 1.15 (95% CI 1.08, 1.22), 1.30 (95% CI 1.21, 1.39), and 1.33 (95% CI 1.23, 1.43) among those born when the mother was 25–29, 30–34, and ≥35, respectively.

Higher relative weight at 10 independently predicted risk of primiparous preeclampsia (RR 1.43, 95% CI 1.31, 1.57). Although the estimates for mother's age changed very little when we added this term to the model (Table S1), inclusion in the model of the cross-product of mother's age and the daughter's relative weight at age 10 showed evidence of multiplicative interaction ($P < 0.001$). When we stratified the analysis by this factor, risk of preeclampsia was not associated with mother's age at delivery in daughters who, at age 10, had been heavier than their peers but decreased with increasing mother's age in those with low or normal childhood weight (Figure 1).

All subsequent analyses are restricted to the subset of daughters who reported a low or normal relative weight at age 10 (referred to as not having been overweight as children, despite the imprecise nature of the definition).

Compared with menarche between 12 and <15 years, menarche before age 12 was associated with an RR of preeclampsia of 1.33 (95% CI 1.20, 1.48), whereas menarche at age 15 or later was associated with an RR of 0.82 (95% CI 0.70, 0.96). Nevertheless, the association between mother's age and preeclampsia persisted in all strata of age at menarche (Figure 2, left). Similarly, estimates changed little across categories of the daughter's age at 1st birth (Figure 2, right).

Accounting for father's age when the daughter was born did not meaningfully affect the estimates of mother's age at delivery (Figure S2), and neither did accounting for the daughter's prenatal exposure to maternal smoking or maternal preeclampsia (Supplementary Figure S3), although both prenatal exposures were associated with increased preeclampsia risk [RRs from the complete case analysis including both factors (similar to those from the multiply imputed one), were 1.14 (95% CI 1.02, 1.27) for maternal smoking and 3.09 (95% CI 2.55, 3.73) for maternal preeclampsia]. Estimates for the complete case and multiply imputed analyses were similar; however, the predictors used for imputation were poorly correlated with maternal smoking and maternal preeclampsia.

Despite the increasing proportion of preeclampsia over time, the association with mother's age at delivery was not meaningfully different across birth cohorts (Supplementary Figure S4, left). Because of small numbers, we could not corroborate our findings in Non-Hispanic black or Hispanic women (Supplementary Figure S4, right); younger mother's age at the daughter's birth appeared to be associated with an elevated risk of preeclampsia in all strata, but the estimates were highly imprecise.

Compared with daughters whose mothers were 20–24 years old when they were born, daughters of teenage mothers had a higher probability of having a BMI ≥ 25 in their 30s, whereas the opposite was the case for daughters born when the mother was ≥ 25 (Table S2). In contrast, height increased slightly with increasing mother's age at delivery (Table S2).

Comment

Principal findings

In this study, we observed an inverse association between mother's age at delivery and daughter's subsequent risk of primiparous preeclampsia, restricted to daughters who reported not having been heavier than peers as children. In this subset, the association was consistent across strata based on age at menarche, age at first birth, and birth cohort. There was no clear association in daughters who had been heavier than their peers at age 10, but the estimates were imprecise. To the best of our knowledge, mother's age at delivery has not previously been examined as a predictor of a daughter's risk of preeclampsia.

Although a mouse experiment has provided suggestive evidence that advanced maternal age may program aspects of the offspring cardio-metabolic health early in development,¹⁸ findings from human studies are conflicting. Our results suggested that advanced maternal age at delivery did not increase a daughter's risk of preeclampsia, despite predicting childhood overweight, which, in turn, modified the association between mother's age at delivery and preeclampsia. However, relative childhood weight seems unlikely to be an important mediator of this association, given how little the estimates for mother's age at delivery changed when it was included in the model.

Most studies of childhood adiposity in relation to mother's age at delivery^{20, 29, 30, 33, 34} did not identify an increased risk in offspring of older mothers; however, the one that reported a higher risk of obesity with older mother's (or guardian) age was based on US girls aged 9–10,³² a study population similar to ours.

An earlier analysis of Sister Study participants reported that women born to teenage mothers had an elevated risk of early menarche,³⁷ a predictor of preeclampsia in this study and in another cohort.¹⁴ Nevertheless, at least in daughters who were not relatively heavy as children, the association between young maternal age and daughter's preeclampsia persisted in analyses stratified by (Figure 2, left) and adjusted for (not shown) the daughter's age at menarche.

