Prenatal health behaviors and stress as contributors to socioeconomic gaps in adverse birth outcomes for Korean women*

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Abstract

   Despite delayed childbearing for women in both high and low socio-economic status(SES) in Korea since the economic crisis in the late 90s, more attention has been drawn to women's older age and biomedical characteristics than other socioeconomic, behavioral, and psychological factors to predict preterm birth (PTB) or low birth weight (LBW). Thus, this study aims to explore contributing factors in the prenatal period—health care and stress, and psychosocial correlates of stress—to the SES differentials in PTB or LBW among Korean women. We surveyed 951 women aged 30-44 years who had delivered in the last three years. We estimated the odds ratios of PTB or LBW between the SES groups adjusting for the following four categories of variables : (a) prenatal health behaviors (e.g., regular hospital visits, folic acid supplementation, gestational increase in body mass index, smoking, and regular meals) ; (b) prenatal stress (e.g., negative life events, anxiety about fetal health, etc.) ; (c) psychosocial correlates of stress (e.g., anxiety about fetal health, social support, and residential environment) ; (d) maternal medical history and birth characteristics. Among Korea mothers, the SES gaps in preterm birth or LBW were completely explained by the prenatal health behaviors and stress in prenatal period with the biomedical characteristics for mothers and newborns held constant. PTB or LBW births for Korean women in low-SES occupations could be prevented by promoting their health behaviors and building stress-coping skills in the prenatal period.

Keywords : adverse birth outcomes, prenatal health behaviors,
            prenatal stress, socioeconomic status

I. Introduction

With the rapid rise in late marriages, the average age at first marriage for Korean women is 30.1 years old in 2016, up 2.3 years from 2006(Statistics Korea, 2017). According to previous studies (Carolan, 2003 ; Kenny et al., 2013 ; Kim, Kim, & Kim, 2011), the risk of adverse birth outcomes, such as preterm birth(PTB) and low birth weight(LBW), increases proportionally with a higher maternal age. In general, mothers over 30 have typically been regarded as a high-risk pregnancy group. In contrast, emerging evidence argues that mothers over 30 today, of higher socioeconomic status(SES) and lower parity than their predecessors, experience normal birth outcomes that are comparable to those of their younger counterparts, since the high SES of these women may counterbalance the increased physiological risk of age on adverse birth outcomes(Carolan & Frankowska, 2011 ; Wang, Tanbo, Åbyholm, & Henriksen, 2011). Given this trend, further research and data are needed to understand how older mothers' socio-demographic changes influence birth outcomes.

In this context, Korean women are well positioned to examine this relationship for two reasons : First, Korea has undergone a rapid delay of childbearing during the past decade. According to Statistics Korea, the percentage of mothers aged over 35 having children rose sharply from 8.8% in 2004 to 12.4% in 2014, with the average age of first birth(Kim et al., 2016). Second, in general, women of high SES tend to delay childbearing in order to establish their careers first(Kye, 2008). Interestingly, however, under the conditions of economic hardship, Korean women of low SES are also inclined to delay childbearing due to their financial instability(Cho et al., 2011 ; Eun, 2003 ; 2005). Women of both high and low SES now comprise the elderly population in Korea. Thus, we believe that mothers aged 30 and over in Korea, which has shifted economically since the economic crisis, can be a good example for this study.

Meanwhile, prenatal health behaviors and stress have been reported as major contributors to the association between maternal SES and birth outcomes. For instance, Courtney(2009) found that black and low SES mothers tend to receive inadequate or no prenatal behaviors, and their infants remain at high risk for poor outcomes, suggesting that pregnant women's race, poverty and educational background are important barriers to accessing adequate prenatal health behaviors. Lauria et al.(2013) also argued that maternal socioeconomic conditions have a more important role in determining prenatal health behavioral inequalities, compared to maternal medical conditions. Furthermore, prenatal stress which has a negative influence on pregnancy-related conditions and infant birth weight, differs between high and low SES groups. Meririll, Richards, & Sloan(2011) found that stress among pregnant women is more pronounced among homeless women than non-homeless women because they are exposed to more stressful life events and physical and sexual assault, and had smaller social networks and experienced housing instability. It is important to note that there are socioeconomic gaps in prenatal health behaviors and stress. However, little is known about the nature and mediating effect of prenatal health behaviors and stress on the association between maternal SES and birth outcomes, particularly for Korean women.

