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Gestational age-specific risk of stillbirth during term pregnancy according to maternal age

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Abstract

Purpose To investigate the gestational age-specific risk of stillbirth according to the maternal age group particularly regarding stillbirth risk at the end of pregnancy.

Methods This study was a retrospective national cohort study of all singleton term pregnancy using the Korean Vital Statistics database ($n = 2{,}798{,}542$). We evaluated the risk of stillbirth by gestational week in mothers aged 20–49 years according to maternal age group and neonatal birth weight.

Results The risk of stillbirth in women aged 41 years and older was significantly higher than in women aged 20–29 years between 37 and 40 weeks' gestation. The stillbirth rate per 10,000 ongoing pregnancy in women aged 37–38 years at 39 weeks' gestation (4.22, 95% confidence intervals [CI] 3.01–5.90) and that in women aged 39–40 years at 40 weeks' gestation (8.15, 95% CI 4.83–13.77) were significantly higher in comparison with in those aged 20–29 years at 39 weeks' gestation (1.95, 95% CI 1.64–2.33) and at 40 weeks' gestation (2.59, 95% CI 2.1–3,18). The risk of stillbirth showed an increasing pattern at 40 gestational weeks, in women aged 39 years and older.

Conclusions Delivery plan need to be set up and supported to decrease rates of stillbirth at term in women aged 35 years and older with other risk factors and in women aged 37 years and older regardless of risk factors, and especially in women older than 40 years of age.

Keywords Stillbirth · Maternal age · Delivery · Obstetrics · Gestational age

Introduction

The trend towards delayed childbearing has accelerated in many high-income countries in recent decades. In Korea, the mean maternal age at childbirth increased from 28.1 years in 1996 to 32.4 years in 2016 [1, 2]. In addition, the live birth rates of Korean women over aged 35 years substantially has increased from 5.3 to 26.3%, and also those of women over the age 40 has increased 0.6 to 3.1% during the same period [1, 2].

The designation of a "high-risk pregnancy" is overly vague. Although risk factors for when a consultation by

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specialists is recommended have been designated by the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists, maternal age was not included as a factor [3], The National Institute of Child Health and Human Development defined high-risk pregnancy as "one that threatens the health or life of the mother or her fetus", which typically includes pregnancies in teenagers and in women aged 35 years or older [4]. Because more than 25% of live births occur in women aged 35 years or older in Korea [1, 2], the effect of maternal age on birth outcomes is becoming increasingly important. In addition, we need to define the high-risk individuals who are expected to show poor pregnancy outcomes and who should receive intensive antenatal care, based on maternal age. Although several studies have reported that stillbirth risk increases with advanced maternal age, it has also been revealed that stillbirth is related with race/ethnicity, pre-pregnancy body mass index, birth weight, the use of assisted reproductive therapies, and smoking [5–7]. Black women are at greatest risk of fetal or infant death [8–10]. The prevalence of stillbirth tends to increase with gestational age (GA), although the magnitude varies greatly, with the highest risk seen in black women and the lowest risk seen in white women [8–10]. A previous study suggested that labor should be induced at 40 weeks' gestation in women aged 40 years or older in their first pregnancy as a mean to avoid stillbirth [11].

In this study, we investigated the risk of stillbirth during term pregnancies, identified the high-risk group, based on maternal age, and estimated the GA-specific risk of stillbirth in each maternal age group, to better inform older mothers and maternity care providers of stillbirth risk at the end of pregnancy.

Methods

De-identified Korean Vital Statistics Birth Certificate and Vital Statistics Fetal Death File data [1] on a total of 3,061,050 newborns from singleton pregnancies were obtained from Statistics Korea. Korean Vital Statistics is a nationwide database that was developed to understand birth, death, marriage, and divorce, i.e., the basic causes of change in population size and population structure of Korea. Data from Korean Vital Statistics are released monthly and annually via a press release on the website (http://kosis.kr) and in online publications, such as Annual Report on the Vital Statistics. Data were collected after the Korean Vital Statistics obtained informed consent from all participants. Raw data on all fetuses delivered from 2009 to 2015 (444,849 in 2009; 470,171 in 2010; 471,265 in 2011; 484,550 in 2012; 436,455 in 2013; 435,435 in 2014; and 438,420 in 2015) were analyzed. Our results were generated based on 2,798,542 births after exclusions. Pregnancy dating was determined using the best obstetric estimate as opposed to the last menstrual period. However, if the estimated GA based on the last menstrual period was significantly different from that estimated by ultrasound, then GA as determined by early ultrasound was used for this purpose and there was no allowance for GA correction following birth. GA is denoted by completed weeks; so, for example, a GA of 40 weeks indicates 40 weeks plus up to 6 days. Body weight was measured to the nearest 10 g. This study used anonymous registry data and we obtained approval from the institutional review board of the Catholic University of Korea (KC17ZESI0171).