In daughters with low or normal childhood relative weight, birth to a teenage mother was associated with a higher risk of adult overweight and with slightly shorter stature, which may have partially mediated the association between mother's age at delivery and daughter's risk of preeclampsia. While the association with height is in agreement with previous reports,^{19, 21} a higher risk of overweight in offspring of younger mothers was reported in Americans 50 and older¹⁷ and in Norwegian³¹ -but not Swedish¹⁹- male conscripts.

Strengths of the study

Strengths of this study include detailed information on family factors and pregnancy history; the study population was large enough to run several subgroup analyses, which allowed us to explore possible effect modification and to check the consistency of our findings. It is reassuring that the estimates between mother's age at delivery and daughter's preeclampsia were similar across birth cohorts, given the changes in access to contraception and childbearing age that occurred across the lifetimes of participants.

Limitations of the data

The main limitation of this study is that all information was self-reported. However, the overall prevalence of preeclampsia in this study (6.2%) was very close to the 6.3% reported for primiparous participants in the Nurses' Health Study who had given birth between 1964 and 2008.⁵ (In our study, 83% of the births occurred in this same period, and 17% between 1947 and 1963). Furthermore, multiples, stillbirths, and preterm births were, as expected, more common in preeclamptic pregnancies; preeclampsia was associated with age at menarche²¹ and childhood overweight⁹ in the expected direction, as well as with a lower probability of having subsequent children.³⁸ Although older participants had to recall whether they had had preeclampsia several decades after the event, the association with the mother's age at delivery was consistent across birth cohorts. To check whether the daughter's own educational level (higher in daughters of older mothers³⁹) may have resulted in differential accuracy in reporting preeclampsia, we included completed education in the model restricted to daughters who had not been overweight at age 10. The point estimate for having been born to a mother younger than 20 years decreased from 1.275 to 1.263, somewhat allaying concerns about differential misclassification due to education. Daughters whose mother had died before they answered the questionnaire were more likely to not have answered the question on whether they had been prenatally exposed to preeclampsia (22.9%, vs. 5.5% in participants whose mother was alive). Still, despite the higher probability of preeclampsia in women who were themselves born of a preeclamptic pregnancy, accounting for this factor had little impact on the estimates for mother's age at delivery (we did not have information on whether the mother had had preeclampsia in other pregnancies).

Recalled relative weight is subjective and likely reflects different actual weights across the period spanned by this study. Yet, notwithstanding its limited quality, higher relative weight at age 10 was associated with increased risk of preeclampsia (8.3% vs. 5.8%), as expected, and appeared to be an effect measure modifier.

Mother's age at the daughters' birth was also self-reported. In an add-on study that enrolled 1788 mothers of daughters who had been 35 to 59 years old at cohort entry, the mother's report of her age at delivery was within ± 1 year of the daughter's report in 92.6% of instances, and within ± 2 years in 96.7%. The agreement for 5-year categories of mother's age was 90.5%. Despite a degree of misclassification, it seems unlikely that errors in mother's age would correlate with preeclampsia.

Sister Study participants are more educated, wealthier, and more frequently white than women in the underlying US population, as is the case in many volunteer cohorts.³⁵ For example, the proportion of whites (83.7%) and blacks (8.8%) in the total cohort³⁵ is similar to the 83.3 and 8.2%, respectively, reported for the WHI Prospective Study.⁴⁰ The higher proportion of participants with a Bachelor's degree or higher (51% in the Sister Study, vs. 42% in the WHI Prospective study) is consistent with the fact that the Sister Study recruited younger women (35 to 74, versus 50 to 79) about a decade later. Regardless, it is unclear how this type of selection would result in a spurious association between their mother's age at delivery and preeclampsia.

All Sister Study participants had a sister diagnosed with breast cancer, thought to occur less frequently following preeclampsia, although the overall evidence is controversial.^{6, 41, 42} Still, sisters of women with breast cancer may have a lower risk of preeclampsia, possibly due to inherited factors.⁴³ Thus, we cannot rule out that Sister Study participants may differ in terms of preeclampsia risk (and, possibly, risk factors) from the general population. However, as previously noted, the prevalence of preeclampsia in this study is similar to that in another cohort that was not selected based on breast cancer risk.⁵

Interpretation

Increasing mothers' age at delivery may be associated with a slightly lower risk of preeclampsia in primiparous daughters who had not been overweight as children.