Hahn-Holbrook et al.(2013), Hobel et al.(2008), Gavin et al.(2012), and Zhu et al.(2010) utilized stressful life events, lack of social support, and poor neighborhood conditions in pregnant women as prenatal maternal stress to investigate the determinants of adverse birth outcomes. In Korea, Kim et al.(2016) found that prenatal health behaviors have important effect on PTB and LBW, regardless of maternal age. As mentioned above, both prenatal health behaviors and stress have been linked conclusively with birth outcomes. However, these findings are based on studies in Western societies, and there is no evidence that both factors function as mediators in maternal SES and birth outcomes, and which mediator is more involved. Meanwhile, Korean people tend to hold a strong belief

that the probability of having a baby with genetic abnormalities dramatically increases once a woman passes the threshold age of 30. As a consequence of living in a society where deep-rooted stigma is attached to the handicapped and disabled(Lee et al., 2005), Korean women may experience greater stress than younger women due to exacerbated anxiety over their fetus' health. Therefore, this study had two objectives : to examine whether Korean women of low SES experience a higher risk of adverse birth outcomes compared to those of high SES ; and whether both prenatal health behaviors and stress mediate the effect of maternal SES on adverse birth outcomes.

Ⅱ. Methods

1. Data and participants

The Korean National Health and Nutrition Examination Survey also includes health information for women, but does not provide some data that are considered very significant variables(e.g., prenatal health behaviors and stress, birth outcomes, maternal medical history, etc.) in this study. Therefore, from May to June of 2011, we directly surveyed Korean women aged 30-44 years who had given birth in the last three years due to the fact that there was no data to verify our study. Sex, age, and geographical residence statistics from the 2010 Current Population Survey provided by Statistics Korea were considered during data collection. The subjects in the selected regions were recruited randomly from a variety of public places, such as centers for community health, childcare and welfare services, in order to reduce the probability of having over-representation from a specific social class. Before each interview was conducted, an informed consent statement was read to the respondent, who could either accept or decline to participate. After

the informed consent document, including personal information protection, was signed and clearly written, each interview was conducted by trained interviewers. However, we did not have IRB approval. Among the 1,009 total subjects participating in the survey, we omitted 58 respondents with missing data, resulting in 951 subjects used for this analysis.

2. Measures

1) Dependent variable

As suggested by previous studies(Quinn et al., 2016 ; Rijken et al., 2014 ; Wallace et al., 2017), we defined adverse birth outcomes as PTB($<$ 37 weeks) or LBW($<$ 2,500g), and these represented the dependent variables in this study. Of all the participants, 7.6%(n=72) experienced PTB and/or LBW, which is under the proportion(11.2% in 2011) reported by Kim et al.(2016)'s study, not considering the overlap between PTB and LBW. In our subjects, 69.4%(n=50) were categorized as having both preterm and LBW ; consequently, the dependent variables were dichotomized into normal and adverse birth outcomes.

2) Independent and mediating variables

We considered maternal SES, prenatal health behaviors, and prenatal stress before and/or during pregnancy as the independent and mediating variables in this study. Details for each variable are presented as follows. First, for the variable of maternal SES during pregnancy, maternal educational attainment(0=college or more, 1=high school or less), monthly household income(0=3 million won or more, 1=less than 3 million won), mother's employment status(0=unemployed, 1=employed), and the spouse's occupational status(0=non-manual, 1=manual) were collected. The reason for factoring the spouse's occupation(and not that of the mother) into the

maternal SES variable is that over half of the subjects(68%) were unemployed and that the spouse's occupation proved to be a more significant indicator of adverse birth outcomes than that of the mother's occupation in Korea(Kim & Cho, 2011). Second, prenatal health behaviors consisted of five variables : regular hospital visits before and during pregnancy(0=yes, 1=no), folic acid supplementation before and during pregnancy(0=yes, 1=no), a gestational increase in Body Mass Index(BMI)(0=within normal range, 1=beyond normal range) during pregnancy(Crane et al., 2009), cigarette smoking before and during pregnancy(0=no, 1=yes), and regular meals during pregnancy outside of morning sickness periods(0=yes, 1=no). Third, prenatal stress included four variables : experiencing negative life events during pregnancy(e.g., serious illness, death, apprehension, loss of spouse/close family members, domestic violence, residential relocation, or physical shock to gravid abdomen)(0=no, 1=yes), satisfaction with spouse/family member support during pregnancy(0=satisfied, 1=dissatisfied), residing in a hazardous environment(e.g., excessive noise, pollution, poor water quality, or stench)(0=no, 1=yes), and anxiety about the fetal health status(0=no, 1=yes).

