Neighborhood Context and the Risk for Developmental Disabilities in Early Childhood

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Abstract

The effects of place on human health and development have been extensively studied in recent years in the adult and adolescent populations, but minimal research has addressed neighborhood effects in early childhood. This analysis of the National Survey of Children's Health 2011/2012 cross-sectional survey examined relationships between risk for developmental disability in early childhood and neighborhood characteristics in a nationally-representative sample of children ages 0–5 years. Parents reported on their child's development using a well-validated parent report screening tool for developmental problems (the Parent's Evaluation of Developmental Status tool), and neighborhood and family characteristics. Multinomial logistic regression analyses were conducted for each of three neighborhood variables: physical disorder, safety, and isolation. After controlling for parental and child characteristics, the three neighborhood variables were each significantly associated with moderate (but not severe) risk versus low to no risk for developmental disabilities. When all neighborhood characteristics were included simultaneously in the same model, only physical disorder remained statistically significant [OR 1.44 (95% CI 1.09–1.91)], though modestly attenuated. These results suggest that neighborhoods may have effects on early childhood development, after controlling for individual child, parental, and family characteristics.

Keywords Neighborhood context · Early childhood development · Developmental disability · National Survey of Children's Health 2011/2012

Significance

Neighborhood context is well documented as a determinant of adult and adolescent health, but little research has addressed the effects of neighborhood context on early childhood development. Regional differences in developmental disabilities exist, indicating that place may be important to early childhood development. This study found that neighborhood context (physical disorder) is associated with the risk for developmental disabilities in early childhood (ages 0–5) in a nationally-representative survey sample ($n = 27{,}059$) after controlling for socioeconomic family context and parent characteristics. Neighborhoods may have direct or indirect effects on early childhood development amenable to community-based intervention.

Introduction

Developmental disabilities, characterized by a failure to meet developmental milestones within a typical age range, produce oftentimes permanent behavioral, learning, language, social-emotional or physical impairments. Developmental disabilities affect approximately 15% of all children over age 3 in the United States and include attention-deficit-hyperactivity disorder (ADHD), autistic spectrum disorders (ASDs), cerebral palsy, sensory disabilities (e.g. blindness), intellectual disability, and other developmental delays and disabilities [Centers for Disease Control and Prevention (CDC) 2016]. The CDC (2014) estimates that health-care

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related costs of developmental disabilities range from $7833 to more than $22,000 per affected person annually, depending on geographic location within the U.S. Coupled with diminished earning potential and non-health care required services, the economic costs alone of developmental disabilities can be devastating for individuals, families, and communities. Yet despite decades of focused research that has escalated recently due in part to the increasing prevalence of ASDs, the causes and mediating factors of developmental disabilities are largely unknown (Rice et al. 2007).

Over the past several decades, social determinants have been increasingly recognized as significant contributors to disorders of health and development (Leventhal and Brooks-Gunn 2000; Shonkoff 2003, 2012). As such, research on the effect of neighborhood environments in shaping health and well-being has been burgeoning. Recent advances in complex statistical analyses and the availability of cohort data collected across the life span has enabled more longitudinal research to be conducted, and the findings suggest that exposure to adverse neighborhood environments during childhood can contribute to long-term disparities in health and well-being across the life span. For example, in one study, lower neighborhood socioeconomic position (% households without access to basic amenities—water, toilet, bath) during childhood was found to be associated with poorer self-rated health during adulthood (Dundas et al. 2014). In another, the level of neighborhood social cohesion experienced during childhood influenced adolescent mental health outcomes (hyperactivity, anxiety, depression) and prosocial behavior (Kingsbury et al. 2015). However, despite this growing body of evidence to suggest that place matters in early childhood, most research has focused on adolescent and adult outcomes with limited work on how neighborhood characteristics may affect the basic skills and functions of young children during this sensitive developmental window.

