


ORIGINAL ARTICLE

Risk of adverse pregnancy outcomes by maternal occupational status: A national population-based study in South Korea

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Abstract

Objective: This study examined the association between maternal occupational status and adverse pregnancy outcomes in the general South Korean population.

Methods: We analyzed 1 825 845 employed and non-employed women with a diagnostic code for pregnancy in the National Health Insurance Service (NHIS) database (2010–2019) of South Korea. Based on their employment status and type of occupation, we calculated risk ratios for three adverse outcomes: early abortive outcomes (miscarriage, ectopic pregnancy, and molar pregnancy), stillbirth, and no live birth (diagnosis of pregnancy with no record of live birth thereafter, which include early abortive outcomes and stillbirth) with adjusting for covariates.

Results: Overall, 18.0%, 0.7%, and 39.8% ended in early abortive outcomes, stillbirths, and no live births, respectively. The risk of early abortive outcomes and stillbirths was higher in non-employed women than in employed women, while no live births were more frequent in employed women. Those in the health and social work industry showed the highest risk of no live births. Manufacturing jobs (1.030, 95% CI: 1.013, 1.047) and health/social work (1.029, 95% CI: 1.012, 1.046) were associated with an increased risk of early abortive outcomes compared with financial and insurance jobs. Consistently higher risks of no live births were observed in the manufacturing, wholesale/retail trade, education, health/social work, and public/social/personal service occupation.

Conclusion: Employment during pregnancy and several occupation types were associated with a higher risk of pregnancy loss. Additional research using detailed job activity data is needed to determine specific occupational causes of adverse pregnancy outcomes.

KEYWORDS

live birth, miscarriage, occupation, pregnancy, stillbirth, women

Seung-Ah Choe considered as Co-first Author

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1 | INTRODUCTION

Occupational activities affect workers' reproductive health. For pregnant women, toxic chemicals, radiation, and extreme temperatures in the workplace can interfere with the development of the embryo or fetus, leading to pregnancy loss or fetal anomalies. In addition to physical hazards in the workplace, compared with men, women are more likely to be exposed to discrimination, work-related psychological stress, and biological agents, which can increase the risk of adverse reproductive outcomes.¹ While empirical evidence of occupational and environmental causes of pregnancy loss or fetal death has been reported, the etiology of individual adverse outcomes is largely unknown.

Early abortive outcomes such as spontaneous abortion, molar pregnancy, and ectopic pregnancy are common, affecting 8%–20% of all recognized pregnancies and up to 30% of all pregnancies.² As a less frequent outcome, fetal death in utero or stillbirth, defined as pregnancy loss after 20 weeks of gestation, occurs in 14 of 1000 births globally.³ Given the continuous process of human pregnancy, extending from fertilization to childbirth, the risk of pregnancy loss before confirmation of the intrauterine gestational sac could also be associated with the occupations of pregnant women. Furthermore, artificial abortion due to fear of exposure to teratogens or prenatally detected fetal anomalies may be more frequent with higher exposure to occupational hazards. However, the association between occupational factors and adverse outcomes other than spontaneous abortion or stillbirth has not been explored in most previous studies.

The association of women's employment status and occupation with pregnancy outcomes, using a population-based database, has been reported in several studies.^{4,5} Many prior studies on the association between women's occupation and pregnancy outcomes are based on survey data or specific occupational group without comparative analysis of relative risk between the jobs.^{6–8} To develop a more focused approach in reducing occupational hazards in the workplace, identifying high-risk occupation would be important. In Korea, most clinical pregnancies are diagnosed in physicians' offices or hospitals, and induced abortions which fails to meet the requirements of the Mother and Child Health Act were regarded to be illegal until 2019.⁶ Although there are no national statistics about induced abortion without medical indication, it has been reported to be 7%–15% based on population-based survey data.^{9,10} Identification of pregnancy loss or termination of pregnancy based on the diagnostic code, therefore, may underestimate the incidence of adverse pregnancy outcomes, excluding chemical pregnancies and induced abortions due to the fear of congenital anomaly.

