

Equity in maternity care under universal health coverage: prenatal care utilization and obstetric outcomes among migrant women in Korea, 2022

Received: 21 February 2026

Accepted: 19 August 2026

Published online: 24 August 2026

Cite this article as: Kim J.H., Lee B.M., Kim S. *et al.* Equity in maternity care under universal health coverage: prenatal care utilization and obstetric outcomes among migrant women in Korea, 2022. *Arch Public Health* (2026). <https://doi.org/10.1186/s13690-026-02059-y>

Ji Hoi Kim, Bo Mi Lee, Soomin Kim, Hyemin Jung, So-hee Kim, Joong Shin Park, Seung Mi Lee & Jin Yong Lee

We are providing an unedited version of this manuscript to give early access to its findings. Before final publication, the manuscript will undergo further editing. Please note there may be errors present which affect the content, and all legal disclaimers apply.

If this paper is publishing under a Transparent Peer Review model then Peer Review reports will publish with the final article.

Title page**Equity in maternity care under universal health coverage: prenatal care utilization and obstetric outcomes among migrant women in Korea, 2022**

Authors: Ji Hoi Kim^{1,2}, Bo Mi Lee^{3,4}, Soomin Kim^{3,4}, Hyemin Jung^{4,5,6}, So-hee Kim^{1,2}, Joong Shin Park^{1,2}, Seung Mi Lee^{1,2,7,8,9,10}, Jin Yong Lee^{3,5}

Affiliations: Full information for each author

¹ Department of Obstetrics and Gynecology, Seoul National University Hospital, Seoul, Republic of Korea

² Department of Obstetrics and Gynecology, Seoul National University College of Medicine, Seoul, Republic of Korea

³ HIRA Research Institute, Health Insurance Review & Assessment Service, Wonju, Republic of Korea

⁴ Department of Health Policy and Management, Seoul National University College of Medicine, Seoul, Republic of Korea

⁵ Department of Public Health and Community Medicine, Seoul Metropolitan Government – Seoul National University Boramae Medical Center, Seoul, Republic of Korea

⁶ Institute of Health Policy and Management, Seoul National University Medical Research Center, Seoul, Republic of Korea

⁷ Healthcare AI Research Institute, Seoul National University Hospital, Seoul, Republic of Korea

⁸ Medical Big Data Research Center & Institute of Reproductive Medicine and Population, Medical Research Center, Seoul National University, Seoul, Republic of Korea

⁹ Interdisciplinary Program in Artificial Intelligence, Seoul National University, Seoul, Republic of Korea

¹⁰ Interdisciplinary Program in Medical Informatics, Seoul National University, Seoul, Republic of Korea

** Ji Hoi Kim and Bo Mi Lee contributed equally to this work as co-first author.*

** Seung Mi Lee and Jin Yong Lee contributed equally as co-corresponding authors*

Address for Correspondence:

Jin Yong Lee, M.D., Ph.D.

Department of Health Policy and Management, Seoul National University College of Medicine,
Seoul, Republic of Korea

101 Daehak-ro, Jongno-gu, Seoul 03080, Korea.

Phone: 82-2-2072-3124; Fax: 82-2-740-8156

E-mail: jylee00snu.ac.kr

Seung Mi Lee, M.D., Ph.D.

Department of Obstetrics and Gynecology, Seoul National University College of Medicine,
Seoul, Republic of Korea

101 Daehak-ro, Jongno-gu, Seoul 03080, Korea.

Phone: 82-2-2072-4857; Fax: 82-2-762-3599

E-mail: lbsmsnu.ac.kr

Word Count : 3,305

Reference Count : 28

Table Count : 3

Graphics Count : 1

Abstract

Background

Prior studies have reported higher rates of pregnancy complications among racially and ethnically minoritized populations, highlighting structural inequities and social determinants of health. Migrant women may represent a socially vulnerable group with potential disparities in access to and utilization of maternity care. Although Korea operates a universal health coverage system that provides comprehensive maternity services to all pregnant women, including migrants, non-financial barriers may still influence care utilization and outcomes. This study evaluated prenatal care utilization and obstetric complications among migrant women in Korea.

Methods

We conducted a nationwide, population-based cross-sectional study using National Health Insurance claims data in Korea. Migrant women were defined as foreign-national women registered in Korea's resident registration system. Prenatal care utilization was assessed based on the number of prenatal visits, and obstetric complications were defined as the occurrence of any major pregnancy- or delivery-related complication. Prenatal care utilization and obstetric complications were compared between migrant women and Korean-born women, and adjusted odds ratios with 95% confidence intervals were estimated.

Results

Of 202,690 deliveries, 10,772 (5.3%) were to migrant women. Migrant women were younger than Korean-born women (mean age, 30.46 vs 32.97 years; $P < 0.001$) and were more likely to receive Medical Aid and receive care at medical institutions located in city/rural areas. Migrant women had fewer prenatal care visits than Korean-born women (mean, 14.97 vs 18.11 visits; $P < 0.001$). However, migrant women were not at increased risk of overall obstetric complications compared with Korean-born women (aOR, 0.91; 95% CI, 0.87–0.95), including gestational hypertension and obstructed labor. The association differed by maternal age, with lower odds

observed among women younger than 35 years but not among those aged 35 years or older.

Conclusions

In this nationwide cross-sectional study, migrant women had lower prenatal care utilization but did not have higher odds of any obstetric complication than Korean women. Associations varied by specific complications and maternal age groups. Despite universal health coverage, persistent disparities in prenatal care utilization highlight the need to identify and address barriers to equitable maternity care for migrant women.

