Spatiotemporal Variation of Low Birth Weight in Texas, 2006-2016

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INTRODUCTION

- Understanding geographic patterns of health outcomes such as low birth weight (LBW) can help identify community-level risk factors and target prevention efforts.
- LBW shows poor year-to-year consistency in small geographic areas, whereas other birth-related indicators, such as smoking during pregnancy, show high year-to-year correlation.
- This suggests that LBW is either not subject to geospatial influence or that the relationship between LBW, time, and place may be more complex than assumed.

METHODS

- This study aimed to test whether groups of ZIP codes in Texas had distinct temporal patterns of LBW across eleven years of data (2006-2016), in comparison to smoking during pregnancy, using the following methods:
- Geospatial weighting to explore spatial versus aspatial clustering
- K-Means Clustering & K-Means Longitudinal Models
- Latent Profile Analysis
- Latent Growth Mixture Model
- Bayesian Spatial and Spatio-temporal Models

RESULTS

Table 1. Year-to-year correlations

	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
LBW	0.42	0.45	0.38	0.40	0.38	0.35	0.41	0.31	0.38	0.35
smoking	0.93	0.93	0.92	0.93	0.93	0.92	0.91	0.92	0.91	0.90

p values < 0.001

Figure 1. Year-to-Year Correlation, 2006-2016

a. LBW b. Smoking during Pregnancy

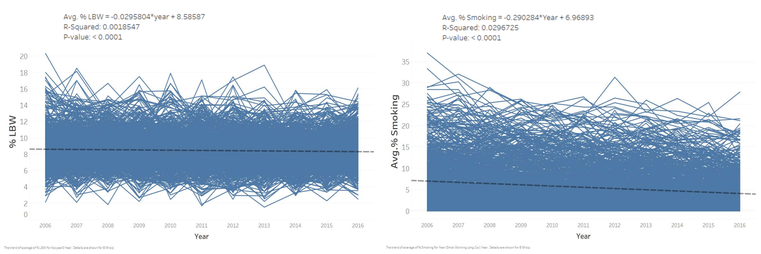
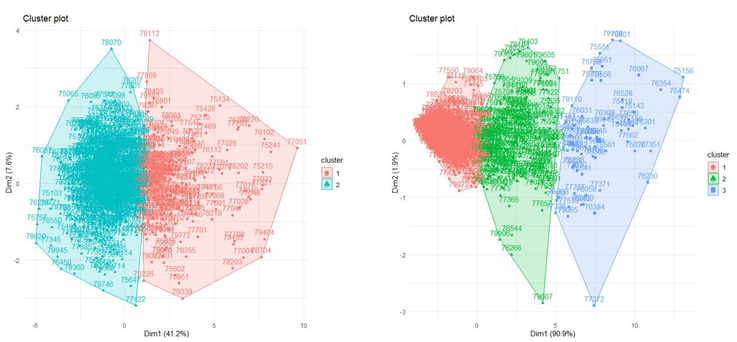


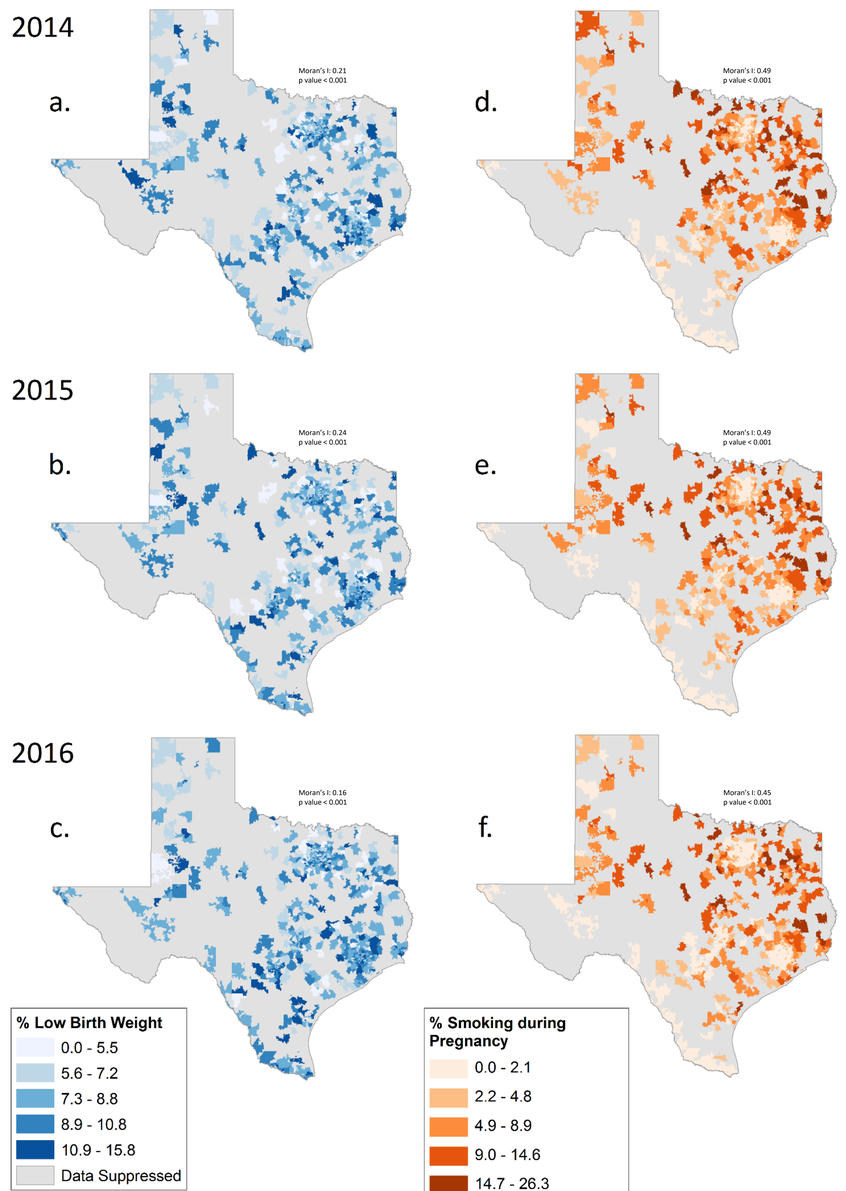
Figure 2. K-Means Clustering with Spatial Correction

