Conceptualization and Assessment of Prenatal Maternal Stress in Diverse Women: A Structural Equation Modeling Approach

Ceylan Cizmeli[1], Marci Lobel[1], and Audrey Saftlas[2]

[1]*Department of Psychology, Stony Brook University*

[2]*Department of Epidemiology, University of Iowa*

There is converging evidence both from animal and human studies that high stress during pregnancy is a risk factor for adverse birth outcomes such as preterm delivery and low birthweight (e.g., Beydoun & Saftlas, 2008). The most consistent and compelling evidence about the deleterious effects of stress is offered by studies employing a multidimensional measure of prenatal maternal stress (Lobel, Hamilton, & Cannella, 2008). Multivariate definition comprised of stress stimuli, responses, and appraisals is conceptually powerful but operationalizing this construct has proved challenging to researchers. Furthermore, most studies employing this multivariate approach have used small samples. As a result, the validity of this approach among diverse women is unknown.

We conducted a population-based study to examine the validity of a theoretically-founded, multivariate operational definition of prenatal maternal stress (PNMS). The study sample consisted of 2,709 female residents of Black Hawk, Johnson, Polk and Scott counties in Iowa who delivered a singleton live born infant between May 1, 2002 and June 30, 2005. Women were excluded if they (a) were under the age of 18 at the time of delivery, (b) did not speak English, or (c) had Type 1 or Type 2 diabetes mellitus, systemic lupus, or chronic renal disease. Eligible participants were identified from Iowa birth certificate files. Telephone contact was attempted within 3 to 6 months following delivery. Of the 7,202 potential respondents

identified from birth certificates, 4,250 (59 %) women were reached by phone. Of these, 12.9 % (*N* =548) were ineligible for participation. Over 77 % (*N* =2,866) of the 3,702 eligible women agreed to participate, and of these, 94.5 % (*N* =2,709) completed the computer-assisted telephone interview. Data were collected via Computer-Assisted Telephone Interviews conducted by trained, experienced female interviewers.

Based on prior research and theorizing about prenatal stress (e.g. Lobel, 1994), we conceptualized PNMS as a latent variable represented by stress stimuli (number of major life events), stressful appraisals (life events distress, perceived stress, pregnancy-specific distress), and emotional responses to stress (state anxiety). Prenatal life events were assessed with the Prenatal Life Events Scale adapted from previous research with pregnant women (PLES; Lobel, 1996). Two indices were computed from the life events instrument: (1) number of life events during pregnancy, and (2) a mean life event distress score. The mean life event distress score was obtained by summing distress ratings and dividing by the total number of life events reported. Thus, the stressfulness of life events was independent of the number of events experienced. Participants who reported no events were assigned an event distress score of zero. Perceived stress was measured by an abbreviated version of the Perceived Stress Scale (PSS; Cohen & Williamson, 1988). The Revised Prenatal Distress Questionnaire (NuPDQ; Lobel et al., 2008) and the Anxiety subscale of the State Trait Personality Inventory (STPI ; Spielberger, 1995) were used to assess pregnancy-related distress, and state anxiety respectively.

We used structural equation modeling to analyze the data. First, we tested the fit of the hypothesized measurement model through Confirmatory Factor Analysis (CFA). The Chi-square, Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) were used to evaluate model fit (Hu & Bentler, 1999). A non-significant Chi-square value, a CFI

value greater than .95, and an RMSEA value less than .06 with a non-significant close fit test result were used as indicators of good model fit. All indices suggested that the hypothesized multivariate model of PNMS fit well, χ^2 (3) = 5.239, p = .155; CFI = .99; RMSEA= .02 (90 % CI= .00-.04; PClose = .99). Next we evaluated whether this model is appropriate for various groups of women. Using structural equation modeling, we examined the multigroup equivalence of the hypothesized model of PNMS across marital status, employment, education, income, ethnicity, age, gravidity, parity, and pregnancy intendedness. As hypothesized, the model exhibited equivalence across all groups, confirming the validity of this multivariate approach among diverse groups. We also examined whether particular elements of prenatal maternal stress are associated with psychosocial factors such as pregnancy intendedness and structural variables such as socioeconomic status and ethnicity. Using structural equation modeling, we found that younger women and those with poor to low income experienced more life events than older women and those with moderate-to-high income, whereas single women had higher levels of life event distress relative to partnered women. Moreover, higher levels of perceived stress were observed among White, multiparous, moderate-to-high income women and those with intended pregnancies relative to their comparison groups. These findings underscore the possibility that pregnancy may be particularly stressful for women with greater commitment to motherhood.

In conclusion, our findings indicate that multivariate approaches to defining PNMS are valid for diverse groups of women and suggest that these approaches can be particularly useful in population-based studies to uncover differences in degrees and types of stress for pregnant women of various backgrounds and psychosocial characteristics for future prevention and intervention programs.