

SPECIFIC AIMS

Maternal health is a concerning problem in the United States (U.S.). When compared to other high income countries, U.S. maternal death ratios are more than double, with 17.4 deaths per 100,000 live births (Declercq and Zephyrin, 2020), with over half of all deaths (52%) occurring after the day of delivery (up to one year). While temporal mortality trends, when adjusted for changes in maternal death surveillance, indicate minimal increases from 2000 to present (Joseph et al., 2021), rates of mortality for at-risk populations are magnitudes higher than the overall population. For example, maternal death ratios are 2.5 times likely for Black women, three times as likely for Hispanic women, and over twice as likely for Indian/Alaska Native women (Heck et al., 2021, Huang et al., 2022). Issues of rurality, health system shortages that impact prenatal, delivery and postpartum care access, as well as high levels of poverty, affect the ability to address these complex issues - which span economic, sociological, and political factors (March of Dimes, 2022).

The causal mechanisms related to maternal and infant health are complex. While direct impacts as a result of delivery (severe bleeding, infections) are well established (Macdorman et al., 2016), a plethora of secondary and tertiary variables have long term implications with maternal and infant health, including (but not limited to) access to healthcare services, health insurance guidelines, age, comorbidities (e.g., high blood pressure, diabetes, obesity, cancer, etc.), economic status, race/ethnicity, and geography. The proposed case study will address these critical gaps in research, by constructing a multi-year modeling strategy, informed by stakeholder engagement, to assess the effects of these wide-ranging sets of variables on maternal and infant health. Building upon previous research methods (Seamon et al., 2022), the team will model the spatiotemporal variations of variable influence on known maternal morbidity and infant health outcomes, integrating outcomes into technological tool sets which can be used by local community organization, governmental health entities, hospitals, and other policymakers within the state of Idaho (<https://modelingidahohhealth.org>).

Aim 1. Model a wide set of spatiotemporal variables which impact maternal and infant birth health factors, including disparities in access to obstetric services for underserved communities.

A. With stakeholder input, assemble a wide range of maternal morbidity factors from 2015 to 2022 for the assigned study area (state of Idaho), and perform spatial downscaling modeling techniques to generate statistically representative outcomes at the U.S. County level.

B. Using the assembled data, construct spatially explicit modeling outputs to evaluate how factors impact 1) maternal morbidity, 2) infant health (low birthweight, premature births), and 3) long term (3-5 year) women's health.

Computational modeling will be conducted to both 1) predict and 2) evaluate feature variation across geography and time for the state of Idaho (at a county level). A set of modeling algorithms (spatially weighted regression, geographically weighted random forest, geographically weighted neural networks) will be run. Technology dashboards and an application programming interface (API) will also be constructed. Model development will integrate closely with community engagement workshops, outlined in Aim 2.

Aim 2. Engage with stakeholders to better understand the factors which impact maternal and infant health.

A. Conduct an initial series of community workshops to elicit input and recommendations on maternal health needs and outcomes.

B. Engage with Idaho's department of health and welfare (IDHW) to describe initial model results for iterative modification and updating.

Community organizations will be surveyed regarding their goals and needs regarding maternal and infant health. Based on survey results and initial data analysis, a set of facilitated workshops (4) will be conducted across the state of Idaho. The results of the workshops will be evaluated and used to formulate key variables to assess, including availability of perinatal and postnatal services, policy impeding or facilitating access to early and adequate care, geographic barriers to care access, and legislative factors impacting access to care. After initial model development, results and technological tool construction will be presented to the state of Idaho's department of health and welfare (IDHW) for final input and review. The input gained will be used to finalize models and toolsets.