BMJ Open

Is limited access to obstetric services associated with adverse birth outcomes? A cross-sectional study of Korean national birth data

Hye Sook Min,[1] Saerom Kim,[1,2] Seulgi Kim,[3] Taeho Lee,[4] Sun-Young Kim,[5] Hyeong Sik Ahn,[6] Seung-Ah Choe[6,7]

To cite: Min HS, Kim S, Kim S, *et al*. Is limited access to obstetric services associated with adverse birth outcomes? A cross-sectional study of Korean national birth data. *BMJ Open* 2022;**12**:e056634. doi:10.1136/bmjopen-2021-056634

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2021-056634).

Received 22 August 2021
Accepted 04 May 2022

For numbered affiliations see end of article.

Correspondence to
Dr Seung-Ah Choe;
seungah@korea.ac.kr

ABSTRACT

Objectives The geographical disparity in the access to essential obstetric services is a public health issue in many countries. We explored the association between timely access to obstetric services and the individual risk of adverse birth outcomes.

Design Repeated cross-sectional design.

Setting South Korean national birth data linked with a medical service provision database.

Participants 1 842 718 singleton livebirths from 2014 to 2018.

Primary outcome measures Preterm birth (PTB), post-term birth, low birth weight (LBW) and macrosomia.

Results In the study population, 9.3% of mothers lived in districts where the Time Relevance Index (TRI) was as low as the first quartile (40.6%). Overall PTB and post-term birth rates were 5.0% and 0.1%, respectively. Among term livebirths, LBW and macrosomia occurred in 1.0% and 3.3%, respectively. When the TRI is lower, representing less access to obstetric care, the risk of macrosomia was higher (adjusted OR=1.15, 95% CI 1.11 to 1.20 for Q1 compared with Q4). Similarly, PTB is more likely to occur when TRI is lower (1.05, 95% CI 1.00 to 1.10 for Q1; 1.03, 95% CI 1.01 to 1.05 for Q2). There were some inverse associations between TRI and post-term birth (0.80, 95% CI 0.71 to 0.91, for Q2; 0.84, 95% CI 0.76 to 0.93, for Q3).

Conclusions We observed less accessibility to obstetric service is associated with higher risks of macrosomia and PTB. This finding supports the role of obstetric service accessibility in the individual risk of adverse birth outcomes.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The strength of this study is to use the national birth data linked with a medical service provision database.

⇒ Annual time relevance index calculated at the district level was used as a standardised indicator of accessibility to obstetric service.

⇒ As a study of repeated cross-sectional design, there are possibilities of reverse causation and residual confounding effects.

INTRODUCTION

The primary goal of modern obstetric care is to improve perinatal health outcomes for mothers and infants. Securing basic obstetric care, including local availability of obstetric delivery services, is crucial for timely and adequate perinatal care. Essential obstetric care services are accessible to most women in high-income countries.[1] Still, access to obstetric clinics can vary by region due to physician shortages and concurrent closures of hospital obstetrics.[2 3]

The estimated global preterm birth (PTB) rate for 2014 was 10.6%,[4] and low birth weight (LBW) incidence decreased by 1.2% between 2000 and 2015, while it slightly increased from 7.3% in 2000 to 7.9% in 2015 in North America.[5] Despite the widely implemented labour induction practice before 42 gestational weeks, post-term births still make up 0.3%–7% of all births in industrialised societies.[6 7] Macrosomia increases the risk of labour abnormalities, shoulder dystocia, birth trauma and maternal morbidity. In 2017, 7.8% of all live-born newborns in the US weigh 4000 g or more and the proportion.[8 9] Newborns that survive abnormalities in the gestation period and intrauterine growth are more likely to suffer life-long health problems than their normal counterparts.[7 10] Consequently, the distribution of adverse birth outcomes across the region will likely shape regional health disparities. In some instances, adverse birth outcomes can be prevented with timely medical intervention.[11 12] Therefore, it is important to make essential obstetrical care available to every pregnant mother.

