GYNECOLOGY

Advanced paternal age and the risk of spontaneous abortion: an analysis of the combined 2011–2013 and 2013–2015 National Survey of Family Growth

Brian T. Nguyen, MD, MSCP; Erica J. Chang, MD; Kristin A. Bendikson, MD

BACKGROUND: Maternal and paternal age at first birth are increasing across the global population. Spontaneous abortion, one of the most common abnormal pregnancy outcomes, is known to occur more frequently with increasing maternal age. However, the relationship of advanced paternal age and spontaneous abortion is poorly understood, and previous results have yielded conflicting results.

OBJECTIVE: To examine the influence of paternal age on the risk of spontaneous abortion among singleton pregnancies conceived without assisted reproductive technologies.

MATERIALS AND METHODS: This was a retrospective, case-control study using combined pregnancy data from the Centers for Disease Control and Prevention's 2011–2013 and 2013–2015 National Survey of Family Growth. Spontaneous, singleton pregnancy data from women aged 15–45 years were analyzed. Ongoing pregnancies, induced abortions, ectopic pregnancies, preterm births, and intrauterine fetal deaths were excluded. Bivariate associations of pregnancy outcome (spontaneous abortion at <20 weeks and ≤12 weeks vs. live birth at ≥37 weeks) and paternal age were determined, along with those of maternal age and selected demographic and pregnancy characteristics. Significant associations were included in a multivariable logistic regression, which accounted for multiple pregnancies derived from the same respondent.

RESULTS: A total of 12,710 pregnancies from 6979 women were analyzed, consisting of 2300 (18.2%) spontaneous abortions and 10,410 (81.8%) term live births. Median maternal and paternal ages were 25 and 28 years, respectively. After adjusting for maternal age, race/ethnicity, socioeconomic status, marital status, and pregnancy intention, pregnancies resulting in spontaneous abortions had 2.05 (95% confidence interval, 1.06–2.20) times the odds of being from a father aged 50 years or older, vs. 25–29 years of age. These relationships remained significant when defining SABs at ≤12 weeks (adjusted odds ratio, 2.30; 95% confidence interval, 1.17–4.52).

CONCLUSION: Paternal age may increase the odds of spontaneous abortion, independent of selected factors, including demographics, pregnancy intention, and maternal age. This association was robust across several gestational age–based definitions of spontaneous abortion, even after adjustment.

Key words: abortion, advanced paternal age, miscarriage, paternal age, pregnancy loss, spontaneous abortion

Spontaneous abortion (SAB), generally referred to as "miscarriage," refers to the loss of a clinically recognized pregnancy before 20 weeks' estimated gestational age (EGA).[1] SAB is one of the most common abnormal pregnancy outcomes, occurring in approximately 10–20% of all clinically recognized pregnancies.[2–5] SAB is expected to increase in frequency because of the rising age of men and women attempting to conceive in developed nations, including the United States.[6,7] Data from the US National Vital Statistics System (2000–2014) indicates a greater than 20% increase in the proportion of first births among women at or above the age of 35 years,[8] and as multiple studies consistently find advanced maternal age to be 1 of the strongest, independent, prepregnancy predictors of SAB,[9–11] SAB is a growing problem that warrants the attention of all healthcare providers involved in preconception care and reproductive life planning.

Healthcare providers are sometimes criticized for their normalization of SAB, an experience that can be very personal and difficult to a pregnant patient,[12] with the potential for enduring psychological consequences for herself,[13] her male partner,[14] and their relationship as a couple thereafter,[15] regardless of its prevalence. Given that SAB can neither be treated nor reversed, counseling and the management of parental expectations are some of the only interventions that can be offered. A 2013 survey of men and women in the United States who experienced a SAB revealed that more than 2 in 5 reported feelings of guilt, and nearly 80% wanted to know potential causes even if they were unpreventable.[16] The survey also noted that providing an explanation for the SAB could more than halve the odds of individuals experiencing guilt. In addition, the survey noted that men were more than twice as likely as women to believe that SABs were caused by lifestyle choices. Thus, providing an accurate assessment of SAB risk and its contributors at the time of pregnancy planning, or preconception, may be very valuable, particularly among men who are frequently ignored in the contexts of both pregnancy planning and pregnancy loss.[17]

Maternal age–related SAB is thought to be primarily mediated by the increasing incidence of chromosomal abnormalities, specifically trisomy, in these pregnancies.[18–20] As several studies also link advancing paternal age to de novo mutations that may

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AJOG at a Glance

Why was this study conducted?