Trial registration

Not applicable.

Keywords: Emigrants and Immigrants; Pregnancy Complications; Prenatal Care; Universal Health Coverage; Health Equity

Contributions to the Literature

Text box 1. Contributions to the Literature

- Broadens the evidence base on migrant maternal health by providing nationwide population-level data from a setting where financial access to maternity care is widely ensured.
- Contributes to debates on structural determinants of maternal health by examining whether disparities persist when insurance coverage is nearly universal
- Advances public health discussions by underscoring that achieving maternal health equity requires addressing structural and non-financial barriers—such as communication and care coordination—beyond insurance coverage alone.

Background

Prior studies—particularly from the United States—have shown that racially and ethnically minoritized pregnant individuals experience a disproportionately higher burden of severe maternal morbidity and pregnancy-related mortality than White individuals, reflecting persistent inequities in maternity care^{1,2}. These patterns underscore ongoing challenges in achieving equity in maternal health, even in high-resource settings. These disparities are widely attributed to structural inequities and social determinants of health, including differential access to high-quality care and the cumulative effects of racism and socioeconomic disadvantage across the life course^{3,4}. Migration-related factors may influence pregnancy outcomes through socioeconomic disadvantage, language and cultural barriers, and challenges in navigating and coordinating maternity care⁵. International evidence suggests that pregnancy outcomes among immigrant women vary substantially across host countries and healthcare systems, highlighting the importance of evaluating maternal health outcomes within specific national contexts rather than extrapolating findings from other settings^{6,7}.

In Korea, migrant pregnant women—many of whom are foreign-born—may experience social vulnerability related to socioeconomic disadvantage and language barriers, which could contribute to disparities in maternal health outcomes⁸. At the same time, Korea's universal health coverage and maternity support programs provide broad access to antenatal and delivery care for all pregnant women, including migrant women. However, evidence from Korea suggests that socially vulnerable groups may continue to experience differences in care processes and outcomes even within a high-coverage system. For example, nationwide analyses have shown that teenage pregnancies are more often associated with inadequate prenatal care and an increased risk of preterm delivery⁹. Similarly, Medical Aid recipients—a low-income population—have been reported to have higher risks of pregnancy complications such as

preeclampsia, preterm delivery, and obstetric hemorrhage compared with National Health Insurance beneficiaries¹⁰. Consistent with this pattern, recent claims-based analyses of antenatal care in Korea (2013–2022) have shown that insufficient prenatal care remains more common among migrant women and other socially vulnerable groups, suggesting persistent inequalities in care processes despite broad coverage¹¹.

In this nationwide study, we evaluated prenatal care utilization and obstetric complications among migrant women compared with Korean-born women using a recent delivery claims from 2022. We further examined whether associations between migrant status and obstetric complications differed according to prenatal care utilization categorized by the number of prenatal visits, with the aim of assessing disparities across the prenatal care pathway and informing targeted perinatal care strategies.

Methods

Study Design and Data Source This nationwide, population-based cross-sectional study used retrospective claims data from the Korean National Health Insurance (NHI) system, which covers nearly the entire population of Korea.

Descriptive trend analysis, 2013–2022

To describe long-term changes in the representation of migrant women among deliveries, we examined the annual number and proportion of migrant women among all deliveries from 2013 to 2022.

Main cross-sectional analysis, 2022

For the main cross-sectional analysis, we identified all eligible women with delivery-related claims in 2022, the most recent year available at the time of analysis. A total of 202,690 women with delivery-related claims between January and December 2022 were identified. Women aged 45

years or older and those with abortion-related claims were excluded. There were no missing data for the variables included in the analyses; therefore, no imputation was required. Prenatal care utilization and obstetric complications were compared between migrant women and Korean-born women.

This study was approved by the Institutional Review Board of the Health Insurance Review and Assessment Service (HIRA) (approval No. 2025-065-001). Informed consent was waived because the study used retrospective, de-identified administrative data.

Data collection

Data on demographic characteristics, healthcare utilization, and pregnancy-related outcomes were extracted from the Korean NHI claims database. Maternal age at delivery, insurance type, and the location of the medical institution were obtained for all women included in the study.

Migrant women were defined as foreign-national women registered in Korea's resident registration system (identification number categories 6 or 8). Insurance type was used as a proxy for socioeconomic status and classified as Medical Aid(MA) or National Health Insurance(NHI). The location of the medical institution was categorized as metropolitan, or city/rural based on the administrative region of the institution. Metropolitan areas included Seoul Special City and the six metropolitan cities (Busan, Daegu, Incheon, Gwangju, Daejeon, and Ulsan), whereas all other administrative areas were classified as city/rural.

Prenatal care adequacy was assessed using a visit-count-based measure adapted from previous nationwide Korean claims-based studies^{9,12}. Because the original Kessner Index incorporates both the timing of prenatal care initiation and the number of visits^{13,14}, and information on the timing of care initiation was unavailable in our claims data, our measure was based solely on the total number of prenatal visits during pregnancy. Nine or more visits were classified as adequate,

whereas fewer than nine visits were classified as inadequate. Definitions of delivery and obstetric complications were based on diagnosis codes from the International Classification of Diseases, 10th Revision (ICD-10) (see Additional file 1: Table S1). Delivery type was categorized as cesarean section or vaginal delivery.

