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Ecological contributions to maternal-infant functioning: Differences between rural and urban family contexts

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Abstract

Aims: This study considered urban-rural differences in maternal-infant interactions (sensitivity/responsiveness and synchrony/reciprocity), infant temperament, and parenting stress, for samples similar in socioeconomic and racial composition. Higher sensitivity/responsiveness and synchrony/reciprocity were hypothesized for urban dyads, with more challenging temperament profiles predicted for rural infants. Rural mothers were expected to report more parenting-role stress.

Methods: Urban ($n = 68$; San Francisco Bay) and rural ($n = 120$; inland Pacific Northwest) mothers of infants provided ratings of temperament and parenting stress. Parental sensitivity/responsiveness and synchrony/reciprocity were coded from mother-infant play observations. Groups were compared via analyses of covariance.

Results: Urban mothers demonstrated significantly more sensitivity/responsiveness and synchrony/reciprocity compared to their rural counterparts. Rural mothers rated their infants significantly higher in negative affectivity and distress in response to limitations.

Conclusion: Although socioeconomic status is traditionally implicated in rural and urban population differences, our results suggest other factors (e.g., isolation, access to resources) warrant further exploration. Rural ecology appears to present risk that should be examined more closely in maternal-infant

interactions and child social-emotional development. The variability of risk within urban and rural classifications (e.g., suburban, inner-city) also requires consideration.

1 | INTRODUCTION

According to Bronfenbrenner's (1979) bioecological model, exchanges between the developing organism and its environment drive processes involved in human development. That is, developmental outcomes result from a multitude of factors at different levels of influence including individual or biological, interpersonal, and macro-level contextual systems, interactions within and among which play an important role (Bronfenbrenner, 1979; Bronfenbrenner & Evans, 2000). There are significant macro-level differences between urban and rural settings that can be expected to influence family functioning, including resource (e.g., healthcare) accessibility, economic characteristics, and sociocultural factors (Evans, 2006). Several distinctions in developmental pathways have been identified. For example, child-rearing practices were shown to vary between urban and rural families, such that rural parents demonstrated lower levels of warmth and responsiveness (Sheridan, Koziol, Clarke, Rispoli, & Coutts, 2014) as well as more intrusive parenting behavior (Bornstein et al., 2008). Rural residence was also linked with less-optimal developmental outcomes, such as lower levels of school readiness by kindergarten (Miller & Votruba-Drzal, 2013). Frameworks have been proposed to explain how and what parenting practices may account for effects of economic resources (i.e., poverty and wealth) on child development (Brody & Flor, 1998; Vernon-Feagans & Cox, 2013). However, differences among rural and urban communities with respect to parental functioning and early (i.e., infant) development have not been sufficiently investigated.

Socioeconomic status (SES) has often been treated as a proxy for rural status, yet the two constructs are not identical. Measures of SES typically comprise a combination of parental education level, employment status, occupational prestige, and total household income (Ensminger & Fotherill, 2003). Although these variables may vary between certain urban and rural populations, additional factors including remoteness, social isolation, ideologies of individualism and self-sufficiency, and limited access to supportive resources are likely more critical and unique to the rural-urban distinction (Hirsch & Cukrowicz, 2014). In addition, a child's primary social network is more likely to be kin-based in the rural context (Vernon-Feagans & Cox, 2013), likely influencing early development. Research is needed to examine differences between demographically similar samples across rural and urban settings, to identify effects of social ecology that are not a function of SES. Parental characteristics and the quality of interactions with the child play a pivotal role in the bioecological model, serving to encourage either a healthy developmental trajectory or one that deviates from typical or expected pathways.

Early childhood contextual factors confer risk and protection with respect to subsequent outcomes, and in infancy, the quality of interactions with parents represents a key contributor (Seifer et al., 2014). Sensitivity, often used interchangeably with "responsiveness," represents the most widely studied factor in parent-child interaction. Sensitivity refers to the parent's ability to accurately encode infants' cues, whereas responsiveness refers to appropriate reactions to such cues from the infant. Because appropriate responding represents the only observable marker for accurate encoding of infants' cues, these terms are combined for the purposes of this study. Research consistently demonstrates that higher levels of sensitivity and responsiveness in early interactions are critical to social-emotional development and adjustment, such as more secure attachment (McElwain & Booth-LaForce, 2006), lower temperamental fearfulness (Braungart-Rieker, Hill-Soderlund, & Karrass, 2010; Gartstein, Hancock, & Iverson, 2018), and advanced effortful control, a product of executive functioning that provides the foundation for flexible self-regulation (Kochanska, Murray, & Harlan, 2000). Maternal sensitivity was also shown to moderate the effects of depression on infant temperament characteristics (Parade, Armstrong, Dickstein, & Seifer, 2018), serving a protective function. Mother-infant interactional synchrony, or reciprocity, has also received significant empirical attention, with a related construct of dyadic coregulation examined on emotional and physiological levels in studies

of relational health (Welch, 2016). Beneficial effects of this coregulation are starting to be recognized with respect to improvements in both maternal sensitivity and infant behavioral outcomes, when incorporated into a dyad-oriented reciprocal intervention (i.e., each member invoking a positive state change in the other; Welch & Myers, 2016). Higher levels of synchrony/reciprocity predicted gains in infant attachment security, the development of empathy, and aspects of emerging self-regulation in infancy—a component of temperament underlying adaptive emotional and behavioral control, with stability noted across the lifespan (Feldman, 2007). Child temperament attributes, in turn, represent a key domain of social-emotional development.

