Using Area-based Exposures to Evaluate the Relationship Between Maternal Stress and Birth Outcomes: Analysis of South Carolina PRAMS Data

Stephen Nkansah-Amankra, PhD, MPH, MA[1],Kathryn J. Luchok, PhD[2], James R. Hussey, PhD[3]

[1]University of Northern Colorado/Colorado School of Public Health, Greeley
[2,3]Director, South Carolina Access Initiative/Arnold School of Public Health, University of South Carolina, Columbia

137th American Public Health Association Annual Conference
November 6-11, 2009

November 9, 2009

Presenter Disclosures

Stephen Nkansah-Amankra, PhD, MPH, MA,
Kathryn J. Luchok, PhD,
James R. Hussey, PhD

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose

Purpose

- To evaluate relationships among area-based exposures, maternal-level factors and birth outcomes (low birth weight-LBW, preterm births-PTB)

Research background

- Intervention efforts to reduce low birth weight (LBW) and preterm births (PTB) in the United States have had limited success, partly due to over-reliance on individual level programs that do not consider contexts affecting maternal and child health outcomes.

Birth Outcomes

- LBW, defined as an infant with weight less than 2,500 grams and
- PTB, defined as a child born before 37 weeks of completed gestation
- These are major contributors to infant and neonatal morbidity, mortality and racial disparities in health outcomes across population groups in the United States.
- Economic and social costs

Stress and neighborhood exposures

Background

- Some investigators believe that the differences in response to environmental stresses and adequacy of social resources available to various racial groups are the main mediating routes by which stress-effects differentially leads to adverse birth outcomes

Limitations: Previous studies

- Relationship between area-based exposures and birth outcomes have been mixed.
- Limited number of maternal level covariates from the birth certificate data
- Multilevel clustering of mothers and the areas of residences are not accounted for.
- Inability to evaluate the relative contributions of different stresses to LBW or PTB.

Methods

- The individual-level data for the study came from the South Carolina PRAMS (2000-2005).
- Area-based exposures were taken from the SC census data (2000).
- The overall response rate for PRAMS averaged at 72%.

Variables

- Outcome variables:
  - LBW,
  - PTB
- Independent Variables
  - Maternal-level characteristics (stress, income, age, education, race)
  - Neighborhood level factors (150% below federal poverty, % of African-American population, household crowding, low education)

Statistical Analysis

- Series of statistical models were developed to assess the relationships among area-based exposures, maternal factors and the main outcomes.
- Interaction models were tested with stress (emotional, financial, spousal, and traumatic) and neighborhood contexts.
- We used SAS Proc GLIMMIX (SAS ver 9.1.3)

Sample

- The two racial groups- African-American (≈48%) and Whites (≈52%) dominate the entire population giving birth in the state from 2000-2003. During this period, the weighted prevalence of low birth weight for African-American and White infants was 13.2% and 6.5% respectively.
- The weighted prevalence of preterm delivery was 14.2% for African-American children and 8.9% for White infants born in South Carolina.

Results

- Overall, more than 63% of weighted African-American mothers reported trauma stress and almost 67% of weighted White mothers reported financial stress.
- More than 56% of the weighted sample lived in a high poverty area (>20% of census tract residents with income below 150% federal poverty line), and almost 47% of mothers were resident in the middle quartile of neighborhood low education

Results: Descriptive Findings

- Mothers reporting emotional, financial, spousal and traumatic stresses were significantly at higher risks of having low birth weight and to some extent preterm deliveries.
- With adjustment for maternal race, risks associated with stress (emotional, spousal) and LBW were considerably reduced, however the risk associated with financial stress was increased slightly.

Results

- Almost all the risks associated with neighborhood contexts and low birth weight or PTD were eliminated when we included maternal race in the models.

Summary of major findings

❖:

- Area-based exposures on birth outcomes showed mothers in poor neighborhoods were at increased risks of LBW.
- Maternal stresses increased risks of LBW or PTD.

Summary

- For example area-based high poverty, predominantly African-American census tracts, low education categories and household crowding (census tract with 3.8-7.71% residents) significantly associated with LBW plausibly through plausible mediating influences of maternal stress.

Summary

- The relationship between maternal stress and LBW or PTB was modified by neighborhood contexts in that mothers living in the more advantaged census tracts were relatively at a lower risk compared with residents in predominantly African-American census tracts.

Discussion

- Most advantaged neighborhoods are associated with effective coping resources, to minimize stress effects.
- Maternal race as a mediator (not to be adjusted for) vs. being a true confounder (to be adjusted for).
- Most likely, stress acts as a partial mediator of the relationship between area-based contexts and birth outcomes

Limitations

- The census tracts used as proxy measures of area-based contexts and may not represent the actual perception of mothers' spatial and social boundaries.
- The length of time respondents have been living in census tracts
- The PRAMS survey only collected data from women with live births.
- Using life event inventories as a measure of maternal stress is likely to lead to misclassification.

Strengths

- Use of multilevel analysis to simultaneously model individual and area-based contexts to determine odds of adverse birth outcomes.

- The relatively large sample size provided adequate statistical power for sub-group analyses.

Conclusion

- The association of maternal stresses was independent of maternal-level covariates, but related to neighborhood contexts.
- Study showed that different area-based exposures contributing to maternal stresses have a more significant impact on LBW than on PT.
- Life event stresses and area-based resources may be important determinants of prenatal health before, during pregnancy and postpartum periods.

Acknowledgement

- South Carolina Department of Health and Environment for providing and geocoding the PRAMS data to be linked with the census 2000 data.

Questions or comments