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Rural Neighborhood Context, Child Care Quality, and Relationship to Early Language Development

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Abstract

Research Findings—Prior research with older urban children indicates that disadvantaged neighborhood context is associated with poorer early development, including poorer verbal ability, reading recognition, and achievement scores among children. Neighborhood disadvantage in rural communities and at younger age levels may also be related to development; however this relationship has received little examination. In this study we utilize data from the Family Life Project, a representative sample of babies born to mothers in poor rural counties in North Carolina and Pennsylvania, to address questions related to the relationship between neighborhood context (disadvantage and safety) and children's early language development. We examine mediation of this relationship by child care quality. We also examine geographic isolation and collective socialization as moderators of the relationship between neighborhood context and child care quality. Results indicated that while neighborhood disadvantage did not predict children's development or child care quality, neighborhood safety predicted children's receptive language, with child care quality a partial mediator of this relationship. Collective socialization but not geographic isolation moderated the relationship between neighborhood safety and child care quality.

Practice or Policy—Implications for policy, practice, and future research are discussed, including improving community safety through community policing, neighborhood watch, and social networks and increasing access to quality child care.

Neighborhood conditions can impact residents' well-being across domains, including child development (Brody et al., 2001) and physical health (Hill, Ross, & Angel, 2005). Urban-focused research suggests that neighborhood poverty, one of the primary indicators of disadvantage, is associated with poorer child development, including verbal ability, reading recognition, and problem solving skills (Caughy & O'Campo, 2006; Leventhal & Brooks-Gunn, 2000). Neighborhood conditions may exert unique effects on children and families in

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rural communities, yet this relationship has received little attention (Burke, O'Campo, & Peak, 2006). Although it is a common view that poverty is centered in major urban settings, over 85% of persistently poor counties are rural, more than half of poor U.S. children live in non-urban settings, and there is evidence of different risk and protective factors in urban and rural areas (Economic Research Service, 2004; Parisi, McLaughlin, Grice, Taquino, & Gill 2003). Examining these relationships in rural settings is crucial as rural communities are simultaneously more challenged by limited access to formal child care, public transportation, affordable housing, living wage jobs, and social services (Whitener, Duncan, & Weber, 2002) and more supported by less exposure to violent crime, higher access to extended family, stronger connections to religious institutions, and a greater sense of community (Durham & Smith, 2006).

Using data from the Family Life Project, a longitudinal study of babies born in rural, low-wealth counties in North Carolina and Pennsylvania, we address questions related to the relationship between neighborhood context and children's language development. We examine mediation of this relationship by child care quality and moderation of the relationship between neighborhood context and child care quality by geographic isolation and collective socialization. Extensive research, summarized below, has examined the relationship between neighborhood of residence and children's outcomes (Duncan et al., 2007; Hertzman & Power, 2005), as well as, to a lesser degree, the relationship between neighborhood conditions and the child care that families use (Burchinal, Nelson, Carlson, & Brooks-Gunn, 2008a). However, for the most part, the literature focuses heavily on urban settings and to a certain extent on children in later childhood. In the following review we highlight the important literature to date that has examined these relationships and point out the gaps that this study begins to fill.

Literature Review

Conceptual Model

The bio-ecological model provides the theoretical foundation for this study (Bronfenbrenner, 1989; Bronfenbrenner & Evans, 2000). In this model, human development is shaped by reciprocal interactions between individuals and persons, objects, and symbols in the immediate external environment. The strength of these interactions depends upon exposure over time and intensity (Bronfenbrenner & Evans, 2000). While proximal processes (interactions in the microsystems of home, peers, and school) are the driving force, other interactive systems also affect development. The mesosystem includes the interrelationships between the various settings of the microsystem, such as the strength of relationships between the neighborhood and home; the exosystem, more remote social settings that the child does not participate in but can have indirect effects on the child (e.g. a parent's workplace); and the macrosystem, or larger societal norms and attitudes that can indirectly affect the child (Bronfenbrenner, 1989). Each of these systems, individually and in concert, shapes human development. As the child grows, the microsystem extends beyond the home to other individuals, groups, and social settings in which the child is a direct participant, including child care, school, and the neighborhood (Bronfenbrenner & Evans, 2000). We are particularly interested in how neighborhood characteristics might influence one of the key

competencies in early childhood, language development. Language develops rapidly in early childhood and better vocabulary and syntactic ability have been linked to later school readiness and literacy. Although there is considerable variability in children's early expressive and receptive language, standardized measures have been used to provide an overall index of these skills across SES and race (National Research Council, 2008). Previous studies have shown that both parental language input and the quality of child care experiences are related to children's early language (e.g., Dearing, McCartney, & Taylor, 2009; Vernon-Feagans, Hurley, Yont, Wamboldt, & Kolak, 2007) although there is little research that looks beyond these two to include neighborhood influences on early language development.

Neighborhood Context

Neighborhood conditions have been variously characterized by socioeconomic structure: few affluent neighbors/high poverty (Caughy & O'Campo, 2006), lack of environmental resources such as playgrounds, retail outlets, health facilities (Auchincloss, Van Nostrand, & Ronsaville, 2001), and lower levels of safety (Adams, Rohe, & Arcury, 2005; Curry, Latkin, & Davey-Rothwell, 2008), or through a combination of these factors. Two typical combinations are neighborhood disorder (indices such as crime, abandoned houses, high unemployment, and unsupervised children; Hill et al., 2005) and neighborhood disadvantage (Census-derived items such as poverty rate and per capita income; Brody et al., 2001; Sampson, Sharkey, & Raudenbush, 2008). Several of these measures that we will refer to as "neighborhood context" are available in the Family Life Project dataset, allowing us to assess whether these constructs are related to children's language development.