This gap in the literature arises in part due to the assumption that adolescents receive more direct exposure to neighborhood conditions than do young children who are much more dependent on parents and other adults to provide close, constant supervision (Boardman and Saint Onge 2005). Despite this assumption, rates for disabilities (intellectual/cognitive, social-emotional, and physical) among children across U. S. metropolitan areas show clear disparities in prevalence that are place-based, with prevalence rates varying from 1.2 to 13% across metropolitan areas (Brault 2011). These disparities lend some support to the notion that place may matter in early childhood. According to theorists and public policy advocates, neighborhood factors such as neighborhood isolation, physical disorder, and safety may play a role in the development of young children by enhancing or limiting extra-familial social interaction, providing or constraining enrichment opportunities for gross motor development and exploration, and through indirect effects that are transmitted from parents and older siblings who are exposed to neighborhoods more directly (Shonkoff 2003). Yet, empiric evidence to confirm these assumptions is lacking.

In order to test whether place, and particularly neighborhood contexts, influence the risk for developmental disabilities, we undertook an analysis of the National Survey of Children's Health (NSCH) 2011/2012, a nationally-representative sample of children ages 0–17 years across the United States. The purpose of this research was to examine whether neighborhood contexts, specifically physical disorder, isolation, and safety, were related to the risk for developmental disability in early childhood.

Methods

This analysis used publicly available data from the 2011/2012 NSCH (Child and Adolescent Health Measurement Initiative 2013). The NSCH was conducted by the Centers for Disease Control, National Center for Health Statistics, State and Local Area Integrated Telephone Survey program via phone interview in Spanish and English.

Sample

The nationally-representative NSCH sample consisted of 95,677 Spanish- and English-speaking households with children less than 18 years of age, selected via list-assisted random-digit-dial (RDD) landline telephone numbers, and supplemented with an independent RDD sample of cellphone numbers from each of the 50 states and the District of Columbia. One child was randomly selected if more than one child lived in the household, and interviews were conducted with a parent or guardian who knew about the child's health and health care. The NSCH research team obtained verbal informed consent from the participating parent or guardian. Screening for developmental disabilities was collected for children ages 0–5 years. Thus, for the purposes of this analysis, a subset of the total sample was selected to include only parents or caregivers of children aged 0–5 years who were asked the developmental screening questions for the focal child ($n = 29,997$). This analysis was approved by [redacted] University Biomedical Institutional Review Board and complies with all prevailing legal and ethical requirements.

Measures

Dependent Variable

Risk for developmental problems was assessed by parent report using the Parent's Evaluation of Developmental Status (PEDS) tool. The PEDS is a standardized screening tool that uses parent reports of concern with multiple developmental

domains (Brothers et al. 2008). Concerns that are predictive of developmental disability/problems differ by age of the child, so the scoring for the PEDS categorizes children as no risk if parents report no concerns, low risk if parents report concerns only in non-predictive domains, moderate risk of if parents report concerns in one predictive domain, and high risk if two or more predictive domains are of concern. Validity was established by Brothers et al. (2008) at each age, with high reliability (test–retest = .98 to .99, interrater = .82 to .96, kappa = .81). The tool was adapted slightly to the constraints of the NSCH, namely the elimination of open-ended questions and the inability to gauge child age in units smaller than 1 year. For the purposes of this study, we categorized the responses as no/low risk = 0, moderate risk = 1, or severe risk = 2. In all analyses, no/low risk (0) was treated as the comparison value.