a. LBW b. Smoking during Pregnancy



Not all birth outcome data show **time-space dependent relationships**, calling into question their use as **place-based metrics of health**.

Figure 3. Percent of live births by ZCTA, 2014 – 2016, for Low Birth Weight (a – c) and Smoking during Pregnancy (d – f)



RESULTS

Figure 4. Latent Profile Analysis

a. LBW b. Smoking during Pregnancy

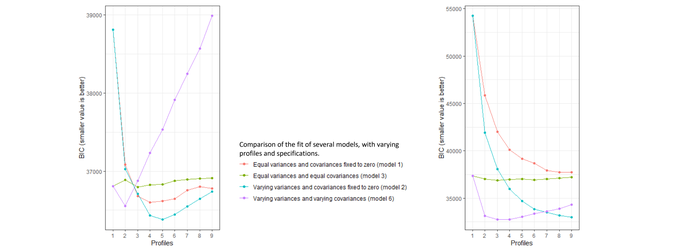


Figure 5. Latent Growth Mixture Model

a. LBW b. Smoking during Pregnancy

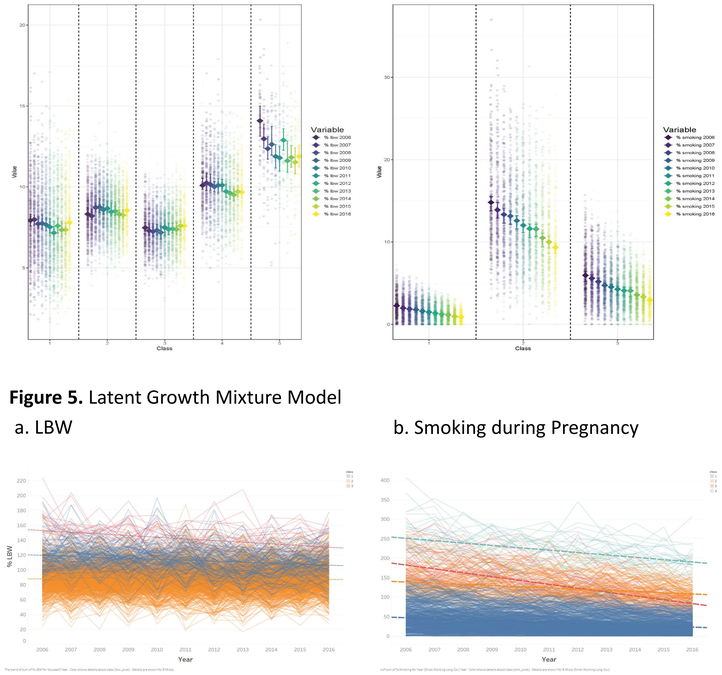


Table 2. Bayesian Spatial and Spatio-temporal Models

Model	Components	DIC	Effective number of parameters
1. Spatial v_i and non-spatial v_i random effects	$\alpha_0 + v_i + v_i$	37184.42	724
2. Uncorrelated time effects φ_{2t}	$\alpha_0 + v_i + v_i + \varphi_{2t}$	37147.38	729
3. Space-time interaction ψ_{it}	$\alpha_0 + v_i + v_i + \varphi_{2t} + \psi_{it}$	37149.52	736

α_0 represents the intercept or grand mean

DISCUSSION

- These findings did not find a time-space relationship in low birth weight and suggest that a single year of data should not be used to inform place-based policies aimed at reducing LBW.
- Additional research should incorporate co-variates, such as smoking during pregnancy, which may impact spatial-temporal relationships in low birth weight.
- Future research of other birth outcome data, such as preterm birth, should also consider spatial-temporal variation and trends.

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