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Child Vocabulary, Maternal Behavior, and Inhibitory Control Development Among Spanish-Speaking Children

Tatiana Nogueira Peredo,

School of Behavioral and Brain Sciences, The University of Texas at Dallas

Margaret Tresch Owen,

School of Behavioral and Brain Sciences, The University of Texas at Dallas

Raúl Rojas, and

School of Behavioral and Brain Sciences, The University of Texas at Dallas

Margaret O'Brien Caughy

University of Texas School of Public Health, Dallas Regional Campus

Abstract

Research Findings—The roles of child lexical diversity and maternal sensitivity in the development of young children's inhibitory control were examined in 100 low-income Hispanic Spanish-speaking children. Child communication utterances at age 2½ years were transcribed from 10-min mother–child interactions to quantify lexical diversity. Maternal behavior was rated independently from the interactions. Inhibitory control was measured with a battery of tasks at ages 2½ and 3½. Greater maternal sensitivity was correlated with higher vocabulary at 2½. Greater vocabulary predicted positive growth in child inhibitory control skills from ages 2½ to 3½ in multivariable regression models that controlled for maternal education, family income, the home environment, and mothering quality.

Practice or Policy—These findings suggest that supporting vocabulary development in low-income Spanish-speaking children is important for the development of inhibitory control skills, an important foundation for school readiness and academic success.

Hispanics composed 17% of the total U.S. population and 26% of children younger than 5 years in 2012 (U.S. Census Bureau, 2013). Young Hispanic children are disproportionately overrepresented among children living in poverty, with 34% in poverty compared to 25% of young children overall in the United States (U.S. Census Bureau, 2011). Many children in this rapidly growing population lack school readiness skills and are at risk for academic difficulties (Jacobson Chernoff, Flanagan, McPhee, & Park, 2007; Lonigan, Farver, Nakamoto, & Eppe, 2013). Inhibitory control skills are important school readiness skills that are highly predictive of children's academic success (Blair & Razza, 2007; Jacobson Chernoff et al., 2007; McClelland et al., 2007; Miller et al., 2006; Raver et al., 2011; Sektnan, McClelland, Acock, & Morrison, 2010). However, few studies have examined processes that influence the development of these skills in Spanish-speaking Hispanic

children. Learning more about supportive factors that impact the acquisition of inhibitory control for low-income Spanish-speaking Hispanic children, such as mothering qualities and verbal abilities, is important for designing interventions aimed at alleviating disparities in academic achievement for this fast-growing at-risk population.

Children of all ethnicities from low-income households are at risk for deficits in self-regulation skills and successful language development compared to their more affluent peers (Fernald, Marchman, & Weisleder, 2013; Hart & Risley, 1995; Pan, Rowe, Singer, & Snow, 2005; Raver et al., 2011). Lack of resources in the home, poor-quality neighborhoods, greater parent stress and depression, and lower qualities of maternal sensitivity contribute to school readiness risks for children from low-income households (Brooks-Gunn & Markman, 2005; García Coll & Pachter, 2002; Magnuson & Duncan, 2002).

PARENTAL SENSITIVITY IN HISPANIC PARENTS

Sensitive parents are emotionally available, engaged and responsive to children's signals and needs, cognitively stimulating, warm, and not harsh or hostile (McFadden & Tamis-LeMonda, 2013; Whiteside-Mansell, Bradley, Owen, Randolph, & Cauce, 2003). Insensitivity can be marked by emotional detachment from the child; negativity toward the child; and/or intrusive, overly directive behavior that undermines the child's autonomy. Given the risks for academic difficulties for children of low socioeconomic and ethnic minority status, sensitive parenting may be a particularly important protective factor (McFadden & Tamis-LeMonda, 2013).

Maternal sensitivity in early childhood is related to many positive child outcomes, including language (Hirsh-Pasek & Burchinal, 2006; Leigh, Nievar, & Nathans, 2011; National Institute of Child Health and Human Development Early Child Care Research Network [NICHD ECCRN], 2001) and self-regulation (Kochanska, Murray, & Harlan, 2000; Lengua, Honorado, & Bush, 2007; Mistry, Brenner, Biesanz, Clark, & Howes, 2010; Spinrad et al., 2012). Much of the research relating child outcomes to parental sensitivity comes from samples of predominantly White middle-class parents. However, studies with more ethnically diverse samples are growing, and some have examined qualities of sensitive parenting in Hispanic mothers. Collectively these studies have found that, similar to in middle-class White families, higher levels of sensitivity, engagement, and responsiveness relate to better child outcomes for Hispanic children (De Von Figueroa-Moseley, Ramey, Keltner, & Lanzi, 2006; McFadden & Tamis-LeMonda, 2013; Weisleder & Fernald, 2013).

Acculturation, acculturation stress, and cultural values are contextual factors that may shape parenting sensitivity and associations with child outcomes in Hispanic families in the United States in distinct ways, and these factors make this group unique from other low-income populations (Gaitan, 2012; Gamble & Modry-Mandell, 2008; García Coll & Pachter, 2002; Hill, Bush, & Roosa, 2003; Ispa et al., 2004; Parke et al., 2004; Weiss, Goebel, Page, Wilson, & Warda, 1999). *Acculturation* is the term used for changes that occur within an individual from contact with a culturally distinct group (Schwartz, Unger, Zamboanga, & Szapocznik, 2010). Acculturation stress is the result of disconnections between values of an individual's home and host culture and of discrimination (Schwartz et al., 2010). Similar to

other stressors faced by low-income families that may lead to depressive symptoms in mothers (Lee, Huang, Halpern, & Newschaffer, 2007), for Spanish-speaking Hispanic mothers, acculturation stress may impact child development through its negative effect on parenting quality (Li-Grining, 2012).