Conclusion

These findings should be replicated in other populations; nevertheless, given the widespread tendency to delay childbearing,^{13, 14} they provide some reassurance that having being born to an older mother is not, *per se*, a risk factor for preeclampsia.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

Preeclampsia by mother's age at delivery, stratified by relative weight at age 10^a.

Vertical dashed line at 0.77, 1, and 1.3 are included to facilitate comparisons.

^a Multivariable log-binomial regression. Models include: number of older siblings born to the same mother (0, 1, 2), race/ethnicity, age at 1st birth (restricted cubic spline with 3 knots), income level growing up, and 5-year birth cohort.

^b Predictive marginal probabilities of preeclampsia (in %)

Figure 2.

Preeclampsia by mother's age at delivery, stratified by age at menarche (left) and age at first birth (right)^a. Analysis restricted to participants not overweight at age 10.

Vertical dashed line at 0.77, 1, and 1.3 are included to facilitate comparisons.

^a Multivariable log-binomial regression. Models include: number of older siblings born to the same mother (0, 1, 2), race/ethnicity, age at 1st birth (restricted cubic spline with 3 knots – in right panel, adjustment is within each age stratum), income level growing up, and 5-year birth cohort.

^b Predictive marginal probabilities of preeclampsia (in %)

Table 1.

Characteristics of daughters, by categories of mother's age when they were born

Characteristic	Mother's age at delivery (years)									
	<20		20–24		25–29		30–34		35	
	n	%	n	%	n	%	n	%	n	%
Race/ethnicity										
Non-Hispanic white	1,383	71.3	8,099	83.4	10,519	86.8	7,807	86.2	5,870	84.1
Non-Hispanic black	342	17.6	840	8.7	781	6.4	641	7.1	584	8.4
Hispanic	129	6.6	482	5.0	509	4.2	403	4.4	365	5.2
Other	87	4.5	285	2.9	309	2.5	206	2.3	162	2.3
Income level, childhood										
Well off	39	2.0	471	4.9	873	7.2	681	7.5	458	6.6
Top income	959	49.4	5,838	60.1	7,478	61.7	5,458	60.3	3,865	55.4
Low income	687	35.4	2,659	27.4	2,928	24.2	2,220	24.5	1,964	28.1
Poor	256	13.2	738	7.6	839	6.9	698	7.7	694	9.9
No. of older siblings^a										
None	1,439	74.1	4,353	44.8	2,614	21.6	763	8.4	176	2.5
One	404	20.8	3,332	34.3	3,910	32.3	1,975	21.8	762	10.9
Two or more	98	5.0	2,021	20.8	5,594	46.2	6,319	69.8	6,043	86.6
Heavier at age 10 ^b	270	13.9	1,511	15.6	2,113	17.4	1,736	19.2	1,335	19.1
Age at menarche										
<12 years	490	25.2	1,998	20.6	2,363	19.5	1,791	19.8	1,416	20.3
12 to <15	1,264	65.1	6,677	68.8	8,519	70.3	6,397	70.6	4,940	70.8
15+	187	9.6	1,031	10.6	1,236	10.2	869	9.6	625	9.0
Age at 1st birth										
<20 years	636	32.8	1,752	18.1	1,738	14.3	1,200	13.2	980	14.0
20–24	773	39.8	4,110	42.3	4,559	37.6	3,276	36.2	2,533	36.3
25–29	362	18.7	2,461	25.4	3,629	29.9	2,695	29.8	1,974	28.3
30–34	123	6.3	1,009	10.4	1,579	13.0	1,322	14.6	1,042	14.9

Characteristic	Mother's age at delivery (years)									
	<20		20–24		25–29		30–34		35	
	n	%	n	%	n	%	n	%	n	%
35	47	2.4	374	3.9	613	5.1	564	6.2	452	6.5
Birth cohort										
1930–1944	580	29.9	2,943	30.3	3,606	29.8	2,434	26.9	1,724	24.7
1945–1954	758	39.0	3,806	39.2	4,756	39.2	3,403	37.6	2,445	35.0
1955–1974	603	31.1	2,957	30.5	3,756	31.0	3,220	35.5	2,812	40.3
Primiparous preeclampsia	161	8.3	639	6.6	699	5.8	556	6.1	429	6.1

^aIncludes full and maternal half siblings.

