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Original article

Short interpregnancy interval and adverse birth outcomes in women of advanced age: a population-based study

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ABSTRACT

Purpose: Short interpregnancy interval (IPI) has been linked with adverse birth outcomes. However, the association in advanced age women needs further investigation. This study aims to examine the association between short IPI and adverse birth outcomes including preterm birth, post-term birth, low birth weight, and macrosomia, in a population of advanced age U.S. women.
Methods: The 2016 U.S. public-use natality data was analyzed. Analysis was restricted to women with second-order singleton live births who were ≥35 years at first live birth ($n = 46{,}684$). Multinomial logistic regression analysis was used to examine the association between short IPI and adverse birth outcomes.
Results: Short IPI in advanced age women was significantly associated with higher odds of extremely preterm birth (0–5 months IPI: adjusted odds ratio [AOR] = 2.43, 95% confidence interval [CI] = 1.07–5.52; 6–11 months IPI: AOR = 2.17, 95% CI = 1.09–4.31), very preterm birth (0–5 months IPI: AOR = 1.63, 95% CI = 1.04–2.56), and extremely low birth weight (0–5 months IPI: AOR = 2.43, 95% CI = 1.28–4.60) in the second delivery. An inverse relationship between short IPI and post-term birth was observed and no significant association between short IPI and macrosomia was found.
Conclusions: Short IPI in advanced age women increases the odds of adverse birth outcomes in the second delivery.

Introduction

Over the past 2 decades, women have increasingly initiated childbirth later in life due to career and educational goals [1]. In the United States, from 2007 to 2016, birth rates for women in their late 30s and early 40s rose by 11% and 19%, respectively [2], while birth rates declined to record lows for women in all age groups under 30 years [3]. Consequently, women of advanced age (35 years and older at first live birth) often have short pregnancy intervals in an attempt to have their desired number of children and avoid pregnancy complications that may arise due to increasing age. Results from a study that examined the 2006–2010 National Survey of Family Growth (NSFG) reported that women who initiated childbearing at 30 years and older were significantly more likely to have short interpregnancy intervals (IPIs) than women who initiated childbearing before the age of 30 years [4].

IPI is the time interval between a previous live birth and conception of the subsequent pregnancy [5]. While a strict cutoff for optimum IPI is yet to be established, research has shown that short IPI (less than 18 months) is associated with poor birth outcomes when compared to an IPI of 18–23 months [6–10]. A retrospective cohort study among Dutch women of reproductive ages demonstrated that short IPI was associated with preterm birth and low birth weight [9]. Similarly, a population-based cohort study of reproductive age U.S. women reported that short IPI increased the risk of preterm birth and its recurrence [11]. In addition, a meta-analysis by Kozuki et al. demonstrated that short IPI increased the risk of small for gestational age, infant mortality, and preterm birth in women of reproductive ages [12].

A few studies have reported positive associations for the relationship between short IPI and adverse perinatal outcomes in

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women of advanced age [7,9]. However, these studies used a methodological approach that compared the effect of short IPI on perinatal outcomes in advanced age women relative to women of nonadvanced age (e.g., 25–29 years). Although these studies attempted to adjust for confounding effects that may arise from reproductive and fertility differences between women of advanced age and younger age women [13], the choice of younger age women as comparison group may result in residual and/or unmeasured confounding that may bias the study findings [14]. As a result, effect sizes may be underestimated or overestimated. A simulation study that examined the impact of residual and unmeasured confounding in epidemiologic studies demonstrated that effect sizes of the magnitude frequently reported in observational epidemiologic studies may be generated by residual and/or unmeasured confounding alone [14].

To address this challenge, the present study uses women of advanced age as the comparison group, that is, advanced age women who had short IPI were compared with other advanced aged women who had "optimal IPI," to determine the odds of adverse birth outcomes when compared to normal birth outcomes. This methodological approach will effectively control for reproductive and fertility differences that may otherwise act as residual or unmeasured confounding and will produce a more accurate estimate of the true effect of short IPI on adverse birth outcomes in women of advanced age. Therefore, this study, using a nationally representative sample of advanced age women, aims to (1) examine the association between short IPI and adverse birth outcomes among women of advanced age in the United States and (2) address the challenge of residual or unmeasured confounding by comparing women of advanced age who have short IPI with other advanced aged women who have "optimal IPI."