Neighborhood effects on language development—Research with children in later childhood has suggested that neighborhood factors can influence children's development and ability to learn and succeed in school (Hill & Herman-Stahl, 2002; Ingoldsby et al., 2006). Early language is associated with later academic achievement (e.g., Hertzman & Power, 2005). Neighborhood-level poverty alone was associated with lower test scores for 4- to 5-year-olds, which, although somewhat attenuated, was independent of other socioeconomic indicators (McCulloch & Joshi, 2001). Neighborhood risk, as measured by aggregate income, education level, female-headed households, and crime, was negatively related to academic performance, again controlling for family characteristics (Shumow, Vandell, & Posner, 1999).

In a pre-Kindergarten study, neighborhood quality was related to language competence (Barbarin et al., 2006); in higher-quality neighborhoods children scored higher on receptive language than children in lower-quality neighborhoods. Further, using less typical neighborhood characteristics, Lloyd and Hertzman (2010) found that neighborhoods characterized by a higher immigrant concentration were associated with better kindergarten language scores, 4th grade numeracy scores, and 4th grade reading scores in both urban and rural settings, as well as increased kindergarten communication scores in urban neighborhoods, while concentrated neighborhood affluence was associated with better 4th grade outcomes and an improvement in scores over time in urban settings only. Further, in

rural settings high residential instability was associated with worsening scores over time and poorer 4th grade scores.

Race has also been examined in relation to neighborhood context (e.g., Brooks-Gunn et al., 1993; Sampson, Morenoff, & Earls, 1999). Benefits of higher-quality neighborhoods are more likely to accrue to residents of White neighborhoods, albeit in an urban context (Sampson et al., 1999). In addition, Brooks-Gunn and colleagues (1993) found that White 3-year-olds benefited more from a higher proportion of affluent neighbors than did their Black counterparts, as measured by IQ scores, similar to findings by Turley (2003) in which only young White children saw cognitive and social development benefits from increased neighborhood income.

Other neighborhood characteristics: geographic isolation and collective socialization—Geographic isolation and collective socialization moderate the relationship between neighborhood context and child outcomes in urban settings and in other contexts. Geographic isolation is an indicator of how far one resides from jobs, shopping outlets, and public institutions and may be a risk factor given less access to services, or a protective factor given less exposure to drugs, violence, and other social ills (Burchinal, Vernon-Feagans, Cox, & The Family Life Project Key Investigators, 2008b). The impact of geographic isolation on school achievement, mediated by school quality, accounted for the rural deficit in educational attainment and nearly the entire rural/urban achievement gap (Roscigno & Crowley, 2001). Further, in a qualitative study, geographic isolation exacerbated the experience of poverty (Atchinson, 2001). However, geographic isolation may be protective: isolation buffered the impact of social risk on parenting and infant development: risk was a stronger negative predictor of parental warmth when families were less isolated (Burchinal et al., 2008b). These families tended to live in public housing exposing residents to many of the societal problems associated with increased unemployment and the drug trade. While the relationship between isolation and child care quality has yet to be examined, we might expect that isolation makes quality child care difficult to access (Kratas, Zuiker, & Bauer, 2004).

Collective socialization suggests a level of trust and cohesion among neighbors (Bursik & Grasmick, 1993). Brody and colleagues (2001) found that collective socialization moderated the relationship between neighborhood disadvantage and affiliation with deviant peers: the relationship was weaker in the presence of higher socialization. In other work children's reading achievement was associated with high neighborhood expectations for educational attainment and high collective socialization (Emory, Caughy, Harris, & Franzini, 2008). Families in neighborhoods characterized by higher trust between neighbors were more likely to select child care homes and less likely to use exclusive parental care or relatives (Burchinal et al., 2008a). Relationships with neighbors may be related to child care, and in turn child outcomes, by providing families with trusted individuals to provide information about child care options (Burchinal et al., 2008a). Although it has not been explicitly examined, the effect may be stronger in rural settings where residents experience a stronger sense of community, solidarity, and deeply shared values and identity (Lev-Wiesel, 2003).

Child Care Quality

Quality child care has been demonstrated to be a consistent buffer for the development of low-income children and may also be a protective factor for disadvantaged neighborhood environments (e.g., Fuller, Livas, & Bridges, 2005; McCartney, Dearing, Taylor, & Bub, 2007). It serves a protective function for children from more impoverished environments leading to better school readiness, receptive language, and expressive language (Caughy, DiPietro, & Strobino, 1994; McCartney et al., 2007). Yet, although families in disadvantaged and/or rural neighborhoods have less access to programs and services, including limited access to child care (Zimmerman & Hirschl, 2003) and are less likely to experience quality child care due to less state oversight and regulation; caregivers with less education and training; and higher ratios (Magnuson & Waldfogel, 2005; Maher, Frestedt, & Grace, 2008), this relationship holds for rural children. Child care quality was a significant predictor of rural children's language at three years (Vernon-Feagans, Gallagher, & Kainz, 2010).

