Positive Parenting Practices, Health Disparities, and Developmental Progress

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abstract

OBJECTIVE: To describe interactive activities between parents and young children in a nationally representative sample. We hypothesized that the frequency of participation in interactive activities would be different across economic strata and would be associated with developmental delay.

METHODS: Children 4 to 36 months of age were identified by using The National Survey of Children's Health 2011–2012. Interactive caregiving practices were reported by poverty status. Developmental concerns were derived from caregiver responses and scoring of the Parents Evaluation of Developmental Status. Multivariable logistic regressions with weighting were used to explore the effect of interactive practices on risk for developmental delay across poverty levels. Covariates including age, gender, insurance type, maternal education, parenting stress, and ethnicity were adjusted in the models.

RESULTS: In our sample (n = 12 642), caregivers with the lowest income versus highest income reported lower participation in reading (33% vs 64%; $P < .0001$), singing or telling stories (52% vs 77%, $P < .0001$), and taking their child on an outing (13% vs 22%, $P < .0001$). Less frequent participation in interactive activities during the week were associated with increased risk of developmental delay among low-income families (Reading odds ratio [OR] 1.57, 95% confidence interval [CI] 1.15–2.13; Singing songs/Telling Stories OR 1.66, 95% CI 1.15–2.40; Outings OR 1.48, 95% CI 1.11–1.97).

CONCLUSIONS: Despite evidence emphasizing the protective effects of supportive parenting practices on early child development, our work demonstrates significant disparities in parenting practices that promote early child development between economically advantaged and disadvantaged parents. Innovative population-level strategies that enrich parenting practices for vulnerable children in early childhood are needed.

WHAT'S KNOWN ON THIS SUBJECT: Interactive activities and routines promote early childhood language skills and subsequent educational achievement. Population studies describing parent-child participation in interactive activities and their associations with early child development among vulnerable populations are needed.

WHAT THIS STUDY ADDS: Significant disparities exist in parenting practices that promote child development between economically advantaged and disadvantaged parents. Participating in less interactive activities was associated with increased risk of developmental delay among low-income families, suggesting a need to enrich parenting practices.

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Dr Shah conceptualized and designed the study, obtained funding to support the study, contributed to interpreting the data, and drafted the initial manuscript; Dr Sobotka contributed to designing the study, interpreting data, and drafting the manuscript; Dr Chen carried out the statistical analysis, drafted the analysis section, and critically reviewed the manuscript; Dr Msall contributed to study design, interpreting data, and providing critical revision of the manuscript; and all authors approved the final manuscript.

www.pediatrics.org/cgi/doi/10.1542/peds.2014-3390

DOI: 10.1542/peds.2014-3390

Accepted for publication May 21, 2015

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

There are >14 million children younger than 18 years who live in families with incomes below the federal poverty level (FPL) (<$23 834 a year for a family of 4) in the United States. More than 30 million children in the United States live in low-income families, defined as twice the FPL, the minimum estimated income necessary to meet a child's basic needs.[1,2] There is a clear deleterious impact of poverty that begins early in a child's life and has substantial life course implications for these vulnerable populations. Studies have consistently demonstrated that children growing up in poverty demonstrate poorer developmental outcomes, specifically in early cognitive and language skills, emerging before the age of 3 years.[3–9] These deficits are predictive of lower preacademic skills needed for kindergarten success, and worsen as a child progresses through school, resulting in poorer academic performance, decreased graduation rates, lower educational attainment, and unhealthy and delinquent behaviors.[10,11]

Interactive parenting practices that provide cognitive stimulation to a child, such as reading, talking, and playing, promote the development of early childhood language skills, which in turn affect school readiness and subsequent educational achievement.[10–17] Combined with emerging neurobiological research showing caregiving as a protective influence from the impact of poverty on the structure of the developing brain, there exists a strong rationale to encourage interactive caregiving practices during the first 3 years of life when critical neuronal and synaptic brain processes are forming.[18–21] To that end, the pediatric, public health, and scientific communities have called on pediatricians to encourage daily interactive activities and routines, including reading, playing, telling stories, and eating meals together to promote early child development and education.[22,23]

Despite these recommendations, to our knowledge, representative population studies describing the alignment between current recommendations and participation in interactive activities in the first 3 years of life have not been published. Also missing from this discussion are population-level studies describing the relationship of interactive parenting practices on child development in low-income families during early childhood. This study aims to fill this critical gap in the literature. Furthering the scientific and public health communities' understanding of current interactive parenting practices among vulnerable populations is essential to refine existing, and develop new, strategies that may be effective for improving developmental outcomes in high-risk populations.

