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Is Older Maternal Age a Risk Factor for Preterm Birth and Fetal Growth Restriction? A Systematic Review

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To determine if there was an association between advancing maternal age and adverse pregnancy outcomes (preterm delivery and small-for-gestational-age births), a systematic review was conducted based on a comprehensive search of the literature from 1985 to 2002. Ten studies met the following inclusion criteria: (1) assessed risk factors for preterm birth by subtype (i.e., idiopathic preterm labor, preterm premature rupture of membranes) and small-for-gestational-age (SGA) birth (fetal growth restriction); (2) used acceptable definitions of these outcomes; (3) were published between January 1985 and December 2002; (4) were restricted to studies that have considered preterm birth due to idiopathic preterm labor or premature rupture of membranes or both; (5) were restricted to singleton live births; (6) were conducted in a developed country; and (7) were published in English. The majority of the studies reviewed found that older maternal age was associated with preterm birth. There is insufficient evidence to determine if older maternal age is an independent and direct risk factor for preterm birth and SGA birth, or a risk marker that exerts its influence on gestational age or birth weight or both through its

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association with age-dependent confounders. Future research is needed to quantify the independent and unconfounded impact of delayed childbearing on neonatal outcomes, as well as to identify the pathways involved.

BACKGROUND

Current fertility trends suggest that an increasing number of women in developed countries are delaying childbearing until their midthirties and beyond (National Center for Health Statistics, 1995; Statistics Canada, 1996). Since the 1970s, birth rates for women aged 20 to 29 years have decreased, while the proportion of first births to women in their thirties and forties has risen substantially (Ventura, Martin, Curtin, Mathews, & Park, 2000). The age-specific fertility rates for American women aged 30 to 34 years increased from 52.3 births per 1000 women in 1970 to 95.6 births in 2001. For women aged 35 to 39 years, the rate doubled over the same period from 18.0 to 41.4 births per 1000 women (Guyer et al., 1999; MacDorman, Minino, Strobino, & Guyer, 2002; Ventura, Martin et al., 2000).

Similar trends have been reported in other industrialized countries. Between 1980 and 1997, the proportion of first births to Canadian women aged 30 to 34 years rose from 18.1% to 30.2% of all live births. Among women aged 35 to 39 years of age, live births tripled from 4.1% in 1980 to 12.4% in 1997 (Statistics Canada, 1994, 1999). With the availability and increasing use of assisted reproductive technologies, including in vitro fertilization and ovulation stimulation, women are now able to postpone childbearing into their forties and fifties. Although births to women 40 years and older are relatively rare, the fertility rate among this group also doubled, increasing from 3.8 in 1970 to 8.1 per 1000 women aged 40 years and older in 2001 (MacDorman et al., 2002; Ventura, 1989).

Women of advancing reproductive age are now responsible for a greater percentage of total live births. In the United States, more than 13% of all births are to women 35 years and older, and 22% of these births are to first-time mothers (Martin, Hamilton, & Ventura, 2001). This can be attributed to an increase in delayed childbearing (Ventura, Mosher, Curtin, Abma, & Henshaw, 2000), particularly among better-educated women, and to the maturing of the baby boom cohort, which has shifted the age distribution of the female population of childbearing age (Berendes & Forman, 1991; Bouvier, 1980). The current trend to older maternal age at first birth will continue, and some researchers anticipate that the "elderly primigravida" will become the norm (Freeman-Wang & Beski, 2002).

A number of social, educational, and economic forces have contributed to this trend. These include women pursuing higher education and a career, expanded roles for women in the workplace, the need for dual incomes, postponed or second marriages (Freeman-Wang & Beski, 2002), and a history of infertility (Berkowitz, Skovron, Lapinski, & Berkowitz, 1990; Bobrowski & Bottoms, 1995; Dulitzki et al., 1998; Hansen, 1986; Kirz, Dorchester, & Freeman, 1985). Increasingly, many women are delaying the age at first marriage and first birth in order to complete their education and to advance their careers. Trends indicate a substantial increase in labor force participation among women aged 25 to 44 years (Blackburn, Bloom, & Neumark, 1993; Chandler, Kamo, & Werbel, 1994; Lansac, 1995; Statistics Canada, 1996). By 1994, the age at first birth among 45.5% of female college graduates in the United States was 30 years and over (Heck, Schoendorf, Ventura, & Kiely, 1997; Ventura, Mosher et al., 2000).

With more women postponing childbearing until their later reproductive years, there is increased awareness and concern among women and health care providers about the effects of advancing maternal age on both maternal and fetal morbidity and mortality. Over the past several decades, researchers have examined this issue. The results, however, have been equivocal and inconclusive. Some studies have shown an increased risk of low birth weight (<2500 g; Cnattingius, Berendes, & Forman, 1993; Cnattingius, Forman, Berendes, & Isotalo, 1992; Dollberg, Seidman, Armon, Stevenson, & Gale, 1996; Seidman, Samueloff, Mor-Yosef, & Schenker, 1990), preterm delivery (<37 weeks' gestation; Astolfi & Zonta, 2002; Cnattingius et al., 1992; Dildy et al., 1996; Dulitzki et al., 1998; Gilbert, Nesbitt, & Danielsen, 1999; Milner, Barry-Kinsella, Unwin, & Harrison, 1992; Prysak, Lorenz, & Kisly, 1995; Scholz, Haas, & Petru, 1999; Seidman et al., 1990) and SGA births (i.e., birth weight < tenth percentile for gestational; Dildy et al., 1996; Dollberg et al., 1996; Dulitzki et al., 1998; Lansac, 1995; Vercellini et al., 1993). Other studies, though, have shown no significant increase in these outcomes with advancing maternal age (Berkowitz et al., 1990; Bianco et al., 1996; Seidman et al., 1990).

Several investigators reported that when age-dependent confounders (i.e., parity, socioeconomic status, preexisting chronic diseases, smoking status, and antenatal complications) are controlled, women 35 years and older are at minimal increased risk, and their neonatal outcomes are comparable with those of younger women who are of "optimal reproductive age" (Bianco et al., 1996; Edge & Laros, Jr., 1993; Prysak et al., 1995). In a large population-based study conducted in Sweden, however, researchers found that delayed childbearing was associated with an increased risk of poor pregnancy outcomes even after adjusting for maternal complications and other risk factors (Cnattingius et al., 1992).