Despite the benefits of quality child care we know very little about how neighborhood conditions are related to child care quality in rural settings, a gap we begin to address in the present study. In urban settings, children in communities with denser social networks were less likely to be cared for in homes by unrelated adults (Burchinal et al., 2008a), whereas in higher-trust neighborhoods child care homes were more commonly used and exclusive parent/relatives care was less common. Families participating in the Los Angeles-based Moving to Opportunity (MTO) program were likely to relocate to lower poverty neighborhoods where they were then more likely to select center-based care (Hanratty, McLanahan, & Pettit, 1998).

It is clear from this overview that neighborhood characteristics play an important role in shaping children's development. However, given the distinctiveness of rural settings, including differing social connections and greater geographical isolation, examining these associations within a rural community is needed. We use data from the Family Life Project to examine these relationships for families residing in low-wealth, rural communities. One of the strengths of this dataset is the inclusion of multiple reports of neighborhood conditions, including linked Census data from participants' block groups, objective assessments of neighborhood safety by highly-trained data collectors, and resident perceptions of the level of trust among neighbors through a measure of collective socialization. Many researchers have characterized neighborhood conditions through resident perception instead of or in addition to Census-based variables (e.g., Cantillon, 2006; Macintyre, Ellaway, & Cummins, 2002). For example, perceptions of safety have been positively related to more objective measures of neighborhood disadvantage in rural settings (Kruger, 2008). Cantillon (2006) examined the impact of neighborhood structural characteristics on youth outcomes, focusing on perception of neighborhood quality as a key to understanding how residents respond to local conditions. Further, others maintain that characterizing neighborhoods with Census data alone may not adequately capture their multidimensional nature (Macintyre et al., 2002; Subramanian, Kubzansky, Berkman, Fay, & Kawachi, 2006). For this reason we draw upon the multiple neighborhood context measures to address the following questions: 1) Is neighborhood context (disadvantage and

safety) predictive of children's language development above and beyond family and child demographic characteristics?; 2) Is the relationship between neighborhood context and child language development mediated by child care quality?; and 3) Are neighborhood context effects interactive: do geographic isolation and collective socialization moderate the relationship between neighborhood context and child care quality? With the Family Life Project, we are not only well-positioned to understand individual differences that predict successful developmental outcomes; we can generalize our findings to children in similar settings.

Methods

Data

Data are drawn from the Family Life Project (N=1292), designed to examine the development of children's social and academic competence in non-urban, poverty contexts, oversampling for low-income and Black families. Recruitment procedures called for an epidemiologically valid sample of non-Black and Black families from three counties in eastern North Carolina and three counties in central Pennsylvania, capturing the contexts of the "Black South" in North Carolina, and the "Appalachian Mountain" region of Pennsylvania, two geographic centers of US poverty (Dill, 1999). Families were recruited in hospitals at the time of their child's birth, during which demographic and poverty data were gathered. Based on this information, families were randomly selected for participation and were again contacted and visited when children were 2 months old for formal enrollment. Ultimately, enrollment comprised 59% non-Black and 41% Black families, of which a total of 78% were below 200% of the federal poverty level. For complete recruitment methods please see Crouter, Lanza, Pirretti, Goodman, and Neebe (2006). Data were collected with children and families in their homes when the children were 6, 15, 24, and 36 months old. If the children were in child care for at least 10 hours per week, regardless of the number of caregivers, interviews were conducted with providers and observations made at each time point with the arrangement the parent identified as the primary child care provider. As not all study children were using child care the sample size for this analysis was reduced (child care participation ranged from a low of 34.2% at 15 months to a high of 40.5% at 36 months) to 217 children with consistent child care experience from 15 to 36 months. Data related to neighborhood conditions were drawn from the 2000 US decennial Census and linked to each participant at the Census block group level.

Measures

Neighborhood context—Neighborhood context is the primary predictor of child outcomes, composed of two constructs: 1) Census-derived neighborhood disadvantage and 2) neighborhood safety. Neighborhood disadvantage was based on five Census variables from the 2000 decennial Census at the block group level. Census geographical units, developed at the local level in an attempt to approximate actual perceived neighborhoods (Cromartie & Swanson, 1996), have been used in rural neighborhood effects research, both Census tracts (Kobetz, Daniel, & Earp, 2003) and the smaller Census block groups (Auchincloss et al., 2001; Sharkey & Horel, 2008). The systematic way in which Census data are collected and the availability of a wide variety of data, particularly for

socioeconomic composition, make these constructs a valuable data source (Diez Roux, 2001). The challenge of using relatively large Census units is heterogeneity. Internal homogeneity is assumed (Charnock, 1982); however, this assumption is challenged in rural regions as Census units are geographically larger where populations are smaller. In a geographically large unit, variation will be high and variation between spatial units may be limited, contextual effects will be harder to detect, and neighborhood effects may be underestimated (O'Campo, 2003). Therefore, we selected the smaller Census block group unit. As relatively little research to date has examined contextual effects in rural settings it is unclear how Census units operate and, given the benefits of Census definitions, warrant examination.