In South Korea, the number of obstetric clinics has continued to decrease, especially in rural areas. This fact can be attributed to the declining number of women of reproductive age, smaller volumes of childbirth and a rising fear of medical litigation among obstetricians.[13] In December 2018, 65 of 250 administrative districts had no obstetric clinics or hospitals with obstetric services.[14] In terms of equitable access to essential obstetric care and the risk of adverse birth outcomes in rural populations, this district-level disparity in the distribution of obstetric service is concerning.[15–17] Instances of PTB and LBW in Korea have risen in recent decades.[18]

Previous studies have focused on the impact of regional factors on adverse birth outcomes at the national level.[2 19] Given that essential obstetric services are covered by Korea's national health insurance, the financial barrier would be minimal. Exploring the association between the geographical distribution of obstetric facilities and adverse birth outcomes of Korean women would provide insight into the potential effects of proximity to the facilities on birth outcomes.

METHOD

Data

This study analysed nationwide cross-sectional data at multiple time points. We used the merged national birth data and a medical service provision database based on the district code and year. Korea's national birth data between 2014 and 2018 were retrieved from Statistics Korea (http://kosis.kr/eng/). This data are based on the birth certificates that the parents submit at birth registration and include all live birth records issued in South Korea from 2014 to 2018 across 250 districts. Of all singleton live births (n=2 177 211), we excluded multiple births, extreme maternal age (<15 or ≥45 years), missing for maternal age, gestational age at birth, birth weight and missing district of birth (n=3 34 503, 15.4%). The final study population comprises 1 842 718 singleton births (online supplemental figure 1). This study used an anonymised publicly open data set (https://mdis.kostat.go.kr).

Definition of adverse birth outcomes

Primary outcomes of interest were PTB, post-term birth, LBW and macrosomia. We identified PTB where the gestational age at birth was less than 37 weeks and post-term birth at 42 complete weeks or higher.[6 20] The outcomes were selected based on prior knowledge and analytical convenience. The gestational age on the birth certificate, captured by obstetricians who attended the delivery, is based on the physician's estimate. The estimate is based on ultrasounds taken early in the pregnancy and the date of the mother's last menstrual cycle. Gestational age was referred to in weeks, rounding off to the lowest completed week. For example, birth at 36^{+6} weeks was coded as 36 weeks. According to the universal definition, LBW is defined as a birth weight of less than 2.5 kg. In comparison, macrosomia is defined as a birth weight of higher than 4 kg regardless of gestational age.[1 9]

Measurement of obstetric service coverage

We used a medical service provision database retrieved from the Health Map system (http://www.healthmap.or.kr/) developed by the National Medical Center of Korea. As a nationally supported health information project, this system has provided annual regional indicators of essential medical service coverage since 2014. We adopted 'districts' (*gu*'s and *gun*'s) as a unit of small areas where the obstetric service coverage is measured. 'Districts' are comparable to 'boroughs' in some western countries. In order to calculate the indicators, the system analysed (1) the national health insurance data to determine the number of obstetric services used by expectant mothers—a total of 513 delivery facilities nationwide, (2) driving time to the service point from the patient address using the ArcGIS Desktop v. 10.5 (ESRI, Redlands, CA) and (3) the total number of births by women living in the district. For the obstetric service coverage indicator of the 250 districts, the system calculated the annual Time Relevance Index (TRI) of obstetric service, defined as follows:

$$\mathrm{TRI} = \frac{\text{Number of deliveries in obstetric care facility within 60-minute driving distance from home by women living in the district}}{\text{Total number of deliveries by women living in the district}} \times 100$$

For example, a TRI of 60% in the district means the proportion of births in an obstetric care facility within a 60 min travel period from the mother's home is 60% of all births in the district.