3) Covariates

In this study, we contained maternal medical history and biological characteristics of the new born variables as the possible covariates of the study population identified by the results of previous studies(Blondel et al., 2002 ; Graham et al., 2007 ; Lisonkova et al., 2010) in order to examine both the net and medicating effect of prenatal health behaviors and stress on the association between maternal SES and adverse birth outcomes. First, maternal medical history included five variables : delivery mode at birth(0=vaginal delivery, 1=C-section), pre-existing medical conditions before and/or during pregnancy(e.g., hypertension, diabetes, venereal diseases, uterine diseases, or etc.)(0=not present before or during pregnancy,

1=present before but not during pregnancy, 2=present during but not before pregnancy, 3=present before and during pregnancy), simultaneous/therapeutic abortion or adverse pregnancy outcomes before a recent birth(e.g., still birth, PTB, LBW, or congenital malformations)(0=no, 1=yes), and experience of high fever/severe diarrhea/vaginal bleeding during pregnancy(0=no, 1=yes). For maternal age, birth outcomes are adversely increasingly influenced by a higher maternal age and, particularly, a maternal age of 35 years and over at delivery has greatly increased compared to those aged 30-34 years(Kim et al., 2016 ; Lisonkova et al., 2010). Therefore, maternal age was classified into two groups(0=30-34, 1= 35-44). Second, the variable of biological characteristics of the newborn included sex(0=male, 1=female), birth plurality(0=singleton, 1=multiple births), and birth order(0=first, 1=second, 2=third).

4) Statistical analysis

Distributions of the study population were presented in ⟨Table 1⟩. Descriptive analysis was conducted to examine the relationships of variables of interest before and/or during pregnancy(e.g., maternal SES, prenatal health behaviors, prenatal stress, maternal medical history, and biological characteristics of the newborn) and adverse birth outcomes ⟨Table 2⟩. To test the mediating roles of health care and stress in the prenatal period in the association between maternal SES and adverse birth outcomes, the following three steps, suggested by Baron & Kenny(1986), should be accepted : (1st condition) maternal SES is related to adverse birth outcomes(see Table 2) ; (2nd condition) maternal SES is related to the mediators(see Table 3) ; and (3rd condition) the mediators are related to adverse birth outcomes, controlling for maternal SES, and the significant relationships of maternal SES to adverse birth outcomes are weaker when the mediators are added than when mediators are not considered(see Models 2-4 of Table 4). Maternal medical history and the newborn's characteristics were basically controlled in the analysis.

Ⅲ. Results

〈Table 1〉 shows the distribution of the study participants according to the characteristics of variables. As mentioned earlier, the maternal age of the subjects ranged from 30 to 44 years ; consequently, their SES tended to be higher than that of women in their 20s in this population. For example, 71.6% of the participants had at least a college education, 60.4% earned a household income of more than three million won per month, 32.0% was employed, and more than 50% had spouses with non-manual jobs. As for prenatal health behaviors, 95.7% of the mothers regularly visited the hospital, with the remaining 4.3% receiving none or irregular medical care, only in emergency situations. Folic acid supplementation before and during pregnancy was taken by 57.6% of participants, whereas 42.4% did not take folic acid at all, or did only before or only during pregnancy. Only 38.2% of participants were within the normal range of gestational BMI increase relative to their pre-pregnancy BMI ; 2.1% smoked both before and during pregnancy ; 79.2% had a regular eating pattern of three meals a day during pregnancy, excluding periods of morning sickness. With regard to prenatal stress, 24.4% had experienced negative life events ; 67.3% had anxiety about fetal health status ; 58.3% was not satisfied with the support received from their spouses or family members ; 21.6% had resided in a hazardous environment. For maternal medical history, 34.2% gave birth by planned or emergency C-section. Most of the mothers had not suffered from diseases either before or during pregnancy that could affect birth outcome, but 7.1% and 6.1% incurred disease during either or both periods, respectively. There was a history of abortion or adverse pregnancy outcomes in 23.6% of the participants and of high fever, severe diarrhea, or uterine bleeding during pregnancy in 12.4%. Those with a maternal age between 30 and 34 comprised 73.5% of the participants in this study. Finally, there was nearly an equal number of male and female new-

borns, with the majority being singleton births and either first or second in birth order.

〈Table 1〉 Characteristics of study participants

Characteristics			%	N
Maternal socioeconomic status	Education	High school and less	28.4	270
		College or more	71.6	681
	Monthly Household Income	〈 3 million won	39.6	377
		≥ 3 million won	60.4	574
	Employment status	Employed	32.0	304
		Unemployed	68.0	647
	Spouse's Occupation	Non-manual	55.4	527
		Manual	44.6	424
Prenatal health behaviors	Regular hospital visits	Yes	95.7	910
		No	4.3	41
	Folic acid supplementation	Yes	57.6	548
		No	42.4	403
	Gestational increase in body mass index	Within normal range	38.2	363
		Beyond normal range	61.8	588
	Cigarette Smoking	Yes	2.1	20
		No	97.9	931
	Regular meals outside of morning sickness periods	Yes	79.2	753
		No	20.8	198
Prenatal stress	Negative life events	Yes	24.4	232
		No	75.6	719
	Anxiety about fetal health	Yes	67.3	640
		No	32.7	311
	Satisfaction with spouses or family members	Yes	32.7	397
		No	58.3	554
	Residing in a hazardous environment	Yes	21.6	205
		No	78.4	746
Maternal medical history	Delivery mode at birth	Vaginal delivery	65.8	626
		C-section	34.2	325
	Pre-existing medical conditions	Not present before or during pregnancy	76.5	727
		Present before not during pregnancy	7.1	67
		Present during but not before pregnancy	10.4	99