According to the psychobiological model, temperament represents biologically based individual differences in reactivity and regulation (Rothbart & Derryberry, 1981), structurally defined in infancy by surgency/extraversion, negative affectivity, and orienting/regulation (Gartstein & Rothbart, 2003). Embedded within each of these overarching factors are fine-grained scales with distinct implications for later functioning. Within the surgency/extraversion construct, low-intensity pleasure, defined as enjoyment of calm activities, was associated with a protective effect (e.g., with respect to internalizing and externalizing problems) and high-intensity pleasure (i.e., enjoyment of more stimulating activities) with risk for externalizing difficulties (Gartstein, Putnam, & Rothbart, 2012). Negative affectivity distinctions also have implications, as a low threshold for frustration bodes risk for social deficits and conduct problems (Lengua, 2002), whereas fear/inhibition is linked to risk for anxiety (Muris, 2006). In infancy, soothability and orienting attention represent cornerstones of temperamental regulation, which becomes more advanced over the first year of life (Gartstein & Hancock, 2019; Gartstein, Putnam, Aron, & Rothbart, 2016). Temperamental regulation is conceptualized as attentionally based across the lifespan and becomes more flexible, affording greater volitional control due to executive attention and inhibitory control skills "coming online," later in childhood. Therefore, it is important to consider developmentally relevant, underlying fine-grained scales in addition to the three overarching temperament constructs. Despite notable developmental shift in manifestations of temperament in infancy, considerable stability has also been noted (e.g., Bornstein et al., 2015). Thus, early temperament is generally viewed as a set of traits, closely linked to later-appearing personality (Rothbart, 2012; Gartstein et al., 2016).

Individual differences in temperament as early as infancy predict children's adaptive functioning beyond other risk factors (Nigg, 2006) with low surgency/extraversion associated with later depression (Olino et al., 2011), high negative affectivity contributing to externalizing and internalizing behaviors in toddlerhood (Sidor, Fischer, & Cierpka, 2017), and low orienting/regulation predicting later-developing attentional problems (Sullivan et al., 2015). In contrast, higher infant surgency/extraversion has been predictive of more advanced effortful control over emotions and behavior (Gartstein, Slobodskaya, Putnam, & Kinsht, 2009; Komsi et al., 2006). Caregiver characteristics also play an important role in the transactions between the child and the environment captured by the bioecological model (Bronfenbrenner, 1979; Bronfenbrenner & Evans, 2000), with parenting stress critical among these characteristics.

Stress experienced in the parental role contributes to the developmental context, such as by impacting the quality of parent-child interactions (e.g., Mäntymaa et al., 2012). Higher levels of parenting stress can interfere with a caregiver's ability to respond appropriately to their child in difficult situations (Assel et al., 2002) and have been associated with infant temperament (e.g., lower surgency/extraversion; Gartstein & Hancock, 2019) as well as increased risk for internalizing and externalizing problems in childhood (Mäntymaa et al., 2012; Rodriguez, 2011). Whereas infant temperament is conceptualized as a trait-based construct subject to contextual shaping of development, parenting stress operationalizations are more consistent with a state-based model—for example, occurring as a function of transition to parenthood (Mihelic, Filus, & Morawaska, 2016). Parenting stress is influenced by factors beyond socioeconomic status that vary between urban and rural contexts, such as access to child-rearing resources (Conger, Conger, & Martin, 2010), social isolation, and stigma surrounding participation in counseling or mental healthcare services (Heidari, Gissandaner, & Silovsky, 2018). Therefore, parenting-role stress is important to consider insofar as it may influence developmentally important family processes and, subsequently, child outcomes, differing across community types (i.e., urban vs. rural).

1.1 | The present study

The bioecological model suggests that an interplay of infant temperament, parent-child interactions, and environmental factors is responsible for shaping child development. Although differences in parenting for urban and rural samples have been addressed (e.g., Sheridan et al., 2014; Vernon-Feagans & Cox, 2013), mother-infant interactions in particular have not been adequately examined. Stress associated with parenting has also not been compared for rural and urban families beyond that inferred from economic burden or single parenthood, which has traditionally been the focus of research on family functioning in rural communities (Brody & Flor, 1998; Miller & Votruba-Drzal, 2013; Robinson et al., 2017). Early differences in temperament between rural and urban samples have not been examined to date, despite their likely implications for diverging developmental pathways. This study aims to address these gaps in research by examining differences in observed parent-child interactions, infant temperament (in terms of overarching factors and at the fine-grained level), and parenting stress, between rural and urban samples similar in terms of SES and racial/ethnic composition.