^bBased on the daughter's report of having been heavier at age 10, compared with girls of the same age.

Table 2.Characteristics of daughters and their pregnancy outcome, by preeclampsia in 1st birth.

	No preeclampsia n=37,319		Preeclampsia n=2,484	
	n	%	n	%
<i>Characteristics of participants</i>				
Age at 1 st birth				
<20 years	5,883	15.8	423	17.0
20–24	14,134	38.4	937	37.7
25–29	10,474	28.1	647	26.1
30–34	4,743	12.7	332	13.4
35	1,905	5.1	145	5.8
No. of previous pregnancies ^a				
0	30,027	80.5	1947	78.4
1	5,455	14.6	386	15.5
2+	1,837	4.9	151	6.1
Heavier at age 10 ^b	6,384	17.1	581	23.4
Age at menarche				
<12 years	7,412	19.9	646	26.0
12 to <15	26,153	70.1	1,644	66.2
15+	3,754	10.1	194	7.8
Had 1 subsequent birth ^c	30,856	82.9	1,915	77.3
<i>Outcome of pregnancy</i>				
Multiple birth	383	1.0	87	3.5
Stillbirth (singletons)	285	0.8	35	1.5
Boys (singleton live births) ^d	18,931	51.7	1,249	52.9
Missing	11	0.0	1	0.0
Birth <37 weeks (singleton live births) ^d	1,930	5.3	282	12.1
Birth <34 weeks (singleton live births) ^d	570	1.6	90	3.9
Missing	519	1.4	35	1.5

^aWhen gravidity >0, the previous pregnancies had not ended in a live- or stillbirth.^bBased on the daughter's report of having been relatively heavy at age 10, compared with other girls of the same age.^cRestricted to the 99.7% of daughters who had been at least 40 years old when pregnancy history was last obtained (37,223 without preeclampsia and 2,476 with preeclampsia).^d% based on births with non-missing values.

Table 3.Relative risk (95% CI) of preeclampsia. Multivariable log-binomial regression^a.

	Total births	Preeclampsia n (%)	RR (95% CI)
Mother's age (yrs)			
<20	1,941	161 (8.3)	1.20 (1.01,1.43)
20–24	9,706	639 (6.6)	1.00 (Reference)
25–29	12,118	699 (5.8)	0.88 (0.79,0.98)
30–34	9,057	556 (6.1)	0.92 (0.81,1.03)
35	6,981	429 (6.1)	0.89 (0.78,1.03)
No. older siblings			
0	9,345	578 (6.2)	1.00 (Reference)
1	10,383	619 (6.0)	0.97 (0.87,1.09)
2	20,075	1,287 (6.4)	0.99 (0.88,1.12)
Race/ethnicity			
Non-Hispanic white	33,678	2,048 (6.1)	1.00 (Reference)
Non-Hispanic black	3,188	237 (7.4)	1.05 (0.92,1.20)
Hispanic	1,888	122 (6.5)	0.93 (0.78,1.12)
Other	1,049	77 (7.3)	1.12 (0.90,1.39)
Income level, childhood			
Well off	2,522	158 (6.3)	1.00 (Reference)
Top income	23,598	1,449 (6.1)	0.96 (0.82,1.12)
Low income	10,458	635 (6.1)	0.96 (0.81,1.14)
Poor	3,225	242 (7.5)	1.19 (0.97,1.45)
Birth cohort			
1930–34	1,412	69 (4.9)	0.97 (0.74,1.27)
1935–39	3,833	192 (5.0)	1.00 (Reference)
1940–44	6,042	298 (4.9)	0.99 (0.83,1.18)
1945–49	7,333	399 (5.4)	1.09 (0.92,1.29)
1950–54	7,835	509 (6.5)	1.31 (1.11,1.54)
1955–59	6,505	488 (7.5)	1.52 (1.29,1.79)
1960–64	4,341	332 (7.6)	1.56 (1.30,1.87)
1965–69	2,043	158 (7.7)	1.59 (1.29,1.96)
1970–74	459	39 (8.5)	1.74 (1.24,2.44)

^aThe model additionally includes daughter's age at 1st birth (modeled as a restricted cubic spline with 3 knots, at 19, 24, and 32 years). Relative risks were 0.97 (95% CI: 0.96, 0.99) and 1.04 (95% CI: 1.01, 1.06) for the first and second term, respectively.