In a Canadian study of 283,956 infants, researchers found that delayed childbearing (maternal age ≥35 years) was responsible for a substantial proportion of the population increases in the rate of preterm births and multiple births (i.e., twins, triplets; Tough et al., 2002). Between 1990 and 1996, the number of births to women 35 years of age and older increased from 8.4% to 12.6%. Among these women, preterm deliveries increased by

14%, and multiple birth rates increased by 15% for twins, and 14% for triplets. When compared with younger women, those of advancing maternal age were 40% more likely to deliver preterm. In addition, the risk of preterm delivery increased modestly as a function of increasing age, even in the absence of age-related chronic health problems (e.g., hypertension, diabetes mellitus). When in vitro fertilization pregnancies were excluded, delayed childbearing contributed to 43% of the change in preterm rates and 23% of the provincial multiple birth rates. These results suggest that there is a maternal age effect, and that older maternal age contributes significantly to population rate increases in adverse neonatal outcomes such as low birth weight and preterm birth.

Such disparate findings may be due to a number of methodological differences and limitations observed across the different studies. These include the following: differences in the study setting and population sampled (i.e., hospital-based versus population-based studies); failure to control for age-dependent confounders that are also related to pregnancy outcomes; inability or failure to control for environmental and social confounders, including the reasons for delaying childbearing; inadequate sample size and power; treating women who delay childbearing as a homogeneous group; inappropriate risk modelling; failure to examine the relationship between maternal age and comorbidity; inconsistency in defining "advanced maternal age"; failure to select appropriate controls; differences in the age category selected for the reference group; incomplete or inaccurate data sources or both (e.g., studies relying on birth certificate data); incomplete consideration of preexisting chronic diseases and pregnancy complications believed to be associated with older maternal age; failure to address secular trends and changes in practice patterns over time; and varying definitions of the study outcomes being assessed.

The majority of studies have treated preterm delivery as a "single entity." This may be inappropriate, however, if preterm delivery is a "cluster of conditions with different etiologies" or etiological pathways that result in the delivery of an infant before 37 completed weeks of gestation (Pickett, Abrams, & Selvin, 2000). The effects of maternal age on the incidence of preterm delivery may vary according to the specific subtype. Failing to consider the heterogeneity of preterm births may have prevented researchers from determining conclusively the relationship between older maternal age and the risk of preterm delivery. Shaw and colleagues (2001) noted that etiological studies with more precisely defined outcomes will be better able to identify causal associations by reducing the influence of misclassification resulting from etiological heterogeneity.

STUDY PURPOSE

The inconclusive findings concerning the effects of delayed childbearing need to be examined and resolved. Women rely on health care professionals to provide information on the risks associated with older maternal age in order to make informed and appropriate choices. The purpose of this systematic review, therefore, was to examine whether there is evidence of an association between older (advanced) maternal age and preterm delivery (by subtype/clinical presentation), and SGA births (i.e., fetal growth restriction). Preterm births are classified into three distinct clinical presentations: idiopathic preterm labor, preterm premature rupture of membranes, and (iatrogenic) preterm induction or operative delivery resulting from medical problems or complications in either the mother or fetus (i.e., medically indicated preterm delivery). In this study, we consider spontaneous preterm births only (i.e., idiopathic preterm labor or preterm premature rupture of membranes).

The study outcomes are defined as follows:

(1) idiopathic preterm labor (PT-LABOR)—spontaneous onset of uterine contractions that progress, with or without rupture of chorioamniotic membranes, to preterm birth (i.e., a delivery before 37 weeks completed gestation);
(2) preterm premature rupture of membranes (PROM)—involves rupture of the chorioamniotic membranes any time before the onset of labor and results in a delivery before 37 weeks completed gestation; and
(3) small-for-gestational-age birth (SGA)—defined as the birth of an infant with a birth weight $<$ tenth percentile for gestational age using sex-specific criteria.

Preterm deliveries that occur after either PT-LABOR or PROM are classified as spontaneous preterm deliveries (PT-BOTH). For this study, PT-BOTH is defined as delivery before 37 weeks completed gestation preceded by spontaneous labor or premature rupture of membranes or both.

Initially, we planned to obtain a summary estimate of the risks of these outcomes. However, the risk estimates used in the different studies varied (i.e., adjusted odds ratio, crude odds ratios, relative risk). There was also inconsistency in the ages included in the reference category used to calculate these estimates. For example, in one study the reference category consisted of women 20 to 24 years of age (Aldous & Edmonson, 1993), in another, it consisted of women 20 to 29 years of age (Berkowitz, Blackmore-Prince, Lapinski, & Savitz, 1998), and in two other studies, the reference category included women up to 34 years of age (Kramer, McLean, Eason, & Usher, 1992; Lang, Cohen, & Lieberman, 1992). This heterogeneity, coupled with the small number of studies in the review, made it impossible to obtain a quantitative summary of the effect of age on preterm birth according to subtype and fetal growth restriction (i.e., SGA births). Instead, we summarize the findings of the studies and discuss the strength of the evidence.

METHODS

Search Strategies

A comprehensive search for published and unpublished studies was undertaken using several search strategies. A computerized search of on-line databases (i.e., MEDLINE, CINAHL, EMBASE, HEALTHSTAR), abstracting services (i.e., Cambridge Scientific Contents, Dissertation Abstracts International), and registers and indexes (i.e., Cochrane Collaboration, Canadian Research Index) was conducted for the period of January 1985 to December 2002. Medical subject headings and keywords used to retrieve articles follow: infant low birth weight, preterm, prematurity, small-for-gestational-age, intrauterine growth restriction, fetal growth restriction, neonatal or pregnancy outcome, perinatal complications or morbidity, etiology, risk factors, epidemiology, older maternal age, and advancing maternal age. Additional articles were obtained from the reference lists of relevant studies.

Any article whose title or abstract suggested an investigation of any potential risk factor(s) associated with preterm birth was retrieved. At this stage we were inclusive, not limiting the search to maternal age. Instead, we included studies whose primary focus was other risk factors (e.g., weight gain, nutrition, previous obstetrical history) so that we could later examine whether the study estimated the effect of maternal age on preterm birth or SGA births or both. For instance, Kramer and his colleagues (1992) examined the relationship between maternal nutrition and preterm birth, but also presented an adjusted odds ratio for other factors (e.g., age $\geq$35 years, urinary tract infection, smoking, and maternal drinking behavior) that increase the risk for preterm birth. Thus, we included this study. This process resulted in the retrieval of 900 potentially relevant articles or abstracts. The majority (95%) of articles were found through the computerized searches.