District-level covariates

Our analysis included area deprivation index (ADI) and the total number of births as district-level covariates. ADI is a measure of the neighbourhood's socioeconomic status at the small-area level.[21–23] We used the previously developed method of calculating ADI as a composite indicator for the administrative district, calculated by summing up the Z scores of nine indices: (1) single-person households, (2) households without a car, (3) households not living in an apartment, (4) female homeowners, (5) households with inadequate conditions—lack of either kitchen, toilet, bath, water, heating facilities or any combination thereof, (6) divorced or bereaved, (7) those with a secondary level of education or lower, (8) older adults over 65 years and (9) lower class households—unemployed, unskilled labourers, precarious workers with a secondary level of education or lower,[21] which were obtained from the 2015 Korea National Statistical Office Population and Housing Census. The index has been validated in terms of multiple district health outcomes.[21 24] The total number of births in the district was included in the model to adjust for population size. We assigned district-level exposures including annual TRI to women living in the same districts as individual exposures.

Statistical analysis

We first calculated the proportions and crude OR of PTB, post-term birth, LBW and macrosomia by each district in the population. Second, using Spearman correlation tests, we assessed a pairwise association structure of the four adverse birth outcomes and three district-level features—TRI, total number of livebirths and ADI—using 5-year averages for each district. Third, we constructed mixed-effects multinomial logistic regression models to compute the individual-level OR of each adverse outcome adjusted for maternal age, parental education, parental occupation, parity, sex of neonates, year and season of birth, total number of livebirths and district ADI. We modelled the three district-level variables as quartiles because they were not normally distributed. This modelling approach is parameterised to allow flexibility in the comparisons across the response categories when analysing ordinal response data.[25] We modelled a clustering effect in 17 regions covering the 250 districts. The effect by health facility was not assessed because the public data set has no health facility information. Adjusted ORs for each adverse outcome were estimated comparing quartile ranks of TRI. Statistical analyses and mapping were performed using SAS and R (V.3.0.3; R Development Core Team, Vienna, Austria).

Patient and public involvement

Patients or the public were not involved.

RESULTS

In the period studied, singleton childbirths occurred in 250 districts. A fourth of the mothers were 35 years old and above (table 1). Half of the births were of nulliparous women and male babies. Most mothers were unemployed at the time of childbirth. The average number of births in the district was 1538, and 80% of all births occurred in less deprived districts than median. Of the mothers studied, 9.3% lived in districts where the accessibility is in the lowest quartile.

Overall incidences of PTB and post-term birth were 5.0% (n=94 579) and 0.1% (n=2639), respectively, during the study period. LBW occurred in 1.0% (n=18 722) and macrosomia was observed in 3.3% (n=61 753) of all singleton livebirths. The geographical distribution of four adverse birth outcomes and TRI generally showed higher PTB or post-term birth rates and lower TRI in the south-eastern region than other parts of the country (online supplemental figure 2). The clustering pattern of districts with the highest quartile was not evident for LBW or macrosomia. The total number of births in the district was positively correlated with TRI (ρ=0.75) and negatively correlated with ADI (−0.81, table 2). For other pairs, the correlation coefficients were generally low.

Living in districts with lower TRI was associated with a higher risk of PTB (OR=1.08, 95% CI 1.05 to 1.10, for Q2 vs Q4) and macrosomia (1.12, 95% CI 1.08 to 1.16, for Q1 vs Q4) and with a lower chance of post-term birth (0.78, 95% CI 0.69 to 0.88, for Q2 vs Q4) in the unadjusted analysis (table 3). Adjusted ORs were consistently higher for macrosomia, reaching the highest risk when the TRI is lowest (1.15, 95% CI 1.11 to 1.20, for Q1 compared with Q4—figure 1). Similarly, adjusted ORs for PTB were higher for a lower TRI (1.05, 95% CI 1.00 to 1.10 for Q1; 1.03, 95% CI 1.01 to 1.05 for Q2) than for the highest TRI (online supplemental table 1). For post-term birth, the risks were lower when TRI was lower,

Table 1 Individual and district-level (n=250) characteristics of preterm and term births among all singleton livebirths (n=1 842 718)

