A multiple outcome analysis on the effects of smoking and stress on LBW, preterm, and SGA births

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Statement of problem and rationale

- LBW, SGA and preterm often viewed as important indicators of population health
- They are of public health importance because of their strong relationship with infant morbidity and mortality
- In US, rates of these outcomes are higher than in other developed countries; SC rates higher than average

Epidemiological and statistical issues

- Smoking and stress may induce fetal hypoxia
- It is plausible that stress could modify the effect of smoking on LBW, preterm, and SGA

Epidemiological and statistical issues

- Important to investigate birthweight and gestational age (GA) simultaneously in order to effectively plan perinatal interventions (Villar et al., 1983)
- But LBW, preterm and SGA are correlated outcomes, so appropriate modeling is needed
- Appropriate modeling of these outcomes in single analysis while taking into account correlations among them using generalized estimating equations (GEE)

Purpose and research question

- Purpose
  - Assess interaction effects of smoking and stress on LBW, SGA and preterm in a model that considers all these outcomes simultaneously using GEE

Purpose and research question

- Research question
  - Is the association between smoking and adverse pregnancy outcomes *(LBW, preterm, SGA)* stronger among those women experiencing stress in each type category *(partner-associated, traumatic, financial, emotional)* than among those women experiencing no stress?

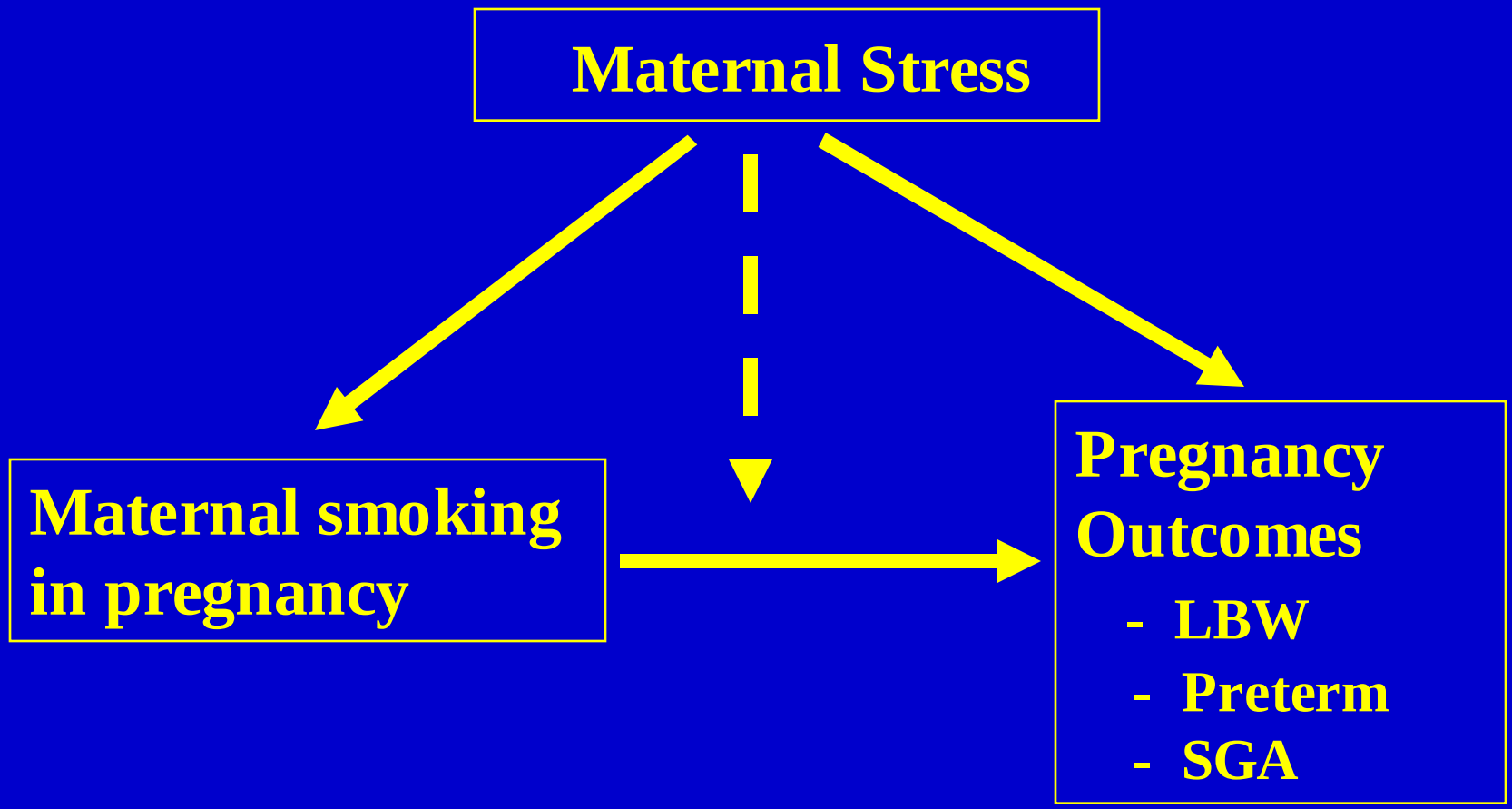

Fig. 1. The hypothetical causal model of the effect of maternal smoking and stress on pregnancy outcomes. A solid arrow indicates a causal relationship; a broken arrow indicates effect modification.

Methodology
Data source and study design

- Pregnancy Risk Assessment Monitoring System (PRAMS) survey (1995 - 1999; Phase III) - systematic stratified sampling of 2,100 SC mothers delivering live births per year
- Excluded multiple births,
  race other than black and white,
  missing GA or GA <20 weeks or >44 weeks,
  implausible birth weight for GA,
  missing smoking status
- n = 6,404 (weighted n = 205,408)

Definition of Variables

Dependent Variables

A. LBW baby - live born infant weighing < 2500 grams

B. Preterm baby - live born infant < 37 completed weeks gestation

C. SGA baby - live born infant < 10^{th} percentile of birth weight for gestational age by gender and race (Alexander et al., 1999)

Independent variables