Relevance and Validity Assessment

As shown in Table 1, studies were included if they: (1) assessed risk factors for preterm birth by subtype (i.e., idiopathic preterm labor, preterm premature rupture of membranes) and SGA birth (fetal growth restriction); (2) used acceptable definitions of these outcomes; (3) were published between January 1985 and December 2002; (4) were restricted to studies that have considered preterm birth due to idiopathic preterm labor or premature rupture of membranes or both; (5) were restricted to singleton live births; (6) were conducted in a developed country; and (7) were published in English. Studies assessing preterm births resulting from iatrogenic (medically-induced) labor or operative delivery, and those including stillbirths and fetal deaths, and multiple pregnancies, were included only if they provided separate analysis for these variables. Studies that included pregnancies complicated by antepartum death, multiple gestation, and induced deliveries not preceded

TABLE 1. Relevance criteria

Author (year of publication)	Yes	No
Study characteristics		
1. Study conducted in a developed country	☐	☐
2. Sample are from a developed country (i.e., not recent immigrants)	☐	☐
3. Study conducted after 1985	☐	☐
4. English language articles only	☐	☐
Sample		
1. Pregnancies resulting in singleton births (or multiple births analyzed separately)	☐	☐
2. Sample includes live births only (or stillbirths analyzed separately)	☐	☐
3. Birth was the result of spontaneous labor or premature rupture of membranes (or medically induced labors analyzed separately)	☐	☐
Risk factor		
1. Primary focus of the study is the effect of maternal age on birth outcome or	☐	☐
2. Primary focus of the study is other risk factors but includes maternal age	☐	☐
3. Study provides at least one age category (i.e., ≤20 yrs, ≥35 yrs)	☐	☐
Outcome		
1. Preterm delivery (<37 weeks/259 days)	☐	☐
2. Intrauterine growth restriction (birth weight < tenth percentile)	☐	☐
Study meets relevance criteria	☐	☐

by spontaneous labor and premature rupture of membranes were excluded. Finally, multiple publications from the same study were not included.

Criteria used to determine if a study was relevant for the review were extremely stringent. The intent was to address some of the methodological weaknesses in studies identified previously by Kramer (1987) and included in his meta-analysis of the determinants of low birth weight. All the retrieved articles were reviewed by one investigator (JO) and a research assistant who had master's degree in Public Health Sciences and expertise in epidemiological methods to determine if they were relevant to include in the review. Fifty articles were used in the training process. On completion of the training, the author assessed a subset of the studies ($n = 35$). Cohen's kappa, a measure of agreement that corrects for chance, was used to assess the inter-rater agreement (Waltz, Strickland, & Lenz, 1991). As the level of agreement (kappa = 0.77) was acceptable, the secondary reader was not necessary for the remaining articles. The investigator was available to the research assistant throughout the process, however, to answer any questions or discuss any issues of concern.

An instrument to evaluate the methodological quality of the studies was modified from Liddle and colleagues (1996) and then pretested (see Table 2). Factors included in the assessment of the methodological quality included criteria related to study design, inclusion criteria, measurement of risk and outcome, control of potential confounders, appropriateness of the statistical analysis, and discussion of study limitations. Each category was rated as satisfactory, unsatisfactory, or not reported. The overall validity rating (see Table 3) was based on the number of satisfactory ratings. To achieve a strong rating, the study had to receive a minimum of 11 satisfactory ratings

TABLE 2. Methodological checklist

Author (Year of publication)	Satisfactory	Not satisfactory	Not reported
Quality criteria			
1. Study addresses an appropriate and clearly focused study question.	☐	☐	☐
2. Inclusion criteria for subject selection stated clearly and unambiguously.	☐	☐	☐
3. Comparison group(s) taken from similar populations.	☐	☐	☐
4. Exclusion criteria stated clearly and used for the different study groups.	☐	☐	☐
5. Risk factors and outcomes measured independently (i.e., blind assessment of exposure/outcome).	☐	☐	☐
6. Exposures measured in a standard, reliable, and valid way.	☐	☐	☐
7. Outcomes measured in a standard, reliable, and valid way.	☐	☐	☐
8. Study methods and analysis clearly detailed and appropriate for study question(s).	☐	☐	☐
9. Confidence intervals were provided (where appropriate).	☐	☐	☐
10. Possible confounders were controlled by one of the following: matching, restriction, stratified analysis.	☐	☐	☐
11. The study minimized the risk of:			
(1) bias (e.g., selection, information/measurement);	☐	☐	☐
(2) confounding.	☐	☐	☐
12. Possible study limitations and their impact on risk estimates and study conclusions were discussed.	☐	☐	☐
13. The total number of subjects and the number of subjects in each group were clearly identified.	☐	☐	☐
Total number of satisfactory ratings			

including a satisfactory rating for attempts to minimize the risks of selection bias. Using this instrument, one investigator (CNC) and the research assistant rated the quality of all relevant studies. Interrater agreement was assessed and the level of agreement beyond chance (kappa) was 0.90. Using these criteria, all studies but one study received a strong rating (Rodriguez, Regidor, & Gutierrez-Fisac, 1995).

Data Collection

An instrument to extract data was developed, pretested, and modified. Extracted data included the following: study design, year published, sample size, data source, age assessed, study outcomes, statistics used, and the quality rating. Data were extracted according to these predetermined criteria from all studies by both investigators. The level of agreement between the two investigators was high (kappa = 0.92; Waltz et al., 1991).

TABLE 3. Criteria for assessment scores

Strong rating
Satisfactorily met all or most of the study evaluation criteria.
In order to receive this assessment, the study must receive a minimum of 11 satisfactory ratings, **must** include a satisfactory rating for item #10 on the checklist, and **must** also provide adjusted odds ratios or relative risks for the age variable (i.e., The study generates an independent risk estimate for age controlling for other possible confounders? Where the criteria have not been met, the conclusions of the study are thought "very unlikely" to change).
Moderate rating
Partially met the study evaluation criteria.
In order to receive this assessment, the study must receive a minimum of 8 satisfactory ratings and **must** include a satisfactory rating for item #10 on the checklist. Those criteria that have not been satisfied or not adequately reported are thought "unlikely" to alter the study conclusions.
Weak rating
Few or no study evaluation criteria are met ($\leq$8 satisfactory ratings obtained). No satisfactory rating attained for criteria #10. The conclusions of the study are thought "likely" or "very likely" to alter.