The Family Life Project dataset contains a linking code for the Census block group for each respondent's home address (Matthews & Zeiders, 2006). Based on previous research (Brody et al., 2001; Sampson, Raudenbush, & Earls, 1997), five Census variables describing aggregated household characteristics were selected and combined through factor analytic methods to represent neighborhood disadvantage: per capita income, percent below poverty, proportion of households that are female-headed, proportion receiving public assistance, and proportion unemployed. To create this composite, the five individual indicators were factor analyzed using principal components analysis to identify and compute a composite disadvantage score. The eigenvalues revealed that the first factor explained 73% of the variance. Because of this and the leveling off of the eigenvalues on the scree plot after the first factor, one factor was extracted for use as the neighborhood disadvantage composite. The baseline measure at 6 months was used. For families who moved over the course of the study Census measures for each residence were weighted by residential tenure and averaged as the strength of interactions is dependent upon exposure over time and intensity of exposure (Bronfenbrenner & Evans, 2000).

Neighborhood safety is a composite mean score, derived from home visitors' ratings of noise, dwelling safety, and community safety (Cronbach's $\alpha = .79$), common markers of safety (Dodge, Pettit, & Bates, 1994; Lanza, Rhoades, Nix, Greenberg, & The Conduct Problems Prevention Group, 2010). These ratings were completed by highly trained data collectors who are long-time residents of the study counties following home visits that lasted 2 to 3 hours. The noise question asked: "The noise level in this neighborhood around this dwelling is..." where 1 = *very quiet* and 4 = *very noisy* (reverse coded). The dwelling safety question asked: "The safety of the neighborhood around this dwelling is..." where 1 = *very safe/crime free* and 4 = *very unsafe/high risk* (reverse coded). The community safety question asked: "How safe is the area outside of this building?" where 1 = *obviously dangerous* and 4 = *above average safety*. Based on previous methods, safety ratings were averaged across time with higher scores indicating safer neighborhoods.

Child care quality—Child care quality, the mediator between neighborhood context and language, was measured with the Home Observation for Measurement of the Environment, designed to measure the quality and quantity of stimulation and support available to the child, focusing on the child within the environment (HOME Inventory; Caldwell & Bradley, 1984). Although the HOME is used primarily in home environments, it is also suitable for use in child care settings (De Marco, Crouter, & Vernon-Feagans, 2009; Dowsett, Huston,

Imes, & Gennetian, 2008). Ratings were made by trained data collectors after observing the setting for one and one half hours. The HOME Inventory consists of 45 items in six subscales: 1) Responsivity, 2) Acceptance, 3) Organization of the environment, 4) Learning materials, 5) Parental involvement, and 6) Variety of experience. As previous studies have shown three subscales, Responsivity, Acceptance, and Learning Materials, to be most related to children's outcomes, the 28 items for these three subscales were collected for the Family Life Project and used to create a summed score (Bradley, 1994). Summed scores of these yes/no items (e.g., "*Caregiver's voice conveys positive feelings toward the child*") ranged from zero to 28, higher scores indicating higher quality (Cronbach's $\alpha = .67$). The HOME Inventory was selected for the Family Life Project because many of the children were not in formal child care centers, but rather in informal arrangements. For example, at 15 months 54% of settings were informal (50% relative and 4% family child care). The HOME largely focuses on the relationship between caregiver and child, giving less focus to resources and environmental factors that may differ greatly between center and informal settings.

Moderators—The two potential moderators are collective socialization and geographic isolation. Collective socialization was assessed through a computer-based questionnaire allowing for complete confidentiality of all responses. The 14-item measure (true/false) evaluated individual perceptions of the level of trust between neighbors, for example, "*People in this neighborhood can be trusted*" (Brody et al., 2001). Collected from the primary caregiver, typically the mother, at the 24-month wave of data collection, items were summed and averaged to create a mean scale score (Cronbach's $\alpha = .82$).

The Family Life Project investigators developed a construct to measure geographic isolation using Global Positioning System technology (Burchinal et al., 2008b). Latitude and longitude measurements were taken with GPS units for each family residence. These measurements were used to compute the physical distance from the residence to the nearest 10 important community services: gas station, physician's office (any type), library, fire station, elementary school, high school, public park, supermarket, freeway on-ramp, and public transportation. A summary score was computed as the mean of the 10 distances and log transformed to reduce distributional skew. For families who did not move over the course of the study the original, 6-month isolation measurement was used. For others a summary variable was created across waves, again weighting for residential tenure.

Language development—Child's language development was assessed at 36 months with the *Preschool Language Score* (PLS-4) and the *Wechsler Preschool and Primary Scale of Intelligence* (WPPSI). The PLS-4 is a norm-based measure of children's language skills, measured from birth to 6 years (Zimmerman, Steiner, & Pond, 2002). One subscale, *Expressive Communication*, was used to measure the child's ability to communicate with others. At 36 months children were tested for the ability to verbally demonstrate language concepts. The data collector either observed or asked the parents about the child's language ability, including such skills as using the plural tense, -ing endings, verbs, counting items in a picture, and the ability to answer questions logically. Reliability was high (Cronbach's $\alpha = .89$). The *Receptive Vocabulary* subtest was selected from the *Wechsler Preschool*

and *Primary Scale of Intelligence* (WPPSI; Kaufman, 1992). We chose Receptive Vocabulary and Expressive Communication to assess both receptive and expressive language ability. In the Receptive Vocabulary task the child looked at groups of four pictures, pointing to the one the examiner named aloud. The WPPSI yields reliable and stable IQ scores. For this subsample Cronbach's alpha was satisfactory at .64.