Characteristics			%	N
		Present before and during pregnancy	6.1	58
	Simultaneous/ therapeutic abortion or adverse birth outcomes before a recent birth	Yes	23.6	224
		No	76.4	727
	Experience of high fever, severe diarrhea, vaginal bleeding	Yes	12.4	118
		No	87.6	833
	Maternal age	30–34	73.5	699
		35–44	26.5	252
Biological characteristics of the newborn	Sex	Male	50.9	484
		Female	49.1	467
	Birth plurality	Singleton	98.5	937
		Multiple births	1.5	14
	Birth order	First	36.7	349
		Second	48.2	458
		Third	15.1	144
Total			100.0	951

〈Table 2〉 presents the percentages of study participants reporting adverse birth outcomes before and during pregnancy, according to the characteristics of variables. Korean women of low SES were more likely to have adverse birth outcomes than their high SES counterparts. This pattern was especially pronounced for both the monthly household income and spouse's occupation variables. Inappropriate prenatal health behaviors were also significantly associated with adverse birth outcomes among Korean women. That is, mothers who did not attend regularly scheduled follow-up hospital visits, did not take folic acid, smoked cigarette, or ate three regular meals a day before and/or during pregnancy were at a considerably higher risk of adverse birth outcomes than their counterparts. Women who were stressed prenatally, particularly those with negative life experiences during pregnancy, were also more inclined to have adverse birth outcomes. These findings strongly supported the first condition for a mediating relation.

Among covariates, maternal medical history of pre-existing dis-

eases and simultaneous abortion or adverse birth outcomes before and/or during pregnancy was strongly associated with an increased risk of adverse birth outcomes ; this was also the case for those who experienced high fever, severe diarrhea, or vaginal bleeding during pregnancy. The proportion of adverse birth outcomes, however, did not significantly differ between the two maternal age groups. With respect to biological characteristics of the newborn, a plurality showed significant differences between two groups in that multiple births resulted in more adverse birth outcomes compared with singleton births.

〈Table 2〉 Percentages of Korean women reporting adverse birth outcomes(ABO), preterm birth or/and low birth weight, according to the characteristics of variables

Characteristics			% of ABO		N	p-value
			Yes	No		
Maternal socioeconomic status	Education	High school and less	10.0	90	270	†
		College or more	6.1	93.9	681	
	Monthly Household Income	〈 3 million won	10.3	89.7	377	**
		≥ 3 million won	5.7	94.3	574	
	Employment status	Employed	7.6	92.4	304	NS
		Unemployed	7.6	92.4	647	
	Spouse's Occupation	Non-manual	4.9	95.1	527	***
		Manual	10.8	89.2	424	
prenatal health behaviors	Regular hospital visits	Yes	7.1	92.9	910	*
		No	17.1	82.9	41	
	Folic acid Supplement action	Yes	3.5	96.5	548	***
		No	10.3	89.7	403	
	Gestational increase in body mass ndex	Within normal range	5.5	94.5	363	†
		Beyond normal range	8.8	91.2	588	
	Cigarette Smoking	Yes	20.0	80	20	*
		No	7.3	92.7	931	
	Regular meals outside of morning sickness periods	Yes	5.7	94.3	753	***
		No	14.7	85.3	198	
prenatal stress	Negative life events	Yes	18.5	81.5	232	***

Characteristics			% of ABO		N	p-value
			Yes	No		
		No	4.0	96	719	
	Anxiety about fetal health	Yes	8.8	91.2	640	*
		No	5.1	94.9	311	
	Satisfaction with spouses or family members	Yes	4.5	95.5	397	**
		No	9.8	90.2	554	
	Residing in a hazardous environment	Yes	12.7	87.3	205	**
		No	6.2	93.8	746	
Maternal medical history	Delivery mode at birth	Vaginal delivery	4.8	95.2	626	***
		C-section	12.9	87.1	325	
	Pre-existing medical conditions	Not present before or during pregnancy	4.5	95.5	727	***
		Present before not during pregnancy	9.0	91	67	
		Present during but not before pregnancy	14.1	85.9	99	
		Present before and during pregnancy	32.8	67.2	58	
	Simultaneous/therapeutic abortion or adverse birth outcomes before a recent birth	Yes	20.5	79.5	224	***
		No	3.6	96.4	727	
	Experience of high fever, severe diarrhea, vaginal bleeding	Yes	24.6	75.4	118	***
		No	5.2	94.8	833	
	Maternal age	30-34	7.3	92.7	699	NS
		35-44	8.3	91.7	252	
Biological characteristics of the newborn	Sex	Male	7.9	92.1	484	NS
		Female	7.3	92.7	467	
	Birth plurality	Singleton	7.0	93	937	***
		Multiple births	42.9	57.1	14	
	Birth order	First	9.2	90.8	349	†
		Second	5.5	94.5	458	
		Third	10.4	89.6	144	
Tota l			7.6	92.4	951	