We used the 2011–2012 National Survey of Children's Health to further explore the relationship between interactive caregiving practices and child development in our nation's most vulnerable children.[24] We sought to describe (1) parent-child interactive activities among a nationally representative sample of children younger than 36 months and (2) differences between parent-child interactive activities across diverse economic strata. Additionally, we sought to test the hypothesis that less participation in interactive activities is associated with increased risk of development delay among those experiencing significant adversity.

METHODS

Data Source and Study Sample

We used the National Survey of Children's Health (NSCH) 2011–2012 for our analysis.[24] A detailed methodology and survey design of the NSCH has been described in detail elsewhere.[25] Children 4 to 36 months were included in our analysis if their parent or caregiver (who will subsequently be referred to as "parent") answered at least 1 of the questions regarding developmental concerns of interest. Respondents were grouped according to the income levels as categorized and reported by the NSCH. Children from families who reported incomes <200% FPL were described as living in low-income families.

Measures

Participation in Activities

The outcomes of interest were parent-reported prevalence of the following activities: (1) reading together, (2) singing songs or telling stories, (3) family outings, and (4) eating a meal together. Parents were asked in the past week how often they participated in each of these activities.

Developmental Concerns and Risk for Developmental Delay

Questions derived from the Parents' Evaluation of Developmental Status (PEDS) were administered to parents regarding specific areas of their child's development to evaluate their child's risk for developmental delay. The PEDS has been recommended and validated as 1 tool to be used in primary care visits during early childhood to evaluate a child's development and is a sensitive and specific tool to assess a child's risk of developmental delay.[26] The NSCH uses a research version of the clinical PEDS, which has been used in several previously published studies; it is similar to the clinical PEDS but omits 2 open-ended questions.[26–29]

Parents of children 4 months to 5 years were asked 8 questions regarding whether they had "a lot," "a little," or "not at all" concern for specific areas of their child's development, which included expressive and receptive language, fine motor, behavior, learning, and social-emotional development; responses of "a lot" or "a little" were qualified as having a concern. Of the 8 questions asked in the PEDS, there

are age-specific parental questions that are most predictive of identifying which children have developmental delay. We scored parental responses by using the PEDS scoring method to identify children at "high," "moderate," "low," or "no" risk for developmental delay. We reported children as being at risk for developmental delay if they were identified as having high or moderate risk, consistent with scoring of the PEDS.

Sociodemographic and Parental Covariates

Sociodemographic and parental characteristics that may influence child development were examined based on previously published research documenting the association of these variables on child development.[30–36] Sociodemographic variables included the child's age, gender, race/ethnicity, and insurance status. All these variables were originally categorical in NSCH, and we further grouped their categories for our study. Age was grouped into 4 to 5 months, 6 to 11 months, 12 to 17 months, 18 to 23 months, and 24 to 36 months. Race/ethnicity was combined to create 4 race categories: non-Hispanic white, non-Hispanic black, Hispanic, and other. Insurance status was grouped into no insurance, public insurance, and private insurance.

Parental characteristics included maternal education and parenting stress. Maternal education was grouped into less than high school, high school graduate, and more than high school. To determine the presence of parenting stress, parents were asked the following 3 questions: "During the past month, how often have you felt [child] is much harder to care for than most children his/her age?" "During the past month, how often have you felt (he/she) does things that really bother you a lot?" and "During the past month, how often have you felt angry with (him/her)?" Parenting stress was considered present if the parent answered "usually" or "always" to at least one question, consistent with previously published studies using this measure.[37,38]