Many have noted impacts of cultural values in Hispanic families on the mother's sensitive responsiveness and its influence on child outcomes (Gamble & Modry-Mandell, 2008; Hill et al., 2003; Ispa et al., 2004; Parke et al., 2004; Weiss et al., 1999). Two traditional Hispanic cultural values of particular relevance are *familismo* and *respeto*. Gamble and Modry-Mandell (2008) found that higher levels of *familismo*, or the view that strong family ties supersede individual needs, were related to greater warmth in the mother-child relationship in Mexican American families. Hispanic parents who adhere to the value of *respeto*, or the belief that children should be obedient and respect their elders without question, may be more likely to emphasize discipline and reprimands as parenting strategies (Calzada, 2010). Although the present study did not directly measure acculturation, acculturation stress, or the cultural values of *familismo* and *respeto*, we present these constructs to contextualize low-income Spanish-speaking families.

THE ROLE OF SENSITIVITY AND VERBAL ABILITIES IN THE DEVELOPMENT INHIBITORY CONTROL

Inhibitory control skills are part of children's *self-regulation skills*, broadly defined as the ability to control emotions and behaviors, and they relate to temperamental tendencies to regulate reactivity, arousal, and emotions as well as more complex cognitive capacities (Blair & Diamond, 2008; McClelland & Cameron, 2011; Rothbart, Sheese, Rueda, & Posner, 2011; Ursache, Blair, & Raver, 2012). *Inhibitory control* can be specifically defined as the ability to resist habits, temptations, or distractions to suppress a natural behavioral response in favor of a more appropriate or correct response and is a key component of self-regulation abilities (Blair & Diamond, 2008; Blair & Razza, 2007; Rothbart et al., 2011; Ursache et al., 2012). Inhibitory control has been shown to be central in the development of self-regulation skills in early childhood as one of the earliest self-regulation skills to emerge, and it has been found to uniquely contribute to early academic ability (Blair & Razza, 2007; Diamond, 2002).

It has been suggested that focusing on developing emotional, attentional, and behavior regulation in young children at risk for school failure may be a more effective strategy for promoting school readiness than focusing on gaining academic content (Blair & Diamond, 2008). Both maternal sensitivity (Blair et al., 2011; Brophy-Herb, Stansbury, Bocknek, & Horodyski, 2012; Lengua et al., 2007; Mistry et al., 2010) and verbal skills (Fuhs & Day, 2011; Kuhn, Willoughby, Wilbourn, Vernon-Feagans, & Blair, 2014; Vallotton & Ayoub, 2011) have been shown to positively relate to children's self-regulation abilities in early childhood. However, very little of this research has been based on studies with Hispanic children. Although a few studies of the role of parenting sensitivity on the development of inhibitory control included significant percentages of Hispanic children (12%–23%), their samples were not large enough to allow for examination of predictors of variations within this group (Bernier, Carlson, & Whipple, 2010; Landry, Miller-Loncar, Smith, & Swank,

2002; Mistry et al., 2010; Spinrad et al., 2007). Similarly, studies that have examined the role of children's language abilities in the development of inhibitory control skills have included no Hispanic children (Kuhn et al., 2014) or included small percentages of Hispanic children but no Spanish-speaking Hispanic children (Fuhs & Day, 2011; Vallotton & Ayoub, 2011).

Vallotton and Ayoub (2011) suggested two mechanisms through which language may aid inhibitory control: (a) Children with a greater use of language (i.e., those who are more talkative) have more control over their environment, are less frustrated, and are better regulated; and (b) children who have larger vocabularies have more mental tools or symbolic representations that aid them in regulating their emotions and impulses. Another theory connects inhibitory control with the ability to engage in self-talk. As speech becomes internalized and verbal thought is present, this ability helps to regulate behavior by allowing children to repeat the rules or expectations of the task in their mind (Barkley, 1997). Following a sample of 146 low-income children in Early Head Start, Vallotton and Ayoub (2011) found that children who had better language abilities were more regulated. Child vocabulary was uniquely predictive of self-regulation skills and remained so even when maternal vocabulary, child cognitive abilities, and child age were controlled. Similarly, Fuhs and Day (2011) reported that verbal ability was positively associated with growth in response inhibition skills among preschoolers.

THE PRESENT STUDY

The purpose of the present study was to examine the roles of maternal sensitivity and child vocabulary in the development of child inhibitory control skills within a sample of low-income Spanish-speaking Hispanic young children. Although low-income Hispanic children living in the United States demonstrate deficits in foundational school readiness skills (Mancilla-Martinez & Lesaux, 2011; McClelland et al., 2007; Snow & Kim, 2007; Vagh, Pan, & Mancilla-Martinez, 2009), little research has focused sufficiently on the determinants of inhibitory control and vocabulary development and their associations in this population. With a few notable exceptions (McClelland et al., 2007; Raver et al., 2011; Weisleder & Fernald, 2013), studies either have not included Hispanic children (Blair & Razza, 2007; Carlson, Davis, & Leach, 2005; Hart & Risley, 1995; Kuhn et al., 2014) or have systematically excluded those who do not speak English (Landry et al., 2002; NICHD ECCRN, 2005a; Pan et al., 2005; Vallotton & Ayoub, 2011; Whiteside-Mansell, Bradley, & McKelvey, 2009).