† p<0.1, *p<0.05, **p<0.01, ***p<0.001, NS : not significant

Note : Chi-square test is performed

〈Table 3〉 documents the association of education, monthly household income, and spouse's occupation with prenatal health behaviors and prenatal stress. Overall, Korean women of low SES were not only less likely to have prenatal health behaviors but also more likely to have prenatal stress than their high SES counterparts. In particular, a significant association between maternal SES and prenatal stress was observed among Korean women. That is, the second condition was partially met.

〈Table 3〉 Association of maternal SES with prenatal health behaviors and stress in Korea women

Characteristics			Education		Monthly household income		Spouse's occupation		N
			High school or less	College or more	〈 3 million won	≥ 3 million won	Non-manual	Manual	
prenatal health behaviors	Regular hospital visits	Yes	93.7	96.5	95.8	95.6	96.6	94.6	910
		No	6.3	3.5	4.2	4.4	3.4	5.4	41
		p-value	†		NS		NS		
	Folic acid supplementation	Yes	40.7	43.0	43.0	42.0	45.5	38.4	548
		No	59.3	57.0	57.0	58.0	54.5	61.6	403
		p-value	NS		NS		*		
	Gestational increase in body mass index	Within normal range	38.8	36.7	37.9	38.3	36.8	39.9	363
		Beyond normal range	61.2	63.3	62.1	61.7	63.2	60.1	588
		p-value	NS		NS		NS		
	Cigarette Smoking	Yes	98.2	97.0	2.9	1.6	2.3	1.9	20
		No	1.8	3.0	97.1	98.4	97.7	98.1	931
		p-value	NS		NS		NS		
	Regular meals outside of morning sickness periods	Yes	78.5	79.4	74.5	82.2	80.8	77.1	753
		No	21.5	20.6	25.5	17.8	19.2	22.9	198
		p-value	NS		**		NS		
prenatal stress	Negative life events	Yes	27.4	23.2	23.9	24.7	20.1	29.7	232
		No	72.6	76.8	76.1	75.3	79.9	70.3	719
		p-value	NS		NS		***		
	Anxiety about fetal health	Yes	73.3	64.9	67.6	67.1	66.8	67.9	640
		No	26.7	35.1	32.4	32.9	33.2	32.1	311
		p-value	*		NS		NS		
	Satisfaction with spouses or family members	Yes	30.7	46.1	39.0	43.6	46.5	35.9	397
		No	69.3	53.9	61.0	56.4	53.5	64.1	554
		p-value	***		NS		***		
	Residing in a hazardous environment	Yes	27.4	19.2	28.4	17.1	83.1	72.6	205
		No	72.6	70.8	71.6	82.9	16.9	27.4	746
		p-value	**		***		***		

† p〈0.1, *p〈0.05, **p〈0.01, ***p〈0.001, NS：not significant

⟨Table 4⟩ presents the results of the multivariate logistic re-gression analysis, as odds ratios, assessing the association between maternal SES and adverse birth outcomes, along with the covariates and mediating factors. Model 1 included maternal SES and co-variates(maternal medical history and biological characteristics of the newborn) only as a baseline model. In contrast to the descrip-tive result as shown above, only the spouse's occupation was stat-istically significant, and manual jobs, compared with non-manual jobs, doubled the risk of adverse birth outcomes. For other varia-bles, the patterns of association were consistent with the findings from the descriptive analyses and did not show any significant dif-ferences between them. The odds ratio for the association between the spouse's occupation and adverse birth outcomes, however, was reduced when prenatal health behaviors and prenatal stress were contained in Model 2 and 3, respectively. In particular, the magni-tude of this reduction was greater when prenatal stress was taken into account in Model 3 than when prenatal health behaviors were held in Model 2. For example, the odds ratio for the mothers whose spouses had a manual job decreased from 2.07 to 1.93 in Model 2(decreased to 6.8%) and from 2.07 to 1.65 in Model 3(decreased to 19.3%), causing a loss of statistical significance in the latter. These findings indicate that prenatal stress as a mediator plays a more important role in adverse birth outcome disparities caused by the spouse's occupation than do prenatal health behaviors. In the final model, the odds ratio for maternal SES on adverse birth outcomes decreased further when both prenatal health behaviors and pre-natal stress were considered together. The overall odds ratio of the association between maternal SES(spouse's occupation) and adverse birth outcomes, compared to its association in Model 1, decreased to 29% when both prenatal health behaviors and stress were con-sidered in Model 4. This indicates that both mediators influence the social disparities in adverse birth outcomes among Korean women, although the impact of prenatal stress was greater than that of pre-natal health behaviors.