RESULTS

Characteristics of the Studies

We reviewed 900 studies. Ten studies met our stringent inclusion criteria and were included in the review. The most common reasons for exclusion were that the study did not include an assessment of the effect of maternal age; the sample included multiple births, stillbirths, or preterm births resulting from medical inductions or an operative delivery (and failed to analyse these groups separately); or the study failed to control for age-dependent confounders (i.e., parity, socioeconomic status, maternal chronic conditions, smoking status, and antenatal complications). Of the 10 studies included, 8 used a cohort design (Abrams, Newman, Key, & Parker, 1989; Aldous & Edmonson, 1993; Berkowitz et al., 1998; Harlow et al., 1996; Kramer et al., 1992; Lang et al., 1992; Mercer et al., 1996). The remaining two studies used a case-control design (Berkowitz, 1985; Lieberman, Ryan, Monson, & Schoenbaum, 1987; Rodriguez et al., 1995).

Characteristics of the studies are outlined in Table 4. Studies were conducted in the United States (Abrams et al., 1989; Aldous & Edmonson, 1993; Berkowitz, 1985; Berkowitz et al., 1998; Harlow et al., 1996; Lang, Lieberman, & Cohen, 1996; Lieberman et al., 1987; Mercer et al., 1996), in Canada (Kramer et al., 1992) and in Spain (Rodriguez et al., 1995). The majority of the studies (n = 8) were retrospective cohort studies (Abrams et al., 1989; Aldous & Edmonson, 1993; Berkowitz et al., 1998; Harlow et al., 1996; Kramer et al., 1992; Lang et al., 1992; Lieberman et al., 1987; Mercer et al., 1996). Two case-control studies were included (Berkowitz, 1985; Rodriguez et al., 1995) in which women who delivered a preterm or SGA infant were compared with women who delivered term infants of normal birth weight.

TABLE 4. Characteristics and results of the studies included in the systematic review

Abrams B, Newman V, Key T, Parker J. (1989). Maternal weight gain and preterm delivery.			
Sample: USA; $n = 2163$ women referred to Prenatal Nutrition Project due to low income or medical and obstetrical problems.	**Purpose:** to examine the relationship between maternal weight gain and preterm birth (PTB). **Method:** interviews and review of medical records; gestational age confirmed. Risk factors included: age, parity, maternal ethnicity & anthropometric factors, sociodemographic & lifestyle factors and timing of prenatal care.	**Results:** AOR for PT-BOTH = 2.91 (1.32, 6.45) for women <16 yrs age. Reference age >16 yrs (mean age: 24.2 yrs).	**Discussion:** Maternal age <16 yrs associated with a moderate increase in PTB due to spontaneous PT-LABOR or PROM).
Aldous MB, Edmonson MB. (1993). Maternal age at first childbirth and risk of low birth weight and preterm delivery in Washington State.			
Sample: USA; $n = 16{,}492$ women who delivered in Washington State between 1984 and 1988. All Black women were included in the sample.	**Purpose:** to examine the effect of delayed childbearing on the risks of low birth weight (LBW; <2500 g), very LBW (<1500 g), and preterm birth (PTB; <37 weeks gestation). **Method:** Washington birth certificates; reported gestational age only 80% accurate; infants with unknown gestational age excluded. Risk factors included: marital status, occupational status (maternal & paternal), smoking status, prenatal care timing & number of visits, reproductive and medical history, problems in pregnancy, and type of delivery.	**Results:** AOR PT-BOTH = 1.0 (0.86, 1.3) for women 25–29 yrs; 1.4 (1.1, 1.7)* for women 30–34 yrs; 1.6 (1.4, 2.0)*; and, 1.8 (1.3, 2.6)* for women ≥40 yrs. Reference age 20–24 yrs.	**Discussion:** The risk of LBW, very LBW, and PTB among first-born White infants increased modestly but progressively with increasing maternal age starting in the late 20s or early 30s.
Berkowitz GS, Blackmore-Prince C, Lapinski RH, Savitz DA. (1998). Risk factors for preterm birth subtypes.			
Sample: USA; $n = 31{,}107$ births at Mount Sinai Hospital in New York City between 1986 and 1994. Randomly selected only one pregnancy for women who had more than one eligible pregnancy during study period.	**Purpose:** to examine the risk factors for preterm birth subtypes (spontaneous PT-LABOR, PROM, and medically induced PTB). **Method:** use of a computerized perinatal database; gestational age confirmed. Risk factors included: sociodemographic factors, maternal and infant characteristics, lifestyle factors, medical and reproductive risk factors. A number of potential risk factors were not considered due to use of database and factors recorded.	**Results:** AOR for PT-LABOR = 1.5 (1.3, 1.9) for women <20 yrs; 0.95 (0.8, 1.1) for women 30–34 yrs; and, 0.93 (0.8, 1.1) for women ≥35 yrs. AOR for PROM = 0.85 (0.7, 1.1) for women <20 yrs; 1.4 (1.2, 1.6) for women 30–34 yrs*; and, 1.5 (1.3, 1.8)* for women ≥35 yrs. Reference age 20–29 yrs.	**Discussion:** Older mothers (30–34 and ≥35 yrs) are at an increased risk for PROM, whereas younger women (<20 yrs) are at an increased risk for spontaneous PT-LABOR.

(*continued*)

TABLE 4. (*Continued*)