In this study, we focus on Spanish-speaking, predominantly foreign-born mothers and their young children living in a large metropolitan area of the southwestern United States. Participating families were recruited when the target child was 2½ years of age, an age at which child self-regulatory capacities are just beginning to emerge. This population of first-generation Hispanic children being raised in a Spanish-dominant home environment represents a group of children uniquely at risk for early academic failure but for which experts have very little data regarding the dual domains of language and self-regulation development. Specifically, we ask the following research questions: What is the role of maternal behaviors in supporting vocabulary and inhibitory control development in this

population? Does vocabulary mediate the relation between maternal sensitivity and inhibitory control? We predicted that higher levels of maternal sensitivity and lower levels of maternal intrusiveness would be associated with higher vocabulary and better inhibitory control skills. Furthermore, we predicted that higher maternal sensitivity and lower maternal intrusiveness would be associated with greater growth in child inhibitory control capacities from age 2½ to age 3½ and that this relation would be mediated by the association of maternal behavior with child vocabulary.

METHOD

Participants

The sample for this study was drawn from a larger study of school readiness among ethnic minority preschoolers and their families. The larger study included 407 predominantly low-income families (183 African American and 224 Hispanic) recruited using a variety of community-based recruitment strategies, including distributing flyers at community agencies and recruiting families at community fairs and schools. Of the 224 Hispanic children recruited for the larger study, 177 were identified as monolingual Spanish speakers based on parent report. The other 47 Hispanic children were primarily English speaking. Given the present study's interest in the role of child vocabulary in the development of inhibitory control skills, English-speaking Hispanic children were not included to avoid confounds of the different languages. We excluded the one monolingual Spanish-speaking child whose father was the primary caregiver. Of the remaining 176 children, 167 (95%) completed the second home visit. Those who were lost to follow-up did not differ from those who completed the second home visit in terms of child gender, family income, maternal behavior, and/or child inhibitory control at Time 1.

Secondary to the time required for the labor-intensive process of child language transcription, we randomly selected 100 of these 167 monolingual Spanish-speaking children for more in-depth language coding (described in detail later). All children in the present sample were tested in Spanish for the inhibitory control measures, and the mother–child interaction videos were reviewed to ensure that the mother and child spoke Spanish during the interactions. Those who were randomly selected for inclusion did not differ from those who were not in terms of child gender, family income, child inhibitory control at either time point, or maternal behavior ratings; however, mothers in the selected group were less likely to have finished high school compared to those not selected (44% vs. 60%, respectively), $\chi^2(1) = 3.96, p < .05$; sample size 167. Demographic information for the selected sample of 100 is summarized in Table 1. A large majority of the families, almost 75%, reported incomes below the federal poverty level. Slightly more than half of the mothers had less than a high school education, and most (93%) lived with a spouse. In addition, 95% of the mothers were foreign born, and 97% of the foreign-born mothers reported Mexico as their country of origin.

Procedure

All data collection took place in families' homes. Families were visited at two time points, when the children were 2½ (Time 1) and 3½ (Time 2) years old, and each home visit took

approximately 2 hr. The home-visiting team included one native Spanish speaker who conducted the interview with the mother and a fully bilingual data collector who completed all child assessments. Both the parent interviewer and child assessor completed a 3-day training that included detailed review of all assessments as well as practice with other trainees and similar-age children. All interviewers/assessors were certified for data collection by completing a minimum of two practice assessments correctly according to a fidelity checklist. At the end of each home visit, mothers received a gift card and a small toy for their child for their participation.

Measures

Child inhibitory control—Three tasks (snack delay, wrapped gift, and forbidden toy) were used to assess inhibitory control at Time 1, and two tasks (snack delay and wrapped gift) were used at Time 2. The forbidden toy task was dropped at Time 2 because of time constraints. In the snack delay task, children were asked to wait until the examiner rang a bell before they ate a piece of candy (Kochanska et al., 2000). This task consisted of four trials with delays of 10 s, 20 s, 30 s, and 15 s (in the order presented). The amount of time in seconds that the child waited until touching or eating the candy was coded from videotapes of the procedure. Interrater reliability (intraclass correlation coefficient [ICC]) for this task was .99 based on double coding 15% of cases. In the wrapped gift task, the children were told that the experimenter had a gift for them but not to peek while the experimenter wrapped the gift behind them (60 s; Kochanska et al., 2000). The task also included a wait-for-the-bow phase in which the experimenter asked the child to not touch the wrapped gift placed in front of the child while the experimenter left the room to get a bow for the present (90 s). The videos were coded for latencies to peek, touch, and open the present. A total of 21% of wrapped gift videos were double coded, and interrater reliability (ICC) ranged from .90 to .99.

The forbidden toy task was adapted from the NICHD Study of Early Child Care and Youth Development procedure (NICHD ECCRN, 1998). The child was asked to wait to touch or play with an attractive toy until the home visitor returned to the room (150 s) after having played with the toy with the visitor for 60 s. The attractive toy was a car that moved accompanied by an engine sound after it was shaken and placed on the floor. The child's videotaped behavior was coded for latency to touch the car. Interrater reliability (ICC) for the forbidden toy task was .95 based on double coding 16% of cases.