The results of the multivariate analysis show that both variables of prenatal health behaviors and stress also had direct effect on adverse birth outcomes. Regarding prenatal health behaviors, mothers with regular hospital visits, folic acid supplementation, gestational increase in BMI, and cigarette smoking before and during pregnancy would be 3.17, 3.00, 2.04 and 4.35 times, respectively, more likely than their counterparts to experience adverse birth outcomes. For prenatal stress, on the other hand, only the negative life events variable significantly elevated the risk of adverse birth outcomes. That is, mothers with negative life events during pregnancy were 4.43 times more likely to have negative birth outcomes than their counterpart. This indicates that the third condition of mediating effect of prenatal health behaviors and stress was satisfied.

Meanwhile, anxiety about fetal health, albeit statistically insignificant, increased the risk to 1.50. The risk was also elevated in mothers with a previous medical history. Particularly those who had incurred disease(hypertension, diabetes, etc.) both before and during pregnancy experienced a 4.9-fold higher risk of adverse pregnancy outcomes as compared to mothers without any disease history ; the risk was also higher relative to those who had a disease either before or during pregnancy. More importantly, mothers who had undergone simultaneous abortion and/or adverse birth outcomes before a recent birth had more than a six-fold risk of adverse birth outcomes than did their counterparts. Maternal age was not significant. Of the newborn characteristics, multiple births increased the risk of adverse birth outcomes 29-fold relative to singleton births.

〈Table 4〉 Adjusted odds ratios (OR) for the associations of prenatal health behaviors and stress, and maternal medical history with adverse outcomes in Korean women

Characteristics			Model1	Model2	Model3	Model4
			OR	OR	OR	OR
Maternal socioeconomic status	Education	High school and less	1.06	1.05	0.98	0.97
		College or more (ref.)				
	Monthly Household Income	〈 3million won	1.37	1.31	1.45	1.38
		≥ 3 million won (ref.)				
	Employment status	Employed	0.83	0.82	0.65	0.61
		Unemployed (ref.)				
	Spouse's Occupation	Non-manual (ref.)				
		Manual	2.07*	1.93*	1.65	1.47
prenatal health behaviors	Regular hospital visits	Yes (ref.)				
		No		3.59*		3.71*
	Folic acid supplementation	Yes (ref.)				
		No		2.92**		3.00**
	Gestational increase in body mass index	Within normal range (ref.)				
		Beyond normal range		1.74+		2.04*
	Cigarette Smoking	Yes		3.64+		4.35*
		No (ref.)				
	Regular meals outside of morning sickness periods	Yes (ref.)				
		No		1.77+		1.71

Characteristics			Model1	Model2	Model3	Model4
			OR	OR	OR	OR
prenatal stress	Negative life events	Yes			3.96***	4.43***
		No (ref.)				
	Anxiety about fetal health	Yes			1.46	1.50
		No (ref.)				
	Satisfaction with spouses or family members	Yes (ref.)				
		No			1.30	1.15
	Residing in a hazardous environment	Yes			1.13	1.25
		No (ref.)				
Maternal medical history	Delivery mode at birth	Vaginal delivery				
		C-section	1.86*	1.93*	1.74+	1.90*
	Pre-existing medical conditions	Not present before or during pregnancy (ref.)				
		Present before not during pregnancy	1.47	1.08	1.13	0.81
		Present during but not before pregnancy	2.35*	2.37*	2.02	1.95
		Present before and during pregnancy	5.47***	5.46**	4.90**	4.90**
	Simultaneous/therapeutic abortion or adverse birth outcomes before a recent birth	Yes	5.72***	6.40***	5.57***	6.40***
		No (ref.)				

Characteristics			Model1	Model2	Model3	Model4
			OR	OR	OR	OR
	Experience of high fever, severe diarrhea, vaginal bleeding	Yes	2.96**	2.55**	2.36*	1.96[†]
		No (ref.)				
	Maternal age	30–34 (ref.)				
		35–44	0.89	0.89	0.96	0.93
Biological characteristics of the newborn	Sex	Male (ref.)				
		Female	1.00	1.02	0.95	0.94
	Birth plurality	Singleton (ref.)				
		Multiple births	18.86***	25.40***	20.84***	28.86***
	Birth order	First (ref.)				
		Second	0.60	0.63	0.57	0.59
		Third	0.73	0.87	0.72	0.80
Adjusted R–square			0.33	0.39	0.39	0.44
−2Log Likelihood			367.91	341.37	344.40	316.88

[†] p⟨0.1, *p⟨0.05, **p⟨0.01, ***p⟨0.001

Ⅳ. Discussion

This study demonstrated that the impact of maternal SES, especially the spouse's occupation status, on preterm and LBW birth was mediated by prenatal health behaviors and prenatal stress in Korean women aged 30-44 years. The strength of this study is to illuminate the mechanisms of social disparities in adverse birth outcomes for Korea women. This is an especially important issue considering the delayed childbearing trend evident in many developed countries and the changes in sociodemographic characteristics of the study population.