The composite outcome of any obstetric complication was adapted from a previous nationwide claims-based study in Korea that identified women with at least one of several maternal obstetric complications using ICD-10 diagnosis codes⁹. The primary outcome was any obstetric complication, defined as the occurrence of at least one of the following conditions: preeclampsia or eclampsia, gestational hypertension, gestational diabetes mellitus, placenta previa, Abruption placentae, obstructed labor, preterm delivery, perineal laceration, or obstetric hemorrhage. Gestational diabetes mellitus was defined as having at least two claims with a relevant diagnosis code during pregnancy. For all other obstetric complications, including gestational hypertension, the presence of at least one relevant diagnosis code recorded as a primary or first-listed secondary diagnosis during the perinatal period was used to define the condition.

Statistical Analysis

Descriptive analyses were performed to summarize maternal characteristics and pregnancy outcomes. Differences between migrant women and Korean-born women were assessed using χ^2 test for categorical variables and Student's t-test for continuous variables.

Logistic regression models were used to estimate crude and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) for the association between migrant status and obstetric complications. Adjusted models included maternal age group, area of the medical institution, insurance type, and prenatal care adequacy. Subgroup analyses were conducted according to maternal age group, insurance type, area of the medical institution, and prenatal care adequacy; in each subgroup

analysis, the stratification variable was excluded from the adjustment set. Effect modification was assessed by including an interaction term between migrant status and each subgroup variable in the corresponding model. For the nine individual obstetric complications, P values from the adjusted regression models were corrected for multiple comparisons using the Holm method; the primary outcome, any obstetric complication, was not included in this multiple-comparison adjustment. Sensitivity analyses were conducted by excluding gestational diabetes mellitus and gestational hypertension from the definition of any obstetric complication and, separately, by excluding prenatal care adequacy from the adjustment model.

All analyses were performed using SAS Enterprise Guide version 7.1 (SAS Institute, Cary, NC, USA). Statistical significance was defined as two-tailed *p*-values of < 0.05 . This study was reported in accordance with the STROBE guidelines for cross-sectional studies¹⁵.

Results

Trend in the proportion of migrant women among all deliveries in Korea, 2013–2022

From 2013 to 2022, the total number of deliveries decreased from 405,784 to 202,690, and deliveries to migrant women decreased from 16,382 to 10,772. The proportion of migrant women among all deliveries increased from 4.04% in 2013 to 5.31% in 2022 (Figure 1).

Maternal characteristics, prenatal care, and type of delivery

A total of 202,690 women with delivery claims in 2022 were included, comprising 10,772 migrant women and 191,918 Korean women (Table 1). Migrant women were younger than Korean women (mean age 30.46 vs 32.97 years), with a higher proportion aged <25 years (14.18% vs 2.28%) and a lower proportion aged ≥ 35 years (22.81% vs 34.36%). Medical Aid coverage was more frequent among migrant women, and migrant women more often received care in city/rural areas than metropolitan areas (39.04% vs 33.27% and 60.96% vs 66.73%,

respectively). Migrant women had a higher proportion of inadequate prenatal care (10.11% vs 2.08%). Cesarean delivery was less frequent in migrant women than Korean women (49.47% vs 56.33%).

Table 1 about here.

Obstetric complications: overall and individual outcomes

Overall, 24.12% of migrant women and 25.91% of Korean women experienced at least one obstetric complication. After adjustment, migrant status was associated with slightly lower odds of any obstetric complication (adjusted odds ratio [aOR] 0.91, 95% CI 0.87–0.95) (Table 2).

Among individual complications, migrant women had lower adjusted odds of gestational hypertension (aOR 0.64, 95% CI 0.54–0.75) and obstructed labor (aOR 0.82, 95% CI 0.76–0.89). Perineal laceration was more frequent among migrant women (2.50% vs 1.90%), with higher adjusted odds (aOR 1.16, 95% CI 1.02–1.32). Preeclampsia/eclampsia, placenta previa, abruptio placentae, preterm delivery, and obstetric hemorrhage did not differ significantly after adjustment. Gestational diabetes mellitus was less frequent among migrant women in the unadjusted comparison (7.44% vs 8.72%), but this difference was attenuated after adjustment (aOR 0.96, 95% CI 0.89–1.04). After Holm correction for multiple comparisons, the associations with gestational hypertension and obstructed labor remained statistically significant, whereas the association with perineal laceration was no longer statistically significant (Holm-adjusted $P=0.18$). Sensitivity analyses yielded similar estimates when gestational diabetes mellitus and gestational hypertension were excluded from the definition of any obstetric complication (aOR 0.92, 95% CI 0.87–0.97) and when prenatal care adequacy was excluded from the adjustment model (aOR 0.90, 95% CI 0.86–0.94) (Additional file 1: Table S3).

Table 2 about here.

Any obstetric complication by age, insurance type, area, and prenatal care adequacy

In subgroup analyses of any obstetric complication (Table 3), the association between migrant status and obstetric complications differed by maternal age (P for interaction = 0.01). Reduced odds were observed among women aged <25 years (aOR 0.78, 95% CI 0.68–0.90), 25–29 years (aOR 0.86, 95% CI 0.79–0.94), and 30–34 years (aOR 0.92, 95% CI 0.85–0.99), whereas no meaningful difference was observed among women aged ≥ 35 years (aOR 1.01, 95% CI 0.92–1.10). The association also differed by insurance type (P for interaction = 0.01); however, the estimate for Medical Aid recipients (aOR 0.56, 95% CI 0.38–0.82) was based on a small number of migrant women ($n=223$) and should therefore be considered exploratory and interpreted cautiously. No statistically significant interaction was observed by area (P for interaction = 0.09) or prenatal care adequacy (P for interaction = 0.13). When stratified by prenatal care adequacy, the association remained in both the adequate care group (aOR 0.92, 95% CI 0.87–0.96) and inadequate care group (aOR 0.80, 95% CI 0.68–0.95). In additional subgroup analyses of individual obstetric complications according to prenatal care adequacy (see Additional file 1: Table S2), complication-specific associations were broadly consistent with the main findings.