Control variables—A standard series of control variables were used in the multivariate analysis, maternal age, state, number of children, child's gender, family structure, maternal education, income-to-needs ratio, and race, as each has been shown to impact children's developmental outcomes (Duncan et al., 1994; Yeung, Linver, & Brooks-Gunn, 2002), and to control for neighborhood selection bias (Ceballo, McLoyd, & Toyokawa, 2004). Maternal age, number of children, and maternal education are all continuous variables. State is dichotomous with North Carolina coded as one. Child gender is coded as female equals one. Family structure is coded such that married equals one. Race is a dichotomous variable in the Family Life Project sample (non- Black or Black, which is coded as one). Poverty status was based on an income-to-needs ratio, a standard measure of a family's economic situation, where 1.0 indicates the poverty line and was used as the cut-off point for poor and non-poor. This ratio is computed by dividing family income, exclusive of federal aid, by the federal poverty threshold for that family's size. In 2008-9 the federal poverty level for a family of four was \$21,200/year (US Department of Health and Human Services, 2010). However, given the high correlation between family's poverty status and the neighborhood context variables (both disadvantage and safety) the neighborhood indicators were used as proxies for family poverty in multivariate analysis.

Data analysis strategy—Following descriptive analysis of the sample, analysis consisted of a series of regression models based on our research questions. We began with basic regression, followed by tests of moderation and mediation (see Figure 1). We used a regression model-building technique that allowed for testing variance explained with the addition of distinct blocks of predictors while addressing specific moderation and mediation hypotheses. We considered a multi-level modeling framework to take into account nested sources of variability (Snijders & Bosker, 1999). However, given our rural sample this method was not feasible. To utilize multi-level modeling it is suggested that neighborhood units contain at least 10 subjects (Snijders & Bosker, 1993). However, in our sample 59% of tracts and 93% of block groups contain five or fewer study families. Yet, because participating families were clustered within neighborhoods we anticipated the potential for correlated error terms; a violation of OLS regression, which may lead to increased Type I error due to inappropriately estimated standard errors. To correct for this clustering we used a Huber White Correction to adjust standard errors and produce unbiased hypothesis tests (Hayes & Cai, 2007).

To address the first research question (i.e., Does neighborhood context predict young children's language development at 36 months of age?), we regressed children's WPPSI and PLS scores on the set of covariates and a block of the neighborhood context variables. To address the second research question (i.e., Is the relationship between neighborhood context and child development mediated by child care quality?) tests of mediation were conducted.

We investigated mediated effects of child care quality by testing the significance of the joint product of the effect of neighborhood context on the mediator and the effect of the mediator on the child outcome, often called the *ab* product term or the indirect effect. Simulation studies have indicated that the standard error associated with the *ab* product term can be underestimated in clustered designs, leading to inflation of the Type I error rate (Krull & MacKinnon, 2001). To address this issue and promote accurate hypothesis testing we used a bias-corrected bootstrap to obtain more precise standard errors and confidence intervals. The bias-corrected bootstrap provides superior power for detecting indirect effects in single-level (MacKinnon, Lockwood, & Williams, 2004) and clustered analysis (Pituch, Stapleton, & Kang, 2006).

For research question three (i.e., Does geographic isolation or collective socialization moderate the relationship between neighborhood context and child care quality?) we added interaction terms (e.g., neighborhood disadvantage x isolation; neighborhood disadvantage x socialization; neighborhood safety x isolation; neighborhood safety x socialization) and the main effects terms to the model predicting child care quality. Statistically significant interaction terms provided evidence for moderated effects, and we investigated significant change in variance accounted for (R^2) with the second block of terms.

Results

Descriptive Analyses

Description of neighborhood disadvantage—Table 1 provides an overview of the neighborhoods in which this subsample resides, based on the neighborhood disadvantage composite. For these families the average neighborhood-level poverty rate is 5%, although it ranges up to a high of 47%. Female-headed households average 7% with a high of 56%. Neighborhood TANF receipt and unemployment rate were quite low, at 1% and 2% respectively (high of 20% and 15%). Per capita income was \$5,187 (high of \$29,343). Correlations were conducted between these variables and child care quality and outcomes. Significant correlations were found between the PLS and female-headed households and unemployment rate.

Sample description—In this subsample, the majority of mothers were married (51%) and over half were Black (53%) (see Table 2). Mothers averaged 27 years of age and had an average income-to-needs ratio of 2.3. For 2003, the year baseline Family Life Project data was collected, the poverty threshold for a family of four was \$18,660/year (US Census Bureau, 2004). An income-to-needs ratio of 2.3 is 230% of the federal poverty line, or roughly equivalent to \$43,000 for a family of four. Neighborhood disadvantage averaged -0.3 , ranging from a low of -1.56 to a high of 3.62 , with higher scores indicating higher disadvantage. Neighborhood safety averaged 3.2 out of 4 (ranging from a low of 1.7 to a high of 4), with higher scores indicating safer communities. Child care quality was fairly high, averaging 25.3 out of 28 . The language scales were all standardized at a mean of 100 . This indicates that the children in this sample scored about average on the PLS – Expressive Communication and the WPPSI – Receptive Vocabulary measure. Neighborhood safety, geographic isolation, and collective socialization were significantly correlated with child

care quality. Neighborhood safety, disadvantage, collective socialization, geographic isolation, and child care quality, were significantly correlated with the Expressive Communication and Receptive Language.

Neighborhood context and child outcomes—We examined research question one with regression models to determine if neighborhood context predicted language development over and above family demographic characteristics. We found that WPPSI – Receptive Vocabulary alone was significantly related to context, specifically level of neighborhood safety (see Table 3).