Harlow BL, Frigoletto FD, Cramer DW, Evans JK, LeFevre ML, Bain RP, McNellis D, & the RADIUS Study Group. (1996). Determinants of preterm delivery in low-risk pregnancies.			
Sample: USA; $n = 14{,}928$ women enrolled in the Routine Antenatal Diagnostic Imaging and Ultrasound Study (RADIUS).	**Purpose:** to examine the determinants of preterm delivery in low-risk pregnancies (i.e., no medical indication for an ultrasound examination at their first obstetrical visit). **Method:** personal interview, hospital medical records; gestational age confirmed. Risk factors included: sociodemographic, maternal anthropometric and lifestyle factors, prenatal tests, medical and reproductive history.	**Results:** RR = 1.84 (1.2, 2.8)* for spontaneous PT-LABOR for women <20 yrs when compared with women ≥20 yrs. RR = 1.25 (stated as an increased risk with no CI provided). These RRs were not adjusted for potential confounders. When adjusted for maternal age the RR for PROM (maternal age per 5 yrs) = 1.3 (1.0, 1.5)*.	**Discussion:** Maternal age was not predictive of spontaneous PT-LABOR or PROM.
Kramer MS, McLean FH, Eason EL, Usher RH. (1992). Maternal nutrition and spontaneous preterm birth.			
Sample: Canada; $n = 8022$ infants born at Montreal's Royal Victoria Hospital between 1980 and 1989 with complete data.	**Purpose:** to examine the impact of maternal nutritional factors on spontaneous PTB (PT-BOTH). **Method:** McGill Obstetric and Neonatal Database; adequate control of potential confounders. Preterm deliveries were included only if spontaneous onset of labor or induction for PROM was documented. Risk factors included: maternal age, parity, marital status, lifestyle and nutritional factors, pregnancy complications, and obstetrical history.	**Results:** AOR PT-BOTH by gestational age: <37 wks: <20 yrs = 1.04 (.75, 1.44); ≥35 yrs = 1.13 (.98, 1.24); <34 wks: <20 yrs = 1.15 (.74, 1.77); ≥35 yrs = 1.15 (.93, 1.41); and, <32 wks: <20 yrs = 1.10 (.60, 2.01); ≥35 yrs = 1.05 (.79, 1.40). Reference age group: 20–34 yrs.	**Discussion:** Maternal age was not a significant determinant of PTB resulting from spontaneous PT-LABOR or PROM.
Lang JM, Lieberman E, Cohen A. (1996). A comparison of risk factors for preterm labor and term small-for-gestational-age birth.			
Sample: USA; $n = 12{,}718$ women recruited into the Delivery Interview Program at the Boston Hospital for Women between August 1977 and March 1980.	**Purpose:** to determine the effects of 23 risk factors on preterm labor and term SGA births in healthy women, and to compare the respective risk models. **Method:** interviews and medical records used to collect data. Risk factors included: genetic/constitutional factors, sociodemographic & lifestyle factors, obstetrical/medical factors and prenatal care.	**Results:** AOR PT-LABOR: ≤15 yrs = 1.6 (0.7, 3.7); 16–19 yrs = 1.2 (0.8, 1.8); 20–24 yrs = 1.3 (1.0, 1.7)*; ≥35 yrs = 1.1 (0.8, 1.6). AOR term SGA: ≤15 yrs = 1.6 (0.8, 3.2); 16–19 yrs = 0.9 (0.7, 1.3); 20–24 yrs = 1.1 (0.0, 1.4); ≥35 yrs = 0.9 (0.7, 1.1).	**Discussion:** No significant increase in PT-LABOR or SGA births in women ≥35 yrs. An increased risk of PT-LABOR was associated with young maternal age (women aged 20–24 years).

(*continued*)

TABLE 4. (*Continued*)

Mercer BM, Goldenberg RL, Das A, Moawad AH, Iams JD, Meis PJ, Copper RL, Johnson F, Thom E, McNellis D, Miodovnik M, Menard MK, Caritis SN, Thurnau GR, Bottoms SF, Roberts J. (1996). The preterm prediction study: A clinical risk assessment system.			
Sample: USA; $n = 2929$ women participating in the Preterm Birth Prediction Study between October 1992 and July 1994.	**Purpose:** to develop a risk assessment system for the prediction of spontaneous PT-LABOR or PROM. **Method:** structured interviews, medical records, medical examinations and laboratory testing; data collected at 23 & 24 wks gestation. Comprehensive list of factors used to develop risk index—sociodemographic & lifestyle factors, work/home environment, symptoms, cultures, treatments and examinations in current pregnancy, and anthropometric factors.	**Results:** Crude OR PT-BOTH (multiparous women): <16 yrs – –; ≥35 yrs = 1.08 (0.61, 1.92); (nulliparous women): <16 yrs = 0.73 (0.24, 2.20); ≥35 yrs = 0.57 (0.09, 3.72). Age was not included in the final multivariate risk model.	**Discussion:** Maternal age was not a significant predictor of preterm delivery due to spontaneous labor or PROM.
Berkowitz GS. (1985). Clinical and obstetric risk factors for preterm delivery.			
Sample: USA; $n = 488$ infants who were delivered at the Yale-New Haven Hospital between 1977 and 1988.	**Purpose:** to examine clinical and obstetric risk factors for preterm delivery preceded by spontaneous PT-LABOR or PROM. **Method:** structured standardized questionnaire and hospital delivery records; gestational age confirmed. Risk factors included: maternal age, marital status, race, socioeconomic status, maternal height, pregravid weight, weight gain, gynecologic characteristics, previous preterm delivery, pregnancy complications and prenatal care.	**Results:** Crude OR = 1.8 (1.2, 2.6)* for women under 25 yrs of age compared with women >25 yrs. Age was not a significant predictor of preterm delivery in the multivariate analysis of risk factors for preterm delivery.	**Discussion:** Maternal age was not associated with preterm delivery due to spontaneous PT-LABOR or PROM.

(*continued*)

TABLE 4. (*Continued*)

Lieberman E, Ryan KJ, Monson RR, Schoenbaum SC. (1987). Risk factors accounting for racial differences in the rate of preterm birth.			
Sample: USA; $n = 8903$ women who participated in the Delivery Interview Program at the Boston Hospital for Women between August 1977 and March 1980.	**Purpose:** to examine the risk factors that could possibly explain the increased risk of spontaneous PTB to Black women. **Method:** interviews and medical records; gestational age confirmed. Risk factors included: medical conditions, sociodemographic factors, obstetrical history, and problems in current pregnancy.	**Results:** Crude OR for spontaneous preterm delivery (PT-BOTH) in women ≤19 yrs = 1.69 (no CI given). For multivariate modeling, age ≤19 yrs, single marital status, less than high school education, and receiving welfare assistance were combined into a single factor for analysis (i.e., EDB—the economic–demographic–behavioral factor). EDB variable was defined as one or two or more of these variables. AOR for spontaneous preterm delivery for EDB factor = 1.31.	**Discussion:** EDB factor (interaction of maternal age ≤19 yrs, single marital status, less than high school education, and welfare assistance) is associated with increased risk of preterm delivery due to spontaneous PT-LABOR or PROM among Black women.
Rodriguez C, Regidor E, Gutiérrez-Fisac JL. (1995). Low birth weight in Spain associated with sociodemographic factors.			
Sample: Spain; $n = 41{,}590$ births registered in 1988.	**Purpose:** to examine the impact of different sociodemographic factors on low birth weight (<2500 g) in both preterm (<37 wks gestation) and term (37–42 wks gestation) infants. **Method:** birth registration records. Risk factors included: maternal age, parity, marital status, maternal activity (at home, outside), paternal occupation, type of pregnancy (singleton vs. multiple gestation), infant sex, and size of municipality of residence.	**Results:** AOR for preterm LBW: <20 yrs = 1.32 (0.98, 1.77); 20–24 yrs = 1.07 (0.90, 1.27); 30–34 yrs = 1.21 (1.04, 1.41)*; ≥35 yrs = 1.28 (1.04, 1.59)*. AOR for term LBW/SGA: <20 yrs = 1.63 (1.25, 2.14)*; 20–24 yrs = 1.34 (1.14, 1.57)*; 30–34 yrs = 1.09 (0.93, 1.27); ≥35 yrs = 0.96 (0.75, 1.21).	**Discussion:** Women over 30 yrs of age are at an increased risk of delivering a preterm LBW infant, whereas younger women are at an increased risk of delivering a term LBW/SGA infant.