Inclusion and exclusion criteria

The study population comprised all singleton deliveries to Korean mothers between 37 and 42 6/7 weeks of gestation. We excluded fetal or infant deaths caused by congenital abnormalities in the death registry. Newborns with unknown body weight or GA ($n = 16{,}420$), those with GA < 37 weeks or > 42 weeks ($n = 234{,}371$), patients with multiple pregnancies ($n = 45{,}135$), and cases of extreme maternal age (< 20 or > 49 years old, $n = 17{,}991$) were excluded. Some of the exclusions ($n = 79{,}686$) were duplicated.

Maternal age and birth weight groups

Women were classified by age into four categories: 20–29 years; 30–34 years; 35–39 years; and 40–49 years of age. In addition, women were classified by age into six categories to estimate the risk of stillbirth per 10,000 ongoing pregnancies, to evaluate the significantly high risk of stillbirth group, based on maternal age.

We defined small for GA (SGA) as an infant birth weight below the 10th percentile for a particular GA; appropriate for a particular GA (AGA) as an infant birth weight between the 10th percentile and 90th percentile; and large for GA (LGA) as an infant birth weight above the 90th percentile for a particular GA according to Korean reference curves for birth weight by GA, sex, and plurality of newborns in Korea [12]. Therefore, we stratified our analysis into an SGA group, an AGA group, and an LGA group,

Outcome measures

Stillbirth was defined as intrauterine fetal death occurring after 20 weeks' GA and before the start of delivery, or that occurring during labor. The risk of stillbirth at a given GA was calculated as the number of stillbirths (whether antepartum or intrapartum) at that GA per 10,000 ongoing pregnancies, minus half of the births in the given week. This correction factor (subtracting 50% of the deliveries during the week of investigation from the denominator of total ongoing

pregnancies) was described by Smith as a way to correct for the censoring of pregnancies that are delivered during the week, assuming they occurred on average halfway through the week [10, 13].

Statistical analysis

All statistical analyses were performed with SAS version 9.3 (SAS Institute Inc., Cary, NC, USA), including proportions, odd ratios (ORs), and 95% confidence intervals (CIs). Chi-squared tests were performed to compare proportions of independent variables and an ANOVA test was performed to compare means. The risk of stillbirths by maternal age, education, parity, and nationality, and neonatal birth weight, was analyzed by multivariable logistic regression analysis following the adjustment by GA at delivery. Poisson regression analysis was performed to compare the risk of stillbirth by GA in each maternal age group and each birth weight group. Statistical significance was reached with a p value of < 0.05 or if the 95% CIs did not overlap.

Results

Clinical characteristics

Our analysis included 2,798,542 deliveries from singleton live births and stillbirths, of which 195,304 (6.98%) were SGA and 207,709 (7.42%) were LGA (Table 1). There were 1571 total stillbirths, of which 356 (22.66%) were in the SGA group and 173 (11.02%) were in the LGA group. Baseline characteristics of the study cohort, based on four maternal age groups, are shown in Table 1. Among 2,796,971 singleton live births, 521,291 (18.6%) were born to women aged 35 years and older and 62,216 (2.22%) were born to women aged 40 years and older. The proportions of SGA and LGA were significantly high in the live births and stillbirths, in the deliveries in women aged 40 years and older, as compared with those in the other age groups.

Logistic regression analysis of the likelihood of stillbirths

Logistic regression models of the likelihood of stillbirths during term pregnancy were used to estimate the effects of maternal age, birth weight, maternal education, parity, and maternal nationality, after adjusting for GA at delivery (Table 2). Reference comparison groups were appropriate for gestational age at each gestational weeks, maternal education more than high school graduation, multiparity, and non-Korean maternal nationality. The OR of maternal age was 1.172 (95% CI 1.055, 1.301) according to each 5-years-of-age increase. The odds ratios of SGA and LGA were 4.531 (95% CI 3.708–5.538) and 2.216 (95% CI 1.684–2.915), respectively. The odd ratios of maternal education level of less than high school graduation and nulliparity were 1.677 (95% CI 1.025–2.744) and 2.275 (95% CI 1.883–2.748), respectively.