Variables	All singleton births (n=1 883 377)
Individual-level features	
Maternal age (years)	
15–24	97 357 (5.2%)
25–34	1 300 150 (69.0%)
35–45	483 925 (25.7%)
Nulliparity	1 001 557 (53.2%)
Male baby	967 148 (51.4%)
Maternal occupation	
Unemployed	1 110 978 (59.0%)
Manager, professional worker	318 122 (16.9%)
Clerical, service worker	412 739 (21.9%)
Manual worker	41 538 (2.2%)
Paternal occupation	
No paid occupation	157 158 (8.3%)
Manager, professional worker	643 425 (34.2%)
Clerical, service worker	745 637 (39.6%)
Manual worker	337 157 (17.9%)
Maternal education	
High school or lower	431 922 (22.9%)
College/university	1 291 155 (68.6%)
Graduate school	144 543 (7.7%)
Paternal education	
High school or lower	449 184 (23.8%)
College/university	1 225 144 (65.1%)
Graduate school	178 003 (9.5%)
Season of birth	
Spring	492 224 (26.1%)
Summer	464 211 (24.6%)
Fall	453 017 (24.1%)
Winter	473 925 (25.2%)
District-level features	
Total births in the district, mean±SD	1,538.2±1342.2
Total births in the district, quartiles	
1Q (<342)	63 930 (3.4%)
2Q (342–1254)	201 470 (10.7%)
3Q (1255–2494)	621 608 (33.0%)
4Q (2495–5696)	946 219 (50.2%)
ADI, mean±SD	1.0±7.8
ADI	
1Q (<–5.9, least deprived)	606 321 (32.2%)
2Q (–5.9––1.4)	901 297 (47.9%)
3Q (–1.4–6.2)	334 700 (17.8%)

Continued

Table 1 Continued

Variables	All singleton births (n=1 883 377)
4Q (6.2–18.4, most deprived)	41 059 (2.2%)
TRI, mean±SD	66.0±34.1
TRI, quartiles	
1Q (<40.6%, lowest accessibility)	175 377 (9.3%)
2Q (40.6–87.6%)	412 107 (21.9%)
3Q (87.7–94. 0%)	936 403 (49.7%)
4Q (94.1%–97.4%, highest accessibility)	359 490 (19.1%)

*Average birth weight and its CI were calculated only in term births.
ADI, area deprivation index; 1Q, first quartile; 2Q, second quartile; 3Q, third quartile; 4Q, fourth quartile; TRI, time relevance index.

while the central estimates across quantiles do not follow a linear trend (0.80, 95% CI 0.71 to 0.91, for Q2; 0.84, 95% CI 0.76 to 0.93, for Q3 compared with Q4). Among covariates, the adjusted OR magnitudes were generally larger for individual than for district-level features, especially for maternal age and the sex of the baby. The association between TRI and macrosomia was stronger when maternal age was 35 years or older, or when ADI was high (online supplemental table 2). Interaction by maternal education, occupation and total number of births in the area was not statistically significant.

1Q, first quartile; 2Q, second quartile; 3Q, third quartile; 4Q, fourth quartile; TRI, time relevance index. The estimates are adjusted for maternal age, parental education, parental occupation, parity, sex of neonates, year and season of birth, total number of livebirths and ADI.

DISCUSSION

We observed evidence indicating that TRI, representing accessibility to an obstetric delivery facility in the district, is inversely associated with the risk of macrosomia and PTB. Positive association with post-term birth was observed but was not evident for LBW. For macrosomia, the association with TRI was stronger when maternal age was 35 years or older, or when ADI was high. This result suggests that limited of access to care among vulnerable populations may have a more profound effect. Through analysis of national birth data, we identified a positive association between limited accessibility to obstetric services and adverse birth outcomes at the individual level.