It was hypothesized that greater levels of maternal sensitivity/responsiveness would be observed for urban dyads, replicating the findings of Sheridan et al. (2014), and that higher levels of synchrony/reciprocity would also emerge in urban dyads. In addition, we hypothesized that mothers of rural infants would report significantly more challenging infant temperament profiles, based on research indicating the role of parent-child interactions in temperament development (e.g., Gartstein et al., 2018; Parade, Armstrong, Dickstein, & Seifer, 2018) as well as studies that suggest that urban-rural differences in parenting (e.g., lack of available caregiver supports, different disciplinary strategies) occur as a function of factors beyond SES (Conger et al., 2010). We predicted that a more challenging profile for rural infants would include lower overall orienting/regulation and higher negative affectivity, with the fine-grained scales associated with each factor differing as well. With regard to surgency/extraversion, related analyses should be considered exploratory. Although higher levels have been shown as protective with respect to certain outcomes (e.g., effortful control; Gartstein et al., 2009), existing research also suggests higher surgency/extraversion represents greater reactivity, posing risk for externalizing difficulties (Martel, Gremillion, & Roberts, 2012). Lastly, we predicted that rural caregivers would report higher levels of parenting stress based on unique aspects of rural ecology expected to impact caregiver wellbeing (e.g., isolation, reduced access to mental health resources; Oddi, Murdock, Vadnais, Bridgett, & Gartstein, 2013; Vernon-Feagans & Cox, 2013).

2 | METHODS

2.1 | Participants

This project constituted a secondary analysis performed with existing data collected in the context of two independent studies, including an urban sample (n = 68) and a rural sample (n = 120) of mother-infant dyads. Prospective participants in both samples were informed that taking part in the study would entail providing information concerning infant temperament and their own stress in the parental role, as well as participating in laboratory observations of parent-infant interactions. The urban sample comprised dyads from the metropolitan San Francisco Bay area (population about 7.2 million; Bay Area Census, 2010) recruited through local birth announcements. For this cross-sectional study, families were contacted 2 weeks before their infants were eligible for participation (i.e., within 2 weeks of turning 6, 9, or 12 months old). Efforts were made to ensure an approximately equivalent distribution of age and gender. The rural sample originally consisted of 148 mother-infant dyads recruited through a universal prevention program (First Steps) before these services were provided and local birth announcements in two adjacent counties in the inland Pacific Northwest (Latah County, Idaho population about 39,300; Whitman County, Washington population about 49,000; United States Census Bureau, 2017a, 2017b). In this sample, infants were evaluated longitudinally, at 6, 8, 10, and 12 months of age, with assessments timed within about 2 weeks of each age. Both samples included only healthy, full-term

infants, and were predominantly Caucasian and of middle SES. There were no significant differences between the groups on race/ethnicity or SES indicators (Table 1). However, the San Francisco Bay area and the inland Northwest communities vary on widely used rurality measures, such as the Index of Relative Rurality (Waldorf & Kim, 2018) ranging from 0 (most urban) to 1 (most rural): San Francisco Bay area, California = 0.25; inland Northwest, Washington and Idaho = 0.53.

As the original rural data set was longitudinal, a cross-sectional data set was derived to match the age distribution of the urban data set. Independent observations were selected for 6- and 12-month evaluations. Rural dyads providing data at either 8 or 10 months were combined into a new 9-month data point to match the urban sample before all analyses, as a number of infants were assessed within 2 weeks of 9 months (m_{age} = 38.06 weeks, *SD* = 2.84 weeks), similar to the urban babies. That is, independent observations (i.e., nonoverlapping with those chosen for 6- and 12-month age groups) were selected so that mean age would most closely approximate that of the 9-month group in the urban sample (m_{age} = 38.64 weeks, *SD* = 1.93 weeks), with no significant differences detected (Table 1). Selection decisions were made in a manner that also ensured an equivalent gender distribution across the urban and rural samples (Table 1).

2.2 | Procedure and measures

The Infant Behavior Questionnaire-Revised (IBQ-R; Gartstein & Rothbart, 2003) was completed by mothers and collected at the time of the laboratory visit used to observe parent-child interactions. The IBQ-R is a 191-item parent-report measure, designed for use with infants between 3 and 12 months of age. Specific, observable behaviors indicative of infant temperament characteristics are rated on a 7-point Likert scale for frequency of occurrence within the past week (or 2 weeks for less-common events, e.g., encountering an unfamiliar adult). Factor analytic studies indicated three higher-order factors consisting of 14 scales as follows: (a) surgency/extraversion (73 items), including activity level, smiling and laughter, vocal reactivity, approach, high-intensity pleasure seeking, and perceptual sensitivity; (b) negative affectivity (59 items), which comprises fear (i.e., inhibition), distress in response to limitations, sadness, and falling reactivity (negative