Inhibitory control composites for Time 1 and Time 2 were created for analysis purposes based on results of a confirmatory factor analysis as sums of dichotomized scores of latency variables for the snack delay, wrapped gift, and forbidden toy (Time 1 only) tasks (Caughy, Mills, Owen, & Hurst, 2013). Latency variables were dichotomized because the scores for each of the inhibitory control tasks had bimodal distributions, indicating that children primarily displayed either full latency or no latency. For example, in the snack delay task there were four trials. The child's score was either 0 (did not wait at all or waited very briefly before touching or eating the candy) or 1 (waited until the bell rang) for each trial.

Child vocabulary—Conversational language samples of the mother–child interactions collected when the children were 2½ years old were transcribed for the 100 children included in this sample to obtain a measure of lexical diversity skills at this age. Language sampling analysis is recommended for assessments of language ability of Spanish-speaking children residing in the United States for two reasons. First, this method provides rich data on child language abilities; and second, there is a lack of adequately normed standardized instruments for this population (Rojas & Iglesias, 2009). A measure of lexical diversity was derived from transcripts of 10-min videotaped mother–child interactions from the Time 1 data time point. Time 1 was chosen as the context for deriving a measure of child language abilities because of the greater variability in child language skills at this early time point (see Vallotton & Ayoub, 2011). Almost identical semistructured play-based interactions with mothers have been used to assess the language abilities of preschoolers in English (Pan et al., 2005; Vallotton & Ayoub, 2011) but have not been used to measure the language abilities of preschool-age children in the United States who speak Spanish.

The transcripts were analyzed using Systematic Analysis of Language Transcripts (SALT; Miller & Iglesias, 2012) software because of the program’s ability to analyze transcripts in Spanish. Number of different words (NDW) was calculated from the transcripts as a measure of child vocabulary and an indicator of lexical diversity (Miller, Adriacchi, & Nockerts, 2011). All of the children in the present study were identified via parent report as monolingual Spanish speakers. This was confirmed by our language sampling analysis at Time 1, which indicated that 97% of the words used by the children across the 100 language samples were in Spanish. It should be noted that although some children occasionally used English words during the interactions (3% of the time), this was not surprising given that all children in the sample were residing in the United States. Children were credited for words spoken in either Spanish or English; thus, the variable NDW was a measure of total vocabulary in both Spanish and English.

Three bilingual undergraduate research assistants and the lead author (also bilingual) transcribed the conversational language samples for the present study. All three undergraduate student coders were native Spanish speakers. The lead author is not a native speaker of Spanish but is fully bilingual. All four coders completed a minimum of 7 hr of SALT online training modules and 3 hr of face-to-face training with the lead author. The online SALT training (<http://www.saltsoftware.com/training-and-ceus/self-paced-online-training>) included two 1-hr courses on transcription formatting and utterance segmentation, a 2-hr course on transcription conventions for Spanish transcripts, and 3 hr of Spanish or Spanish–English bilingual practice transcripts with feedback. Coders completed the online practice transcripts as many times as necessary to ensure that they understood and corrected any errors. In addition, all coders completed a master transcript of a mother–child dyad in the study (checked for accuracy by persons with native proficiency in Spanish and with exceptional knowledge of SALT transcription conventions) and received feedback from the lead author. Coders had to have fewer than six errors on the master transcript before completing transcripts for the study. Because of the length of time necessary to produce a full transcript with both mother and child utterances (>3 hr for 10 min) and the study’s focus on child productions, all mother utterances in the interaction were replaced with a dummy

word. Twenty out of the 100 transcripts were double coded for inter-rater reliability, which was excellent ($\alpha = .95$). In addition, the lead author or a second coder checked all transcripts for accuracy of SALT transcription conventions and Spanish grammar prior to running analyses.

Maternal behavior—Indicators of maternal sensitivity were coded from the same videotaped semistructured mother–child play interactions. The interaction procedure was adapted from the NICHD Study of Child Care and Youth Development Project (NICHD ECCRN, 1999). At the beginning of the 15-min interaction, mothers were given three numbered bags containing (a) a wordless picture book (*Good Dog Carl*; Day, 1996), (b) a toy cooking set, and (c) a Discovery Cottage Playhouse by Fisher-Price. The home visitor instructed the mother to play with her child as she normally would and to move from one toy to the next as they wished starting with Bag 1. Global ratings of maternal behavior included sensitivity/responsiveness, intrusiveness, detachment, cognitive stimulation, positive regard, and negative regard using 5-point adaptations of the coding system used at 24 months in the NICHD Study of Early Child Care and Youth Development (Owen et al., 2010). Three bilingual raters, different from those who transcribed the interactions, coded the interactions from the video recordings. Interrater reliability was calculated based on an ICC (Shrout & Fleiss, 1979) determined from independent double coding of 28% of videotapes and ranged from .79 to .85 for the six maternal behavior rating scales for the Hispanic mothers in the larger sample.

A confirmatory factor analysis of the ratings of the larger study's entire Hispanic sample of mothers indicated that a single factor for five of the maternal behaviors—sensitivity, cognitive stimulation, positive regard, negative regard, and detachment—fit the data best (Caughy & Owen, 2014), $\chi^2(2) = 4.11$, $p = .13$, comparative fit index = 1.00, Tucker–Lewis index = .99, root mean square error of approximation = .07, sample size 220. A maternal sensitivity composite was formed as the sum of the global 5-point ratings of sensitivity/responsiveness to child, cognitive stimulation, detachment (reversed), positive regard for child, and negative regard for child (reversed). The raw score for intrusiveness (1–5) was also used in the current study's analyses of maternal behavior.