To capture all pregnancies that did not end in a live birth, we identified all pregnancy cases including those without any codes for pregnancy outcome, which are presumed to be chemical pregnancy or induced abortion. This study focused on the risk of no live births, which is defined as no record of childbirth after confirmation of pregnancy in the health insurance claims data, thus encompassing a broad range of outcomes of pregnancy loss. We estimated the risk of no live births according to women's employment status and occupation during pregnancy.

2 | METHOD

2.1 | Data

This retrospective cohort study used data from the National Health Information Service (NHIS) database of South Korea. The NHIS database contains information on sociodemographics, including age, employment status (insurance holder who is an employer or employee vs. dependent), premium percentiles (proxy for income percentile), residential district, and clinical information on diagnoses, prescribed medications, procedures, and treatments covered by the NHIS for every visit to health institutions. The NHIS covers approximately 97% of the Korean population as a universal health insurance system managed by the government of Korea, and the remaining 3% of the population are medical aid beneficiaries. Essential antenatal care visits including antenatal ultrasonography are covered by the NHIS, being recorded in the insurance claim database in Korea.^{11,12} We constructed a national cohort of women aged 20–49 years with a diagnostic code for pregnancy from 2010–2019. To assess pregnancy outcomes, we restricted the study population to women with a first pregnancy episode in the database and the date of first appearance of the pregnancy code from 2010 to 2018, yielding a total of 2 053 234 women. To adjust for clinical risk factors, those without preconception health check-up data ($n = 221\,328$; 10.8%) were excluded. We excluded medical aid beneficiaries from the analysis as they are low-income groups and those with severe medical conditions or disabilities, and thus are not optimal comparison groups for employed individuals. The final study population included 1 825 845 pregnant women (1 248 618 employed and 577 227 non-employed women, Appendix A). In assessing risk of adverse outcomes across occupational groups, we excluded 264 280 women working in less popular industry (less than 5%) because it is difficult to determine whether this group would have higher risk than financial/insurance occupation. Interpretation of the risk estimate for this category would be difficult due to the substantial heterogeneities within the group. We retrieved

the data of women's age, residence area, level of income, pre-pregnancy body mass index (BMI), hemoglobin, fasting blood glucose, and history of smoking. Information of marital or cohabitation status was not available in our database.

2.2 | Occupational status and pregnancy outcomes

Information on women's employment status was retrieved from the NHI subscription type. Excluding medical beneficiaries, we first divided the population into employed and non-employed (dependent on employee NHI subscribers and NHI subscriptions as business owners or their dependents). The employed population was further classified into 18 occupational categories based on the International Standard Industrial Classification of All Economic Activities Revision 3.0.13 adopted by the NHI database.¹³ Seven common occupational categories (manufacturing, wholesale/retail trade, financial/insurance, real estate/renting/leasing, education, health, and social work, and public, social, or personal service), each of which comprised more than 5% of the employed study population, were included in the further analysis to examine the association between occupational category and pregnancy outcomes.

We identified live births based on the presence of treatment codes for obstetric delivery within 273 days of the first appearance of any pregnancy code, which corresponds to 43 weeks of gestation (Appendix B). This assumes that the earliest valid pregnancy test can be performed at 4 weeks of gestation, given that a sensitive test can detect hormones in maternal serum or urine by 8–9 days after ovulation.¹⁴ Although there is no validation study, this operative definition has been used in prior studies.^{15,16} Three adverse pregnancy outcomes were defined: (1) early abortive outcomes, (2) stillbirth (intrauterine fetal death), and (3) no live birth including (1) and (2). Early abortive outcomes were defined as the presence of ICD-10 codes for early spontaneous pregnancy loss that included miscarriage, ectopic pregnancy, and molar gestation. Stillbirth was defined as stillbirth or fetal death in utero within 273 days of the first appearance of any pregnancy code. No live birth was defined as the absence of treatment codes for obstetric delivery within 273 days of the first appearance of any pregnancy code, including early abortive outcomes and stillbirth. We assumed that most cases of chemical pregnancies, induced abortions, and termination of pregnancies without medical indication were included in the no live birth category because induced abortion was illegal in South Korea during the study period except in cases of rape, incest, and maternal medical indications.