TABLE 1 Sample demographics

Infant demographics		**Rural (%)**		**Urban (%)**
Caucasian		93.22		82.35
African American/Black		2.54		1.47
Asian/Asian American		2.54		8.82
Filipino		0.00		2.94
Hispanic Latino		1.69		4.41
Female		46.67		47.76
	Mean (*SD*)	**Range**	**Mean (*SD*)**	**Range**
Age (weeks) 6-month group	24.11 (1.48)	21-27	26.65 (0.99)	25-28
Age of 9-month group	38.06 (2.84)	33-41	38.64 (1.93)	33-41
Age of 12-month group	48.14 (0.85)	47-50	52.54 (1.89)	49-59
	Rural		**Urban**	
Maternal demographics	**Mean (*SD*)**	**Range**	**Mean (*SD*)**	**Range**
Age (years)*	28.71 (5.43)	20-42	35.91 (3.44)	28-45
Socioeconomic Status Index	38.46 (27.77)	15-90.33	37.29 (25.41)	15-97.16
Years of education	15.87 (2.36)	10-20	16.25 (1.89)	12-20

Note: Significant demographic difference is determined by two-tailed cutoffs.
*Groups differ at the $p < .01$ level.

loading); and (c) orienting/regulation (60 items), encompassing duration of orienting, soothability, cuddliness (i.e., affiliation), and low-intensity pleasure seeking.

The IBQ-R has consistently demonstrated adequate psychometric properties, including moderate agreement between primary and secondary caregivers, with Cronbach's α ranging from .70 to .96 (Gartstein & Rothbart, 2003; Parade & Leerkes, 2008). Construct validity has been reported, including agreement between parent-report and laboratory observation-derived indicators of temperament (Gartstein & Marmion, 2008) and links with underlying neurophysiology (electroencephalogram [EEG] indicators; LoBue, Coan, Thrasher, & DeLoache, 2011). Evidence also supports predictive validity of the IBQ-R—for example, that certain temperament profiles bode risk of early psychopathology (e.g., internalizing symptoms; Gartstein & Bateman, 2008; Gartstein et al., 2010). In both our samples, the higher-order factors of the IBQ-R (urban Cronbach's α = .83–.91, urban M_{α} = .88; rural Cronbach's α = .89–.93, rural M_{α} = .91) as well as each IBQ-R scale (urban Cronbach's α = .73–.90, urban M_{α} = .83; rural Cronbach's α = .76–.90, rural M_{α} = .82) produced satisfactory internal consistency indicators.

Parent-child interaction observations were video-recorded in the laboratory using a standardized observation protocol (Gartstein, Crawford, & Robertson, 2008; Gartstein et al., 2018; see coding scheme in Table 2). Dyadic exchanges were observed during free play, with mothers instructed to engage their infants in typical interactions for 2 minutes using a telephone toy. Ratings for sensitivity/responsiveness and synchrony/reciprocity, designed to serve as markers of dyadic processes that involve coordinated actions of caregivers and infants, were subsequently assigned on a 7-point Likert scale. Ratings were performed by trained coders who were blind to study hypotheses, and who demonstrated adequate interrater reliability in this study (ICC = .62–.98; M_{ICC} = .83).

The Parenting Stress Index (PSI; Abidin, 1995) is a parent-report measure of subjective stress associated with parenthood. For this investigation, the parent domains of Relationship (with co-parent), Competence, Depression, and Role Restriction were examined. The Relationship scale was developed to assess the perceived quality and security of the primary caregiver's relationship with their spouse or partner as it relates to co-parenting. The Competence domain represents one's sense of self-efficacy (e.g., knowledge, ability) within the parenting role. Items on the Depression scale assess symptoms experienced by the primary caregiver, relevant to a parent's emotional and physical availability to the

TABLE 2 Parent-child interaction coding scheme

	Codes/Descriptions		
Scales	**1**	**4**	**7**
Sensitivity/ Responsiveness	Extremely non-responsive/ sensitive: lacks genuine empathy and interest in infant. Parent does not a) initiate play; b) reinforce infant activities; c) draw infant into joint activity; d) give encouragement; e) allow infant independent activity; f) effectively extends infant activity	Moderately responsive/ sensitive: moderate empathy and interest in infant. Parent periodically a) initiates play b) reinforces infant activities; c) draws infant into joint activity; d) gives encouragement; e) allows infant independent activity; f) effectively extends infant activity	Extremely responsive/ sensitive: prompt, regular, genuine empathy and interest in infant. Parent consistently a) initiates play; b) reinforces infant activities; c) draws infant into joint activity; d) gives encouragement; e) allows infant independent activity; f) effectively extends infant activity
Synchrony/ Reciprocity	Extremely asynchronous/ non-reciprocal: a) low frequency of simultaneous movement; b) low tempo similarity; c) low coordination/smoothness	Moderately synchronous/ reciprocal: a) moderate frequency of simultaneous movement; b) moderate tempo similarity; c) moderate coordination/ smoothness	Extremely synchronous/ reciprocal: a) high frequency of simultaneous movement; b) high tempo similarity; c) high coordination/ smoothness