Analysis

We described the characteristics of the sample by poverty levels by using frequency for categorical variables and mean with SE for continuous variables. The distribution of covariates across poverty levels was compared by using the Rao-Scott χ^2 test and simple linear regression for categorical and continuous variables, respectively. Moreover, we fitted a multivariable logistic regression for each developmental concern on each individual activity. In each model, the continuous activity level, poverty level, and their interaction term were considered as the main predictors. Covariates, including age, gender, insurance type, maternal education, parenting stress, and ethnicity were adjusted in the models. Based on the models we presented the odds ratios (ORs) and their 95% confidence intervals (CIs) of every decreased day of activity for families who reported incomes <200% FPL. As there are no published data indicating the minimum number of days for positive effects on early child development, we further explored the data by fitting similar logistic regressions with dichotomized activity levels, 0 to 3 days versus 4 to 7 days to reflect participation in these activities less days of the week versus more days of the week. For a total 7% missing data points, we conducted a sensitivity analysis on the multivariable logistic regressions by using multiple imputation on the sample, and the results were similar (Supplemental Tables 6-8). In all the analyses, sample weights were applied to estimates to reflect population totals. The statistical analyses were conducted by using SAS (version 9.3; SAS Institute, Cary, NC). Two-sided P values <0.05 were considered as statistically significant.

RESULTS

Description of the Sample

The study sample for this analysis included all children 4 to 36 months of age in the dataset, n = 12 642. Children from families who reported incomes <200% FPL were more likely to be uninsured, non-white and come from families with lower maternal education (Table 1).

Participation in Interactive Activities

Of all parents in the sample, 49% reported reading to their children daily, 65% sang or told stories daily, 17% took their child on an outing daily, and 62% reported eating a meal together daily. Of parents in the lowest poverty level, 33% reported reading to their children daily, whereas almost twice the number of parents with the highest income reported reading to their children daily (64%; $P < .0001$). Similarly, parents with the lowest income versus highest income reported lower participation with singing songs or telling stories (52% vs 77%, $P < .0001$) and taking their child on outings (13% vs 22%, $P < .0001$). Parents in the lowest income level did report a greater frequency of eating daily meals together than families in the highest economic group (66% vs 56%, $P = .0002$). When comparing participation in activities most days of the week (≥4 days) versus fewer days of the week (0–3 days), parents in lower-income families also reported less frequent participation in reading together, singing songs/telling stories, and family outings ($P < .0001$; Table 2). Increased frequency of eating meals among low-income families most days of the week versus fewer days no longer remained significant when comparing across multiple income-level categories ($P = .09$; Table 2).

Developmental Concerns

Parents in lower-income families reported greater concerns about their child's expressive and receptive

TABLE 1 Poverty Distributions and Sample Demography

	<100 FPL, *n* = 2595	100–199 FPL, *n* = 2349	200–299 FPL, *n* = 1928	300–399 FPL, *n* = 1550	>400 FPL, *n* = 4220
Age, mo, *n* = 12 642					
4–5	6.3 (0.9)	6.2 (1.0)	9.7 (1.8)	8.7 (2.4)	7.6 (1.0)
6–11	19.5 (1.5)	22.2 (2.0)	21.5 (2.0)	22.2 (2.2)	22.5 (1.5)
12–17	19.2 (1.6)	24.5 (2.1)	22.4 (2.0)	27.1 (2.5)	22.4 (1.4)
18–23	17.8 (1.6)	13.3 (1.3)	13.1 (1.6)	13.6 (1.6)	16.6 (1.4)
24–36	37.3 (2.0)	33.9 (2.1)	33.4 (2.3)	28.5 (2.2)	30.9 (1.6)
Gender, *n* = 12 634					
Boys	50.0 (2.0)	53.0 (2.2)	52.2 (2.5)	52.9 (2.7)	48.8 (1.7)
Girls	50.0	47.0	47.8	47.1	51.2
Insurance, *n* = 12 471					
No insurance	4.08 (0.9)	9.1 (1.6)	4.0 (1.2)	4.6 (1.9)	0.9 (0.3)
Medicaid	86.7 (1.4)	58.6 (2.3)	32.4 (2.7)	15.7 (2.3)	7.7 (1.2)
Private insurance	9.2 (1.2)	32.3 (2.2)	63.6 (2.7)	79.7 (2.7)	91.4 (1.2)
Race/Ethnicity, *n* = 12 388					
Hispanic	46.4 (2.1)	29.6 (2.4)	18.9 (2.7)	13.5 (3.0)	12.0 (1.4)
White, non-Hispanic	25.1 (1.5)	48.8 (2.2)	58.7 (2.6)	68.4 (3.1)	65.8 (1.9)
Black, non-Hispanic	20.9 (1.6)	11.5 (1.3)	10.5 (1.4)	6.0 (1.2)	5.5 (1.1)
Other	7.6 (0.7)	10.1 (1.2)	11.9 (1.5)	12.1 (2.0)	16.7 (1.6)
Maternal education, *n* = 12 001					
Less than high school	38.2 (2.1)	14.0 (1.8)	5.7 (1.6)	2.9 (1.6)	0.7 (0.2)
High school graduate	35.0 (2.0)	31.2 (2.3)	19.8 (2.3)	12.5 (2.0)	6.3 (1.0)
More than high school	26.8 (1.7)	54.9 (2.4)	74.5 (2.6)	84.6 (2.4)	93.0 (1.1)
Other caregivers, *n* = 12 638					
No	82.0 (1.6)	72.9 (2.1)	72.7 (2.1)	64.9 (2.3)	48.1 (1.8)
Yes	18.0	27.1	27.3	35.1	51.9
Marital status, *n* = 12 486					
Single mother, never married	24.8 (1.6)	12.0 (1.3)	8.2 (1.5)	5.6 (1.2)	1.9 (0.3)
Others	75.2	88.0	91.8	94.4	98.1
Parental stress, *n* = 12 617					
Present	13.8 (1.5)	6.2 (1.1)	6.3 (1.4)	4.6 (2.2)	3.7 (0.7)