(*continued*)

TABLE 4. (*Continued*)

Abbreviation	Term	Description
PT-LABOR	Idiopathic preterm labor	Spontaneous onset of uterine contractions that progress, with or without rupture of chorioamniotic membranes, to birth before 37 weeks completed gestation (i.e., preterm birth).
PROM	Preterm premature rupture of membranes	Rupture of the chorioamniotic membranes any time before the onset of labor that results in a preterm birth.
PT-BOTH	Spontaneous preterm delivery	Preterm deliveries that occur after either PT-LABOR or PROM. Defined as delivery before 37 weeks' completed gestation preceded by spontaneous labor and/or premature rupture of membranes.
SGA	Small-for-gestational-age or fetal growth restriction	Defined as the birth of an infant with a birth weight less than the 10th percentile for gestational age using sex-specific criteria.
RR	Relative risk	Is a "ratio of risk" that is estimated in cohort studies. It is defined as the incidence of spontaneous preterm delivery or small-for-gestational-age birth in women 35 years or older divided by the incidence of spontaneous preterm delivery or small-for-gestational-age birth in the reference group of women (i.e., women of younger maternal age).
*	Statistically significant relative risk (RR)	If a relative risk is greater than 1.0 and the 95% confidence interval does not include 1.0, there is an increased risk of a spontaneous preterm delivery or small-for-gestational-age birth.
OR	Odds ratio	Provides an estimate of the relative risk in case-control study. It is defined as the probability (odds or likelihood) of spontaneous preterm delivery or small-for-gestational-age birth in women 35 years and older when compared with women of younger maternal age. *If an odds ratio is greater than 1.0 and the 95% confidence interval does not include 1.0, we can conclude that older maternal age increases the likelihood or odds of having a spontaneous preterm delivery or small-for-gestational-age birth.
AOR	Adjusted odds ratio	Estimate of the independent effect of maternal age on spontaneous preterm delivery or small-for-gestational-age birth, controlling for the effects of age-dependent confounders such as socioeconomic status, maternal chronic conditions, and antenatal complications.

Five studies included were population based and used administrative data (i.e., birth certificates or computerized obstetrical and perinatal databases; Aldous & Edmonson, 1993; Berkowitz, 1985; Berkowitz et al., 1998; Kramer et al., 1992; Rodriguez et al., 1995). The remaining studies used a combination of data sources including patient interviews and hospital and medical records (Abrams et al., 1989; Harlow et al., 1996; Lang et al., 1996; Lieberman et al., 1987; Mercer et al., 1996). Sample sizes ranged from 488 to 31,107 women. Inadequate power was a limitation in some studies. For example, Berkowitz (1985) was unable to establish if maternal age was an independent risk factor for preterm delivery due to a small sample size (175 cases and 313 controls). In the Aldous and Edmonson study (1993) there were insufficient numbers of Black infants to determine conclusively if there was a maternal age effect among first-born Black infants.

Misclassification of birth outcome (i.e., preterm delivery) due to inaccurate estimates of gestational age was not an issue in the studies. At least two measures of gestational age were used to classify age at time of delivery (i.e., last menstrual period and antenatal sonography). Three studies also included clinical estimates of gestational age (Abrams et al., 1989; Berkowitz, 1985; Berkowitz et al., 1998). Infants also were excluded from the study sample or analysis if gestational age at time of delivery was unknown or uncertain (Aldous & Edmonson, 1993; Lang et al., 1992).

With the exception of two studies (Abrams et al., 1989; Lang et al., 1992), samples included both high-risk and low-risk women (i.e., women with and without social, medical, and obstetrical problems). In order to examine the determinants of PT-LABOR and SGA births among women who were healthy at the beginning of their pregnancy, Lang and associates (1992, 1996) excluded women with preexisting diabetes mellitus, hypertension, epilepsy, and asthma. The Abrams and colleagues (1989) study was restricted to women referred to the Prenatal Nutrition Project. Criteria for referral included low income, prepregnancy underweight or obese, low pregnancy weight gain, anemia, history of obstetric complications, or concurrent medical problems. Investigations conducted in the United States considered maternal race and provided separate risk estimates for Black and White women. Findings from some studies must be interpreted with caution, however, due to the small samples of Black births and the resulting imprecision in risk estimates (Abrams et al., 1989; Aldous & Edmonson, 1993; Berkowitz, 1985).

The Aldous and Edmonson study (1993) was the only one designed primarily to quantify the effect of maternal age on birth outcomes (i.e., low birth weight ($<$2500 g), very low birth weight ($<$1500 g), and spontaneous preterm delivery [PT-BOTH]). This population-based study was also unique in that the sample was sufficiently large ($n = 16{,}492$ women) so that the researchers were able to control adequately for important age-dependent confounders and to provide a separate risk estimate for women 40 years and older. By stratifying women into 5-year age categories, these researchers were able to demonstrate that there was a dose-response relationship: that is, the risk of delivering a first-born White premature infant (PT-LABOR) increased moderately with each 5-year maternal age group. The highest risk occurred among women 40 years and older (OR = 1.8, CI 1.3, 2.6). This study also demonstrated that other risk factors can mediate the effects of maternal age. Results suggest that the relatively high socioeconomic status and low smoking prevalence among older women helped to mediate the negative impact of advancing maternal age. Finally, this study found that there was no significant maternal age effect among births of Black infants. This finding must be interpreted with caution, however, due to the small sample size ($n =$ 127 Black infants) and the resulting lack of precision in calculating the risk estimates. More research is required to determine the effects of maternal age and ethnicity on preterm delivery.