Risk of stillbirth by gestational week in six maternal age groups at term

During term pregnancy, the risk of stillbirth in women aged 41 years and older were significantly higher than in women aged 20–29 years of age between 37 and 40 weeks' gestation (Table 3). In comparison with the risk of stillbirth in women aged 20–29 years, the risk of stillbirth was not increased until the age of 36 years of maternal age throughout term pregnancy. The risk of stillbirth in women aged 37–38 years at 39 weeks' gestation (4.22 per 10,000 ongoing pregnancies, 95% CI 3.01–5.9) and the risk of stillbirth in women aged 39–40 years at 40 weeks' gestation (8.15 per 10,000 ongoing pregnancies, 95% CI 4.83–13.77) were significantly higher as compared with that seen at 20–29 years of maternal age (1.95 per 10,000 ongoing pregnancies, 95% CI 1.64–2.33 at 39 weeks' gestation and 2.59 per 10,000 ongoing pregnancies, 95% CI 2.1–3,18 at 40 weeks' gestation, respectively). Until 38 years of maternal age, the risk of stillbirth showed an increasing pattern at 41 gestational weeks (Fig. 1). However, the risk of stillbirth in women aged 39 years and older showed an increasing pattern at 40 gestational weeks, although the 95% CIs overlapped between 39 and 40 gestational weeks.

Risk of stillbirth by gestational week in maternal age groups at term according to birth weight group

The SGA group showed overall higher risk of stillbirth by gestational week in each maternal age group as compared with AGA group (Table 4). Within the SGA group, the risk of stillbirth at 40 weeks' gestation in women aged 20–29 years was comparable with that at 37 weeks' gestation in women aged 41–49 years (10.96 per 10,000 ongoing pregnancies, 95% CI 5.7–21.06 and 14.65 per 10,000 ongoing pregnancies, 95% CI 5.5–39.02, respectively). In the SGA group, the risk of stillbirth at 38 weeks in women aged 41–49 years (21.11 per 10,000 ongoing pregnancies, 95% CI 8.78–50.71) was significantly higher than that in women aged 20–29 years (3.915 per 10,000 ongoing pregnancies, 95% CI 2.66–5.74). The AGA group showed a similar pattern of the risk of stillbirth to that of the total population (Tables 2, 4). There was no significantly higher risk of stillbirth in any maternal age group until 39 weeks' gestation in the LGA group as compared with in the AGA group. Within the LGA group, there was significantly higher risk of stillbirth in women aged 39–40 years at 38 weeks' gestation

Table 1 Demographic characteristics of women with singleton deliveries between 37 and 42 weeks of gestation in Korea between 2010 and 2015