Values in percentages (SE). All $P < .05$, except gender ($P = .5$). May not sum to total due to missing data.

language, learning, behavior, fine motor, and social-emotional development. Twenty-two percent of all children in the sample were at risk for developmental delay. There were significant differences in the risk for developmental delay based on poverty level ($P < .0001$; Table 3). Twenty-eight percent of children living in families with the lowest income were found to be at risk for developmental delay; 19% of children were found to be at risk for developmental delay in families with incomes >400% FPL.

Participation in Interactive Activities and Risk for Developmental Delay

Multivariable analysis with demographic and parental covariates revealed each decreased day of reading, singing or telling stories, taking a child on family outings, and eating a meal during the week was associated with increased expressive language and learning concerns among low-income families (Table 4). Among low-income families, for every decreased day of telling stories/singing songs and taking a child on

TABLE 2 Parent-Child Interactions by Poverty Status

Activity			<100 FPL	100–199 FPL	200–299 FLP	300–399 FLP	>400 FLP	*P*
Reading, *n* = 12 608	% (SE)	0–3 d	47.9 (2.1)	33.8 (2.2)	23.1 (2.1)	20.9 (2.6)	18.9 (1.6)	<.0001
	% (SE)	4–7 d	52.1	66.3	76.9	79.1	81.1	
	Mean (SE)		4.0 (0.1)	4.7 (0.1)	5.3 (0.1)	5.5 (0.1)	5.6 (0.1)	<.0001
Telling stories/Singing songs, *n* = 12 603	% (SE)	0–3 d	26.0 (2.0)	17.6 (1.9)	10.8 (1.4)	8.5 (1.6)	8.5 (1.0)	<.0001
	% (SE)	4–7 d	74.0	82.4	89.2	91.5	91.5	
	Mean (SE)		5.2 (0.1)	5.6 (0.1)	6.1 (0.1)	6.2 (0.1)	6.3 (0.1)	<.0001
Family outings, *n* = 12 629	% (SE)	0–3 d	61.6 (1.9)	46.7 (2.2)	37.8 (2.3)	35.9 (2.6)	33.2 (1.6)	<.0001
	% (SE)	4–7 d	38.4	53.3	62.2	64.1	66.8	
	Mean (SE)		3.4 (0.1)	3.8 (0.1)	4.2 (0.1)	4.4 (0.1)	4.4 (0.1)	<.0001
Eating a meal together, *n* = 12 618	% (SE)	0–3 d	16.9 (1.5)	13.7 (1.4)	12.3 (1.3)	18.6 (2.6)	14.3 (1.3)	.09
	% (SE)	4–7 d	83.1	86.3	87.7	81.4	85.7	
	Mean (SE)		5.7 (0.1)	5.9 (0.1)	5.9 (0.1)	5.5 (0.1)	5.6 (0.1)	.009

May not sum to total due to missing data.

