Identification of Spatiotemporal Associations of Social Determinants of Health on the Incidence of Adverse Birth Outcomes in Louisiana

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INTRODUCTION

- Louisiana is ranked last for maternal health outcomes among all fifty states and Puerto Rico. [1]
- Currently, it is theorized that Social Determinants of Health (SDoH) are a major factor influencing the incidence of adverse birth outcomes (ABOs).
- Previous works have identified SDoH associated with the incidence of ABOs in Louisiana.[2,3]
- Important factors include parish-level racial and ethnic composition, and economic attainment. [2]
- These works, however, have been criticized for limiting the amount of SDoH included in their modelling process.
- Novel spatial data analysis techniques have been developed [4] which identify patterns of spatial correlation have been developed, but not yet applied to ABOs in Louisiana.

AIM

- Corroborate previous associations of the effects of SDoH on the incidence of ABOs in Louisiana.
- Identify changes in the incidence of ABOs across time and space within Louisiana.
- Identify spatial clusters of high or low ABO outcome correlation in Louisiana.

METHODS

- We amassed ABO data from the Louisiana Department of Health for Preterm Birth (PTB) and Low Birth Weight (LBW) at the parish-level from 2009 to 2020.
- We also acquired a large SDoH data set from the Agency of Healthcare Research and Quality. for the same time frame.
- We calculated principal components for our SDoH dataset.
- We fit two Bayesian linear mixed-effect models for PTB and LBW, with year and parish as random effects and principal components 1-9 as fixed effects.
- We calculated Local Moran's I for all parishes.

RESULTS

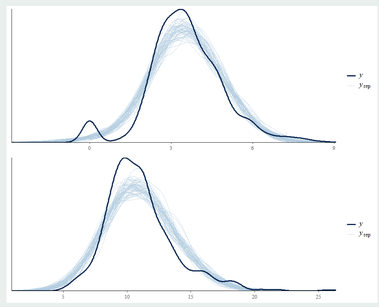

Figure 1. Posterior predicted distributions of LBW and PTB vs. true distributions.

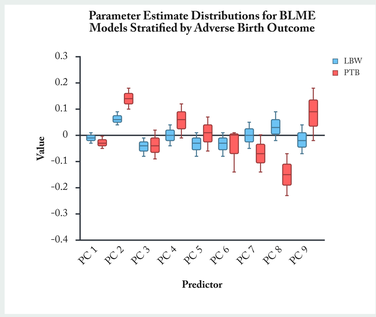

Figure 2. Box Plot of parameter estimates for the first 9 principal components.

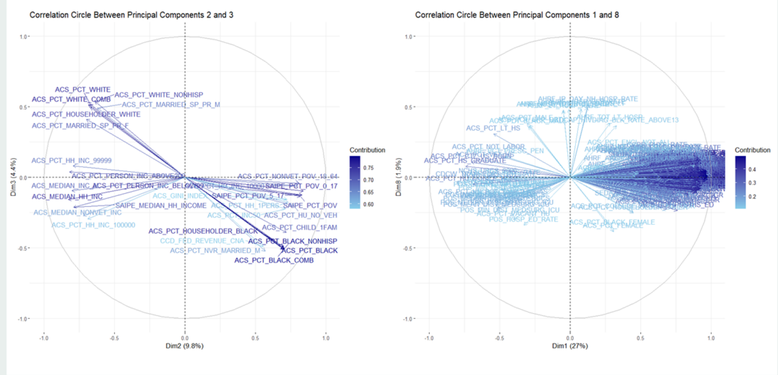

Figure 3. Correlation circles of principal component 2 vs. 3 and 1 vs. 8.

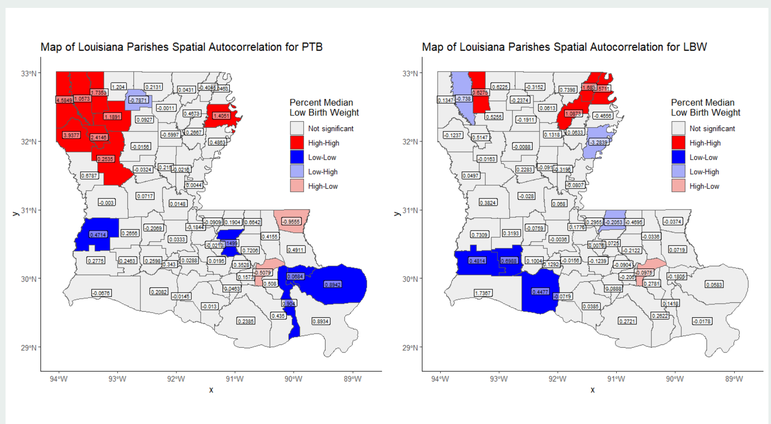

Figure 4. Map of Louisiana colored by clusters as calculated by Local Moran's I.

RESULTS CONT.

- We assessed goodness of fit by comparing our model's predicted distribution with the true distribution. (Fig. 1)
- We identified several significant effects related to parish and SDoH-derived principal components (Fig. 2)
- The predictive models had Bayesian R2 of 52.5% and 46.1% for LBW and PTB, respectively.
- No significant effects were identified across years.
- We used correlation circles to identify which variables impacted the heterogeneity between principal components which were important for the prediction of ABOs. (Fig. 3)
- We identified several clusters of spatially correlated parishes in terms of ABO incidence. (Fig. 4)

DISCUSSION

- Our models had reasonable goodness of fit as corroborated by comparison of the posterior predicted distribution and the Bayesian R^2 metrics.
- The statistically significant parameters we estimated suggest correlative associations between space, racial and ethnic composition, economic attainment, and the incidence of both LBW and PTB.
- For PTB specifically, our models also suggest population density and healthcare usage as important predictive factors.
- We identify no associations between year and te incidence of ABOs in Louisiana.
- We identify several clusters of parishes in Louisiana which are correlated in terms of ABOs.

CONCLUSION

- Our study's analysis validates previous studies" associations of SDoH with ABOs.
- We also identify spatial associations and clusters of high and low ABO incidence in Louisiana.
- We find no change of ABO incidence across time, suggesting ABO incidence in Louisiana has not significantly worsened or improved.

ACKNOWLEDGEMENTS

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LITERATURE

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Code and Supplemental Figures

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