Table 3 about here.

Discussion

Summary of main findings

This nationwide population-based study provides contemporary evidence on prenatal care utilization and obstetric outcomes among migrant women within Korea's universal health coverage system. In this nationwide cross-sectional analysis, migrant women had slightly lower overall odds of any obstetric complication than Korean women; however, the direction and magnitude of associations varied across individual complications. The lower overall odds were

observed among women younger than 35 years but not among those aged 35 years or older.

Migrant women attended fewer antenatal visits and were more frequently classified as having inadequate antenatal care based on the visit-count criterion than Korean women.

Relation to previous evidence and new contributions

Evidence from the United States has consistently documented substantial racial and ethnic inequities in maternal health, including markedly higher maternal and pregnancy-related mortality and severe maternal morbidity among non-Hispanic Black women compared with non-Hispanic White women^{16,17}. In addition, severe maternal morbidity during delivery hospitalization has been reported more frequently among Black and some other minoritized groups than among White women¹⁸. These disparities have been widely attributed to structural factors, such as unequal access to high-quality obstetric care, concentration of minoritized populations in lower-quality delivery facilities, and the cumulative effects of racism and socioeconomic disadvantage, rather than differences in individual risk alone¹⁹.

In contrast, Korea operates a universal health coverage system with maternity-related benefit programs (eg, the National Happiness Card, previously the “Goun-mom” card), which provide broad financial access to antenatal and delivery care⁸. Nevertheless, national claims-based analyses indicate persistent disparities in care processes, with insufficient antenatal care remaining more common among non-Korean women and other socially vulnerable groups, including teenagers and Medical Aid recipients^{9,10,12,20}.

Against this background, our findings add new evidence by showing that, in a recent nationwide cross-sectional analysis of deliveries, migrant women had fewer antenatal visits yet did not have higher odds of any obstetric complication, with associations varying by complication type and maternal age. Although prenatal visit frequency may reflect both healthcare access and increased

clinical monitoring related to pregnancy complications, the association was materially unchanged in a sensitivity analysis excluding prenatal care adequacy from the adjustment model. These findings should be interpreted within the context of Korea's maternity-care environment, where universal health coverage and maternity support programs provide broad access to antenatal and delivery services. This pattern aligns with international evidence indicating that pregnancy outcomes among migrant women are heterogeneous and can differ substantially across host-country contexts and healthcare systems⁷. Similar heterogeneity has been reported in other Asian settings. In Japan, nationwide data showed substantial variation in preterm birth and low birth weight according to maternal nationality²¹, while population-based studies from Taiwan reported lower prenatal care utilization among foreign-born women but no consistently worse birth outcomes compared with native-born women²². Unlike some previous Korean studies that focused specifically on marriage migrants⁸, our study encompassed a broader group of foreign-national women with diverse migration backgrounds. This broader definition may limit direct comparability with those studies but provides a population-level perspective on maternity care among foreign-national women represented in the Korean healthcare system. Overall, these results suggest that in Korea, further gains for migrant women may depend less on increasing visit volume alone and more on strengthening the effectiveness of perinatal care—particularly communication support, coordinated care pathways, and intrapartum quality improvement—within an already high-coverage maternity system.

Subgroup analyses provided additional insight into this pattern. The association between migrant status and any obstetric complication was generally consistent across key subgroups, including prenatal care adequacy and the location of the delivering institution but differed by maternal age. The variation in associations across maternal age groups suggests that maternal age may be an

important factor to consider when interpreting differences in obstetric outcomes between migrant and Korean-born women. Complication-specific patterns may also provide clinically relevant signals for further investigation. Although perineal laceration was more frequent among migrant women and showed higher odds in the conventional analysis, this association did not remain statistically significant after correction for multiple comparisons. Previous research has also reported variation in the risk of severe perineal injury according to maternal country of birth²³. Therefore, this finding should be interpreted cautiously and may warrant further investigation in relation to intrapartum care and communication.

Policy implications for perinatal care in Korea

From a policy perspective, these findings show that, within Korea's universal health coverage system, lower prenatal care utilization among migrant women coexisted with no higher overall odds of any obstetric complication. However, even in settings such as Korea where financial barriers to maternity care are relatively limited, continued gaps in prenatal care use suggest that barriers beyond financial coverage—such as language difficulties, challenges in navigating the healthcare system, and limited access to information— may remain relevant to achieving equity in maternity care^{24,25}.

Accordingly, policy priorities may need to extend beyond increasing the number of prenatal visits alone to strengthening the effectiveness and equity of perinatal care delivery. Evidence from migrant maternity care identifies language barriers and difficulties accessing and coordinating services as key determinants of fragmented care and suboptimal care experiences, supporting targeted strategies such as professional interpretation, culturally responsive counselling, and facilitated referral/follow-up²⁶. Further investigation is needed to assess whether interventions targeting these barriers, including communication support and improved care

coordination across antenatal, intrapartum, and postpartum pathways, can improve access to and quality of perinatal care within an already high-coverage system. However, because our data did not allow differentiation by country of origin, migration status, or duration of residence, the findings cannot identify subgroup-specific barriers or policy needs within the migrant population.