TABLE 3 Developmental Concerns by Poverty Status

	Total Sample			<100 FPL			100–199 FPL			200–299 FPL			300–399 FPL			>400 FPL			*P*
	n	%	SE	*n*	%	SE	*n*	%	SE	*n*	%	SE	*n*	%	SE	*n*	%	SE	
Expressive language	1988	18.0	0.8	536	22.8	1.8	393	16.8	1.6	299	15.8	1.7	221	15.1	2.1	539	16.2	1.5	<.005
Receptive language	1104	10.9	0.7	377	16.7	1.6	245	12.4	1.6	130	6.8	1.1	97	6.9	1.3	255	7.2	1.1	<.0001
Fine motor	728	6.9	0.5	260	9.9	1.1	157	7.96	1.15	81	4.29	0.8	70	6.4	1.4	160	4.3	0.9	<.0001
Behavior concerns	1689	15.6	0.8	508	21.6	1.7	351	15.8	1.7	239	13.7	1.7	165	12.0	1.7	426	11.5	1.3	<.0001
Social-emotional	1581	13.5	0.7	493	19.2	1.6	343	14.9	1.5	212	10.6	1.3	137	8.5	1.3	396	9.7	1.1	<.0001
Learning concerns	781	9.0	0.7	237	12.9	1.7	165	10.5	1.5	108	7.5	1.3	67	5.6	1.2	204	5.6	0.7	<.0001
Risk for developmental delay	2483	21.7	0.8	692	27.8	1.9	500	21.9	1.8	357	18.1	1.7	267	17.9	2.2	667	18.5	1.5	<.0001

family outings there was increased risk of development delay (telling stories/singing songs, OR 1.12, 95% CI 1.05–1.21; family outing, OR 1.10, 95% CI 1.02–1.19). Each decreased day of reading and eating together was associated with greater odds of risk for developmental delay among low-income families; these results had borderline significance in adjusted analyses (reading, OR 1.06, 95% CI 1.00–1.13; eating, OR 1.08, 95% CI 1.00–1.16; Table 4)

Reading, singing songs/telling stories, and family outings less often during the week (0–3 days) compared with more often in the week (4–7 days) was associated with increased expressive and receptive language concerns among low-income families (Table 5). Significant associations were found between the frequency of reading, singing songs/telling stories, and taking a child on family outings and risk of developmental delay among low-income children: children whose parents participated less often during the week in these activities compared with more often in the week were found to have an increased risk of developmental delay (reading, OR 1.57, 95% CI 1.15–2.13; singing songs/telling stories, OR 1.66, 95% CI 1.15–2.40; outings, OR 1.48, 95% CI 1.11–1.97; Table 5).

TABLE 4 Adjusted OR of Developmental Concerns in Families <200% FPL for Every Decreased Day of Parent-Child Activity

Outcome	OR	95% CI
OR of developmental concern for every decreased day of reading a week		
Expressive language	1.08[a]	1.01–1.15
Receptive language	1.08	1.00–1.17
Fine motor	1.10[a]	1.02–1.19
Social-emotional	1.06	0.99–1.14
Learning	1.10[a]	1.01–1.20
Behavior	1.05	0.98–1.12
At risk for developmental delay	1.06	1.00–1.13
OR of developmental concern when told stories or sung song 1 less day a week		
Expressive language	1.10[a]	1.01–1.19
Receptive language	1.12[a]	1.02–1.22
Fine motor concern	1.15[a]	1.06–1.26
Social-emotional	1.08	0.99–1.17
Learning	1.13[a]	1.02–1.26
Behavior	1.05	0.96–1.14
At risk for developmental delay	1.12[a]	1.05–1.21
OR of developmental concern when taken on family outings 1 less day a week		
Expressive language	1.11[a]	1.02–1.21
Receptive language	1.18[a]	1.08–1.29
Fine motor	1.12	1.00–1.25
Social-emotional	1.09	1.00–1.18
Learning	1.16[a]	1.02–1.32
Behavior	1.01	0.92–1.12
At risk for developmental delay	1.10[a]	1.02–1.19
OR of developmental concern when eating a meal together 1 less day a week		
Expressive language	1.09[a]	1.02–1.18
Receptive language	1.12[a]	1.03–1.21
Fine motor	1.08	0.98–1.18
Social-emotional	1.03	0.95–1.11
Learning	1.12[a]	1.02–1.23
Behavior	1.02	0.94–1.11
At risk for developmental delay	1.08	1.00–1.16

Values are after adjusting for age, gender, insurance type, maternal education, parenting stress, and ethnicity.
[a] Significant findings.