A. Mother's smoking status

- Mother's smoking status assessment

  1) 3 months before pregnancy
  2) last 3 months of pregnancy

- Three categories of mother's smoking status

  1) Non-smoker
  2) Smoking 3 months before pregnancy only
  3) Smoking last 3 months of pregnancy irrespective of smoking 3 months before pregnancy

Independent variables

B. Mother's stress 12 months before delivery

- Based on 13 stressors
- Types of stress
  1) Partner-associated
  2) Traumatic
  3) Financial
  4) Emotional
- Definition of types of stress
  - presence or absence
- Types of stress investigated separately

Covariates

Maternal age
Maternal BMI
Alcohol consumption
Maternal education
Maternal weight gain
Marital status
Parity
Adequacy of prenatal care
Previous LBW status
Maternal race

Statistical analysis

- SUDAAN - accounts for weights, complex sampling strategy and correlated observations
- PROC MULTILOG - fit logistic regression model to the 3 binary dependent variables through GEE model-fitting method

Results

A. Mother's smoking

74% mothers were non-smokers
12% smoked three months before pregnancy only
0.1% smoked during last three months of pregnancy only
14% smoked for both periods

Results

B. Mother's stress 12 months before delivery

- **Types of stress**

42% had *partner-related* stress
20% had *traumatic* stress
58% had *financial* stress
40% had *emotional* stress

Results

- There was a possible interaction effect between smoking and traumatic stress for LBW, but not for preterm and SGA

Results

- Smoking during the last three months of pregnancy was positively associated with LBW whether traumatic stress was present or absent

- Smoking before pregnancy had a positive association with LBW only

  in the presence of traumatic stress

  (OR=1.62, 95%CI=1.05-2.49)

  but not in the absence of traumatic stress

  (OR=0.93, 95%CI=0.71-1.22)

Results

- No interaction effect was found for the associations with SGA and preterm
- Adjusted for maternal education, maternal race, previous LBW

Discussion

- GEE analysis of adverse pregnancy outcomes simultaneously showed possible interaction effect of smoking and traumatic stress on LBW but not on preterm and SGA

- Smoking before pregnancy more detrimental in mothers who had experienced traumatic stress

Discussion

- This information could lead to more effective smoking cessation programs for women before and during pregnancy

- Study results were more reliable compared to other studies investigating these outcomes simultaneously without taking correlations into account