Note: Observations are coded on a Likert scale of 1-7. The above descriptions are used as anchors to guide coding, which uses whole numbers across the full range of seven possible ratings per scale.

child. The Role Restriction domain examines one's sense of how parenthood interferes with personal freedoms and other life roles. Parent-domain scales of the PSI have shown moderate-to-high internal consistency as well as test-retest reliability, with Cronbach's α ranging from .88 to .96 (Abidin, 1995), and have been linked with infant temperament (Gartstein & Hancock, 2019; Oddi et al., 2013). In our samples, the PSI parent-domain scales demonstrated acceptable internal consistency overall. The Competence and Depression scales yielded only moderate-to-acceptable scores in the urban sample whereas the others fell in an acceptable range (Cronbach's $\alpha = .63–.74$, $M_{\alpha} = .69$). Only PSI Depression yielded a moderate-to-acceptable score in the rural sample, whereas the other three scales were acceptable (Cronbach's $\alpha = .63–.77$, $M_{\alpha} = .72$).

Demographic information included occupational details used to compute the Revised Duncan Socioeconomic Index (TSEI2; Stevens & Featherman, 1981), a widely used indicator of occupational prestige. The average rankings across both samples were consistent with sales, administrative support staff, and service occupations. Information concerning educational attainment and maternal age was also obtained at enrollment.

2.3 | Statistical analysis

As considerable literature finds that temperament is characterized by age and sex differences (e.g., Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006; Gartstein & Rothbart, 2003), these variables are typically included as covariates when assessing temperament (e.g., when comparing culturally distinct groups; Kirchhoff, Desmarais, Putnam, & Gartstein, 2019). As such, these demographic variables were statistically controlled for in the present study. To determine additional appropriate covariates for urban-rural comparisons, bivariate correlations were calculated between demographic variables (i.e., maternal SES, years of education, age), infant temperament, PSI composites, sensitivity/responsiveness, and synchrony/reciprocity ratings (Table 3), constituting preliminary analyses.[1] Urban and rural samples were also compared on maternal demographics using independent-samples *t* tests to assist in interpreting (and assessing the generalizability of) results addressing our hypotheses. Differences in temperament, parent-child interactions, and parenting stress were assessed via analyses of covariance (ANCOVAs) to account for infant sex and age, and additional demographic factors emerging as influential in preliminary analyses, when evaluating differences based on community type (i.e., urban vs. rural residence). Follow-up comparisons of marginal means via independent-samples *t* tests were conducted to assess directionality of significant *F*-tests, with all analyses performed using the Statistical Package for the Social Sciences (SPSS) version 24.

3 | RESULTS

3.1 | Preliminary analyses

Maternal years of education and age were significantly correlated with several substantive variables (Table 3). However, differences between urban and rural means for SES and years of maternal education were nonsignificant ($p > .05$) despite considerable power (estimated at >.8 to detect both medium and large effect sizes in a two-tailed *t* test using G*Power estimation software). χ^2 tests comparing maternal race/ethnicity categories between groups were also nonsignificant ($\chi^2[4] = 8.97$, $p > .05$). In contrast, urban mothers were significantly older than rural mothers ($t\ [157] = -9.54$, $p < .01$). As maternal age was significantly correlated with variables of interest and different between urban and rural groups, it was included as a covariate in comparative analyses in addition to infant age and sex.

[1]Although infant sex and age were included as covariates due to this approach being "traditional" in the field, correlations between substantive variables and these covariates are also presented in Table 3.

TABLE 3 Correlations among select demographic and outcome variables

	SES	Maternal years of education	Maternal age	Infant age	Infant sex
Sensitivity/Responsiveness	.09	.14	.23*	.12	.02
Synchrony/Reciprocity	−.02	.13	.41*	.17**	.09
Surgency/Extraversion	**−.02**	**−.18****	**−.11**	**.14**	**−.16****
Activity	−.05	−.07	−.22*	.00	−.15**
Smiling and laughter	.07	−.19*	.00	−.05	−.07
High-intensity pleasure seeking	.01	−.04	.00	.08	−.20*
Perceptual sensitivity	.02	−.04	−.019	.07	−.11
Approach	−.11	−.11	−.12	.26*	−0.12
Vocal reactivity	−.02	−.23*	−.08	.19*	.00
Negative affectivity	**−.13**	**−.10**	**.02**	**.19****	**.02**
Fear	−.14	−.13	.13	.29**	.17**
Falling reactivity	−.04	.01	−.09	−.02	.00
Sadness	−.14	−.11	.07	.02	−.03
Distress to limitations	−.13	−.02	−.10	.18**	−.10
Orienting/Regulation	**−.01**	**−.07**	**−.10**	**−.27***	**.03**
Duration of orienting	−.04	−.06	−.20**	−.15**	.00
Low-intensity pleasure seeking	.02	−.13	−.07	−.28*	.09
Soothability	−.07	−.07	−.04	−.04	−.02
Cuddliness	.05	.08	.08	−.26*	.01
PSI total stress	−.24*	−.17**	.04	−.03	.07
PSI competence	−.21*	−.21*	−.06	.10	.09
PSI role restriction	−.23*	−.09	.05	−.05	.07
PSI relationship stress	−.13	−.09	.05	−.06	.04
PSI depression	−.19**	−.17**	.02	−.03	.04

Note: Temperament factors are presented in bold. Significance is determined by two-tailed cutoffs. To interpret directionality of correlations with infant sex, "male" was dummy coded as "1" and "female" "2." Therefore, negative correlations indicate higher variable scores when the infant was male.