DISCUSSION

Our nationally representative study of parents and their children 4 to 36 months of age demonstrated that the frequency of participation in parent-child interactive activities was the lowest among families with the lowest income. In addition, we found that developmental concerns and risk for developmental delay were greatest among low-income children. Finally, we found that among low-income families, less frequent participation in interactive parent-child activities was associated with increased risk of developmental delay.

Our results reveal significant poverty-related disparities in positive parenting practices. Positive parenting practices, including the participation in cognitively stimulating activities, such as reading, promote early childhood language skills and subsequent educational achievement.[3,9,10,13,16] Thus, enhancing positive parenting practices during early childhood

TABLE 5 Adjusted OR of Developmental Concerns in Families <200% FPL When Participating in Parent-Child Activity Less Days A Week Versus More Days a Week

Outcome	OR	95% CI
OR of developmental concern when read to less (0–3) vs more (4–7) days a week		
Expressive language	1.66[a]	1.19–2.30
Receptive language	1.65[a]	1.13–2.43
Fine motor	1.58[a]	1.07–2.34
Social-emotional	1.46[a]	1.03–2.06
Learning	1.60	1.00–2.56
Behavior	1.21	0.84–1.75
At risk for developmental delay	1.57[a]	1.15–2.13
OR of developmental concern when told stories or sung song to less (0–3) vs more (4–7) days a week		
Expressive language	1.52[a]	1.02–2.26
Receptive language	1.75[a]	1.11–2.76
Fine motor concern	1.69[a]	1.07–2.68
Social-emotional	1.34	0.89–2.03
Learning	1.72	0.97–3.04
Behavior	1.14	0.74–1.76
At risk for developmental delay	1.66[a]	1.15–2.40
OR of developmental concern when taken on family outings less (0–3) vs more (4–7) days a week		
Expressive language	1.51[a]	1.11–2.06
Receptive language	1.98[a]	1.40–2.81
Fine motor	1.41	0.93–2.14
Social-emotional	1.20	0.87–1.67
Learning	1.46	0.92–2.30
Behavior	1.24	0.87–1.78
At risk for developmental delay	1.48[a]	1.11–1.97
OR of developmental concern when eating a meal together less (0–3) vs more (4–7) days a week		
Expressive language	1.31	0.87–1.98
Receptive language	1.42	0.89–2.27
Fine motor	1.29	0.78–2.14
Social-emotional	1.14	0.75–1.71
Learning	1.09	0.63–1.89
Behavior	1.02	0.65–1.59
At risk for developmental delay	1.32	0.90–1.93

After adjusting for age, gender, insurance type, maternal education, parenting stress, and ethnicity.
[a] Significant findings.

offers a promising strategy to reduce poverty-related educational disparities.

Reaching a large portion of low-income families with effective interventions to enhance parenting skills will be important if significant decreases in poverty-related parenting disparities are to be made. Most successful interventions designed to strengthen parenting practices have traditionally been delivered through home nursing visits, group sessions, and early education center–based programs. The ability to find trained professionals, along with the cost of these programs, makes widespread dissemination of these programs to large numbers of low-income families a challenge.[39] One possible solution may be to use the primary care office, which provides frequent and well-attended well-child visits, as a setting to access a large population. The advantages are that the primary care setting is established, nonstigmatizing, accessible locally, and has the potential to disseminate parenting interventions. Reach Out and Read, Video Interaction Project, and Healthy Steps are innovative examples of existing programs that have shown promise in leveraging the primary care office to support positive parenting practices.[40–45] Additional strategies that increase interactive parenting practices in vulnerable families that are brief and workable into a busy pediatric clinic will be an important area for future research and public health initiatives.

The American Academy of Pediatrics has called on pediatricians to promote interactive parenting practices, specifically daily reading. Our findings indicate that encouraging not only reading, but also other activities that facilitate verbal communication, such as playing, telling stories, or singing to a child, may be another strategy in promoting early child language skills. Current literature suggests that not only the frequency of participation in activities, but the quality of interactions between the parent and child (eg, quality of language used, responsiveness between caregiver and child) are both central in promoting early childhood language development.[12,13,15,46,47] In our study we were not able to assess the quality of the interactions between parents and children during interactive activities. Additional population-level, as well as longitudinal studies, exploring parent-child interactions during daily routines are needed. However, in the interim, as with reading, it will be important for pediatricians to not only encourage participating in parent-child activities, but also emphasizing frequent, interactive and responsive language during these activities to promote early language development. This requires both modeling and community education efforts.[48]