Material and methods

Data source and study population

This cross-sectional study used the 2016 public-use natality data (National Vital Statistics System, National Center for Health Statistics) for all births registered in the 50 states of the United States, the District of Columbia, and New York City [15]. The public-use natality data set is a collaborative effort between the states, National Center for Health Statistics, and the National Vital Statistics System that collates birth records such as demographic characteristics, medical and obstetric history, and perinatal outcomes from birth certificates. Necessary information required to measure IPI was available in the 2003 revised birth certificate, which was used by all states in the United States and the District of Columbia as of January 1, 2016.

The study population was restricted to women who were aged 35 years or older at the time of their first live birth. In addition, only women with a second-order singleton live birth of at least 20 weeks' gestation were included in the analysis. Maternal age at first live birth was computed by subtracting the time interval between the first and second live births from the maternal age at the second live birth. Younger age women (less than 35 years at first live birth), women with first-order singleton births (i.e., the index delivery is the first live birth) or third or higher order singleton births, multifetal births (e.g., twins, triplets), or live births with congenital birth defects were excluded from the analysis (Fig. 1). Third-order singleton births were excluded to avoid the effect of clustering, and fourth or higher order singleton births were excluded because such births could not be linked to the first birth. Also, women with multifetal births and congenital birth defects were excluded because of their higher risk for adverse birth outcomes [16,17]. This yielded a total of 46,684 women. Because the data set is publicly available and deidentified with no protected health information, ethical review by the Virginia Commonwealth University institutional review board was not required.

Measures

Outcomes

Study outcomes include preterm birth, post-term birth, low birth weight, and macrosomia. Preterm birth and post-term birth were measured using the gestational age at time of delivery. The gestational age at time of delivery was measured using the obstetric

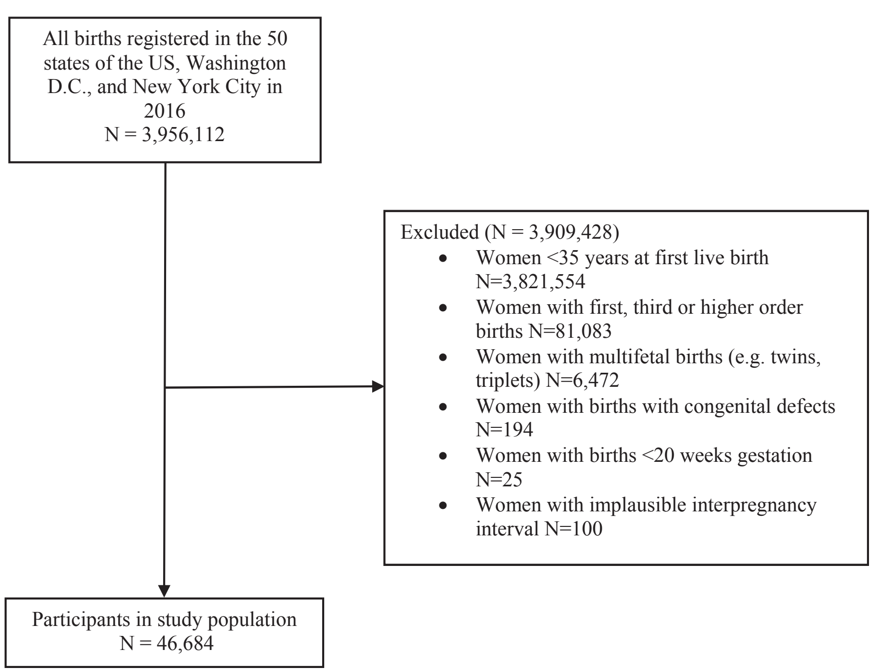

Fig. 1. Selection of study population.