Comparing results across studies was problematic due to the inconsistencies and arbitrariness in defining maternal age groups, as well as the reference age group used for the study comparisons. The operationalization of maternal age appeared to be quite arbitrary: Rationale for choosing the specific ages was not discussed. Future studies need to be able to conceptualize what constitutes older maternal age.

The heterogeneity of low birth weight or preterm delivery was considered only in two studies (Berkowitz et al., 1998; Lang et al., 1992). Their results demonstrate that preterm delivery (i.e., PT-LABOR, PROM) and fetal growth restriction are different pathways with different risk profiles. In future etiologic studies, separate risk models are needed in order to examine the impact of younger and older maternal age on spontaneous preterm delivery and SGA births.

Only two studies provided separate risk models for SGA births (Lang et al., 1992; Rodriguez et al., 1995). Rodriguez and his collaborators used Spanish birth certificates (41,590 births registered in 1988) to examine the impact of different sociodemographic risk factors, including maternal age, on the risk of preterm and term low birth weight. This latter group was assumed to be a proxy for term SGA births. All other studies controlled adequately for the age-dependent confounders identified by Kramer in his meta-analysis of the determinants of low birth weight (Kramer, 1987). Consequently, the results of this study in regard to the sociodemographic risk factors for term SGA births must be considered inconclusive, due to inadequate control of potential confounders. In the other study, Lang and her associates (1992) estimated the effects of 23 factors on the prevalence of preterm labor and SGA births across the full birth weight spectrum. The sample consisted of 12,718 healthy women who participated in the Delivery Interview Program at the Boston Hospital for Women between 1977 and 1980. From their results, these researchers emphasized the need for comprehensive control of confounders in etiological studies of pregnancy outcome. This study was unique in the way the researchers handled pregnancy complications (i.e., pregnancy-induced hypertension, toxemia, trimester-specific bleeding, placenta previa, and abruptio placenta) in the modeling of the potential risk factors. They treated these complications as intermediate outcomes of pregnancy (Kramer, 1987). First, they estimated the effects of 23 risk factors without the addition of pregnancy complications; then they examined changes in the risk estimates (if any) that occurred when these complications were added to the risk model. By using this specific methodology, Lang and her associates were able to identify independent risk factors for PT-LABOR and term SGA births, and also to explore the possibility that some of the study factors had an indirect effect on birth outcome through their association with pregnancy complications.

Finally, only one study provided separate risk models for spontaneous preterm delivery (PT-BOTH) by gestational age (i.e., <37 wks, <34 wks, <32 wks; Kramer et al., 1992). This categorization of preterm birth is of interest to clinicians because moderately preterm, very preterm, and extremely preterm infants differ in terms of etiology and prognosis. Kramer and associates (1992) found no association between maternal age and spontaneous preterm delivery after adjusting for confounders in their multivariate model.

Findings of the Review

Findings are summarized in Table 4. Only one study was designed specifically to investigate the effect of older maternal age on preterm delivery (Aldous & Edmonson, 1993). In all other studies, age was controlled in the multivariate analyses. Three cohort studies reported a significant association between older maternal age and spontaneous preterm delivery (Aldous & Edmonson, 1993; Berkowitz et al., 1998; Harlow et al., 1996). Aldous and Edmonson (1993) found that the risk of spontaneous PT-LABOR among first-born White infants increased as a function of age, starting at 30 years (OR = 1.6, 95% CI 1.4, 2.0). The highest risk was associated with maternal age ≥40 years (OR = 1.8, 95% CI 1.3, 2.6). When a separate analysis was completed for first-born Black infants, the maternal age effect was not significant. Due to inadequate power and imprecise risk estimates, however, these researchers were unable to determine definitively whether maternal age effect increases the risk of preterm delivery among primiparous Black women. This study was able to provide evidence that older maternal age is an independent risk factor for spontaneous PT-LABOR after controlling for other risk factors and possible confounders among primiparous White women. The other two studies found no increased risk of PT-LABOR among older women (Berkowitz et al., 1998; Harlow et al., 1996). These studies also reported that the risk of preterm delivery following PROM increased in women ≥30 years (ORs ranged from 1.3 to 1.5). The risk estimates in older women for PROM and PT-LABOR were similar in magnitude across the studies.

Three studies found no association between maternal age and spontaneous preterm delivery (PT-BOTH; Berkowitz, 1985; Kramer et al., 1992;

Mercer et al., 1996). In one study, age was not significant in the unadjusted risk model and, therefore, was not included in the final multivariate model (Mercer et al., 1996). The remaining studies found no significant association between maternal age and spontaneous preterm delivery once they controlled for other risk factors and possible confounders such as socioeconomic status, parity, smoking, and medical and obstetrical problems (Berkowitz, 1985; Kramer et al., 1992).

Only two studies examined potential risk factors for term SGA births, and included age in the risk models (Lang et al., 1996; Rodriguez et al., 1995). Both found no statistically significant relationship between older maternal age and fetal growth restriction. Rodriguez and colleagues (1995) found that younger women <20 years and women 20 to 24 years were 1.6 and 1.3 times more likely to delivery a SGA infant. They used birth certificate data, however, and were unable to adjust for potential confounders. Consequently, the results are at best tentative regarding the effect of maternal age on birth weight. Additional research is required to determine conclusively if there is a relationship between older maternal age and fetal growth restriction.

DISCUSSION

The question of whether delayed childbearing increases the risk of preterm birth and fetal growth restriction is critical due to the growing number of first births to women in their midthirties and older, to the availability and increasing use of in vitro fertilization and other reproductive technologies that enable women to delay childbearing until the end of their reproductive cycle, and to the concurrent increases in preterm birth rates despite advances in high-risk obstetrical care as well as preterm prevention programs (Statistics Canada, 1995). In Canada, the preterm birth rate increased by 9% over the past 20 years, from 6.3% (1981–1983) to 6.8% (1992–1994). Among singleton and multiple gestation births, preterm births increased by 5% and 25%, respectively, during the same time period (Joseph et al., 1998). Preterm birth is considered a significant public health issue because it is the major determinant of neonatal mortality, and it also contributes substantially to infant and childhood morbidity (McCormick, 1985; Morrison, 1990). Factors contributing to increases in the rates of preterm birth include the recent increases in maternal age, the use of ovarian stimulation and in vitro fertilization, as well as increases in multiple gestation pregnancies (Joseph et al., 2001; Millar, Wadhera, & Nimrod, 1992).