We found that the occupation of the spouse, and not the mother's own education and occupation, which is indicative of maternal SES in Korea, was significantly associated with adverse birth outcomes. Namely, women whose husbands were employed in manual occupations were more likely to have PTB or LBW, compared to those whose husbands were employed in non-manual occupations. This finding is consistent with a previous systematic review(Shah et al., 2010) examining paternal factors linked to birth outcomes that found a higher likelihood of PTB and LWB when paternal occupations entailed high and prolonged exposure to lead. However, another recent study utilizing perinatal and neonatal databases(Campbell et al., 2017) indicates that paternal occupation does not consistently increase the risk of adverse birth outcomes, and that maternal education and income play a role in influencing birth outcomes.

In this study, we focused on four areas of prenatal stress : negative life events, anxiety about fetal health, lack of social support, and living in hazardous environments. Among these, only the association between negative life events and adverse birth outcomes remained statistically significant when all other risk factors were held constant. Indeed, Korean women who experienced negative life events during pregnancy were four times more likely to have ad-

verse birth outcomes than their counterparts who did not experience stress. This is consistent with the results of Dole et al.(2004) who surveyed 1,898 black and white women in the U.S. from university and public health prenatal clinics ; they reported that highly-stressed white, but not black, women with more than eight (out of 39) negative life events had a two-fold increase in the risk of PTB relative to those with low levels of stress with less than two negative life events. Unlike the results from the descriptive analysis, the association between adverse birth outcomes and fetal health anxiety, lack of social support from spouse/family members, and living in hazardous environments was not statistically significant in the logistic regression analysis, even though the expected patterns remained. More specifically, with respect to fetal health anxiety, older women have a higher perception of pregnancy risk than younger women, notwithstanding low-risk pregnancies, which could result in an increased risk for fertility issues and medical complications(Bayampour et al., 2012). Along the same lines, Loke & Poon(2011) reported that the mother's health concerns have a positive correlation with education status. Considering this evidence, we can assume that Korean older women aged over 30, most of whom have at least a college education, are more likely to be anxious about the health of their fetus than are younger women. Indeed, about 70% of Korean women in our study were found to have such concerns.

Specifically, in this study, we also found that prenatal stress was an important mediator between paternal occupation and adverse birth outcomes. This finding is in agreement with previous studies(Gavin, Nurius & Logan-Greene, 2012 ; Gazmararian, Adams & Pamuk, 1996 ; Geronimus, Neidert & Bound, 1993 ; Geronimus, 1996 ; Hoffman & Hatch, 1996 ; Kramer, Hogue, Dunlop & Menon, 2011) indicating that both prenatal health behaviors and stress before and/or during pregnancy are well known as significant mediators between maternal socioeconomic disadvantages and adverse birth outcomes. It is plausible that individuals in low-SES occupa-

tions, such as manual jobs, may be more likely to experience high job stress than those in non-manual jobs, because such(manual) jobs are traditionally lower paid jobs. Gavin et al.(2012) reported that prenatal stress(e.g., antenatal stress, depression, and psychiatric medication) resulting from maternal socioeconomic disadvantages contributed to adverse birth outcomes. In addition to prenatal stress, prenatal health behaviors also was a partial mediator between paternal occupation and adverse birth outcomes. This finding was strengthened by Gazmararian et al.(1996) reporting that maternal SES(e.g., education, poverty status, medicaid coverage for birth delivery and WIC(Women/Infants/Children) program enrollment during pregnancy) is associated with maternal prenatal smoking status, delayed/no prenatal medical care, and unintended pregnancy for white U.S. women. In this study, cigarette smoking before and during pregnancy exerted the strongest influence on adverse birth outcomes when all other risk factors were controlled during analysis. According to Blumenshine et al.(2010)'s systematic review on socioeconomic disparities and adverse birth outcomes, smoking also accounts for the largest proportion of socioeconomic impacts on birth weight.