Previous studies have shown that limited access to obstetric services is associated with the less optimal utilisation of prenatal care services and subsequent risk of pregnancy-related complications.[26 27] Studies of North America and Europe indicated that urban-rural obstetric services disparity leads to unequal prenatal care utilisation, aggravating geographical health disparities even in areas with adequate obstetric care coverage.[26 28]

There are longer travel times to obstetric facilities in rural areas compared with urban areas.[26] Timely access to obstetric facilities is closely associated with maternal survival and sequelae where life-threatening maternal emergencies occurred.[29] A previous study in Korea showed that living in areas with limited obstetric services was associated with a higher risk of pregnancy termination, inadequate antenatal care, acute pyelonephritis and obstetric haemorrhagic transfusions.[13] Development of macrosomia is associated with pre-existing maternal obesity, poorly controlled blood glucose and excessive maternal weight gain during pregnancy.[9 30 31] Improving access to obstetric facilities is considered the most effective method to prevent macrosomia and subsequent maternal-fetal morbidities.[32] Our study adds empirical evidence of an inverse association between area-level accessibility to obstetric facilities and macrosomia and PTB.

Adverse birth outcomes associated with accessibility to obstetric facilities varied between studies. In rural Alabama, counties without obstetric facilities had statistically higher LBW and infant mortality rates than those with the facilities.[3] A French study found no association between distance from obstetric facilities and neonatal mortality.[33] In the same study, neonatal deaths associated

Table 2 Pairwise association between regional variables in 1 842 718 singleton pregnancies in Korea, 2014–2018

District-level variables	Preterm rate	Post-term rate	LBW rate	Macrosomia rate	Total number of births	TRI	ADI
Preterm rate	1.00						
Post-term rate	−0.25	1.00					
LBW rate	0.38	−0.08	1.00				
Macrosomia rate	−0.15	0.06	0.14	1.00			
Total number of births	−0.15	−0.30	−0.08	−0.07	1.00		
TRI	−0.16	−0.10	−0.06	−0.19	0.71	1.00	
ADI	0.15	0.26	0.08	0.08	−0.81	−0.64	1.00

P values for all correlations are <0.05.
ADI, area deprivation index; LBW, low birth weight; TRI, time relevance index.

Table 3 Crude ORs and 95% CI of the four adverse outcomes among 1 842 718 singleton pregnancies in Korea, 2014–2018