Although spontaneous abortion is associated with advanced maternal age, its association with paternal age remains in question. We examined this association using a nationally representative dataset, controlling for potential contributors, not limited to demographics, pregnancy intention, and maternal age.

Key findings

After adjusting for significant contributors, pregnancies resulting in a spontaneous abortion had twice the odds of being from a father aged 50 years or more, compared to fathers between 25 and 29 years old. This association remained significant when defining SAB at less than 12 weeks vs 20 weeks.

What does this add to what is known?

These results suggest that the etiology of SABs and early pregnancy loss may be linked to reproductive changes in the father that are accumulated over time. These findings may inform preconception and/or post-SAB counseling for men and couples.

contribute to the incidence of autosomal dominant disorders and such complex disorders as schizophrenia and autism spectrum disorder,[21–24] and as epidemiologic studies suggest a synergistically increased risk of SAB with both advanced maternal and paternal age,[25] there exists biologic plausibility for an independently increased risk of SAB with increasing paternal age. However, conflicting research findings and studies with nongeneralizable sample populations leave the strength of this relationship unclear. For example, studies of paternal age and SAB among pregnancies requiring assisted reproductive technologies are limited by variations in the distribution of patients at different ages, linked to variations in the cause of infertility among this population.[26,27] General population studies provide mixed conclusions. For example, a case-control study by Kleinhaus using antenatal data from 13,865 women from the 1964-1976 Jerusalem Perinatal Study noted significant, stepwise associations with SAB starting at paternal age 30 years (adjusted odds ratio [adjOR], 1.4; 95% confidence interval [CI], 1.2–1.6), after controlling for both maternal age and such maternal comorbidities as smoking and diabetes.[28] However, the Danish National Birth Cohort from 1997 to 1999 did not find a greater risk of SAB among couples even when the male partner was 50 years of age or older (adjOR, 1.38; 95% CI, 0.66–2.88), even after controlling for maternal age and smoking.[29] The most recent prospective data exploring this association comes from an analysis of Kaiser's California Pregnancy Outcome Study, conducted from 1990 to 1991 among 5121 women. Following an adjusted Cox survival model, the study observed a linear trend in the risk of SAB after age 25 years, with the highest risk incurred by men at age 45 (adjOR, 1.87; 95% CI, 1.01–3.44), also controlling for maternal age and smoking.[30] This study, however, included only women who sought prenatal care and excluded women whose pregnancies had ended by the time of their interview, such that early SABs may have been underreported.

Given that previous studies showed conflicting findings and used datasets that were either more than 2 decades old or inadequately comprehensive, we used representative data from the combined 2011–2013 and 2013–2015 US National Survey of Family Growth (NSFG) to provide more data on the contribution of paternal age to the risk of spontaneous abortion.

Materials and Methods

Survey

The NSFG is a publicly available, population-based database, which asks women 15–45 years of age to recount and describe the outcomes of each of their pregnancies. Specific to each pregnancy, the NSFG collects information on maternal age at the time of the pregnancy, relationship status, pregnancy intention, use of assisted reproductive technologies, and age of her male partner at the time of the pregnancy. Sampling weights for pregnancy data are based on national averages of race, ethnicity, and age from the US Census Bureau.[31] A more complete description of sampling methods and survey design has previously been published.[32] Although the NSFG has surveyed women in cycles since 1973, we present findings from the combined 2011–2013 and 2013–2015 surveys, released in October 2016.[33] As the database is publicly available and includes no identifiers, this study was deemed exempt from full review by the University of Southern California Health Sciences Institutional Review Board.

Study population

We defined SAB as the loss of a clinically recognized pregnancy before 20 weeks' EGA, based on guidelines endorsed by the World Health Organization.[1] Although the rate of SAB among pregnancies conceived using assisted reproductive technologies are thought to be similar to those in the general population,[34] we are interested primarily in the contribution of age as related to the patient's own gametes. In addition, given variations in the rates of loss between singleton and multiple gestations,[35] we limited our analysis to spontaneous (nonassisted) singleton pregnancies. We excluded ongoing pregnancies and pregnancies ending in induced abortion. Ectopic pregnancies and pregnancies resulting in intrauterine fetal demise (pregnancy loss at or beyond 20 weeks' EGA) or preterm birth were also excluded, given their association with pregnancy-specific, maternal behavioral

risk factors that were not captured by the NSFG. We thus examined the contribution of paternal age to the risk of SAB at less than 20 weeks' EGA, using naturally conceived, singleton pregnancies ending in a live birth at term (≥37 weeks' EGA) as a control group.