	Stillbirth						Live birth						*p* value*
	Maternal age group, years (*N*)						Maternal age group, years (*N*)						
	20–29 (507)	30–34 (681)	35–39 (299)	40–49 (84)	All age (1571)	*p* value	20–29 (927,048)	30–34 (1,348,632)	35–39 (459,075)	40–49 (62,216)	All age (2,796,971)	*p* value	
Sex, male	272 (53.7)	345 (50.7)	149 (49.8)	50 (59.5)	816 (51.9)	0.320	473,746 (51.1)	689,216 (51.1)	235,394 (51.3)	31,509 (50.6)	1,429,865 (51.1)	0.016	0.017
GA[a]	38.5 ± 1.2	38.5 ± 1.2	38.5 ± 1.2	38.3 ± 1.1	38.5 ± 1.2	0.537	39.1 ± 1.1	39.0 ± 1.1	38.8 ± 1.1	38.7 ± 1.1	39.0 ± 1.1	< 0.001	< 0.001
37 weeks	125 (24.7)	171 (25.1)	66 (22.1)	25 (29.8)	387 (24.6)	0.814	68,970 (7.4)	112,116 (8.3)	47,856 (10.4)	8362 (13.4)	237,304 (8.5)	< 0.001	< 0.001
38 weeks	141 (27.8)	178 (26.1)	84 (28.1)	24 (28.6)	427 (27.2)		213,568 (23.0)	365,196 (27.1)	147,911 (32.2)	22,445 (36.1)	749,120 (26.8)		
39 weeks	126 (24.8)	178 (26.1)	86 (28.8)	18 (21.4)	408 (26.0)		296,710 (32.0)	420,962 (31.2)	133,333 (29.0)	16,396 (26.4)	867,401 (31.0)		
40 weeks	90 (17.8)	115 (16.9	48 (16.1)	16 (19.1)	269 (17.1)		277,901 (30.0)	360,688 (26.7)	104,508 (22.8)	12,127 (19.5)	755,224 (27.0)		
41 weeks	23 (4.5)	38 (5.6)	13 (4.4)	1 (1.2)	75 (4.8)		67,369 (7.3)	86,616 (6.4)	24,413 (5.3)	2727 (4.4)	181,125 (6.5)		
42 weeks	2 (0.4)	1 (0.2)	2 (0.7)	0 (0)	5 (0.3)		2530 (0.3)	3054 (0.2)	1054 (0.2)	159 (0.3)	6797 (0.2)		
Birthweight, g	3018.9 ± 583.1	3054.6 ± 596.5	3081.3 ± 620.6	3040.8 ± 755.3	3047.4 ± 606.4	0.541	3239.2 ± 352.1	3250.0 ± 351.0	3248.7 ± 360.2	3221.0 ± 371.6	3244.7 ± 354.2	< 0.001	< 0.001
SGA	116 (22.9)	146 (21.4)	74 (24.8)	20 (23.8)	356 (22.7)	< 0.001	70,885 (7.7)	89,833 (6.7)	29,654 (6.5)	4578 (7.4)	194,950 (7.0)	< 0.001	< 0.001
AGA	346 (68.2)	471 (69.2)	180 (60.2)	45 (53.6)	1042 (66.3)		794,753 (85.7)	1,157,852 (85.9)	389,662 (84.9)	52,218 (83.9)	2,394,485 (85.6)		
LGA	45 (8.9)	64 (9.4)	45 (15.1)	19 (22.6)	173 (11.0)		61,410 (6.6)	100,947 (7.5)	39,759 (8.7)	5420 (8.7)	207,536 (7.4)		
Low education[b]	8 (4.1)	4 (1.6)	6 (5.3)	6 (19.4)	24 (1.5)	< 0.001	33,258 (3.6)	9978 (0.7)	5270 (1.1)	2176 (3.5)	50,682 (1.8)	< 0.001	< 0.001
Nulliparity	349 (78.1)	399 (66.8)	114 (44.5)	26 (40.0)	888 (56.5)	< 0.001	646,436 (69.8)	646,971 (48.0)	149,224 (32.6)	20,289 (32.7)	1,462,920 (52.3)	< 0.001	< 0.001

Value was represented as numbers (percentage) or mean ± standard deviation

GA gestational age, *SGA* small for gestational age, *AGA* appropriate for gestational age *LGA* large for gestational age

*Comparison between stillbirth group and live birth group in all age group

[a]Number of gestational age means completed weeks

[b]Low education is defined as maternal education level of less than high school graduation

Table 2 The adjusted odds ratio of stillbirths by gestational age during term pregnancy

	Adjusted odds ratio (95% CI)	*p* value
Maternal age (each 5 year)	1.172 (1.055–1.301)	0.003
SGA	4.531 (3.708–5.538)	< 0.001
LGA	2.216 (1.684–2.915)	< 0.001
Nulliparity	2.275 (1.883–2.748)	< 0.001
Lower maternal education level[a]	1.677 (1.025–2.744)	0.040
Korean maternal nationality	0.649 (0.445–0.945)	0.024

CI Confidence interval, *SGA* Small for gestational age, *LGA* Large for gestational age

[a]Lower maternal education was defined as the education level below the high school graduation

and in women aged 41 years and older at 39 and 40 weeks' gestation, respectively, in comparison with in women aged 20–29 years.

Discussion

In Korea, reductions in stillbirth have occurred in the past several decades due to improved antenatal care and better recognition of risk factors, such as preeclampsia, fetal growth restriction, and diabetes [14]. However, there are still more than 3000 stillbirths that occur in Korea each year [1]. This represents a huge trauma not only for the mother but also for family members. In this study, we demonstrated that advanced maternal age, nulliparity, a maternal education level of less than high school graduation, a classification of SGA or LGA based on the birth weight of the neonate, and non-Korean nationality had increased risk of stillbirth during term pregnancy after adjustment of gestational age. Upon stratification by gestational week and maternal age group, there were increasing risk patterns of stillbirth in women aged 37 years and older, as compared with in the 20- to 29-year-old group.