Independent Variables

To assess neighborhood context, we created three variables: Neighborhood safety, neighborhood physical disorder, and neighborhood isolation. Neighborhood safety was measured using a single question from the survey. Respondents were asked to rate how often they felt that their child was safe in their neighborhood (0 = usually/always, 1 = never/sometimes). Composite measures were developed for both physical disorder and social isolation in which the items were summed and averaged for a mean value (higher values represent higher levels of physical disorder and isolation). Physical disorder was created using three items: (1) litter or garbage on sidewalks or streets, (2) vandalism, such as broken windows or graffiti, and (3) poorly kept or rundown housing (composite α = .59). Social isolation included items that asked about collective efficacy and social cohesion, wherein respondents were asked to agree or disagree with statements. Items included in the composite were: (1) people help each other out, (2) people watch out for each other's children, (3) presence of people that parents can count on, and (4) presence of adults who would help a child who was hurt or scared (composite α = .86).

Covariates

Covariates were selected based on review of existing child development literature and availability within the NSCH data. Child demographics were reported by parent/guardian interviewees. We controlled for child age at time of interview in years and premature birth (< 37 weeks gestation at delivery = 1), sex (male = 1), and low birth weight (< 2490 g = 1) using dichotomous variables. Race and ethnicity were based on parent/guardian report and were dummy coded as white, black, Hispanic, and other

race, categories which were used consistently across all states within the survey. Family demographic characteristics were also included in all analyses. Marital status of the parent/guardian at the time of the interview was dummy coded as married or cohabitating, with single-parent households as the referent group. Parent/guardian physical health and mental health were measured for both parents/guardians if available by report of the parent/guardian interviewee (if information was available on only one parent, then the measure was based on the single parent/guardian report); the dichotomous indicators were coded as 1 if either parent/guardian was reported to be in poor health on that indicator, with fair or better health as the reference group. Parental education was coded based on maternal education where available and paternal education where maternal data was missing, with "less than high school" coded as 1 and high/school or beyond coded as the reference group. Family poverty status (income to poverty ratio) was dummy coded using categories based on percentage of household income to federal poverty guidelines: < 100%, 100% to 199%, 200% to 299%, 300% to 399%, with > 400% as the reference group.

Analysis

Data cleaning, recoding, and analysis were conducted using SAS 9.4. Missing data was minimal, with participants with any missing values accounting for less than 2% of the sample. No differential missingness was found by neighborhood characteristics. All analyses were run with three sensitivity analyses for missing data: (1) listwise deletion, (2) dummy coded missing, and (3) multiple imputation. Results were statistically similar between the three methods, with nearly identical estimates and standard errors, and thus the listwise deletion results are presented here due to ease of interpretation for an analytic sample size of n = 24,879. Results of these sensitivity analyses are available upon request. Demographic characteristics and frequencies of risk for developmental disability were calculated.

To test whether the neighborhood characteristics were associated with risk for developmental disabilities, separate multinomial logistic regressions were conducted for each independent variable individually, while controlling for family and child characteristics. Then, a multinomial logistic model was fit that included all three neighborhood characteristics. Sample weights provided with the data were used to correct for sampling and non-response, such that the resulting analyses are representative of the child (age 0–5 years) population in the U.S. whose parent/guardian has access to a landline or cellular telephone (Data Resource Center for Child and Adolescent Health 2015).

Results

Demographics for the sample are presented in Table 1. In the total sample, 23.3% of parents/guardians reported some predictive concerns with their child's development. Of the children whose parents/guardians reported problems, 15.1% (n = 4106) were categorized as moderate risk, and 8.2% (n = 2236) were rated at severe risk for developmental disability based on parent reports. Neighborhood safety was reported as problematic (respondent never/sometimes felt child was safe in neighborhood) by 10.5% of the parents/guardians. 27% of children were reported as living in neighborhoods with at least one sign of physical disorder [litter or garbage in the street (14.8%), dilapidated housing (15.9%), or vandalism such as broken windows or graffiti (9.9%)]. Parents/guardians reported somewhat or definitely disagreeing with each statement about collective efficacy and social cohesion at rates of 8–10%. Specifically, 9.6% disagreed with the statement "People in the neighborhood help each other out," 9.0% disagreed that neighbors "watch out for each other's children," 9.5% disagreed that they could count on people within the

neighborhood, and 8.3% disagreed that there were people in the neighborhood who could be trusted to help their child if the child was hurt or scared.