With the adjusted maternal medical history and biological characteristics of the newborn, those anxious about the health of their fetus exhibited an increased risk of adverse birth outcomes, albeit not significant. Dole et al.(2004), on the other hand, argued that pregnancy-related anxiety may not play a critical role for adverse birth outcomes when no medical complications are present, which was based on their finding that the association between pregnancy-related anxiety and preterm birth weakened after controlling for the mother's underlying medical conditions(e.g., bleeding during pregnancy and prescribed bed rest). The conflicting results between populations of Korea and the U.S. may be attributed to discrepancies in sociocultural contexts between countries where different perceptions exist about the health of the mother and baby during pregnancy, labor, and delivery. In Korea, people have a

strong belief that talking about something inauspicious will cause it to actually happen(Lee et al., 2005), increasing their anxiety about what has not yet occurred. One of the "inauspicious" events for pregnant women and their family members would be giving birth to a disabled or handicapped baby, and persons with disabilities are still highly stigmatized and discriminated against in Korea. Thus, these women aged over 30 in Korea may be more concerned about the influence of age on their baby's health, especially the increased incidence of chromosomal abnormalities, such as Down syndrome, which is not openly accepted by society(Jain, Thomasma & Ragas, 2002).

This study had the following limitations. First, our findings were derived from self-reported information, which was less accurate and objective than prenatal medical records containing information on biomarkers or previous diagnoses. Nevertheless, a number of studies have suggested that self-reported information is not only a valid measure for physical and mental health status, but also is highly correlated with adverse birth outcomes in various demographic and social contexts. Second, due to the nature of cross-sectional studies, it is difficult to verify in this study the causality between maternal SES and adverse birth outcomes. Therefore, future research should consider adopting a longitudinal design to examine the relationships among our focal issues with greater precision. Third, this study did not include several important variables, such as reproductive rights that can afford women to ability to decide the number, timing, and spacing of their children. According to Wallace et al.(2017), women with the strongest reproductive rights are less likely to deliver PTB or LBW infants than their counterparts with the lowest reproductive rights.

Despite these and other limitations, our findings suggest that greater attention should be devoted to Korean women aged over 30 who are preparing for pregnancy or who are currently pregnant, particularly those who are negligent in their health care and more prone to stress, as well as in the treatment of pregnancy/childbirth

related medical symptoms and diseases, by utilizing this new data. Given the continually increasing older mothers in Korea, adverse birth outcomes may also increase. Therefore, effective public health policies that target older mothers and those from lower socioeconomic backgrounds, including managing prenatal health behaviors and stress, should help reduce the potential risk of birth outcomes for these women and their children. For instance, a greater effort can be made in educating spouses/family members to support Korean women aged 30 and over or reaching out to those with low SES to promote good health behaviors and develop their stress-coping skills. In addition, prenatal tests and treatments can be the most advantageous in guaranteeing the right to health of older pregnant women and fetuses. Older women aged 30 or over who prepare or plan to be pregnant should receive counseling about venereal diseases, gynecological diseases, and history of pregnancy before pregnancy in order to ensure a healthy pregnancy and childbirth. Practices such as developing effective risk-communication skills and delivering accurate information to reduce mothers' anxiety in the prenatal period are also needed.

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초록

여성의 부정적 출산결과에 대한
사회경제적 격차와 산전 건강행동과 스트레스의 영향

김상미*·김동식**

1997년 IMF 이후 사회경제적 지위에 상관없이 여성들의 결혼과 출산 시기는 모두 늦어지기 시작하면서, 미숙아 및 저체중아 출산에 있어 여성들의 사회 경제적·행동적 및 심리적 특성보다는 이들의 연령과 생물학적 특성이 더 중요한 위험요인으로 주목받고 있다. 이에 본 연구는 한국 여성들의 미숙아 및 저체중아 출산에 대한 사회경제적 격차가 산전(임신 전과 임신 중) 시기에 경험한 건강 행동과 스트레스 및 이들의 생물학적 요인과의 연관성을 파악하기 위해, 최근 3년 출산 경험이 있고 그 당시 30세 이상 44세 이하의 여성 951명을 대상으로 면대면 설문조사를 실시하였다. 주요 변수로 고려한 산전 건강행동에는 정기적인 검진, 엽산제 복용, 임신 중 체중 증가, 흡연 및 영양섭취 등이, 산전 스트레스에는 주변인의 죽음과 폭력 경험 등과 같은 부정적인 생활사건, 태아의 건강에 관한 걱정과 불안 등으로 구성하였다. 분석 결과, 여성들의 생물학적 특성 및 신생아의 특성을 보정한 후에도 여성들의 미숙아 및 저체중아 출산의 위험은 이들의 사회경제적 지위에 따 라 차이를 보였다. 그러나 산전의 건강 행동 및 스트레스 변인을 보정한 경우, 기존의 연관성은 완전히 사라졌다. 즉, 산전의 건강 행동과 스트레스는 여성들의 사회경제적 지위와 미숙아 및 저체중아 출산 사이에 매개요인으로 작용하고 있었다. 따라서 사회경제적 지위가 낮은 여성들의 미숙아 및 저체중아 출산 위험을 예방하기 위해 이들의 산전 건강행동을 증진하고, 스트레스를 관리하는 등의 지원이 요구된다.

주제어 : 부정적인 출산결과, 산전 건강행동, 산전 스트레스, 사회경제적 지위

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