As we expected, the risk of stillbirth in the SGA group was significantly higher in most of the gestational weeks during the pregnancy term versus in the AGA group. It seemed that the risk of stillbirth in the SGA group increased in women aged 35 years and older, as compared with in women aged 20–29 years, although there was no statistical significance. Especially, in women older than 40 years of age in the SGA group, the risk of stillbirth per 10,000 ongoing pregnancy at 38 weeks' gestation reached 21.11, which was sevenfold higher than that in same age group of the AGA group and fivefold higher than that in women aged 20–29 years in the SGA group.

Due to the growing number of pregnancies demonstrating advanced maternal age in developed countries, the amount of studies evaluating the association between advanced maternal age and adverse pregnancy outcomes has increased [5, 7, 15]. It is believed that the majority of stillbirths in high-income countries may be related to placental dysfunction [15]. Therefore, increasing awareness and the implementation of effective interventions for modifiable risk factors, such as overweight, obesity, maternal age, and smoking, have been suggested for stillbirth prevention in high-income countries [7]. Because late-onset fetal growth restriction is strongly associated with placental dysfunction, which can affect the risk of stillbirth, neurologic development, and metabolic disease in adulthood, suspected SGA in women aged older than 35 years of age requires more attention [16, 17].

Because there is a concern that labor induction can increase the risk of cesarean delivery, there have been ongoing discussions on the best timing of delivery, labor induction, and mode of delivery in women aged older than 35 years of age. A recent multicenter randomized trial revealed that, among women older than 35 years of age, the induction of labor at 39 weeks of gestation, as

Table 3 Risk of stillbirth by gestational age, in six maternal age groups

Maternal age, years	Stillbirth rate/10,000 ongoing pregnancy (95% CI)				
	Gestational age				
	37 weeks	38 weeks	39 weeks	40 weeks	41 weeks
20–29	1.35 (1.13–1.61)	1.64 (1.39–1.94)	1.95 (1.64–2.33)	2.59 (2.10–3.18)	3.29 (2.19–4.95)
30–34	1.27 (1.09–1.47)	1.44 (1.24–1.67)	2.04 (1.76–2.37)	2.55 (2.13–3.06)	4.24 (3.08–5.82)
35–36	1.45 (1.07–1.98)	2.10 (1.60–2.75)	2.91 (2.19–3.88)	3.48 (2.41–5.05)	4.44 (2.12–9.31)
37–38	1.46 (0.95–2.25)	2.11 (1.45–3.08)	**4.22 (3.01–5.90)**	3.32 (1.93–5.71)	5.22 (1.96–13.91)
39–40	1.92 (1.11–3.30)	2.36 (1.40–3.99)	3.38 (1.92–5.95)	**8.15 (4.83–13.77)**	5.99 (1.50–23.96)
41–49	**4.82 (3.70–7.75)**	**4.94 (2.98–8.19)**	**6.29 (3.48–11.35)**	**10.78 (5.61–20.72)**	6.23 (0.88–44.26)

CI, Confidence interval

Bold indicated a statistically significantly higher compared with the stillbirth risk identified in women aged 20–29 years at the corresponding gestational age ($p < 0.05$)