Next, we examined the mediation model described in question two, testing the pathway linking neighborhood context to child outcomes via child care quality. Both outcome variables, Expressive Communication and Receptive Vocabulary, were tested. Only the model for Receptive Vocabulary was significant. The significant mediation model included three direct paths, from a) neighborhood context to child care quality, b) child care quality to Receptive Vocabulary, and c) neighborhood context to Receptive Vocabulary. An indirect path from safety to Receptive Vocabulary through care quality was also included to test the significance of the mediated pathway. We first ran models with both neighborhood context variables, disadvantage and safety. Neighborhood disadvantage was not significant in either paths a or c and was trimmed from the final model. The final model provided an excellent fit to the data as indicated by the *RMSEA* value of $<.001$, where values less than .05 indicate a good fit (MacCallum, Browne, & Sugawara, 1996). The mediation models are shown in Table 4.

The direct paths between safety and child care quality, $B = 0.855, p < .01$, and child care quality and Receptive Vocabulary, $B = 1.682, p < .01$, were significant. Further, the direct path between safety and Receptive Vocabulary was significant, $B = 8.292, p < .01$. The indirect path between community safety and Receptive Vocabulary through child care quality was significant, $B = 1.437, p < .05$; that is, to a significant degree, the effect of neighborhood safety on increases in receptive vocabulary scores was transmitted via increases in child care quality. The total effect of safety on vocabulary was 9.729, combining the direct effect of 8.292 (85%) and the indirect effect of 1.437 (15%). The mediation effect is partial, that is about 15% of the total effect of safety on development was mediated through care quality.

Moderation analysis—We used hierarchical regression to examine the relationship of neighborhood context to child care quality moderated by geographic isolation and collective socialization, adjusting for clustering (see Table 5), with the inclusion of the four interaction terms listed above. In the first block of predictors, including demographic characteristics, race and child gender were related to lower quality child care, such that Black children ($B = -0.74, p < .05$) and boys ($B = -0.81, p < .01$) received lower quality care. A trend was found indicating that children whose mothers had higher educational attainment received better care ($B = 0.15, p < .10$). The second block added the primary predictors of disadvantage and safety and the moderators, isolation and socialization. Only neighborhood safety was a significant predictor of child care quality. With increased safety, children received higher quality child care ($B = 0.90, p < .05$). The third block added the interaction terms of which

only socialization x safety was significant. To follow-up the significant interaction, methods developed by Preacher were used (Preacher, Rucker, & Hayes, 2007).

As can be seen in Figure 2, at high levels of neighborhood safety, child care is of fairly high quality. However, at lower levels of safety, families who reside in neighborhoods with more trust between neighbors (higher ratings of collective socialization) access higher quality child care than those residing in neighborhoods with less trust among neighbors.

Discussion

This study aimed to provide an initial examination of the relationship between neighborhood context and children's language development in low-wealth, rural settings, a population that has received relatively little attention in the neighborhood effects literature. Our findings demonstrate that neighborhood context is related to child language through influences on the quality of care selected and available to rural parents. Notably, it was the more immediate neighborhood context, based on safety ratings, which were significant, rather than the broader context of disadvantage captured by the data from the decennial Census. Neighborhood safety was a significant predictor in prior research with rural populations (Pinderhughes et al., 2001). This may reflect the challenges of imposing administratively-determined neighborhood proxies in rural communities where such constructs may be less appropriate (i.e. sparsely populated settings) (De Marco & De Marco, 2010; O'Campo, 2003). It may also be that rural neighborhood disadvantage is related to other constructs such as parenting or employment, or may become more salient as children age. Neighborhood disadvantage may be better captured through assessments of resident perceptions of conditions, as was found in Curry and colleagues (2008) examination of neighborhood context and depression. However, the Family Life Project dataset does not contain such a measure.

We then examined how neighborhood context was related to children's language development as mediated by child care quality. These processes appeared to be more important for children's receptive language than for expressive language, similar to findings from Barbarin et al. (2006) with slightly older children. This may have been the case because receptive language (receptive vocabulary) is a more stable measure of children's language because it does not require the child to actually express himself/herself verbally. Compared to expressive language in young children, receptive language may better capture language development since expressive language requires verbal communication from preschool children who are often non-communicative in a standardized testing situation while receptive language only requires the child to point non-verbally. Better receptive language and overall language in may be facilitated in these safer environments by exposing children to more and possibly a greater diversity of language. With a higher level of community safety children may be more frequently out in the neighborhood, interacting to a greater extent with peers and adults, stimulating their language. O'Neil, Parke, and McDowell (2001) support this notion, finding that parents in less safe neighborhoods are more restrictive of their children's activities, whereas in safer settings parents supervise their children less closely. In addition, this relationship was partially mediated by child care quality. Children in safer communities received higher quality child care, which in turn,

fostered language development. Our findings highlight the importance of quality child care, dovetailing with research conducted in urban settings, demonstrating the positive effects of high quality care on child development (Votruba-Drzal, Coley, & Chase-Lansdale, 2004). This is particularly important in rural communities where less formal child care exists, care that is typically of higher quality (Loeb, Fuller, Kagan, & Carrol, 2004). However, the fact that child care only partially mediated the relationship between context and development suggests the importance of the neighborhoods where children reside to their optimal development.