There are limitations of our study that should be noted. First, developmental concerns were reported by parents, and subject to bias. However, previous studies have shown that lower-income families are likely to underestimate developmental delays, particularly speech delays, and therefore our study likely underestimates the impact of poverty on developmental concerns.[49] Second, our analysis did not account for comorbid mental health conditions, which may further underestimate participation in interactive activities. Finally, our study was limited in its cross-sectional design and conclusions regarding causality cannot be made. Although previous

studies have supported a causal relationship of parenting practices on early child development, there also may be a bidirectional effect of poverty on parenting practices and child development that we could not assess. For example, neurobiological research demonstrates there is a direct, deleterious impact of poverty on the developing brain, which can lead to poorer child development. Poorer child development could increase parental stress, which in turn, may worsen parenting practices and further negatively affect a child's development. Future longitudinal research will be needed to further examine this possibility.

Despite these limitations, our results have important implications for the pediatric, public health, and scientific communities. There has been much emphasis on promoting positive parenting behaviors since Hart and Risley's landmark study demonstrating the predictive impact of parenting behaviors in early childhood on a child's future educational achievement.[48,50] However, our findings highlight a disparity between economically advantaged and disadvantaged families and their participation in parenting practices that promote child development. By using population-level data to demonstrate that participating in fewer interactive activities is associated with increased risk of developmental delay among low-income children, our results underscore the critical need for an effective strategy to address this disparity.

CONCLUSIONS

Our population study adds to research data from genetic, biological, and behavioral sciences emphasizing the importance of interactive caregiving practices in promoting developmental competencies. Innovative strategies to enrich parenting practices in early childhood should be developed and evaluated with respect to their impact on developmental trajectories and as a means to narrow educational disparities among vulnerable children experiencing poverty.

ABBREVIATIONS

CI: confidence interval
FPL: Federal Poverty Level
NSCH: National Survey of Children's Health
OR: odds ratio
PEDS: Parents' Evaluation of Developmental Status

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Funding was provided by the National Center for Advancing Translational Sciences, National Institutes of Health, through grant UL1TR000050. Dr Msall was supported in part by the Health Resources and Services Administration, Department of Health and Human Services, Leadership Education in Neurodevelopmental and Related Disorders Training Program T73MC11047–01–00. Funded by the National Institutes of Health (NIH).

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

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THE STAFF OF LIFE: *I am the course director for a clinically-integrated basic science course that studies a variety of disciplines, including microbiology. During the course, we spend some time comparing bacteria and eukaryotes. While eukaryotes are much more complex, the key difference between the two is that eukaryotes have a nucleus and nuclear membrane. Eukaryotes may be single celled (such as a protozoa) or multicellular (such as a fungus or human). What we never discuss in the course is the* Archaea*, prokaryotes in their own kingdom of life. That is too bad, because they are fascinating and may represent the link between bacteria and eukaryotes.*

Scientists have long wondered how life evolved from bacteria to complex eukaryotes approximately 2 billion years ago. As reported in The New York Times *(Science: May 6, 2015), species of* Archaea *may hold the key. Scientists analyzed the DNA of an* Achaea *species found in sediment 2 miles beneath the surface of the Arctic Ocean. They found that the species (dubbed* Lokiarchaeum *for a hydrothermal vent called Loki's Castle near the location where the archaea were found) is much more closely related to eukaryotes than any other species of* Archaea*. More importantly, they found that the organism contains many of the genes that code for structures found in eukaryotes. For example,* Lokiarcheaum *contains genes that code for products necessary for intracellular compartments (such as lysosomes) and structures (such as a skeleton).*

While the organisms probably did not have true intracellular compartments, they were clearly more complex than bacteria. One theory is that by making a skeleton that conferred mobility, the organism could move about and ingest bacteria. Although still a leap and without definitive proof, mobile Archaea *may have ingested bacteria that became intracellular and the forerunners of mitochondria. Since these ingested intracellular bacteria had their own DNA, the host DNA had to be separated from that of the ingested bacteria and hence the evolution of the nuclear membrane. While we may never know the exact story, the jump from prokaryotes to eukaryotes is fascinating and deserves more attention.*

Noted by WVR, MD