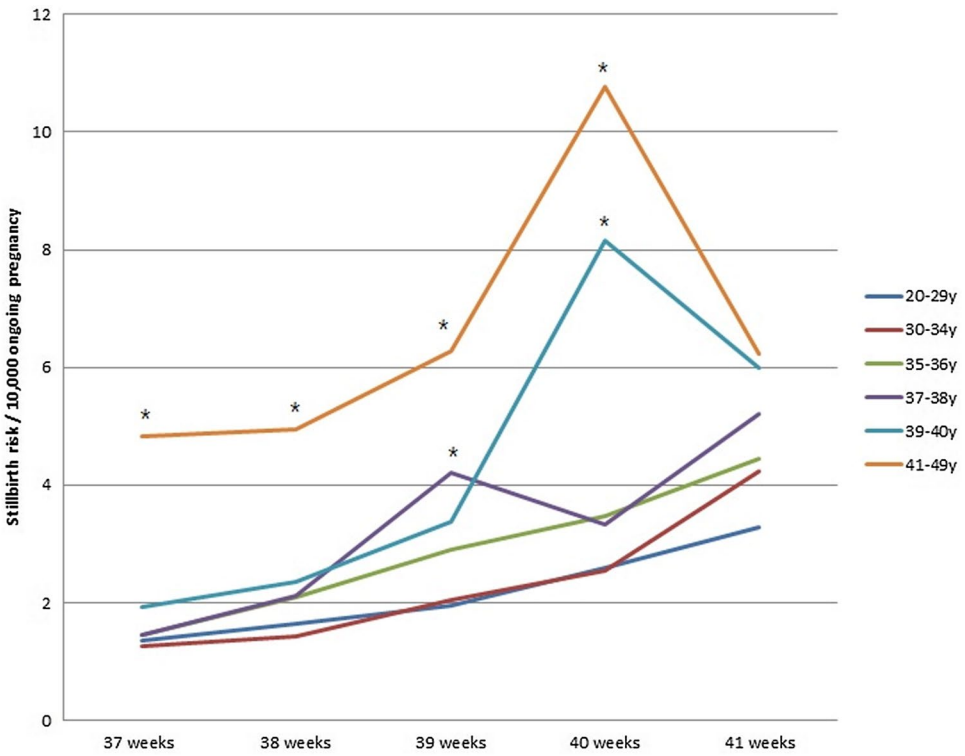

Fig. 1 Risk of Stillbirth by gestational age, in six maternal age groups. An asterisks indicates a statistically significant higher risk of stillbirth rate when compared with the rate identified in women aged 20–29 years at the corresponding gestational age

compared with expectant management, had no significant effect on the rate of cesarean section and no adverse short-term effects on maternal or neonatal outcomes [18]. Previously, several studies suggested earlier induction in women with advanced age, such as by 40 weeks' gestation in nulliparous women aged 40 years or older [11], or by 38 weeks' gestation in women aged 44 years or older [19]. A large population study from United States reported that, among women ≥ 35 years or older with low-risk pregnancies, planned cesarean section was associated with significantly higher risk of maternal morbidity, including hysterectomy, disseminated intravascular coagulation, sepsis, and obstetrical embolism as compared with in healthy women in the planned vaginal group [20]. A separate large population study from Norway reported that, although emergency operative procedures were associated with an increased risk of adverse outcomes, the absolute risk difference in complications between the modes of delivery was low for the majority of outcomes studied, however [21]. Therefore, the induction of labor slightly earlier on in cases of advanced maternal age can be considered under the monitoring of fetus and labor progress. Labor induction may be considered at 39 or 40 weeks' gestation in women aged 39 years and older, based on this study's findings of increasing risk patterns of stillbirth from 40 weeks' gestation, although women aged younger than 39 years showed increasing risk patterns of stillbirth from 41 weeks' gestation. However, our study had the limitations that it could not determine whether the mother did the labor induction.

In this study, the risk of stillbirth is increased in women aged 41 years and older at 38 weeks' gestation and decreased at 39 weeks' gestation in SGA group. It seems that the number of cases is limited in the old maternal age group, especially in SGA group. Most of the clinicians choose delivery especially when the fetus expects SGA in old-aged women.

The other limitation of this study is that there are no individual data about pregnancy complications, body mass index, blood pressure, smoking history, delivery mode, and history of assisted reproduction treatments such as in vitro fertilization, intracytoplasmic insemination, or selective reduction, which can affect pregnancy outcomes. However, this study demonstrated that the risk of stillbirth significantly increases in women aged 37 years and older and was especially high in women aged older than 40 years of age during term pregnancy in a national Korean population.

Non-Korean nationality of mother was a significant risk factor of stillbirth regardless of maternal age. In Korea, many non-Korean nationality women are international marriage migrant women who were at high risk of not receiving adequate antenatal care because of language barriers, social isolation, and lack of medical knowledge [22]. These reasons, together with low education level of the migrant women, are thought to contribute to the increased risk of stillbirth in this population. However, we found that the risk of stillbirth in women aged 39 year and older showed

Table 4 Risk of stillbirth by gestational weeks, in each maternal age group, according to neonatal birthweight group