Variables	Gestational age		Birth weight	
	Preterm birth (n=94 579)	Post-term birth (n=2639)	Low birth weight (n=18 722)	Macrosomia (n=61 753)
Individual-level features				
Maternal age (years)				
15–24	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
25–34	0.87 (0.84 to 0.90)	0.73 (0.70 to 0.77)	1.00 (0.92 to 1.07)	1.30 (1.24 to 1.36)
35–45	1.16 (1.13 to 1.20)	0.86 (0.81 to 0.90)	1.61 (1.49 to 1.73)	1.52 (1.45 to 1.59)
Nulliparity	0.92 (0.90 to 0.93)	1.53 (1.50 to 1.57)	1.27 (1.23 to 1.31)	0.91 (0.89 to 0.92)
Male baby	1.26 (1.25 to 1.28)	0.61 (0.60 to 0.63)	1.03 (1.00 to 1.06)	1.78 (1.75 to 1.81)
Maternal occupation				
No paid occupation	1.15 (1.13 to 1.17)	1.06 (1.03 to 1.09)	1.17 (1.12 to 1.22)	1.05 (1.03 to 1.07)
Manager, professional worker	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Clerical, service worker	1.04 (1.02 to 1.06)	0.95 (0.92 to 0.99)	1.12 (1.06 to 1.18)	1.03 (1.01 to 1.06)
Manual worker	1.11 (1.06 to 1.17)	1.03 (0.94 to 1.12)	1.07 (0.96 to 1.20)	1.11 (1.05 to 1.18)
Paternal occupation				
No paid occupation	1.19 (1.16 to 1.23)	1.07 (1.02 to 1.12)	1.21 (1.14 to 1.29)	1.01 (0.97 to 1.04)
Manager, professional worker	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Clerical, service worker	1.03 (1.01 to 1.05)	1.01 (0.99 to 1.04)	1.11 (1.07 to 1.15)	1.00 (0.98 to 1.02)
Manual worker	1.21 (1.18 to 1.23)	1.16 (1.13 to 1.2)	1.24 (1.19 to 1.30)	1.08 (1.06 to 1.11)
Maternal education				
High school or lower	1.36 (1.33 to 1.40)	1.30 (1.24 to 1.37)	1.39 (1.31 to 1.48)	1.17 (1.13 to 1.21)
College/university	1.03 (1.00 to 1.06)	1.00 (0.96 to 1.05)	1.04 (0.98 to 1.10)	1.02 (0.99 to 1.06)
Graduate school	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Paternal education				
High school or lower	1.35 (1.31 to 1.38)	1.29 (1.23 to 1.35)	1.37 (1.29 to 1.45)	1.16 (1.12 to 1.19)
College/university	1.06 (1.04 to 1.09)	1.03 (0.99 to 1.07)	1.07 (1.01 to 1.13)	1.03 (1.00 to 1.06)
Graduate school	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Season of birth				
Spring	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
Summer	1.08 (1.06 to 1.10)	0.87 (0.78 to 0.98)	1.06 (1.02 to 1.11)	0.95 (0.93 to 0.97)
Fall	1.02 (1.00 to 1.04)	1.06 (0.95 to 1.19)	1.05 (1.01 to 1.10)	0.92 (0.90 to 0.95)
Winter	1.03 (1.01 to 1.05)	1.26 (1.13 to 1.40)	1.04 (1.00 to 1.08)	1.05 (1.03 to 1.07)
District-level features				
Total births in the district, quartiles				
1Q	1.04 (1.00 to 1.08)	1.33 (1.09 to 1.63)	0.99 (0.91 to 1.07)	1.00 (0.95 to 1.05)
2Q	1.09 (1.07 to 1.12)	1.23 (1.09 to 1.40)	1.08 (1.03 to 1.13)	1.04 (1.01 to 1.07)
3Q	1.04 (1.02 to 1.05)	1.15 (1.05 to 1.25)	0.98 (0.95 to 1.02)	0.96 (0.94 to 0.98)
4Q	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
ADI, quartiles				
1Q	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)
2Q	0.93 (0.89 to 0.98)	1.20 (1.09 to 1.32)	1.05 (1.02 to 1.09)	0.98 (0.96 to 0.99)
3Q	0.97 (0.93 to 1.02)	1.33 (1.18 to 1.49)	1.07 (1.03 to 1.12)	1.03 (1.00 to 1.05)
4Q	0.98 (0.93 to 1.03)	1.41 (1.10 to 1.81)	1.07 (0.96 to 1.18)	0.98 (0.93 to 1.04)
TRI, quartiles				
1Q	1.01 (0.99 to 1.04)	0.93 (0.80 to 1.08)	0.99 (0.93 to 1.05)	1.12 (1.08 to 1.16)

Continued

Table 3 Continued

Variables	Gestational age		Birth weight	
	Preterm birth (n=94 579)	Post-term birth (n=2639)	Low birth weight (n=18 722)	Macrosomia (n=61 753)
2Q	1.08 (1.05 to 1.10)	0.78 (0.69 to 0.88)	0.98 (0.94 to 1.03)	1.11 (1.08 to 1.14)
3Q	1.00 (0.98 to 1.02)	0.79 (0.72 to 0.87)	0.97 (0.93 to 1.01)	1.06 (1.03 to 1.08)
4Q	1.00 (reference)	1.00 (reference)	1.00 (reference)	1.00 (reference)

ADI, area deprivation index; 1Q, first quartile; 2Q, second quartile; 3Q, third quartile; 4Q, fourth quartile; TRI, time relevance index.

with out-of-hospital births occurred more frequently where the distance to the obstetric facility was longer.[33] A recent study by Sullivan *et al* showed the more centralised consequences of maternity unit closures in rural North Carolina. Adverse birth outcomes in socioeconomically vulnerable groups within the region highlighted a potentially masked disparity between statewide and national analyses.[34] They noted that the health impact of obstetric facility closures could vary according to each region's socioeconomic and geographic contexts. We observed that the association between lower TRI and higher macrosomia rates remained significant after controlling for the effect of ADI. It suggests that equitable access to obstetric facilities would be important to remedy disparities in birth outcomes.