Further, we found that the effect of neighborhood safety on child care quality was moderated by collective socialization. At higher levels of safety child care quality was high. The differences were found at lower levels of safety where those who had stronger relationships with their neighbors accessed higher quality child care, compared to families in neighborhoods with lower collective socialization. It may be that high cohesiveness buffers unsafe conditions by helping residents to find and/or make better decisions about the care they choose for their children. This is consistent with previous research indicating that high levels of neighborhood disadvantage are associated with low social capital such that the fear of crime and violence associated with disadvantaged neighborhoods leads to few interactions between residents impeding the development of social capital, in both urban and rural settings (Kawachi, Kennedy, & Wilkinson, 1999; Kruger, 2008).

Limitations

Although this study has important implications for social policy and practice, the findings should be considered in light of the limitations. There is a temporal separation between the 2000 decennial Census used to characterize neighborhood disadvantage and the study data collection. However, the time between the 2000 Census and data collection (2003–2006) is not great, and there is a very strong persistence of aggregated measures from the Census over relatively short periods (Jackson & Mare, 2007; Kunz, Page, & Solon, 2003). Most neighborhoods are relatively stable across a four to five year period, even for children from less advantaged families. The findings are also limited in their generalizability as the sample was drawn from rural counties in two states and was not a national sample. The relationship between neighborhood context, child care, and child development may differ in other regions. However, the Family Life Project is representative of the study counties and as such, can be generalized to similar settings.

A final issue relates to the low alpha for the HOME, which although not low enough to preclude use, is an issue for generalizability. The HOME Inventory was originally developed for use in familial home environments, where higher alphas were obtained (.89; Bradley, 1994) and, as such, may not as accurately reflect quality in the child care setting. However, this measure was included in the Family Life Project through consultation with R. Bradley, the measure's co-developer, who also trained the data collectors.

Implications

This research has implications for policy, practice, and future research. Findings demonstrating the importance of neighborhood safety and trust among neighbors suggest the

need to promote these qualities in rural communities. Local governments can partner with residents to improve safety, possibly through community policing programs, stricter enforcement of laws, increased police presence, and neighborhood watch groups (Curry et al., 2008; Hill & Herman-Stahl, 2002). Greater awareness of community policing was related to reduced fear of crime and greater community integration in a study in several rural communities in North Carolina (Adams et al., 2005). Neighborhood watch groups may be particularly valuable in rural communities, characterized by geographic spread (Bickel, Smith, & Eagle, 2002), and limited police personnel. Moreover, methods can be developed to cultivate trust and more solid relationships among neighbors to allow them to better support one another, as suggested by Sampson and colleagues (1997). Further, such networks can serve as avenues for service delivery (Hill & Herman-Stahl, 2002).

Additionally, access to quality child care is clearly important and often limited in rural communities. However, increasing access to quality care is challenging in rural settings as more formal care is clustered around more populous areas and educational programs are harder to access. This challenge calls for innovative planning among social service providers, planners, and policymakers to develop transportation options and child care training programs that increase accessibility and improve quality for spatially-disadvantaged rural areas. Further, as many Family Life Project families (De Marco et al., 2009), and rural families in general, use less formal care, home-based providers, who typically have less education and training on average, can be targeted for increased education and training.

Future directions

This area of research is particularly important given that over 20 million US children live in poverty and poor rural children are further disadvantaged by their lack of access to important programs and services (Lichter & Johnson, 2007). It is crucial that we better understand the short-and long-term consequences of these conditions, including the ways in which poverty and neighborhood quality exert influence at very young ages. To further advance research on the influence of neighborhoods on child and family well-being in rural communities, we plan to next examine how home environments and parenting are related to child development within these contexts, as well as examining children's socioemotional development. As the Family Life Project children enter formal school we can also begin to look at these relationships in relation to school adjustment and academic outcomes, as well as gauging the children's perceptions of neighborhood conditions. Future research may also examine how resident perceptions of neighborhood conditions, through measures such as informal social control, positive neighborhood characteristics, negative neighborhood characteristics, and neighborhood physical disorder (Cherlin et al., 2001), are related to well-being for both children and families in rural settings such as those represented by the Family Life Project.

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Figure 1.

Conceptual Model of the Relationship Between Neighborhood Context and Young Children's Language Development.

Figure 2.
Quality of Child Care as a Function of Neighborhood Safety and Collective Socialization

Descriptive statistics for Census-derived neighborhood disadvantage variables and correlations with child care quality and child outcomes (*n*=217)

Table 1

Census variables	Mean (<i>SD</i>)	Range	Correlation w/ Child Care HOME	Correlation w/ PLS-4 Expressive Communication	Correlation w/ WPPSI- Receptive Vocabulary
Poverty rate	0.05(0.06)	0 to 0.47	-.01	-.13	-.07
Proportion female-headed	0.07(0.10)	0 to 0.56	-.001	-.17*	-.10
Proportion receiving public assistance	0.01(0.02)	0 to 0.20	.05	-.12†	-.05
Proportion unemployed	0.02(0.03)	0 to 0.15	.06	-.18**	-.05
Per capita income	\$5,187.25 (\$5,712.16)	\$231.85 to \$29,343.51	.12†	.01	.09

† *p*<.10,
* *p*<.05,
** *p*<.01,
*** *p*<.001

Table 2Sample Characteristics and Correlations with Child Care Quality and Outcomes ($n=217$)