Covariates—Demographic and other household information was obtained from data collected during the first home visit. Maternal and child ethnicity was assessed using questions based on the format used by the U.S. Census Bureau. Mothers were first asked whether they were Hispanic and then asked which racial group(s) they identified with: Black/African American, White/European American, Asian, American Indian, or other. Mothers could check as many racial groups as they liked. Similar questions were posed regarding the child's ethnicity. Three of the mothers and six children in the current subsample were identified as multiethnic. Of these, two mothers and five children were reported to be Hispanic and White, whereas the remaining multiethnic mother and child were reported to be Hispanic and American Indian.

Maternal language proficiency was determined using two questions regarding how well mothers spoke English and Spanish rated on a 4-point scale from *very poorly* to *very well* (Marin & Gamba, 1996). Mothers who reported that they spoke the language well or very

well were considered proficient in that language. Most (80%) were Spanish dominant or bilingual (18%). Although one mother reported herself as English dominant, only Spanish was spoken during the mother–child interaction. Self-reported language proficiency data were missing for one mother.

Household income data and family size information at each data point were used to calculate an income-to-needs ratio, which divided household income by the federal poverty level for the family size based on standards published by the U.S. Census Bureau for 2010. The income-to-needs ratios for the two time points were averaged. Based on the assumption that the presence of older children in the household provided a source of stimulation for language development, household roster data were also used to compute the number of children living in the household who were older than the target child. The majority of children (97%) lived in a household that included adults other than the mother and older children (82%). The average number of older children in the household was just under two ($M = 1.69$, $SD = 1.17$) and ranged from none to five.

The Home Observation for Measurement of the Environment scale was used to assess the quality of the learning environment of the home, including literacy materials (Bradley & Caldwell, 1980). The Infant/Toddler version of the scale, which is appropriate up until age 3, is composed of 45 binary response items that capture the parent's relationship with the child, the organization of the environment, the availability of play and literacy materials, the parent's involvement with the child, and the variety of stimulation available in the home.

Analysis methods—In order to answer the study's first research question (i.e., What is the role of maternal behaviors in supporting vocabulary and inhibitory control development in this population?), we used correlation and analysis of variance methods to examine the bivariate associations between the primary variables of interest of maternal behavior, child vocabulary, and child inhibitory control. We also examined the relations between these variables and potential confounders (maternal education, family income, the number of older children in the home, the quality of the home learning environment, and maternal language). We used a multivariable linear regression model to test the effects of maternal behavior and child vocabulary on growth in inhibitory control to answer the second research question (i.e., Does vocabulary mediate the relation between maternal sensitivity and inhibitory control?). The hypothesis was that maternal sensitivity would be positively associated with growth in child inhibitory control and that this association would be mediated by greater child vocabulary.

RESULTS

Research Question 1

Descriptive statistics and intercorrelations of the study variables are shown in Table 2. Because of the moderate/high degree of skewness and/or kurtosis for a number of the study variables combined with the relatively small sample size, we used a Spearman rank coefficient to estimate the bivariate relations between the study variables. The Spearman rank coefficient is more robust in situations of nonnormality (Bishara & Hittner, 2012). NDW at Time 1 was positively associated with maternal sensitivity, $r(100) = .23$, $p < .05$,

but not significantly associated with maternal intrusiveness. NDW was not associated with child inhibitory control measured concurrently at Time 1 but was positively associated with inhibitory control at Time 2, $r(99) = .21, p < .05$. Maternal behavior at Time 1 was not significantly associated with child inhibitory control at either time point. Thus, our expectation that greater sensitivity would be positively related to children's greater vocabulary and to greater inhibitory control in early childhood was supported only for the association found between sensitivity and children's vocabulary at Time 1.

Differences in child vocabulary and inhibitory control as well as maternal behavior by child and family characteristics are displayed in Table 3. Inhibitory control at Time 1 did not differ by maternal education, but 1 year later, children of mothers with a high school education or greater displayed greater levels of inhibitory control compared to children of mothers with less than a high school education (6.21 vs. 5.11, respectively), $t(97) = 2.59, p < .05$. Child inhibitory control at Time 2 was also somewhat higher among girls and among children living in households above 100% of the federal poverty level, although these differences did not achieve customary levels of statistical significance. Child vocabulary did not differ by child or household characteristics. Maternal sensitivity was marginally higher among mothers living above 100% of the federal poverty level, but the maternal behavior measures did not differ significantly by child gender or maternal education.

Research Question 2

Child vocabulary was associated with growth in inhibitory control skills, but because of the lack of association between sensitivity and inhibitory control, there was no support for the mediating role of vocabulary on the relationship between sensitivity and inhibitory control and growth in inhibitory control. Table 4 shows the results of the multivariable regression model in which child inhibitory control at Time 2 (age 3½) was regressed on child NDW at Time 1, child inhibitory control at Time 1, maternal behavior at Time 1, and family demographic characteristics. Because child inhibitory control at Time 1 was included in the model, the other coefficients are interpreted in relation to the change in inhibitory control from Time 1 to Time 2. For the purposes of the regression, all continuous variables were centered at the sample mean. As shown in Table 4, NDW was positively associated with change in child inhibitory control from Time 1 to Time 2 even after we adjusted for the confounding effects of maternal education, family income, the quality of the home learning environment, the number of older children in the home, and maternal behavior. Children with greater lexical diversity at age 2½ displayed faster growth in inhibitory control skills between ages 2½ and 3½. Growth in child inhibitory control was also significantly slower among children whose mothers had less than a high school education and significantly faster when the home learning environment was rated as more optimal and when there were older children in the home. Growth in child inhibitory control was unrelated to maternal sensitivity or intrusiveness at Time 1.