2.3 | Statistical analysis

Descriptive statistics for sociodemographic information and clinical characteristics, including women's age, residence (Seoul capital area vs. others), income quartiles (derived from premium percentile), pre-pregnancy BMI, anemia status (yes vs. no), fasting blood glucose, and history of smoking (yes vs. no), were calculated according to employment status and occupational category. To assess the association between occupational status and premature termination of pregnancy, we used log-binomial regression models to estimate the unadjusted and adjusted relative risk ratios (RR) of the three pregnancy outcomes and no live births. Covariates included age, residence, income quartiles, pre-pregnancy BMI, anemia, fasting blood glucose, history of smoking, and year of conception. We further explored the effect modification by women's advanced age (<35 or ≥35 years) on the association between occupational status and the risk of no live birth. All statistical analyses were performed using SAS software (version 9.4; SAS Institute) and R version 4.0.2.

3 | RESULTS

Employed women comprised 68.4% ($n = 1\,248\,618$) of the study population (Table 1). Employed pregnant women were more likely to be younger, have a lower income, and have a normal BMI compared with non-employed women. Non-employment was associated with a higher prevalence of anemia and history of smoking during pregnancy compared with employment.

Overall, 39.8% of all pregnant women had a code for no live births. Among them, 18.0% and 0.7% of pregnancies were cases with early abortive outcomes and stillbirths, respectively. The incidences of miscarriage, stillbirth, and no live births were comparable between employed and non-employed women (Table 2). The seven occupational categories accounted for 90.0% of all employed women in the study population; manufacturing ($n = 210\,909$, 16.9%) and health/social work ($n = 209\,935$, 16.8%) were the most common occupations. Women in wholesale/retail trade and education showed the highest incidence of early abortive outcomes (13.3%) and stillbirth (0.6%), while those employed in health and social work had the highest incidence of no live births (41.4%). In addition, those in financial/insurance occupations had the lowest incidence of all types of adverse pregnancy outcomes.

The crude risks for all three abortive outcomes were lower in employed women, while the risks were different across occupational groups (Appendix C). When adjusting for all covariates, the employed group showed higher risk of early abortive outcomes (RR = 1.011, 95% confidence

TABLE 1 General characteristics of study participants by employment status ($n = 1\,825\,845$)

Variables	Employed ($n = 1\,248\,618$)	Non-employed ($n = 577\,227$)
Age (years)		
15–24	38 144 (3.1)	12 498 (2.2)
25–29	377 609 (30.2)	105 096 (18.2)
30–34	604 604 (48.4)	251 418 (43.6)
35–39	188 031 (15.1)	137 080 (23.7)
40–44	34 154 (2.7)	58 853 (10.2)
≥45	6076 (0.5)	12 282 (2.1)
Residence		
Seoul capital area ^a	571 182 (45.7)	278 271 (48.2)
Income quartile		
Q1 (Lowest)	267 802 (21.4)	106 631 (18.5)
Q2	406 475 (32.6)	129 898 (22.5)
Q3	431 098 (34.5)	196 138 (34.0)
Q4 (Highest)	143 243 (11.5)	144 560 (25.0)
Disability (yes)	5227 (0.4)	4012 (0.7)
Pre-pregnancy body mass index (kg/m ²)		
<18.5	412 890 (33.1)	237 887 (41.2)
18.5–25	726 199 (58.2)	294 615 (51.0)
25–30	91 943 (7.4)	36 746 (6.4)
>30	17 586 (1.4)	7979 (1.4)
Pre-pregnancy hemoglobin		
Anemia (<12g/dl)	458 691 (36.7)	233 824 (40.5)
Fasting blood glucose (mg/dl)		
<100	1 161 610 (93.0)	532 537 (92.3)
100–125	81 086 (6.5)	41 005 (7.1)
≥126	5922 (0.5)	3685 (0.6)
History of smoking	64 399 (5.2)	49 282 (8.5)

Note: Q1, first quartile; Q2, second quartile; Q3, third quartile; Q4, fourth quartile. The numbers in parentheses are column percentages. All compositions were significantly different between the two groups due to differences in size and the large sample size.