Notably, the risk of post-term birth was lower when the TRI was in the second or third quartiles. The direction of association is inconsistent with the TRI gradient, which could be due to unmeasured confounding factors. For post-term births, there could be reverse causation. We postulate that obstetricians would have decided to induce labour before full term in cases where the mother lives remotely from the facility. It could minimise the risk of delayed treatment for an obstetric emergency.

The findings of this study need caution in interpretation. This is a cross-sectional study using data covering only a few years, and reverse causation is possible. The increase in adverse birth outcomes means that obstetricians in the region might have closed their practice or moved to other areas with better medical resources in fear of medical litigation. We believe that this finding should be replicated using data covering a more extended period enabling time-series analysis. Second, this study may have been confounded by unmeasured individual risk factors such as prepregnancy body weight index, underlying medical conditions and individual access to obstetric facilities. This information is not provided in the national birth data or the Health Map system. We recommend developing a database containing this information to minimise potential biases.

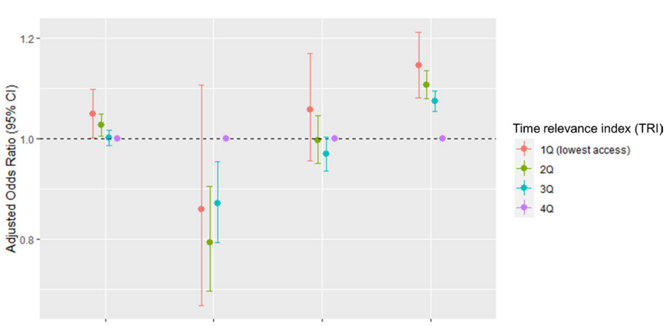

Figure 1 Adjusted ORs of post-term birth (PTB), low birth weight (LBW) and macrosomia in each quartile time relevance index (TRI) rank among 1 842 718 singleton pregnancies in Korea, 2014–2018.

CONCLUSION

After controlling for other individual and district-level factors, district-level TRI was associated with a higher risk of macrosomia and PTB at the individual level. Equitable allocation of obstetric facilities across the districts would be important to minimise the risk of adverse birth outcomes.

Author affiliations
[1]Research Institute of Public Healthcare, National Medical Center, Seoul, Korea
[2]Gender and Health Research Center, People's Health Institute, Seoul, Korea
[3]Public Health Science, Seoul National University Graduate School of Public Health, Seoul, Korea
[4]Public Healthcare Policy, National Medical Center, Seoul, Korea
[5]Cancer Control and Population Health, National Cancer Center, Goyang, Gyeonggi-do, Korea
[6]Preventive Medicine, Korea University—Anam Campus, Seongbuk-gu, Seoul, Korea
[7]Division of Life Sciences, Korea University, Seongbuk-gu, Seoul, Korea

Contributors All authors contributed to the design of this study. HSM and SaK initiated the project. The protocol was drafted by SAC and was refined by HSM. Statistical analysis was done by SAC and analytic advice was provided by TL and SeK. HSM was responsible for drafting the manuscript and S-YK and HSA provided intellectual content. All authors contributed to the manuscript and read and approved the final manuscript. They have all read and approved the final manuscript.

Funding This research was jointly supported by the National Medical Centre (NMC2020-PR-06) and National Research Foundation (NRF-2018R1D1A1B07048821).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. Data are available in a public, open access repository. The national birth data is available at the Microdata Integrated Service of Statistics

Korea (https://mdis.kostat.go.kr) and medical service provision database is at the Health Map system (http://www.healthmap.or.kr).

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ORCID iDs

Saerom Kim http://orcid.org/0000-0002-1766-8432

Seung-Ah Choe http://orcid.org/0000-0001-6270-5020

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