Abbreviation: PSI, Parenting Stress Index; SES, socioeconomic status.

*Correlation is significant at the $p < .01$ level.

**Correlation is significant at the $p < .05$ level.

3.2 | Temperament, mother-infant interactions, and parenting stress

Table 4 provides results for ANCOVAs with respect to community (i.e., urban vs. rural residence), infant age, infant sex, and maternal age. Importantly, although four *F* statistics are displayed for each dependent variable, these values were calculated simultaneously as the result of a single analysis. As such, each *F* statistic represents the ratio of adjusted between- to within-group variance associated with each independent variable. In other words, these statistics reflect the unique effect of each variable while accounting for the influence of other variables in the model.

Negative affectivity differed significantly between groups, with infants from rural families reported to display more frequent expressions of negative emotion (rural $M = 3.37$, urban $M = 3.11$). On the subscale level, distress in response to limitations was also significantly higher in rural infants (rural $M = 4.11$, urban $M = 3.76$; Figure 1).

Both parent-child interaction dynamics differed significantly between urban and rural mother-infant dyads. Specifically, urban mothers displayed greater sensitivity/responsiveness (urban $M = 5.75$, rural $M = 5.27$) and their interactions with infants were characterized by higher levels of synchrony/reciprocity (urban $M = 5.50$, urban $M = 3.91$) compared to their rural counterparts (Figure 1).

TABLE 4 Analysis of covariance *F* values

	Infant age	Infant sex	Maternal age	Community
Sensitivity/Responsiveness	.81	.02	2.09	4.21*
Synchrony/Reciprocity	1.05	1.13	1.84	38.20**
Surgency/Extraversion	**4.45***	**4.29***	**1.74**	**.27**
Activity	.21	3.21***	5.89*	.15
Smiling and laughter	.37	.78	.56	2.27
High-intensity pleasure seeking	1.26	7.33**	.18	.01
Perceptual sensitivity	.50	3.15***	.21	.16
Approach	15.57**	1.74	4.57*	1.84
Vocal reactivity	8.33**	.07	.71	.00
Negative affectivity	**5.30***	**.06**	**.72**	**4.67***
Fear	14.54**	5.56*	2.05	2.91***
Falling reactivity	.08	.01	1.33	1.74
Sadness	.12	.08	.00	1.09
Distress to limitations	7.01**	1.68	.03	4.48*
Orienting/Regulation	**12.24***	**.17**	**2.28**	**2.82****
Duration of orienting	2.22	.08	4.91*	.53
Low-intensity pleasure seeking	18.11**	.97	.52	1.74
Soothability	.00	.06	.56	.39
Cuddliness	13.86**	.00	.02	3.87***
PSI total stress	.18	1.33	.43	.64
PSI competence	2.59	2.90***	1.43	.01
PSI role restriction	.64	.98	.35	.04
PSI relationship stress	1.37	.32	2.51	.47
PSI depression	.03	.34	.17	2.89***

Note: Temperament factors are presented in bold. Urban *Ns* = 63–66, and rural *Ns* = 110–116.
F statistics related to community (i.e., urban vs. rural residence status) are of primary interest, and *F* values for covariates are presented to reflect their respective contributions to the outcome variables.
Abbreviation: PSI, Parenting Stress Index.
*$p < .05$
**$p < .01$
***$p < .10$

Comparisons of parenting-role stress indicators did not reach statistical significance (Table 4), though a trend-level effect was observed for the depression scale (Figure 1). Posthoc power was estimated at >.8 to detect large effect sizes for ANCOVA analyses with our samples.

4 | DISCUSSION

This study investigated differences in infant temperament, parent-child interactions, and parenting stress between urban and rural families. Based on previous findings, it was hypothesized that rural parents would demonstrate less sensitivity/responsiveness and synchrony/reciprocity in interactions with their infants. Infant temperament in the first year of life was also predicted to differ between these two samples, with rural mothers reporting more challenging infant temperament profiles (e.g., characterized by higher scores on negative affectivity, lower scores on orienting/regulation). Lastly, it was expected that rural parents would report higher stress with respect to the parental role across multiple domains considered. Overall, differences were expected and are understood as a function of community type (rural vs. urban residence), and associated differences in social ecology, consistent with the bioecological model (Bronfenbrenner, 1979; Bronfenbrenner & Evans, 2000).