Individually, each of the three neighborhood characteristics was statistically associated with moderate (but not severe) risk for developmental disability [neighborhood physical disorder: OR 1.57 (95% CI 1.19–2.06), isolation: OR 1.13 (95% CI 1.01–1.27), and safety: OR 1.31 (95% CI 1.04–1.65)] after controlling for all child and family covariates (Table 2). When the three neighborhood variables were included simultaneously in the same model, only physical disorder remained significantly associated with moderate (but not severe) risk for developmental disability, though modestly attenuated [neighborhood physical disorder: OR 1.44 (95% CI 1.09–1.91)]. Thus, children living in neighborhoods with higher levels of physical disorder had an increased odds of being at moderate risk versus low to no risk for developmental problems compared to children living in neighborhoods with lower levels of physical disorder. No neighborhood predictors were associated with differential outcomes in children whose parents reported severe risk versus low to no risk for developmental disability.

Table 1 Demographics by risk for developmental disorder

	Low/no risk [n = 20,717 (76.6%)]	Moderate risk [n = 4106 (15.1%)]	Severe risk [n = 2236 (8.2%)]	Total (n = 27,059)
Neighborhood context				
Safety (% unsafe)	8.78	13.23	21.70	10.52
Isolation [mean (SD)] range of scores (1–4)	1.58 [0.65]	1.69 [0.70]	1.80 [0.75]	1.61 [0.67]
Physical disorder [mean (SD)] range of scores (0–1)	0.14 [0.25]	0.17 [0.28]	0.19 [0.30]	0.14 [0.26]
Child				
Age [mean (SD)]	2.55 [1.68]	2.85 [1.59]	3.35 [1.56]	2.66 [1.67]
Male (%)	48.68	56.36	61.85	50.93
Low birthweight (%)	5.79	8.33	12.92	11.90
Preterm birth (%)	10.64	14.17	19.41	6.76
Hispanic (%)	14.04	16.34	25.94	9.21
Black (%)	8.34	10.33	15.21	15.37
Other race (%)	11.94	13.59	16.46	12.56
Subjective health (%)	1.09	2.70	8.50	1.94
Family				
Education < HS (%)	7.21	9.74	18.60	8.53
Poverty category (%)				
< 100%	15.27	19.80	31.26	17.28
100–199%	17.08	18.51	20.30	17.57
200–299%	14.93	15.42	12.30	14.79
300–399%	12.96	11.74	8.94	12.44
Cohabitating parents (%)	9.46	10.44	14.11	9.99
Married parents (%)	71.42	66.15	55.32	69.29
Parent mental health problem (%)	5.54	9.13	15.91	6.94
Parent physical health problem (%)	9.09	13.56	22.78	10.90

Table 2 Multivariable logistic regression models on the associations between neighborhood context and risk for developmental disorder among children aged 0–5 years, 2011–2012 National Survey of Children's Health (N = 27,059)

Risk category	Model 1		Model 2		Model 3		Full model	
	Mod	Severe	Mod	Severe	Mod	Severe	Mod	Severe
Intercept [estimate (SE)]	−2.13 (0.16)	−3.77 (0.24)	−2.27 (0.18)	−3.94 (0.26)	−2.08 (0.16)	−3.79 (0.24)	−2.08 (0.16)	−3.79 (0.24)
Safety OR (95% CI)					**1.31 (1.04–1.65)**	1.20 (0.89–1.52)	1.18 (0.92–1.51)	1.14 (0.85–1.52)
Isolation OR (95% CI)			**1.13 (1.01–1.27)**	1.11 (0.97–1.27)			1.06 (0.94–1.20)	1.11 (0.95–1.28)
Physical disorder OR (95% CI)	**1.57 (1.19–2.06)**	0.85 (0.60–1.20)					**1.44 (1.08–1.90)**	0.77 (0.53–1.10)