Strengths and limitations

A major strength of this study is the use of nationwide claims data capturing nearly all reimbursed obstetric care, enabling robust comparisons between migrant and Korean-born women in a large nationwide sample of deliveries from 2022. The nationwide scope reduces selection bias and enhances generalizability to routine clinical practice in Korea. The large sample size provided sufficient statistical power to evaluate uncommon obstetric complications and to conduct prespecified subgroup analyses by maternal age and antenatal care adequacy. Consistent case ascertainment using standardized ICD-10 coding across institutions allowed systematic identification of delivery mode and obstetric complications within the same data framework. Finally, linkage of adjacent-year claims to the index delivery year improved ascertainment of pregnancy-related encounters across the care episode, strengthening the completeness of exposure and covariate measurement within the constraints of administrative data.

Several limitations should be considered when interpreting the lower overall occurrence of obstetric complications among migrant women. First, the observed differences may partly reflect underlying differences in baseline risk profiles. Migrant women were younger on average, and younger maternal age is associated with lower baseline risk for several complications, particularly hypertensive disorders of pregnancy. In addition, selection effects related to

migration - often discussed as a “healthy immigrant effect” - could contribute to lower observed complication rates^{27,28}. Although maternal age was adjusted for in the analyses, other obstetric risk factors, such as multiple gestation, pregnancies conceived via infertility treatment, and detailed obstetric history, were not fully captured in the claims data and may have contributed to between-group differences.

Second, prenatal care utilization was assessed based on the number of prenatal visits recorded in claims data, which does not capture the timing of prenatal care initiation, continuity of care, or other dimensions of prenatal care adequacy. Prenatal visit frequency may also be influenced by pregnancy complications requiring closer clinical monitoring, and the claims data did not allow us to reliably distinguish pre-existing or early pregnancy complications from those identified later in pregnancy. In addition, fewer antenatal visits may lead to under-detection or under-coding of milder, diagnosis-driven conditions, resulting in differential outcome ascertainment. Moreover, claims-based outcome definitions may vary in sensitivity and specificity across groups; alternative definitions incorporating hospitalization, procedures, or medication claims could yield different estimates.

Third, residual confounding remains possible because claims data do not include key clinical and social variables such as parity, body mass index, smoking, education or income, duration of residence, language proficiency, country of origin, and detailed obstetric history. Furthermore, some migrant populations, including unregistered migrants and others not enrolled in NHI or Medical Aid, may be underrepresented; therefore, the findings may not be generalizable to all migrant women in Korea. Because the main analysis was restricted to 2022, pandemic-era changes in migration patterns may further limit generalizability to other periods. Estimates for

Medical Aid recipients should also be interpreted cautiously because of the small number of migrant women in this subgroup.

Finally, the measure of any obstetric complication combines clinically heterogeneous outcomes with differing directions of association, which may limit its interpretability as a single summary measure. Although the Holm method was applied to account for multiple comparisons across the nine individual complications, complication-specific findings should be interpreted cautiously.

Conclusion

In this nationwide cross-sectional analysis of deliveries in Korea, migrant women had lower prenatal care utilization but no higher odds of any obstetric complication than Korean-born women. Associations differed across individual complications and maternal age groups, highlighting the importance of examining specific outcomes rather than relying solely on an overall measure. Despite universal health coverage, persistent differences in prenatal care utilization highlight the need to identify and address barriers to equitable maternity care among migrant women.

List of abbreviations

aOR: Adjusted Odds Ratio

CI: Confidence Interval

HIRA: Health Insurance Review and Assessment Service

ICD-10: International Classification of Diseases, 10th Revision

MA: Medical Aid

NHI: National Health Insurance

OR: Odds Ratio

SD: Standard Deviation

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of the Health Insurance Review and Assessment Service (HIRA) (approval No. 2025-065-001). The requirement for informed consent was waived because the study used retrospective, de-identified administrative data. All study procedures were conducted in accordance with applicable ethical guidelines and regulations, including the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The data used in this study are not publicly available because they contain individual-level health information and are subject to legal and ethical restrictions. The data were obtained from the Korean National Health Insurance claims database under a data use agreement and can be accessed by qualified researchers upon reasonable request and approval from the Health Insurance Review and Assessment Service (HIRA), in accordance with applicable regulations.

Competing interests

The authors declare that they have no competing interests.

Funding

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (RS-2025-00558188) and also supported by Institute of Information & communications Technology Planning & Evaluation (IITP) grant funded by the Korea government (MSIT) [NO.RS-2021-II211343, Artificial Intelligence Graduate School Program (Seoul National University)]. The funders had no role in the study design; data

collection, analysis, or interpretation; preparation of the manuscript; or the decision to submit the manuscript for publication.

Authors' Contributions

JYL and SML conceived and designed the study. BML and SK acquired the data. BML and JHK conducted the statistical analyses and interpreted the data. JHK, BML, SHK, and SK drafted the manuscript. JYL, SML, JSP, SHK, and HJ critically revised the manuscript for important intellectual content. All authors had access to the data, contributed to the interpretation of the findings, read and approved the final manuscript, and agreed to be accountable for all aspects of the work. BML and SK directly accessed and verified the underlying data reported in this manuscript.

Acknowledgements

Nothing to declare.