^aSeoul capital area refers Seoul, Incheon, and Gyeonggi Province, located in northwestern South Korea. All pregnant women were identified using the NHI database between 2010 and 2019.

interval [CI]: 1.004, 1.018) and no live births (1.011, 95% CI: 1.009, 1.012) than the non-employed group (Table 3). Adjusted RRs for stillbirth of stillbirth were close to null for employed and seven occupational groups compared with non-employed women and financial/insurance occupation, respectively. The effect size of occupational categories on no live births was generally reduced when the covariates were adjusted (Figure 1). Compared with

financial/insurance occupations, manufacturing (1.030, 95% CI: 1.013, 1.047) and health and social work (1.029, 95% CI: 1.012, 1.046) were associated with higher risk of early abortive outcomes. For the risk of no live births, manufacturing (1.008, 95% CI: 1.004, 1.012), wholesale/retail trade (1.004, 95% CI: 1.000, 1.008), education (1.006, 95% CI: 1.002, 1.010), health/social work (1.015, 95% CI: 1.011, 1.019), and public/social/personal service (1.006; 95% CI, 1.001, 1.011) showed higher risks. When comparing women in financial/insurance occupations and those who were not employed, the former showed a higher risk of no live births.

4 | DISCUSSION

The adjusted risk of early abortive outcomes and no live births was higher in employed pregnant women than in those who were not employed. Although the incidence of abortive outcomes was similar, employed women were younger and generally healthier than non-employed women. With adjusting for these protective factors, the direction of association between employment and abortive outcomes changes toward negative. When comparing the seven common occupational categories, the risk of no live births was higher in the other six occupational categories than in financial/insurance jobs. In the context of illegal-induced abortion or termination without medical indication, this study provides empirical evidence indicating the independent role of women's employment status and occupation type during pregnancy on the negative outcomes of their pregnancies using national population data collected for administrative purposes.

Adverse pregnancy outcomes have been previously reported for specific occupational groups such as nurses,^{8,17} physicians, community care providers,¹⁸ hairdressers,^{19–21} flight attendants,^{7,22} and semiconductor industry workers.^{23,24} In a study of multiple cohorts from 13 European countries, employment during pregnancy was associated with a lower risk of preterm delivery than non-employment.²⁵ However, the association between occupational status and abortive outcomes was not consistent in previous studies.^{26,27} We observed a consistently higher risk of no live births in manufacturing, wholesale/retail trade, education, health/social work, and public/social/personal service occupations, although the effect sizes were small. Women in these occupations are exposed to harmful working conditions, such as physical labor in wholesale/retail trade, irregular work schedules in health/social work, and reprotoxic hazards in manufacturing work. In addition to these exposures, psychological stress associated with the working condition also was associated with higher risk of miscarriage.^{21,28} Although we could not separate induced

TABLE 2 Frequency (%) of early abortive outcomes, stillbirth, no live births, and live births by maternal employment status and occupation type

Employment status/common occupational categories ^a	Early abortive outcomes	Stillbirth	No live births ^b	Live births
Non-employed (<i>n</i> = 5,77227)	84658 (14.7)	3564 (0.6)	227437 (39.4)	349790 (60.6)
Employed (<i>n</i> = 12,48618)	159833 (12.8)	6466 (0.5)	495196 (39.7)	753422 (60.3)
Seven common occupations				
Financial/insurance (<i>n</i> = 83743)	10238 (12.2)	394 (0.5)	31614 (37.8)	52129 (62.3)
Manufacturing (<i>n</i> = 210909)	27284 (12.9)	1098 (0.5)	86095 (40.8)	124814 (59.2)
Wholesale/retail trade (<i>n</i> = 120065)	15924 (13.3)	602 (0.5)	46623 (38.8)	73442 (61.2)
Real estate/renting/leasing (<i>n</i> = 151519)	19681 (13.0)	766 (0.5)	58826 (38.8)	92693 (61.2)
Education (<i>n</i> = 136574)	18109 (13.3)	750 (0.6)	52557 (38.5)	84017 (61.5)
Health/social work (<i>n</i> = 209935)	26446 (12.6)	1087 (0.5)	86907 (41.4)	123028 (58.6)
Public/social/personal service (<i>n</i> = 52861)	9352 (13.1)	387 (0.5)	28471 (39.8)	43122 (60.2)

^aCommon occupational categories were defined as occupational groups with >5% of total employed women.