Study variables

Our exposure of interest was paternal age, defined by the NSFG as the male partner's age at the time of the pregnancy outcome. As previous research on paternal age has not confirmed a specific age cutoff associated with any composite or specific adverse pregnancy, neonatal, or early childhood outcome,[24,36] our analysis examines the contribution of paternal age at intervals of less than 25, 25−29, 30−34, 35−39, 40−44, 45−49, and 50 years of age and above. Maternal age is similarly examined at intervals of less than 25, 25−29, 30−34, and 35 years of age and above. These predictors are examined categorically, given the expectation of general homogeneity of SAB risk within levels, with exponential increases in risk when reaching the extremes of age in both men and women. Specifically, the intervals are informed by cutoffs noted in previous studies that showed a nadir in SAB risk below a maternal age of 25 years and an exponential increase in risk after age 35 years.[37]

We included potential covariates according to previous findings of association with SAB, such as race/ethnicity (Hispanic, non-Hispanic white, non-Hispanic black, non-Hispanic other),[38] socioeconomic status (percentage of the Federal Poverty Level),[39] marital status (never married, married, separated/divorced/widowed),[40] and pregnancy intention (intended, mistimed, indifferent/unwanted).[41] Although body mass index (BMI) data are collected by the NSFG, the data reflect BMI at the time of survey rather than pregnancy-specific BMI, such that BMI could not be included as a covariate in the analysis.

Statistical analysis

We first examined the relationship between paternal age and pregnancy outcome using bivariate analysis (χ^2 test). Unadjusted odds ratios (ORs) and 95% confidence intervals (CIs) for pregnancy outcome were subsequently obtained for potential covariates, including paternal age, with significant variables included in model building. Variables concerning for collinearity by tests of correlation were re-examined (variance inflation factor > 4) and omitted if needed. Given that some individual pregnancy outcome data from the NSFG were derived from the same woman, within-group correlations were expected. We thus fit the data to a generalized estimating equations logistic regression model, using the respondent's identification number as the sampling unit. Potential confounders were determined in a backward, stepwise process. Each variable was removed from the full model, and the percent change in OR between paternal age and pregnancy outcome was calculated. If the difference was greater than 10%, the variable was considered a confounder and left in the model. Backward elimination continued until all remaining variables were significant at the $P < .05$ level. Effect modification was assessed by including interaction terms and retained if resulting in a significant difference in the odds of SAB. The adjusted OR (adjOR) and 95% confidence intervals for the independent relationship between paternal age and pregnancy outcome were thus determined. As approximately 96% of SABs occur in the first trimester and are believed to be strongly related to genetic abnormalities,[42] we also performed a subset analysis of pregnancy outcomes at EGA of 12 weeks or less.

All analyses were performed using STATA version 13.1 for Windows (StataCorp, College Station, TX); all percentages presented are weighted according to weights provided by the NSFG/National Center for Health Statistics.

Results

The combined 2011−2013 and 2013−2015 NSFG collected data on 18,901 pregnancies, 12,710 of which met inclusion criteria for the case-control analysis: 2300 (18.2%; mean EGA, 8 weeks; standard deviation [SD], 0.13) cases of SAB at less than 20 weeks' EGA and 10,410 (81.8%; mean EGA 39 weeks; SD, 0.02) term live births from spontaneous pregnancies. The mean maternal age was 25 years; the mean paternal age was 28 years for the collective sample. Table 1 provides the distribution of pregnancy outcomes by paternal and maternal age groups, noting the representation of pregnancies across all age pairings, even at their discordant extremes. Table 2 compares the case and control groups by various pregnancy characteristics, noting significant associations with the outcome for paternal and maternal age, as well as maternal race/ethnicity, socioeconomic status, marital status, and pregnancy intent.