References

1. Admon LK, Winkelman TNA, Zivin K, Terplan M, Mhyre JM, Dalton VK. Racial and ethnic disparities in the incidence of severe maternal morbidity in the United States, 2012–2015. *Obstet Gynecol.* 2018;132(5):1158–1166. doi:10.1097/AOG.0000000000002937.
2. Petersen EE, Davis NL, Goodman D, et al. Racial/ethnic disparities in pregnancy-related deaths—United States, 2007–2016. *MMWR Morb Mortal Wkly Rep.* 2019;68(35):762–765. doi:10.15585/mmwr.mm6835a3.
3. van Daalen KR, Kaiser J, Kebede S, et al. Racial discrimination and adverse pregnancy outcomes: a systematic review and meta-analysis. *BMJ Glob Health.* 2022;7(8). doi:10.1136/bmjgh-2022-009227

4. Dagher RK, Linares DE. A Critical Review on the Complex Interplay between Social Determinants of Health and Maternal and Infant Mortality. *Children (Basel)*. 2022;9(3). doi:10.3390/children9030394
5. Sacks E, Brizuela V, Javadi D, et al. Immigrant women's and families' views and experiences of routine postnatal care: findings from a qualitative evidence synthesis. *BMJ Glob Health*. 2024;8(Suppl 2). doi:10.1136/bmjgh-2023-014075
6. Behboudi-Gandevani S, Bidhendi-Yarandi R, Panahi MH, et al. Adverse Pregnancy Outcomes and International Immigration Status: A Systematic Review and Meta-analysis. *Ann Glob Health*. 2022;88(1):44. doi:10.5334/aogh.3591
7. Fair F, Raben L, Watson H, et al. Migrant women's experiences of pregnancy, childbirth and maternity care in European countries: A systematic review. *PLoS One*. 2020;15(2):e0228378. doi:10.1371/journal.pone.0228378
8. Song IG, Kim MS, Shin SH, et al. Birth outcomes of immigrant women married to native men in the Republic of Korea: a population register-based study. *BMJ Open*. 2017;7(9):e017720. doi:10.1136/bmjopen-2017-017720
9. Lee SH, Lee SM, Lim NG, et al. Differences in pregnancy outcomes, prenatal care utilization, and maternal complications between teenagers and adult women in Korea: A nationwide epidemiological study. *Medicine (Baltimore)*. 2016;95(34):e4630. doi:10.1097/MD.00000000000004630
10. Kim MK, Lee SM, Bae SH, et al. Socioeconomic status can affect pregnancy outcomes and complications, even with a universal healthcare system. *Int J Equity Health*. 2018;17(1):2. doi:10.1186/s12939-017-0715-7
11. Kim S, Kim C, Kim JH. Antenatal care inequalities in South Korea: An analysis of

- health insurance claims data (2013-2022) in a high-resource, high-use country. *Int J Gynaecol Obstet.* 2024;166(2):718–726. doi:10.1002/ijgo.15459
12. Lim NG, Lee JY, Park JO, Lee JA, Oh J. Pregnancy, prenatal care, and delivery of mothers with disabilities in Korea. *J Korean Med Sci.* 2015;30(2):127–32. doi:10.3346/jkms.2015.30.2.127
 13. Institute of Medicine (US) Panel on Health Services Research; Kessner DM. Infant death: an analysis by maternal risk and health care. Its contrasts in health status, vol 1. Washington (DC): Institute of Medicine; 1973.
 14. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. *Am J Public Health.* 1994;84(9):1414–20. doi:10.2105/ajph.84.9.1414
 15. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Lancet.* 2007;370(9596):1453–1457. doi:10.1016/S0140-6736(07)61602-X.
 16. Hoyert DL. Maternal Mortality Rates in the United States, 2023. *NCHS Health E Stats.* 2024.
 17. Joseph KS, Lisonkova S, Boutin A, et al. Maternal mortality in the United States: are the high and rising rates due to changes in obstetrical factors, maternal medical conditions, or maternal mortality surveillance? *Am J Obstet Gynecol.* 2024;230(4):440 e1–440 e13. doi:10.1016/j.ajog.2023.12.038
 18. Creanga AA, Bateman BT, Kuklina EV, Callaghan WM. Racial and ethnic disparities in severe maternal morbidity: a multistate analysis, 2008-2010. *Am J Obstet Gynecol.*

- 2014;210(5):435 e1–8. doi:10.1016/j.ajog.2013.11.039
19. Boghossian NS, Greenberg LT, Buzas JS, et al. Racial and Ethnic Inequalities in Actual vs Nearest Delivery Hospitals. *JAMA Netw Open*. 2025;8(3):e251404. doi:10.1001/jamanetworkopen.2025.1404
 20. Kim MJ. A Comparative Study on Birth Outcomes between Korean Women and Immigrant Women. *Korean J Women Health Nurs*. 2011;17(4):407–414. doi:10.4069/kjwhn.2011.17.4.407
 21. Okui T, Sato Y, Morokuma S, Nakashima N. Association of maternal nationality with preterm birth and low birth weight rates: analysis of nationwide data in Japan from 2016 to 2020. *Matern Health Neonatol Perinatol*. 2023 Mar 8;9(1):3. doi: 10.1186/s40748-023-00149-1. PMID: 36882805; PMCID: PMC9993667.
 22. Chou YA, Chou YJ, Lee CH, Huang N. Pregnancy outcomes among native and foreign-born women in Taiwan: maternal health utilization. *J Womens Health (Larchmt)*. 2008;17(9):1505–1512. doi:10.1089/jwh.2007.0714.
 23. Andre K, Stuart A, Kallen K. Maternal origin matters: Country of birth as a risk factor for obstetric anal sphincter injuries. *Int J Gynaecol Obstet*. 2024;166(1):426–434. doi:10.1002/ijgo.15427
 24. Jang IS, Hwang NM, Yoon MS, Park S. Current Status and Factors Affecting Prenatal Care by Married Immigrant Women. *Korean J Women Health Nurs*. 2010;16(4):326–335. doi:10.4069/kjwhn.2010.16.4.326
 25. Gagnon AJ, Zimbeck M, Zeitlin J, et al. Migration to western industrialised countries and perinatal health: a systematic review. *Soc Sci Med*. 2009;69(6):934–46. doi:10.1016/j.socscimed.2009.06.027