^bNo record of live birth includes early abortive outcomes and stillbirth. Numbers in parentheses represent row proportions.

TABLE 3 Adjusted relative risk of early abortive outcomes, stillbirth, and no live births by maternal employment status and occupational categories

Employment status/common occupational categories ^a	Early abortive outcomes	<i>P</i>	Stillbirth	<i>P</i>	No live births ^b	<i>P</i>
Employment status						
Non-employed	1.000 (reference)	-	1.000 (reference)	-	1.000 (reference)	-
Employed	1.011 (1.004, 1.018)	<.001	0.961 (0.921, 1.003)	0.110	1.011 (1.009, 1.012)	0.003
Non-employed vs. lowest-risk occupation						
Non-employed	1.000 (reference)	-	1.000 (reference)	-	1.000 (reference)	-
Financial/insurance	1.005 (0.986, 1.024)	0.641	0.908 (0.816, 1.009)	0.074	1.008 (1.004, 1.012)	<.001
Occupational category						
Financial/insurance	1.000 (reference)	-	1.000 (reference)	-	1.000 (reference)	-
Manufacturing	1.030 (1.013, 1.047)	<.001	1.083 (0.964, 1.216)	0.180	1.008 (1.004, 1.012)	<.001
Wholesale/retail trade	1.014 (0.996, 1.033)	0.126	0.975 (0.856, 1.110)	0.704	1.004 (1.000, 1.008)	0.038
Real estate/renting/leasing	1.003 (0.986, 1.020)	0.743	0.991 (0.874, 1.122)	0.881	1.003 (0.999, 1.007)	0.093
Education	1.001 (0.984, 1.019)	0.874	1.014 (0.894, 1.151)	0.825	1.006 (1.002, 1.010)	0.005
Health/social work	1.029 (1.012, 1.046)	<.001	1.061 (0.943, 1.195)	0.327	1.015 (1.011, 1.019)	<.001
Public/social/personal service	1.007 (0.987, 1.027)	0.513	1.033 (0.895, 1.193)	0.654	1.006 (1.001, 1.011)	0.011

^aCommon occupational categories were defined as occupational groups with >5% of total employed women.

^bNo record of live birth includes early abortive outcomes and stillbirth. Numbers in parentheses represent row proportions. All estimates were adjusted for maternal age, Seoul capital area residence, income level, pre-pregnancy body mass index, anemia, fasting blood glucose, history of smoking, and year of conception. Estimates with *p* values less than 0.05 are in bold.

abortion from the no live birth group, fear of congenital anomaly associated with the occupational exposure, unstable employment, and discrimination or stigma at the workplace in these high-risk occupations would have led higher incidence of chemical pregnancy or induced abortion. The null association of stillbirth with employment and occupation categories supports the impact of

working environment on early pregnancy. Several Korean studies have reported higher miscarriage rates in workers compared with non-workers,^{29,30} but their findings are limited due to excluding cases with no definite pregnancy outcome, which is also a type of adverse outcome. We believe that our study provides more realistic risk estimates of adverse pregnancy outcomes compared with