DISCUSSION

The present study found that early lexical diversity was significantly related to growth in inhibitory control skills in early childhood for Spanish-speaking Hispanic children. Higher

levels of lexical diversity at age 2½ were associated with faster growth in inhibitory control skills from age 2½ to 3½. This association was significant even after we adjusted for the effects of maternal education, family income-to-needs ratio, maternal parenting qualities of sensitivity and intrusiveness at age 2½, and the quality of the home learning environment. These findings align with reported associations between vocabulary and inhibitory control in samples of low-income English-speaking children (Fuhs & Day, 2011; Kuhn et al., 2014; Vallotton & Ayoub, 2011) and extend them to low-income Spanish-speaking children. As has been suggested by others, children with greater vocabulary may be better able to regulate their behavior using self-talk or mental symbolic representations to control their impulses (Barkley, 1997; Vallotton & Ayoub, 2011). It is also possible that children who use more words are better able to express themselves and have a better sense of control in their environment, leading to less frustration accompanied by better growth in inhibitory control skills (Vallotton & Ayoub, 2011). The findings from the present study suggest that interventions aimed at improving school readiness skills for Spanish-speaking Hispanic children should start early and target early verbal abilities in the child's home language.

It is surprising that we did not find support for an association between maternal sensitivity and inhibitory control in the current study, as a body of previous research has found such an association (Brophy-Herb et al., 2012; Lengua et al., 2007; NICHD ECCRN, 2005b; Spinrad et al., 2012; von Suchodoletz, Trommsdorff, & Heikamp, 2011). There may be a number of reasons for this. It could be that cultural values such as *respeto* and *familismo* have a stronger influence on child behavior than qualities of maternal sensitivity in Hispanic families. For example, for families who adhere to the cultural value of *familismo*, examining only the Westernized dyadic mother-child relationship may not account for the child's experience, which is likely to involve multiple caregivers (Calzada, 2010). Future research should examine families' adherence to these cultural values and whether these beliefs moderate relations between mothering and inhibitory control in other samples of low-income Spanish-speaking Hispanic families in the United States.

Another reason for the null finding on associations between sensitivity and inhibitory control may be that there are other variables that moderate this association that were not considered in the current study. Findings from data of the larger study indicated that the relation between maternal behavior and child self-regulation capacity is moderated by other conditions of risk present in the home. Although the entire sample was considered low income, there was still considerable variability across the sample in terms of other risk conditions present, such as maternal depression and/or household instability. Maternal sensitivity and intrusiveness were associated with child self-regulation capacity for children living in higher risk households but not for children living in lower risk households in findings from the larger study (author reference). The current study, which relied on transcribing a random sample of 100 mother-child interactions from the larger study, did not provide sufficient statistical power to examine how household risk might act as an effect moderator. However, it is important to recognize the heterogeneity of families even within what might otherwise be considered a homogeneous group of Spanish-speaking, mostly Mexican-origin, first-generation caregivers with young children. Other researchers have suggested that sensitivity acts as a protective factor for children at risk (McFadden & Tamis-

LeMonda, 2013). Higher levels of maternal sensitivity may be particularly important for Spanish-speaking low-income children who have additional household risks (e.g., a single parent, extreme poverty, household instability, maternal depression). Future studies should examine how specific risks associated with low-income status in turn are associated with maternal sensitivity and child outcomes in Spanish-speaking Hispanic families.

Another interesting finding from this study is evidence to suggest a considerable vocabulary difference by age 2½ in this sample of Spanish-speaking children compared to low-income samples of English-speaking children (Pan et al., 2005; Vallotton & Ayoub, 2011). Vallotton and Ayoub (2011) reported a mean of 37.6 ($SD = 24.7$) different words in a comparable 10-min semistructured play interaction with mothers at 2 years of age in their sample of low-income English-speaking children. Similarly, Pan and colleagues (2005) reported a mean of 35.7 ($SD = 26$) different words in a 10-min mother–child interaction with children 2 years of age. The mean for number of different words produced by the 2½-year-old children in the 10-min interactions in the present study was 35.6 ($SD = 17.9$), only slightly different from the number of different words reported in the two previous studies, but the children in the current study were 6 months older than the children in the other studies. Although the differences in vocabulary between children in the current sample and these two other low-income samples are apparent, this comparison should be interpreted with caution. Not only are English and Spanish different languages, but maternal talkativeness and vocabulary in the interactions were not controlled for in the present study.