Results of this systematic review suggest that there is a maternal age effect on both gestational age and birth weight. What is consistent across the different studies is that older maternal age is associated with an increased prevalence of preexisting chronic diseases, medical problems during pregnancy, as well as antepartum and labor complications (Chan & Lao, 1999). Other studies indicate that reproductive efficiency (i.e., conception delay, decreased viability of embryos, and trisomic conception) decreases as a function of increasing maternal age (Bobrowski & Bottoms, 1995; Mansfield & McCool, 1989; Stein, 1985). What is unclear, though, is whether maternal age exerts an independent and direct effect on birth outcome, or if it acts indirectly through its association with age-dependent confounders, factors that adversely affect birth outcome and are a function of increasing maternal age, such as maternal chronic hypertension, diabetes, pregnancy-induced hypertension, or history of subfecundity; how the pregnancy was conceived (natural or by means of assisted reproductive technology); and antepartum complications that result in medical intervention and early delivery.

To date, research into maternal age effects has produced disparate findings regarding the specific impact of older maternal age on both maternal and fetal outcomes. These equivocal results are probably a function of methodological differences across, as well as the procedures used in, causal modelling. More rigorous research is required to quantify the independent and unconfounded effects of older maternal age (i.e., delayed childbearing) on the risk of different maternal complications and birth outcomes, including the specific mechanisms or pathways involved (e.g., social, biological, environmental). It is necessary to determine if age effects are direct or indirect. The specific methodology used to address this research question is important because of the multiple factors that influence maternal and fetal health, pregnancy, and birth outcomes, and, if uncontrolled, could possibly mask a maternal age-pregnancy outcome relationship.

In future studies, researchers need to clearly define and provide rationale regarding what constitutes older (advanced) maternal age, and, specifically, the age cutoff(s) at which maternal risks and fetal compromise are increased. Previous studies examining the effect of advanced maternal age generally have limited their investigation to women 35 to 40 years (Chan & Lao, 1999). Pregnancies among primiparous women in this age group generally were regarded as "high risk" by health care providers (Dulitzki et al., 1998; Kirz et al., 1985). Several studies found no increased maternal or fetal risks among women in this age group, however, compared with younger women considered to be biologically at an optimal age for reproduction (Bianco et al., 1996; Edge & Laros, 1993; Kirz et al., 1985; Prysak et al., 1995). These findings may be due to other factors that mediate the effects of older maternal age such as socioeconomic status, maternal health, or education and lifestyle factors. For example, women who delay childbearing are generally better educated, more socially advantaged, have healthier lifestyles, seek early prenatal care, and are also in good health when they become pregnant. These characteristics all contribute to positive pregnancy outcomes (Bianco et al., 1996; Dulitzki et al., 1998).

Aggregating age groups into broad categories (e.g., 30 to 39 years, 35 years and over) may have masked important within-group differences and prevented quantifying the independent effects of maternal age. Increased risks to the mother and newborn may be more a function of even older maternal age–40 years and older.

Researchers need to examine the relationship between maternal age and maternal and fetal outcomes in different subgroups of women. They should use an inclusive set of narrowly defined age groups spanning all ages associated with childbearing (i.e., <15, 15 to 17, 18 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 39, ≥ 40 years). As well, they should examine age effects for a number of different maternal and fetal outcomes. Alternatively, studies could determine empirically the different age cutoffs at which there is an increased risk to the mother or fetus or both for different maternal and fetal outcomes. Investigators need to be consistent in their definition of the reference group (i.e., the age category associated with *optimal reproduction*) to determine maternal age effects. Previous studies often have identified that 20 to 25 years is the ideal age for childbearing. Increased attention on the definition of age groups will help to quantify the effects of maternal age on various pregnancy outcomes and those factors (e.g., biological, social, environmental, and behavioral) that increase risk to the mother and fetus.

To determine the independent effects of maternal age on adverse pregnancy outcomes, the next generation of studies will need to control adequately for age-dependent confounders (e.g., parity, socioeconomic status, lifestyle factors such as smoking, maternal education, maternal health history such as preexisting chronic conditions [hypertension and diabetes], pregnancy complications, history of infertility, how the pregnancy was conceived [naturally versus assisted reproduction], and the reasons for delaying childbearing).

Women who delay childbearing are not a homogeneous group. Some women voluntarily delay childbearing to pursue advanced education, or to begin and to establish careers. There are also some women who are completing their families or starting a second family with a new spouse. Other women delay childbearing because of a history of involuntary infertility. The effects of age on outcome may vary among these different groups of women, and such differences may be missed because older women who delay childbearing are being treated as a homogeneous group. Being able to estimate the independent effects of age alone is challenging because of the many other factors that are associated with adverse birth outcomes. Only controlled studies can determine the independent and unconfounded contribution of maternal age as a risk factor for mother and fetus. Studies must also consider these other risk factors as potential mediators of the maternal age–pregnancy outcome relationship. Previous studies have not consistently controlled for potential confounders or examined interactions. Future studies must address such limitations.

Finally, researchers need to examine maternal age effects in different subgroups of women based not only on age, but also on other potential risk profiles. Results of previous studies may have been confounded because researchers did not consider the heterogeneity of the study population when maternal age effects were modelled. Risk modelling should consider different groups of women separately based on factors such as parity, socioeconomic status, maternal health status (women with preexisting medical conditions including chronic diseases versus women who are healthy), and the occurrence of antenatal complications during the pregnancy. In addition, more attention must be paid to defining the study outcomes. In examining the effect of maternal age on preterm birth, researchers must develop different models of risk based on clinical presentation or subtype (i.e., PT-LABOR, PROM). Maternal age may have differential effects depending on the pathway that leads to early delivery. Improvements in the methodology used to examine the relationship between maternal age and adverse pregnancy outcomes will help us to quantify the independent and unconfounded risks to older women and their fetus.

CONCLUSION

Maternal age may be part of a complex interaction of factors that contribute to preterm and SGA births. It is unclear if older maternal age is an independent risk factor for preterm birth or SGA birth, or a risk indicator. More studies are required that can quantify the independent and unconfounded influence of delayed childbearing on maternal as well as fetal and neonatal outcomes. It is important to conceptualize what constitutes advanced maternal age. If maternal age has a negative impact on pregnancy outcomes, the pathways must be identified, and interactions with other factors must be examined. We must develop a better understanding of the social, biological, medical, and environmental circumstances surrounding this high-risk age group so that we have the evidence needed to better inform women of any and all possible risks.

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