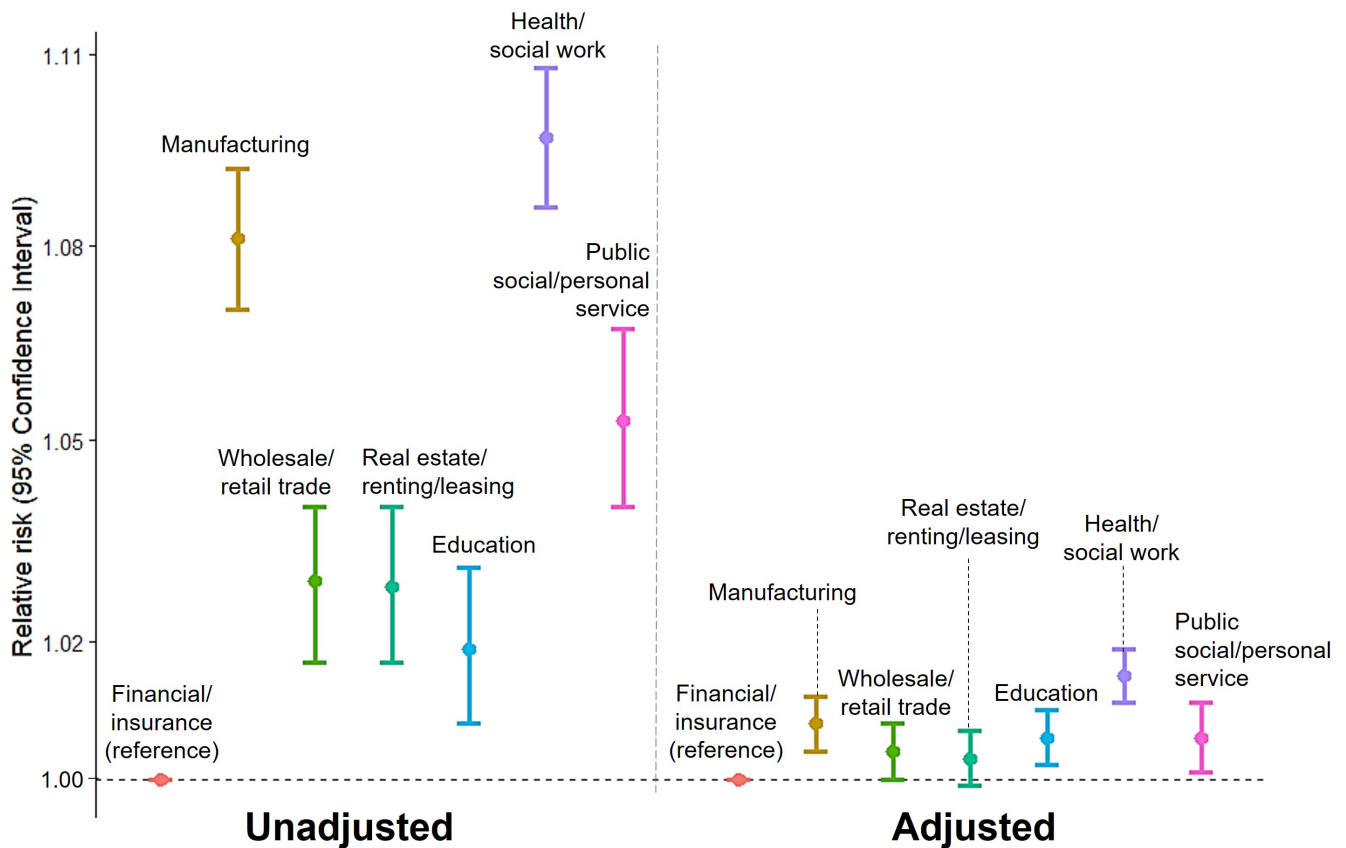


FIGURE 1 Relative risk (RR) for no live births among employed pregnant women in seven common occupational categories.

prior studies, considering chemical pregnancy losses and induced abortions.

The high proportion of no live births in our study can be explained by the pregnancy loss iceberg model.³¹ Once implantation occurs, 40% of losses are early or preclinical pregnancy losses, which are only chemically detectable, and 14% are clinical miscarriages. Chromosomal abnormalities are relatively common cause of early abortive outcomes.³² However, many occupational exposures including chemicals and ionizing radiation have been shown to cause aberrations in spermatozoa and oocytes.^{33,34} While no marker or genetic abnormalities have been specified for exposures at the workplace, several occupations showed above-average incidences of miscarriages in prior epidemiological studies.^{35,36} Although we could not identify illegal abortion cases in the no live birth category, the illegal abortion rate can be estimated to be 7%–15% based on population-based survey data.^{9,10} As induced abortion without medical or legal indication was decriminalized,³⁷ we will be able to assess the risk of induced abortion by women's occupation in the near future.