26. Origlia Ikhilor P, Hasenberg G, Kurth E, Asefaw F, Pehlke-Milde J, Cignacco E. Communication barriers in maternity care of allophone migrants: Experiences of women, healthcare professionals, and intercultural interpreters. *J Adv Nurs*. 2019;75(10):2200–2210. doi:10.1111/jan.14093
27. Hamilton TG. The healthy immigrant (migrant) effect: In search of a better native-born comparison group. *Soc Sci Res*. 2015;54:353–65. doi:10.1016/j.ssresearch.2015.08.008
28. Stipkova M. Immigrant disadvantage or the healthy immigrant effect? Evidence about low birth weight differences in the Czech Republic. *Eur J Public Health*. 2016;26(4):662–6. doi:10.1093/eurpub/ckw029

Table 1. Characteristics and prenatal care utilization of migrant and Korean-born women in Korea, 2022

Variables	Total, No. (%)	Migrant women,	Korean women,	P value
		No. (%)	No. (%)	
Total	202,690 (100.00)	10,772 (100.00)	191,918 (100.00)	
Age, Mean (SD)	32.83 (4.19)	30.46 (5.13)	32.97 (4.09)	<0.001
Age group				
< 25	5,911 (2.92)	1,528 (14.18)	4,383 (2.28)	
25-29	33,990 (16.77)	3,056 (28.37)	30,934 (16.12)	<0.001
30-34	94,397 (46.57)	3,731 (34.64)	90,666 (47.24)	
≥ 35	68,392 (33.74)	2,457 (22.81)	65,935 (34.36)	
Type of insurance				
NHI	201,484 (99.41)	10,549 (97.93)	190,935 (99.49)	<0.001
MA	1,206 (0.59)	223 (2.07)	983 (0.51)	
Area				
Metropolitan	134,628 (66.42)	6,567 (60.96)	128,061 (66.73)	<0.001

City and Rural	68,062 (33.58)	4,205 (39.04)	63,857 (33.27)	
No. of prenatal visit, Mean (SD)	17.94 (6.32)	14.97 (5.82)	18.11 (6.31)	<0.001
Adequacy of prenatal care				
Adequate (≥ 9)	197,606 (97.49)	9,683 (89.89)	187,923 (97.92)	<0.001
Inadequate (< 9)	5,084 (2.51)	1,089 (10.11)	3,995 (2.08)	
Type of delivery				
Cesarean section	113,444 (55.97)	5,329 (49.47)	108,115 (56.33)	<0.001
Vaginal delivery	89,246 (44.03)	5,443 (50.53)	83,803 (43.67)	

SD=Standard Deviation, NHI=National Health Insurance, MA=Medical Aid.

^a P<0.05 calculated by chi-square test or t-test.

Table 2. Obstetric complications among migrant and Korean women in Korea, 2022

Obstetrical complications	No. of women, No. (%)		Crude OR (95% CI)	Adjusted OR (95% CI)^a	Holm-adjusted P value^b
	Migrant	Korean			
	women (N=10,772)	women (N=191,918)			
Any obstetric complication	2,598 (24.12)	49,730 (25.91)	0.91 (0.87–0.95)	0.91 (0.87–0.95)	—
Preeclampsia or Eclampsia	99 (0.92)	1,902 (0.99)	0.93 (0.76–1.14)	0.95 (0.77–1.17)	1.00
Gestational hypertension	145 (1.35)	4,278 (2.23)	0.60 (0.51–0.71)	0.64 (0.54–0.75)	<0.001
Gestational diabetes mellitus	801 (7.44)	16,731 (8.72)	0.84 (0.78–0.91)	0.96 (0.89–1.04)	1.00
Placenta previa	211 (1.96)	4,797 (2.50)	0.78 (0.68–0.90)	0.92 (0.80–1.06)	1.00
Abruptio placentae	21 (0.19)	474 (0.25)	0.79 (0.51–1.22)	0.82 (0.52–1.27)	1.00
Obstructed labor	798 (7.41)	15,572 (8.11)	0.91 (0.84–0.98)	0.82 (0.76–0.89)	<0.001
Preterm delivery	99 (0.92)	1,470 (0.77)	1.20 (0.98–1.47)	0.99 (0.80–1.22)	1.00
Perineal laceration	269 (2.50)	3,644 (1.90)	1.32 (1.17–1.50)	1.16 (1.02–1.32)	0.18

Obstetric hemorrhage 398 (3.69) 6,658 (3.47) 1.07 (0.96-1.18) 1.01 (0.91–1.12) 1.00

OR=Odds Ratio, CI=Confidence Interval.

^a Any obstetric complication was defined as a composite outcome, indicating the presence of at least one of the listed conditions. ORs and 95% CIs were estimated by logistic regression, adjusted for maternal age group, area, type of insurance, and adequacy of prenatal care, with Korean-born women as the reference group.