Maternal age, year	Stillbirth/10,000 ongoing pregnancy (95% CI) in SGA				
	37 weeks	38 weeks	39 weeks	40 weeks	41 weeks
20–29	5.35 (3.89–7.36)*	3.91 (2.66–5.74)*	5.32 (3.70–7.66)*	4.00(2.32–6.89)	10.96 (5.70–21.06)*
30–34	4.78 (3.54–6.44)*	4.91 (3.61–6.66)*	5.13 (3.67–7.19)*	4.95(3.16–7.76)*	9.32 (4.85–17.90)
35–36	5.69 (3.06–10.57)*	9.98 (6.11–16.29)*	7.46 (3.88–14.34)*	13.25(6.89–25.46)*	17.85 (5.76–55.33)*
37–38	5.31 (2.21–12.76)*	9.36 (4.68–18.71)*	7.85 (3.27–18.87)*	8.66(2.79–26.85)	–
39–40	6.54 (2.11–20.27)*	7.43 (2.39–23.02)*	13.72 (5.15–36.55)*	6.32(0.89–44.85)	25.45 (3.58–180.64)
41–49	14.65 (5.5–39.02)*	**21.11 (8.78–50.71)**	11.99 (3.40–7.94)	11.04(1.55–78.36)	54.95 (7.74–390.06)
Maternal age, year	Stillbirth/10,000 ongoing pregnancy (95% CI) in AGA				
	37 weeks	38 weeks	39 weeks	40 weeks	41 weeks
20–29	0.96 (0.76–1.20)	1.41 (1.17–1.71)	1.59 (1.29–1.96)	2.25 (1.76–2.86)	2.07 (1.18–3.65)
30–34	0.97 (0.80–1.16)	1.14 (0.95–1.36)	1.78 (1.50–2.11)	2.10 (1.68–2.61)	3.35 (2.26–4.96)
35–36	0.98 (0.65–1.48)	1.38 (0.96–1.98)	2.28 (1.60–3.24)	2.52 (1.57–4.05)	0.77 (0.11–5.43)
37–38	1.15 (0.68–1.95)	1.48 (0.91–2.41)	**3.40 (2.26–5.12)**	2.15 (1.02–4.51)	4.79 (1.54–14.84)
39–40	1.22 (0.58–2.57)	1.00 (0.42–2.40)	2.36 (1.13–4.96)	**7.04 (3.79–13.09)**	3.7 (0.52–26.25)
41–49	**3.73 (2.06–6.73)**	3.15 (1.57–6.30)	4.17 (1.87–9.28)	**7.37 (3.07–17.71)**	–
Maternal age, year	Stillbirth/10,000 ongoing pregnancy (95% CI) in LGA				
	37 weeks	38 weeks	39 weeks	40 weeks	41 weeks
20–29	1.79 (0.99–3.23)	1.94 (1.07–3.50)	2.40 (1.29–4.46)	5.12 (2.84–9.25)	5.28 (1.32–21.09)
30–34	1.58 (0.97–2.59)	1.74 (1.07–2.84)	1.92 (1.09–3.39)	5.22 (3.20–8.51)*	7.33 (2.75–19.53)
35–36	2.96 (1.41–6.20)	3.31 (1.58–6.94)	5.36 (2.55–11.24)	3.27 (0.82–13.09)	29.47 (9.50–91.37)*
37–38	1.59 (0.40–6.37)	2.72 (0.88–8.44)	9.00 (4.04–20.03)	9.45 (3.05–29.32)	18.48 (2.60–131.22)
39–40	5.02 (1.62–15.58)	**11.64 (5.23–25.90)**	3.37 (0.47–23.93)	21.66 (6.99–67.16)	–
41–49	6.56 (1.64–26.21)	7.72 (1.93–30.85)	**20.76 (6.70–64.37)**	**45.59 (14.70–141.36)**	–

Bold indicates that the stillbirth risk is statistically significantly higher compared with the stillbirth risk identified in women aged 20–29 years at the corresponding gestational age ($p < 0.05$)

An asterisks indicates a statistically significant higher risk of stillbirth when compared with the appropriate gestational age group in the same gestational age and maternal age group ($p < 0.05$)

an increasing pattern at 40 weeks of gestation, even when adjusted for low education level or maternal nationality.

Antenatal care and a delivery plan need to be set up and supported in women aged 35 years and older with risk factors such as suspected SGA and in women aged 37 years and older, regardless of risk factors, especially in women who are older than 40 years of age. Planned delivery can be considered at 39–40 weeks' gestation in women aged 39 years or older, although more studies about the risks and benefits of delivery mode in older nulliparous Asian women are needed.

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Compliance with ethical standards

Conflict of interest All authors have no conflict of interest related with this article.

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Availability of data and materials All data supporting the conclusion of the article are available from the corresponding author on reasonable request.

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