Our study population had twice the number of employed than non-employed women. Prior Korean studies contained similar numbers of employed and non-employed individuals. This is because we included the

first pregnancy in the NHIS database and thus excluded most of the second births for women who were out of employment for childcare of the firstborn. This can be explained with a “motherhood penalty” in wages which causes employment change for the mother after childbirth: some women drop out of the labor force, scale back from full to part-time work, or shift to self-employment after childbirth.³⁸ By restricting the analyses to the first pregnancy episodes, we minimized possible bias from this employment shift.

However, the findings of this study should be interpreted with caution. As there was no information on the specific job activity of each occupation, there may have been bias due to misclassification. For example, some small business owners performing occupational activities similar to those in service occupations might have been included in the non-employed group. However, given that the proportion of business owners comprises those with economic activity as low as 10%,³⁹ we believe the potential bias in our risk estimates of adverse pregnancy outcomes was minimal. Second, as a study based on an administrative database, some diagnostic codes for pregnancy may not be valid. Especially in health and social work, higher incidence of early abortive outcome and stillbirth might have been attributed to better access to obstetric care

and subsequent better detection of early pregnancy loss. Nonetheless, given that the prevalence of early abortive outcomes is similar to that of previous reports,⁴⁰ our estimation based on the diagnostic codes can be acceptable. Third, the effect size is generally small, and the large number of study population would have affected precision of estimates. Given the considerable heterogeneity in each occupational category, this risk estimates would have been larger when we compare more specific occupational activities. To specify exposures associated with abortive outcomes in the high-risk occupational category, more detailed data of activities at the workplace would be needed. Lastly, some information of employment status and occupation may not reflect the actual working status of women at the time of adverse outcomes are diagnosed, because the occupation recorded in the NHIS database is based on the annual collecting process of insurance premium. Given the potential misclassification of employment or occupation would be non-differential, we believe the bias from this limitation would have been toward the null.

5 | CONCLUSION

Employment during pregnancy and several occupation types were associated with a higher risk of no live births, including early abortive outcomes and stillbirth. Our findings highlight the urgent need to assess working conditions to prevent adverse pregnancy outcomes in female workers. Further studies using detailed work environment data are necessary to identify the specific causes of adverse pregnancy outcomes related to each occupation.

AUTHOR CONTRIBUTIONS

CBK drafted and finalized the manuscript. SAC and TK conducted primary analyses. JY wrote the manuscript and supervised the project. JR and JWO reviewed and revised the manuscript. MHK conceptualized the study and reviewed the manuscript.

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DATA AVAILABILITY STATEMENT

The datasets generated and analyzed during the current study are not publicly available due to the institutional policy of the National Health Insurance Sharing Service, but the aggregated data are available from the corresponding author on reasonable request.

DISCLOSURE

Approval of the research protocol: The protocol of this study was approved by the institutional review board of Korea University (IRB-2021-0214). *Informed Consent:* N/A. *Registry and the Registration:* N/A. *Animal Studies:* N/A. *Conflict of Interest:* The authors have no competing interests to declare that are relevant to the content of this article.

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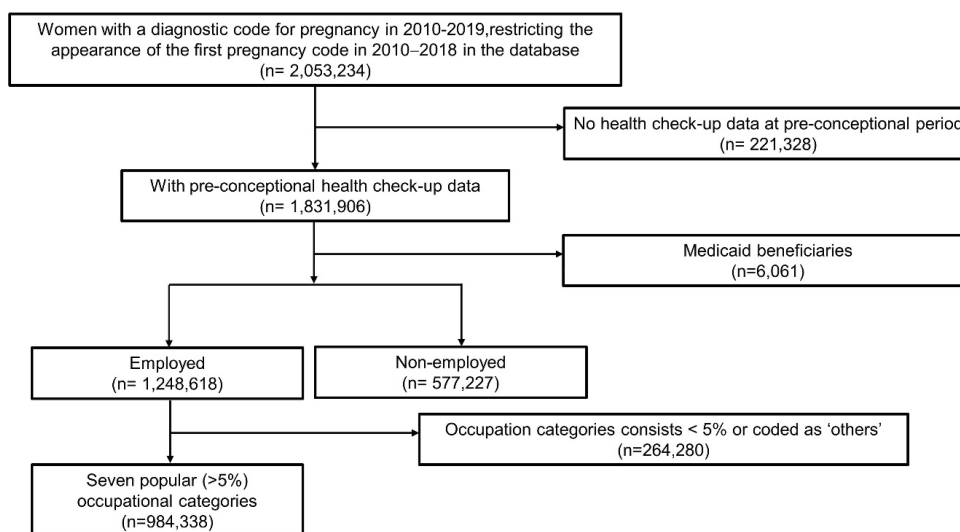
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APPENDIX A