^b Holm adjustment was applied to the nine individual obstetric complications; the primary outcome of any obstetric complication was not included in the multiple-comparison adjustment.

Table 3. Odds of any obstetric complication among migrant compared with Korean-born women by maternal and healthcare characteristics in Korea, 2022

Variable	Crude OR (95% CI)	P for interaction	Adjusted OR ^a (95% CI)	P for interaction ^b
Overall	0.91 (0.87–0.95)		0.91 (0.87–0.95)	
Age group				
< 25	0.78 (0.68–0.89)		0.78 (0.68–0.90)	
25-29	0.85 (0.78–0.93)	0.005	0.86 (0.79–0.94)	0.01
30-34	0.93 (0.86–1.00)		0.92 (0.85–0.99)	
≥ 35	1.02 (0.93–1.11)		1.01 (0.92–1.10)	
Type of insurance				
NHI	0.92 (0.88–0.96)	0.006	0.91 (0.87–0.96)	0.01
MA	0.53 (0.36–0.78)		0.56 (0.38–0.82)	
Area				
Metropolitan	0.92 (0.87-0.98)	0.09	0.94 (0.88–0.99)	0.09
City and Rural	0.85 (0.79–0.92)		0.87 (0.81–0.93)	
Adequacy of prenatal care				
Adequate (≥9)	0.91 (0.87–0.95)	0.09	0.92 (0.87–0.96)	0.13
Inadequate (<9)	0.93 (0.81–1.05)		0.80 (0.68–0.95)	

OR=Odds Ratio, CI=Confidence Interval, NHI=National Health Insurance, MA=Medical Aid.

^a ORs and 95% CIs were estimated by logistic regression. Crude ORs are unadjusted. Adjusted ORs were adjusted for

maternal age group, area, type of insurance, and adequacy of prenatal care, excluding the stratification variable in each subgroup analysis, with Korean-born women as the reference group.

^b P for interaction tests whether the association between migrant status and any obstetric complication differs across levels of the subgroup variable.

Figure 1. Annual number and proportion of migrant women among deliveries in Korea, 2013–2022

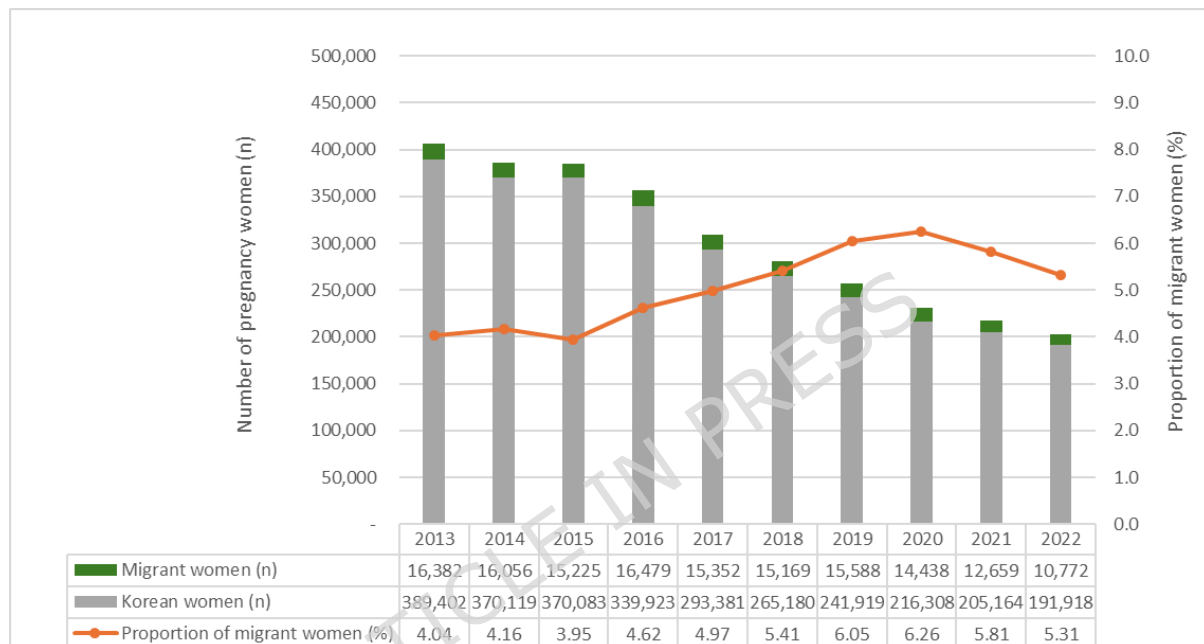


Figure legend: Bars show the annual number of deliveries to migrant women (green) and Korean-born women (grey), and the line shows the proportion (%) of deliveries to migrant women among all deliveries. Data were derived from nationwide National Health Insurance claims in Korea, 2013–2022.

Additional files

Additional file 1

File format: .docx

Title: Supplementary tables

Description: Supplementary Table 1 provides ICD-10 code definitions for obstetric

complications. Supplementary Table 2 presents subgroup analyses of obstetric complications according to prenatal care adequacy. Supplementary Table 3 presents the results of sensitivity analyses for any obstetric complication.

Additional file 2

File format: .docx

Title: STROBE checklist for cross-sectional studies

Description: Completed STROBE checklist for cross-sectional studies indicating where each reporting item is addressed in the manuscript.

ARTICLE IN PRESS