After adjusting for maternal age, maternal race/ethnicity, marital status, and pregnancy intention, pregnancies resulting in SAB had 2.05 (95% CI, 1.06−2.20) times the odds of being from a father aged 50 years or older, compared to a father aged 25−29 years (Table 3). Pregnancies resulting in SAB also had 1.52 (95% CI, 1.04−2.20) times the odds of being from a mother aged 35 years or older, vs 25−29 years. Independent of maternal and paternal age, SAB had 0.72 (95% CI, 0.59−0.88) times the odds of being from a Hispanic/Latina mother, compared to a non-Hispanic white mother. SABs were also linked to incomes at less than 138% and 400% or greater than the Federal Poverty Level (adjOR, 1.23; 95% CI, 1.03−1.47; adjOR, 1.51; 95% CI, 1.15−1.96, respectively). SABs had greater odds of being from single and separated mothers compared to married mothers (adjOR, 1.43; 95% CI, 1.17−1.73; adjOR, 1.90; 95% CI, 1.41−2.57, respectively). Pregnancies ending in SAB were nearly twice as likely to be mistimed (adjOR, 1.86; 95% CI, 1.54−2.24) and had 1.35 (95% CI, 1.10−1.66) times the odds of being unwanted compared to intended pregnancies. The independent relationship between paternal age and SAB remained significant when defining SABs at 12 weeks or less (adjOR, 2.30; 95% CI, 1.17−4.52).

TABLE 1
Pregnancy outcomes by paternal and maternal age from the combined 2011–2013 and 2013–2015 NSFG data

	Maternal age							
	Term live birth at ≥37 wk; n = 10,282 (82.2%)[a]				SAB at <20 wk; n = 2233 (17.8%)[a]			
Paternal age, y	<25 y	25–29 y	30–34 y	35+	<25 y	25–29 y	30–34 y	35+ y
<25	3635 (61.5)	226 (8.1)	32 (1.5)	10 (3.3)	797 (65.1)	65 (9.2)	7 (1.5)	2 (0.9)
25–29	1438 (25.9)	1148 (45.1)	190 (12.6)	15 (4.3)	296 (24.5)	223 (41.5)	51 (13.5)	10 (3.6)
30–34	457 (8.5)	718 (31.1)	661 (50.1)	65 (18.9)	85 (5.8)	151 (35.2)	132 (41.5)	22 (16.1)
35–39	180 (3.0)	291 (9.8)	392 (26.6)	179 (37.7)	35 (2.8)	48 (8.8)	81 (26.2)	54 (48.0)
40–44	52 (0.9)	120 (4.3)	126 (5.6)	108 (26.1)	10 (0.8)	18 (2.6)	34 (11.6)	37 (23.4)
45–49	14 (0.2)	52 (1.2)	60 (3.2)	42 (7.1)	3 (0.2)	8 (2.0)	23 (5.0)	13 (3.6)
50+	11 (0.2)	20 (0.4)	20 (0.5)	20 (2.5)	6 (0.8)	6 (0.7)	4 (0.7)	12 (4.4)

NSFG, National Survey of Family Growth; *SAB*, spontaneous abortion.

[a] Percentages adjusted according to sample weights to reflect the US population.

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Comment

Principal findings

Our analysis of pregnancy data from the NSFG demonstrated that pregnancies ending in SAB had twice the odds of being conceived with men aged 50 years or older, compared to men aged 25–29 years. This association was independent of maternal age, race/ethnicity, marital status, and pregnancy intention. The risk increased even further when the definition of SAB was limited to losses at 12 weeks or less, rather than at 20 weeks' EGA. The robustness of the association after limiting the analysis to a gestational age with a greater incidence of chromosomal defects suggest that paternal age likely influences the risk of SAB via genetic or cytogenetic mutations rather than behaviors of paternal origin.

TABLE 2
Distribution of live birth at term vs spontaneous abortion at <20 wk by selected characteristics

Pregnancy characteristics		Term live birth at ≥37 wk, n = 10,410 (81.8%)[a]	SAB at <20 wk, n = 2300 (18.2%)[a]	*P*[b]
Paternal age, y	<25	3904 (81.4)	871 (18.6)	.05
	25–29	2792 (83.3)	580 (16.7)	
	30–34	1901 (83.5)	390 (16.5)	
	35–39	1042 (80.4)	218 (19.6)	
	40–44	406 (78.7)	99 (21.4)	
	45–49	168 (78.1)	47 (21.9)	
	50+	71 (63.8)	28 (36.2)	
Maternal age, y	<25	5861 (82.0)	1264 (18.0)	.03
	25–29	2604 (82.8)	539 (17.2)	
	30–34	1496 (82.3)	344 (17.7)	
	35+	447 (74.3)	153 (25.7)	

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Clinical implications

The age at first birth of parents has risen over the past 3 decades, with women delaying first childbirth by 1.5 years in the United States and by 3.8 years in other developed countries.[6] For fathers, numerous studies have linked advanced paternal age to various adverse outcomes, such as schizophrenia and autism spectrum disorder.[21–23] Despite these risks, there is still no well-defined threshold for "advanced paternal age," particularly one that considers the risk of SAB. A statement released by Genetics In Medicine in 2008 suggests that a frequently used criterion for advanced paternal age is 40 years or older at the time of conception.[43] Our study contributes data that may be used to update thresholds for paternal age in the future. Nevertheless, providers may consider offering preconception counseling to these men, as well as women who may be pursuing pregnancy with older partners. Just as women older than 35 are given recommendations to undergo genetic counseling, pregnancies conceived with older men may benefit from the same evaluation.