Other studies of low-income Hispanic children have similarly reported lower language abilities compared to monolingual English speakers in the United States (Lonigan et al., 2013; Mancilla-Martinez & Lesaux, 2011; Snow & Kim, 2007; Uccelli & Paez, 2007; Vagh et al., 2009) or monolingual Spanish speakers not in the United States (Páez, Tabors, & López, 2007). However, in some studies, researchers were focused on comparing the English skills of older bilingual Hispanic children with considerable exposure to a second language to those of monolingual English speakers (Lonigan et al., 2013; Uccelli & Paez, 2007). The present study is unique in identifying a possible vocabulary difference in young monolingual Spanish-speaking children residing in the United States before they receive systematic, academic exposure to a second language. As noted by others, many Spanish-speaking children in the United States do not get enough support for their first language (Snow & Kim, 2007). Although they are exposed to Spanish spoken at home, their developing Spanish language abilities are generally not supported in other settings, such as school or other educational environments (Gaitan, 2012). Moreover, Spanish-speaking Hispanics may face higher levels of discrimination than English-speaking Hispanics (Schwartz et al., 2010) that could motivate some parents not to encourage a strong foundation in the Spanish language in their attempts to stimulate their children's English language skills. This may be particularly problematic for children of parents who are not fluent English speakers and cannot model as complex and rich language in English as they could in Spanish, making it very difficult for their children to have a strong language foundation (Hammer, Davison, Lawrence, & Miccio, 2009).

One promising finding from the current study for interventions that target parent training for low-income Spanish-speaking families is that maternal sensitivity was associated with

children's greater lexical diversity as measured in the mother-child interactions at age 2½. As other research has also found that greater maternal sensitivity and responsiveness were related to children's larger vocabularies (Leigh et al., 2011; Tamis-LeMonda, Bornstein, Kahana-Kalman, Baumwell, & Cyphers, 1998), the positive association found between sensitivity and child vocabulary is not surprising. However, the extension of this association to exclusively Spanish-speaking families in the United States is new and adds to the literature. Research with other populations suggests that adult-led and directive behaviors that are characteristic of insensitive or specifically intrusive mothering are likely to hinder vocabulary development, whereas child-led responsive behaviors focused on the child's interests that are characteristic of sensitive and nonintrusive mothering are likely to encourage vocabulary development (Tamis-LeMonda, Kuchirko, & Song, 2014). Studies have suggested that when an adult is directive, children may not be as attentive to the adult's language as they would be when the adult follows their interest (Adamson, Bakeman, & Deckner, 2004; Tomasello & Farrar, 1986; Yoder & Kaiser, 1993). Tomasello and Farrar (1986) provided evidence for the importance of joint attention between parent and child for language acquisition in their study of 17-month-old typically developing children. This research suggested that children learn words more easily when they are engaged and interested and when the adult attends to the child's interest than when the adult tries to recruit the child's attention. This finding suggests that the quality of the mother-child relationship provides an important foundation for teaching and learning words for young Hispanic children in ways similar to those found in other populations.

Limitations

Some important limitations of the present study are its lack of measures of acculturation, acculturation stress, and Hispanic cultural values. There is research to suggest that acculturation level may impact child development, including vocabulary (García Coll & Pachter, 2002; Jackson-Maldonado, Thal, Marchman, Bates, & Gutierrez-Clellen, 1993). Adherence to culturally appropriate caregiving practices (García Coll & Pachter, 2002) and the lack of preparedness of schools to serve Spanish-speaking families (Gaitan, 2012) may place children of less acculturated mothers at a disadvantage compared to children of more acculturated mothers who are also more likely to speak English. García Coll and Pachter (2002) suggested that less acculturated mothers may view it as more appropriate to keep young children at home with them or with extended family members instead of sending their children to school or school-like environments (Fram & Kim, 2008). Mothers who are first-generation immigrants and who do not speak English, like the vast majority of mothers in the current study, may be even less likely to provide preschool experiences for their children. Many U.S. schools and preschools are not adequately prepared to serve Spanish-speaking families, making particularly strong barriers for families who do not speak English to access resources and connect to school environments (Gaitan, 2012). Although in some instances keeping children at home or with extended family may be appropriate and not hindering to children, in some cases not having those experiences may not prepare children adequately for the expectations of U.S. schools, particularly schools that are less prepared to engage with families from different cultural backgrounds.

Jackson-Maldonado and colleagues (1993) found that children born to mothers who were second-generation immigrants had a vocabulary advantage over those born to mothers who were foreign born. Unfortunately, because of the lack of variability in immigration generation in the current study, we were unable to examine differences in mothering behaviors and child vocabulary and inhibitory control by mothers' generational status. Acculturation stress may be particularly salient in the development of self-regulation skills for first-generation immigrant families living in low-income households (Li-Grining, 2012). Given that all of the mothers in our sample were low income and the majority were first-generation immigrants and spoke Spanish only, it is likely that they faced some level of discrimination and acculturation stress (Emmen et al., 2013; Schwartz et al., 2010). However, at this stage of the study, we did not include measurement of such stress, and we were therefore unable to examine how it impacted parenting and child outcomes presented here.

Another limitation of the present study stems from our approach of not including a full transcription of maternal utterances and of measuring child vocabulary within the interactional, play-based context. We cannot rule out the possibility that the differences in child vocabulary size found in the present study compared to other studies may be due to differences in maternal verbal behavior in the interactions. For example, it is possible that the mothers in the current sample were more talkative and had less balanced verbal turns with their children than mothers in the Vallotton and Ayoub (2011) study and that the children in the current sample simply did not have as many opportunities to speak in the interactional context in which they were measured. Ruling out this possibility will require further study.

