

05. AI-based Evaluation of Level III Obstetric Care Access on Postpartum Complications in the United States

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BACKGROUND: Despite advances in obstetrics in the United States, postpartum healthcare remains a leading cause of maternal hospital readmission, morbidity, and death (such as postpartum sepsis and venous thromboembolism). Differences in access to healthcare, socioeconomic status, and underlying medical conditions all contribute. Understanding how these factors are linked to maternal risk is essential for improving prevention and healthcare delivery.

AIM: This study aims to understand the causal effect of geographic access to a level III obstetric hospital on postpartum complication patterns in the United States, using causal machine learning and publicly available health data. **METHOD:** We harvested data from 2,054 US counties across 37 states (2017-2019) using the Maternal Health Equity Linked dataset. With this, we analyzed the drive time to the nearest level III obstetric hospital, population size, the reporting accuracy of postpartum complication related health reports, and the demographic profile (race composition, CDC social vulnerability index) of a single county and its neighbors. GraphSAGE was used for explaining similarities in healthcare between counties (regional patterns), and DoubleML was used for ruling out confounding factors. Performance was assessed using leave-state-out cross-validation; area under the receiver operating characteristics (AUROC) for GraphSAGE and 95% confidence intervals were recorded for the DoubleML coefficients. **RESULTS:** The median drive time to a level III obstetric hospital was 67.5 minutes, with 34.9% meeting maternity-desert criteria (inadequate accessibility to sufficient care). GraphSAGE identified high-burden counties with an AUROC of 0.815 (95% CI: 0.785–0.844). The causal analysis showed that after accounting for social vulnerability and demographic factors, doubling a county's drive time to Level III obstetric care led to a 2.8% increase in the inpatient puerperal-complication rate (95% CI: 1.2–4.4%, $p = 0.001$), robust to excluding Level III host counties. This risk was amplified in rural counties (+6.4%, 95% CI: 2.0–10.9%, $p = 0.004$). **CONCLUSION:** Drive time to the nearest level III obstetric facility has a measurable causal effect on county-level postpartum complication rates. AI-based modeling delineated key geographic and social patterns associated with maternal health outcomes, helping to understand disparities in postpartum healthcare access. Future studies can incorporate patient-level clinical data, such as maternal comorbidities, to personalize postpartum healthcare accessibility (e.g., targeted follow-up, telehealth).

Key Words: Puerperal Disorders, Machine Learning, Health Services Accessibility, Maternal Health, Postpartum Period (Source: MeSH-NLM).