TABLE 2
Distribution of live birth at term vs spontaneous abortion at <20 wk by selected characteristics *(continued)*

Pregnancy characteristics		Term live birth at ≥37 wk, n = 10,410 (81.8%)[a]	SAB at <20 wk, n = 2300 (18.2%)[a]	*P*[b]
Race/ethnicity	Hispanic/Latina	3291 (85.5)	561 (14.5)	<.01
	Non-Hispanic white	4144 (80.1)	1056 (19.9)	
	Non-Hispanic black	2404 (80.3)	584 (19.7)	
	Non-Hispanic other	571 (86.4)	99 (13.6)	
% Federal Poverty Level	<138	5774 (83.3)	1142 (16.7)	
	138–399	3537 (81.7)	835 (18.3)	.04
	400+	1099 (77.9)	323 (22.1)	
Marital status	Single/never married	5250 (80.7)	1272 (19.3)	<.01
	Married	4562 (84.0)	818 (16.0)	
	Separated/divorced/ widowed	598 (72.0)	210 (28.1)	
Pregnancy intent	Intended	5722 (84.4)	1043 (15.6)	<.01
	Mistimed	2790 (76.1)	792 (23.9)	
	Unwanted	1874 (82.1)	451 (17.9)	

SAB, spontaneous abortion.

[a] Percentages adjusted according to sample weights to reflect the US population; [b] *P* values determined via χ^2 tests of association for categorical variables.

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Research implications

Several studies have attempted to identify genetic changes linked to adverse reproductive outcomes among older men with mixed results. For example, 1 study of aneuploidy detected via fluorescent in situ hybridization (FISH) in 15,000 sperm nuclei from each of 5 men less than 40 years old and 5 men more than 60 years old found no significant differences between groups.[44] However, the influences of paternal age may be better detected at a more granular level, with several studies reporting on the loss of sperm DNA integrity or increases in DNA fragmentation among older men,[45,46] as well as increases in the incidence of de novo mutations.[47] The overall level of DNA fragmentation can be tested on the sperm in the ejaculate of men, and it has been hypothesized that higher levels of DNA fragmentation may lead to increased miscarriage rates. In the in vitro fertilization setting, women whose male partners had high levels of DNA fragmentation in their sperm samples were more than twice as likely to have a SAB, according to a meta-analysis of 11 studies.[48] To determine a mechanism, a separate cytogenetic study of zona-free hamster oocytes fertilized with human sperm from younger vs older men noted the greater incidence of both numerical and structural abnormalities among cells associated with sperm from older donors, highlighting the likelihood of preexisting chromosomal damage in the donor sperm that could influence aberrant DNA synthesis at the time of fertilization.[49] There is currently no recommendation by the American Society for Reproductive Medicine for the use of DNA integrity testing to predict the risk of pregnancy loss,[50] although future studies may consider examining the value of such testing in the future.

Study strengths and limitations

Our findings regarding the risk of SAB associated with advanced paternal age, albeit reliant on retrospective data and subsequently unable to demonstrate causality, are robust and valuable for their use of a large, nationally representative sample to capture rare cases of pregnancy at the extremes of paternal age. Only 2 studies, to our knowledge, include larger sample sizes, albeit with limitations: Nybo-Anderson (2004) included only 8 SABs conceived by men older than 50 years,[29] and Kleinhaus (2006) did not stratify paternal age beyond 40 years.[28] Our study included 28 SABs conceived by men at or beyond age 50 years, and used data more generalizable to the US population. Unlike prior studies that recruited pregnant patients at the time of their first prenatal visit,[29,30] our study included all prior pregnancies, thereby including the additional number of early SABs occurring before the initiation of prenatal care that may not have been included. Nevertheless, as the NSFG relies on the respondent's ability to recall pregnancy-specific events, collected data may be subject to recall bias. However, pregnancy is such a salient time period for women that assessments of the reproducibility of women's recall of events up to 30 years prior show high levels of accuracy.[51] Notably, although the association between paternal age and spontaneous abortion from this analysis was robust, it may not be fully independent without prospective study or the inclusion of additional variables (eg, paternal genetic history and risk factors, maternal comorbidities) that may concurrently be associated with SAB. We acknowledge that these data did not include pregnancy-specific assessments of maternal comorbidities or behavioral risk factors that might be more closely associated with SAB. However, controlling for such data, given their prevalence among women of older age, might even strengthen our findings of association between paternal age and SAB. Future studies may consider using the NSFG to evaluate the association of paternal age with other, modifiable pregnancy outcomes (eg, paternal behaviors) to provide further information, which may guide both providers and patients.