Variables	Mean (SD) or N (%)	Correlation w/ Child Care HOME	Correlation w/ PLS-4-Expressive Communication	Correlation w/ WPPSI-Receptive Vocabulary
<i>Demographics</i>				
Maternal age (6-mos.)	27.1 years (5.6)	.20*	.19*	.22*
Family structure	111(51%) Married 106 (49%) Single	.17*	.23*	.25*
Number children < 18 (6-mos.)	2.1 (1.1)	-.10	-.21*	-.20*
Child's gender	105 (48%) Female 112 (52%) Male	-.09	-.19*	-.11
Race	114 (53%) Black 103 (47%) White	-.35*	-.22*	-.36*
State	150 (69%) NC 67 (31%) PA	-.30*	-.01	-.22*
Maternal education (6-mos.)	13.4 (1.9)	.27*	.33*	.34*
Income-to-needs ratio (ave.)	2.3 (1.6)	.30*	.33*	.40*
<i>Neighborhood Context variables</i>				
Census-neighborhood disadvantage	-0.3 (0.8)	-.11	-.20*	-.20*
Neighborhood safety	3.2 (.5)	.24*	.31*	.36*
<i>Moderators</i>				
Geographic isolation	3.7 (4.2)	.16*	.21*	.23*
Collective socialization	5.7 (5.4)	.27*	.25*	.32*
<i>Child care quality mediator</i>				
Child care HOME (ave.)	25.3 (1.6)	1.0	.24*	.33*
<i>Child outcomes (36 months)</i>				
PLS-4	100.6 (15.5)	.24*	1.0	.70*
WPPSI-Receptive Vocabulary	101.0 (18.2)	.33*	.70*	1.0

†
 $p < .10$,*
 $p < .05$,**
 $p < .01$,***
 $p < .001$

Table 3Regression of Receptive Vocabulary on Neighborhood Context – Safety and Disadvantage ($n=217$)

	<i>b</i> (<i>SE</i>)
Number of children	–2.44 (0.99) [*]
Maternal age	–0.01 (0.25)
Child's gender (Male)	–4.85 (2.53) [†]
Race (Black)	–7.25 (2.97) [*]
Family structure (Married)	–2.65 (3.52)
Maternal education	1.54 (0.72) [*]
State (NC)	–2.50 (3.21)
Neighborhood safety	9.61 (2.75) ^{**}
Neighborhood disadvantage	–0.78 (1.11)
R ²	0.27 ^{**}

b: regression coefficient; *SE*: standard error[†]
 $p < .10$,^{*}
 $p < .05$,^{**}
 $p < .01$,^{***}
 $p < .001$

Table 4

Regression of Mediation Model: Relationship between Neighborhood Safety and Receptive Vocabulary Mediated by Child Care Quality ($n=217$)

	Relationship between Neighborhood Safety and Mediator (Child Care Quality) $b(SE)$	Relationship between Neighborhood Safety and WPPSI-RV through Child Care Quality $b(SE)$
<i>Covariates</i>		
Number of children	-0.02 (0.15)	-2.46 (1.04) *
Maternal age	-0.03 (0.04)	0.05 (0.27)
Child's gender (Male)	-0.82 (0.26) **	-3.43 (2.54)
Race (Black)	-0.63 (0.34) †	-6.33 (2.89) *
Family structure (Married)	-0.07 (0.43)	-2.40 (3.56)
Maternal education	0.12 (0.09)	1.39 (0.74) †
State (NC)	-0.51 (0.30) †	-1.54 (3.08)
<i>Focal Predictor</i>		
Neighborhood safety	0.86 (0.33) **	8.29 (2.70) **
<i>Mediator</i>		
Child care quality (HOME)		1.68 (0.61) **
R^2	0.15 **	0.30 **

b : regression coefficient; SE : standard error

†
 $p < .10$,

*
 $p < .05$,

**
 $p < .01$,

 $p < .001$

Table 5

Summary of Hierarchical Regression Analysis Predicting Child Care Quality ($n=217$)

Predictor	Model 1		Model 2		Model 3	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Number of children	−0.05	0.15	−0.01	0.15	0.04	0.16
Maternal age	−0.01	0.04	−0.03	0.04	−0.03	0.04
Child gender (Male)	−0.81**	0.27	−0.81**	0.26	−0.78**	0.25
Race/ethnicity (Black)	−0.74*	0.36	−0.67†	0.37	−0.60†	0.37
Family structure (Married)	0.13	0.44	−0.09	0.44	−0.09	0.43
Maternal education	0.15†	0.09	0.12	0.09	0.13	0.09
State (NC)	−0.34	0.29	−0.48	0.31	−0.43	0.32
Neighborhood disadvantage			0.09	0.19	−0.04	0.19
Neighborhood safety			0.90*	0.35	1.04**	0.35
<i>Moderators</i>						
Geographic isolation			−0.03	0.04	−0.07	0.05
Collective socialization			0.02	0.04	0.04	0.04
<i>Interaction terms</i>						
Disadvantage * Isolation					−0.10	0.09
Disadvantage * Socialization					0.01	0.04
Safety * Isolation					0.10	0.10
Safety * Socialization					−0.20	0.07**
R^2	0.12***		0.15		0.19*	

b: regression coefficient; *SE*: standard error† $p < .10$,* $p < .05$,** $p < .01$,*** $p < .001$