Global tests for all models had $p < .0001$

95% CI did not cross 1.0 are given in bold

Conclusions for Practice

Neighborhood characteristics have long been thought to influence adolescent and adult health outcomes due to the frequency and intensity of direct exposure to neighborhood conditions inherent to those developmental stages, and our findings support the notion that neighborhood disorder may also influence development of basic skills at the earliest ages. The association of neighborhood contexts with moderate but not severe risk (versus low to no risk) for developmental disability may be due to more severe forms of developmental disabilities such as ASDs and cerebral palsy being driven by factors such as genetics or birth injuries (CDC 2015; Cotney et al. 2015; Kakooza-Mwesige et al. 2016). While little prior research exists linking early childhood developmental outcomes and neighborhood context, our findings are supported by similar work in child development and health. A review by Christian et al. (2015) found strong empirical evidence for improved pro-developmental behaviors (e.g. play, physical activity, social interaction) among children who lived in neighborhoods with less physical disorder and more child-friendly physical environments. Furthermore, Zuberi and Teixeira (2017) found that children's parent-reported general health suffered in the presence of neighborhood physical disorder after accounting for individual and familial socioeconomic conditions. Children's general health may provide restrictions on the ability of children to engage in pro-developmental tasks, leading to lags in skill building.

Several limitations of this analysis must be acknowledged. The data upon which this analysis was conducted were from cross-sectional parent/guardian reports, thus, no causal inferences can be drawn from this analysis alone. The PEDS measure used in this analysis is a risk-assessment tool rather than a diagnostic tool. Despite high correlations to diagnosis in previous samples, this limitation should be considered in the interpretation of these results. Further, neighborhood studies have an inherent selection bias, as parents have to some extent self-selected into the neighborhoods in which they live, though selection is often constrained by economic and other factors. Prior criticisms of neighborhood research have suggested that neighborhood context may be an indicator of individual socioeconomic status rather than an independent factor in health and development (Leventhal and Brooks-Gunn 2000). We attempt to control for this association by including multiple indicators of individual health and family socioeconomic status as covariates within the analysis, but unmeasured characteristics of individuals and families may remain untested. Finally, mechanisms through which neighborhood physical disorder may affect child development were not tested here due to the limitations posed by the cross-sectional data.

Despite these limitations, our findings have important implications for both future research and existing social policy. Specifically, future research should examine potential mechanisms through which neighborhood membership, and neighborhood physical disorder in particular, may affect risk for developmental disability. Understanding the relationship between neighborhood context and early child development may require examining both direct and indirect mechanisms. Specifically, direct effects might include added exposure to environmental pollutants such as peeling lead paint that may be more prominent in neighborhoods with severe physical disorder (CDC 2018), or limited opportunities for gross motor development related to inadequate or unsafe outdoor play spaces (Christian et al. 2015). Meanwhile, indirect mechanisms may include effects on parents and older siblings that are transmitted socially to young children, including exposure to violence and disparities in rates of substance abuse disorders, limited economic opportunities, and other social conditions. For example, Barajas-Gonzalez and Brooks-Gunn (2014) found that less safe neighborhoods and higher levels of neighborhood disorder, maternal depression, and family conflict were associated with more frequent

harsh parenting, a known risk factor for child maltreatment and developmental delay (Uwemedimo et al. 2017).

Existing social policy and interventions aimed at reducing the burden of childhood developmental disability have primarily targeted individual factors like prenatal care, child enrichment, and early detection and intervention on the individual level or begin with Head Start and preschool at age 3, which may already be too late to prevent developmental disabilities. If neighborhood context is indeed important for the development of children as young as birth to age five, then community-level interventions such as structured group play activities, parent support groups, and improvements to the quality of locally-available child care and child-friendly destinations may prove effective.

Compliance with Ethical Standards

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