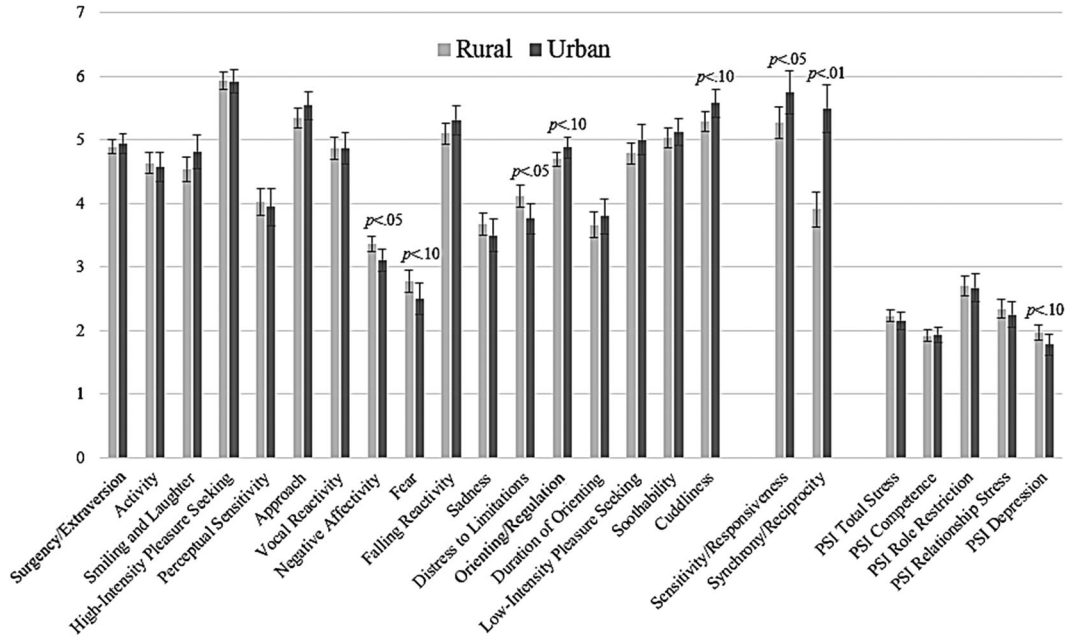

FIGURE 1 Marginal means for variables examined

Specifically, urban mothers demonstrated significantly greater sensitivity/responsiveness and synchrony/reciprocity in interactions with their infants compared to rural mothers, in line with previous research (e.g., Sheridan et al., 2014). These parenting-related effects observed in this study are likely culturally mediated, such that aspects of rural lifestyle and geography confer this risk. For example, access to mental and behavioral health services and child-rearing resources tends to be limited in more rurally situated communities (Conger et al., 2010; Evans, 2006), and social acceptability surrounding the receipt of such services, particularly where anonymity is lacking, may also translate to less-attentive or -mindful parenting (Robinson et al., 2017). To fully interpret the implications for social-emotional development, it is necessary to identify what distinctive characteristics or behaviors of rural caregivers contribute to less-responsive/-reciprocal parenting interactions, which should be undertaken in future research.

Importantly, hypotheses were in part supported with respect to temperament, insofar as rurally situated mothers reported more frequent expressions of negatively valenced emotion by their infants. At the subscale level, distress in response to limitations was significantly higher in the rural context, indicating that it was primarily anger/frustration that differentiated these infants. The latter is generally understood to reflect a more "challenging" child temperament profile, suggesting less-optimal social-emotional functioning. This difference between urban and rural children may be consequential as higher levels of frustration in infancy could increase risk for later attentional, emotional, social, and behavioral problems, particularly in the context of adverse circumstances (Sullivan et al., 2015), and should be examined further.

Another component of this investigation focused on parenting stress, involving pressures and challenges perceived in the parenting role. Contrary to predictions, no statistically significant differences emerged between urban and rural caregivers in this domain of functioning. This outcome may be a result of exposure to different, but potentially functionally equivalent, risk factors. Whereas urban settings generally bring more exposure or proximity to violent crime (Duhart, 2000), isolation can also be expected to translate into stressors for rural parents (Handley et al., 2012). Both groups may still be affected by the normative stressors of transitioning to parenthood. The equivalence could also be due in part to the lack of differences in SES and education between our samples. As urban and rural families often vary on these demographic attributes, our samples presented a

unique comparison opportunity, with the rural location remote in nature and including communities small in size, yet not economically disadvantaged (Latah County, Idaho median household income about $42,100; Whitman County, Washington median household income about $38,600; Data USA, 2016a, 2016b). Our sample was less reflective of poverty, single parenthood, and other risk factors that are traditionally identified as contributing to less-adaptive family functioning and social-emotional outcomes in rural children (e.g., Brody & Flor, 1998; Vernon-Feagans & Cox, 2013).