Study population selection flow



APPENDIX B

Diagnostic and treatment codes used to classify pregnancy outcomes

Type of characteristics	Explanation	ICD-10 and treatment coded
Live birth	Treatment codes for childbirth	R4351, R4353, R4356, R4358, RA431, RA432, RA433, RA434, R3131, R3133, R3136, R3138, RA311, RA312, RA313, RA314, R3141, R3143, R3146, R3148, RA315, RA316, RA317, RA318, R4361, R4362, RA361, RA362, R4380, RA380, R4507, R4508, R4509, R4510, R5001, R5002, R4514, R4516, R4517, R4518, R4519, R4520, V0111, V0112, V0113, V0121, V0122, V0123, V0131, V0132, V0133, O016, O017, F001
No live birth	Early abortive outcomes	O02 Other abnormal products of conception O03 Spontaneous abortion O04 Complications following (induced) termination of pregnancy O07 Failed attempted termination of pregnancy O08 Complications following ectopic and molar pregnancy
	Fetal death in utero, stillbirth	O364 Maternal care for intrauterine death Z371 Single stillbirth Z374 Twins, both stillborn
	Pregnancy code without early abortive outcomes, stillbirth, or treatment codes for childbirth	All diagnostic codes starting with 'O', Z33, Z34, Z35, Z36, Z37, Z38, and Z39 with no codes for early abortive outcomes or stillbirth, or treatment codes for childbirth

APPENDIX C

Unadjusted relative risk of early abortive outcomes, stillbirth, and no live births by maternal employment status and occupational categories

Employment status/ common occupational categories ^a	Early abortive outcomes	<i>P</i>	Stillbirth	<i>P</i>	No live births (including early abortive outcomes and stillbirth)	<i>P</i>
Employment status						
Non-employed	1.000 (reference)	-	1.000 (reference)	-	1.000 (reference)	-
Employed	0.898 (0.891, 0.905)	<.001	0.844 (0.810, 0.879)	<.001	1.007 (1.003, 1.010)	<.001
Non-employed vs. lowest risk occupation						
Non-employed	1.000 (reference)	-	1.000 (reference)	-	1.000 (reference)	-
Financial/insurance	0.842 (0.827, 0.858)	<.001	0.744 (0.671, 0.825)	<.001	0.958 (0.949, 0.967)	<.001
Occupational category						
Financial/insurance	1.000 (reference)	-	1.000 (reference)	-	1.000 (reference)	-
Manufacturing	1.093 (1.070, 1.116)	<.001	1.163 (1.037, 1.304)	.010	1.081 (1.070, 1.092)	<.001
Wholesale/retail trade	1.085 (1.061, 1.110)	<.001	1.084 (0.955, 1.230)	.212	1.029 (1.017, 1.040)	<.001
Real estate/renting/leasing	1.067 (1.044, 1.090)	<.001	1.093 (0.968, 1.233)	.152	1.028 (1.017, 1.040)	<.001
Education	1.080 (1.057, 1.104)	<.001	1.180 (1.045, 1.332)	.008	1.019 (1.008, 1.031)	<.001
Health/social work	1.078 (1.056, 1.100)	<.001	1.168 (1.041, 1.310)	.008	1.097 (1.086, 1.108)	<.001
Public/social/personal service	1.086 (1.058, 1.114)	<.001	1.186 (1.031, 1.364)	.017	1.053 (1.040, 1.067)	<.001

^a Occupational groups with >5% of total employed women, all three occupational groups comprised 90% of all women's occupations.