TABLE 3
Unadjusted and adjusted odds of SAB at <20 and ≤12 wk vs term live birth by select characteristics

Pregnancy characteristics		SAB <20 wk		SAB ≤12 wk
		Bivariate OR (95% CI)	Final model adjOR (95% CI)	Final model adjOR (95% CI)
Paternal age, y	<25	1.18 (0.99–1.40)	1.03 (0.85–1.25)	1.07 (0.86–1.32)
	25–29	Ref	Ref	Ref
	30–34	1.02 (0.83–1.26)	1.04 (0.83–1.29)	1.10 (0.86–1.39)
	35–39	1.19 (0.89–1.59)	1.11 (0.81–1.52)	1.08 (0.76–1.52)
	40–44	1.24 (0.81–1.91)	1.10 (0.70–1.74)	1.10 (0.67–1.82)
	45–49	1.58 (0.84–2.99)	1.49 (0.71–3.13)	1.49 (0.65–3.40)
	50+	2.29 (1.24–4.22)	2.05 (1.06–3.93)	2.30 (1.17–4.52)
Maternal age, y	<25	1.08 (0.90–1.29)	0.89 (0.72–1.10)	0.86 (0.69–1.09)
	25–29	Ref	Ref	Ref
	30–34	0.98 (0.75–1.30)	0.98 (0.72–1.33)	0.92 (0.68–1.24)
	35+	1.62 (1.18–2.21)	1.52 (1.04–2.20)	1.66 (1.12–2.44)
Race/ethnicity	Hispanic/Latina	0.72 (0.60–0.87)	0.72 (0.59–0.88)	0.66 (0.53–0.83)
	Non-Hispanic white	Ref	Ref	Ref
	Non-Hispanic black	1.09 (0.87–1.36)	0.97 (0.77–1.22)	0.92 (0.72–1.18)
	Non-Hispanic other	0.66 (0.49–0.90)	0.67 (0.49–0.93)	0.60 (0.41–0.86)
% Federal Poverty Level	<138	1.16 (0.98–1.37)	1.23 (1.03–1.47)	1.21 (1.00–1.47)
	138–399	Ref	Ref	Ref
	400+	1.33 (1.05–1.70)	1.51 (1.15–1.96)	1.59 (1.20–2.10)
Marital status	Single/never married	1.43 (1.21–1.67)	1.43 (1.17–1.73)	1.40 (1.13–1.74)
	Married	Ref	Ref	Ref
	Separated[a]	2.01 (1.51–2.66)	1.90 (1.41–2.57)	2.14 (1.56–2.94)
Pregnancy intention	Intended	Ref	Ref	Ref
	Mistimed	1.83 (1.55–2.16)	1.86 (1.54–2.24)	1.84 (1.51–2.25)
	Unwanted	1.42 (1.17–1.72)	1.35 (1.10–1.66)	1.30 (1.05–1.61)

Odds of SAB among fathers by age group were determined via multivariable logistic regression, adjusted for maternal age, race/ethnicity, income, marital status, and pregnancy intention.

adjOR, adjusted odds ratio; *CI*, confidence interval; *OR*, odds ratio; *SAB*, spontaneous abortion.

[a] Includes divorced or widowed.

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Conclusion

Although pregnancies with male partners beyond the age of 50 years are uncommon, comprising less than 1% of pregnancies in our nationally representative sample population, they were associated with a statistically significant increase in the risk of SAB, even after controlling for maternal age, sociodemographic factors, and pregnancy intent. Given the biologic plausibility of genetic aberrations increasing in frequency with paternal age and increasing the risk of SAB, these findings should be considered when counseling older men who may be considering pregnancy in the future, as well as those who have recently experienced a SAB. ■

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Author and article information

From the Department of Obstetrics and Gynecology (Drs Nguyen, Chang, and Bendikson), Keck School of Medicine of the University of Southern California, Los Angeles, CA.

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Corresponding author: Brian T. Nguyen, MD, MSCP. nguyenbt@usc.edu