The only significant demographic difference observed between the urban and rural samples in this study was maternal age. On average, urban mothers were 7 years older than rural mothers. This demographic indicator was included as a covariate, and several effects diminished to nonsignificance after controlling for the variance associated with maternal age. This pattern of results suggests maternal age effects may be understudied with respect to parenting. Older mothers may demonstrate greater emotional preparedness for parenthood due to maturity and life experience (McMahon et al., 2011), which could, in turn, contribute to greater partner involvement in child-rearing. Older mothers also tend to return to work later after childbirth across Western cultures (Meggiolaro & Ongaro, 2013), potentially providing greater opportunity for bonding with the infant, in turn facilitating secure familial attachments and adaptive child temperament profiles (Welch & Myers, 2016). Accumulation of wealth and non-wealth resources (e.g., social contacts, support) by the time of childbearing may also be protective for mothers of more advanced age.

4.1 | Limitations

Despite their important contribution, our findings must be considered in the context of several limitations. First, using not only a larger sample size but multiple urban and rural samples would improve power, representativeness, and generalizability of our results. Although our samples provided a unique opportunity to compare geographic location in the absence of social class discrepancies, their composition does not fully represent the variability within urban and rural regions (e.g., inner-city vs. suburban family contexts, different types of agriculture). Larger samples providing greater power for statistical tests will likely yield significance for the trends observed in this study (e.g., rural mothers reporting greater parenthood-related depression). Moreover, the PSI Depression subscale, an indicator of parenting-related dysphoria used in this investigation, showed only moderate-to-acceptable internal consistency for the urban sample, suggesting a need to interpret the related finding with caution (PSI Competence presented the same limitation with respect to reliability). Future research should also assess maternal depression symptoms more thoroughly (e.g., via clinical interviews) in light of previously documented effects on children (Gartstein et al., 2010) and relatively high suicide rates in remote rural settings, particularly among adults of childbearing age (Handley et al., 2012). In addition, future efforts should consider laboratory-based and psychophysiological temperament measures (e.g., EEG recording) to supplement maternal reports.

4.2 | Future directions

In light of our findings, further research should explore possible contributors and mechanisms that underlie the noted differences in infant temperament and mother-infant interactions between the communities studied. For example, examining contextual variables (e.g., limited access to, and utilization of, healthcare and child-rearing resources) capable of altering child and family functioning should be considered, based on previous research (Hirsch & Cukrowicz, 2014). Although we did not collect information about specific, supportive perinatal care or resources available to mothers, we expect that a greater variety of services, such as breastfeeding guidance, coaching in infant massage and other infant-soothing techniques (e.g., skin-to-skin interventions, video-based interaction guidance; Hoffenkamp et al., 2015; Kozhimannil, 2014), is available in more metropolitan areas. It will also be important to examine subgroups within each

broad classification (e.g., inner-city, suburban) as divergent social-emotional outcomes are likely to be observed (Miller & Votruba-Drzal, 2013). With regard to rurality, heterogeneity in "types" of rural contexts (e.g., based on regional differences in agricultural commodities and occupations, proximity to urban areas) are likely relevant to consider. Future research would benefit from identifying subgroups of "rural" or "urban" communities, and from a dimensional treatment of rurality-urbanicity. Cross-cultural parenting research suggests that child-rearing practices are often specific to the environment in which the child is raised (e.g., Bornstein, Putnick, Park, Suwalsky, & Haynes, 2017), and play interactions characterized by less responsiveness and synchrony may constitute appropriate preparation for some rural contexts (e.g., demanding agricultural occupations). Maternal-age effects should additionally be better understood in the context of lifespan-related trade-offs such as energy/stamina and financial stability, which may differentially confer risk and protection with respect to parenting. More distal childhood outcomes (e.g., attachment security, social competence, behavior problems) also warrant consideration and will shed light on the consequences of differences between rural and urban families identified herein. For example, currently there is a lack of research demonstrating that early challenging temperament confers risk for childhood psychopathology equivalently across rural and urban ecologies. Clarifying differential pathways with regard to temperament and risk, and considering rural and urban ecology as presenting moderators of risk, is thus important in future research to provide the foundation for prevention programs and interventions.

4.3 | Clinical and programmatic implications

Results of this study suggest considerable differences in rural and urban ecology with respect to early social-emotional development. With additional research, these are expected to translate into efforts aimed at improving parent, infant, and subsequent child mental health. Community outreach programs designed to enhance parent-child interactions or mitigate risk factors could ultimately be developed, using additional research noted earlier as a guide. For example, recent family-based interventions designed to facilitate nurturing parent-child interactional behaviors have shown promise in reducing parenting stress, promoting emotional connection and yielding more adaptive developmental outcomes for high-risk infants, especially when maternal social overtures follow the familiar communication style of her native culture (Welch & Myers, 2016). Although not comparing rural and urban settings specifically, such findings suggest that cultural differences in parenting may inform the development and promotion of dyadic interventions. Education about parenting and mental health resources and referrals, possibly through telehealth (e.g., Sheeber et al., 2017) or home-visiting programs (e.g., Heidari et al., 2018; Iverson, Gartstein, Desmarais & Neumann, 2019), could also help close the gap in access, especially for younger mothers living in more remote geographic contexts.

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