Our focus on a single dimension of child self-regulation ability, inhibitory control, is another limitation to generalizations that can be made from the present study. Self-regulation is a multidimensional construct including cognitive flexibility and behavioral and emotional self-regulation. It is possible that the associations examined in this study would look quite different if another aspect of child self-regulation were the focus. We chose to focus on inhibitory control in the present study for a number of reasons. First, the rationale for hypothesizing that better language development will facilitate the development of self-regulation can be made most clearly for inhibitory control (Vallotton & Ayoub, 2011). Second, the young age of the children in our study made it difficult to examine other aspects of self-regulation. Inhibitory control is one of the earliest domains of self-regulation to emerge, with more sophisticated forms of self-regulation such as cognitive flexibility emerging later (Garon, Bryson, & Smith, 2008). In other analyses of data from the larger study from which this sample was drawn, we found that complex response inhibition skills requiring cognitive flexibility were too rare to assess reliably when the children were 2½ and were still very rare 1 year later. Even at age 3½ years, 4 out of 5 Hispanic children in the larger sample were unable to demonstrate cognitive flexibility skills (Caughy et al., 2013). Thus, inhibitory control was the only measure of self-regulation for which we could examine change over time at this young age. Our follow-up study of this sample of children into kindergarten and first grade will provide future opportunities to examine questions regarding emerging language, maternal sensitivity, and self-regulation in this sample of Spanish speakers.

Conclusion

Results from the current study add to the literature on the development of Spanish-speaking Hispanic children in several ways. We found that productive vocabulary is important for growth in inhibitory control skills for this population, even when important confounds such as family income and qualities of parenting and the home environment are controlled. Results of the present study extend the evidence linking maternal sensitivity and child vocabulary to Spanish-speaking children, indicating that maternal responsiveness to the child's interests and needs helps to lay a foundation for communication and the development of language skills for this population in processes that appear similar to those shown with other populations (Adamson et al., 2004; Tomasello & Farrar, 1986; Yoder & Kaiser, 1993).

The findings of the current study have implications for interventions designed to alleviate disparities in school readiness and academic success for Spanish-speaking Hispanic children from low-income families. The finding that early vocabulary aids in the growth in inhibitory control skills suggests that interventions aimed at increasing self-regulation abilities and school readiness for this population should start earlier than the preschool years and target early expressive language development. Given the evidence found for low levels of lexical diversity at age 2½ and the association found between children's expressive language and their growth in inhibitory control skills, this early difference in expressive language may be a factor placing these children at risk for deficits in the development of inhibitory control during a period in which such skills typically make rapid improvements. Although one way to target early vocabulary development for this population may be through programs aimed at increasing maternal sensitivity, our findings indicate that other, yet understudied features of parent-child interactions may relate more strongly to language success.

Future research should examine how adherence to cultural values, acculturation status, and acculturation stress impact parenting and child outcomes in this population. Considerably more research is needed on this understudied population to facilitate the development of effective, culturally sensitive intervention approaches to improving school readiness, given that approximately one fourth of U.S. children live in immigrant households with parents who speak a language other than English (Hernandez, Denton, & Macartney, 2008), a population of children at risk for academic difficulties.

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TABLE 1Characteristics of the Study Sample ($N = 100$)

Characteristic	<i>n</i>
Child gender	
Boy	57
Girl	43
Average family income	
<50% federal poverty level	7
50%–99% federal poverty level	66
100%–149% federal poverty level	24
150%+ federal poverty level	3
Household structure	
Nuclear	68
Nuclear extended	25
Single parent	4
Single parent extended	3
Number of older children in the household	
None	18
One or two	58
Three or more	24
Primary caregiver's level of education	
Less than high school	56
High school or greater	44
Mother nativity	
U.S. born	5
Foreign born	95
Country of origin (for foreign-born caregivers)	
Mexico	92
Central America	3
Mother's language proficiency	
English dominant	1
Spanish dominant	80
Bilingual	18

TABLE 2

Descriptive Statistics and Intercorrelations of Study Variables

Variable	<i>M (SD)</i>	Range	Intercorrelations								
			1	2	3	4	5	6	7	8	9
1. Number of different words (T1)	35.56 (17.93)	5–80	—								
2. Inhibitory control (T1)	2.09 (1.96)	0–7	.04	—							
3. Inhibitory control (T2)	5.58 (2.23)	0–8	.21*	.12	—						
4. Maternal sensitivity (T1)	7.80 (2.49)	–1, 12	.23*	.07	.06	—					
5. Maternal intrusiveness (T1)	2.70 (1.06)	1–5	–.16	–.16	–.01	–.48*	—				
6. Maternal education (T1) ^a	0.56 (0.50)	0–1	.09	–.00	–.24*	–.14	.01	—			
7. Average family income-to-needs ratio	0.86 (0.27)	0.35–1.76	.17 [†]	.09	.19 [†]	.24*	–.10	–.24*	—		
8. Number of older children in the household	1.69 (1.17)	0–5	–.17 [†]	.10	.15	.02	.06	.14	–.27**	—	
9. HOME scale	39.57 (3.34)	27–45	.12	.30**	.23*	.49**	–.19 [†]	–.21*	.24*	–.02	—

Note. Correlations reported are Spearman rank coefficients. T1 = Time 1; T2 = Time 2; HOME = Home Observation for Measurement of the Environment.

^a 1 = less than high school, 0 = high school or greater.

[†] $p < .10$.

* $p < .05$.

** $p < .01$.

TABLE 3
Differences in Vocabulary, Inhibitory Control, and Caregiver Behavior by Child and Family Characteristics

Characteristic	Child Gender			Maternal Education			Family Income		
	Male	Female	<i>t</i>	Less than HS	HS+	<i>t</i>	<100% FPL	100%+ FPL	<i>t</i>
Number of different words	34.14 (15.79)	37.44 (20.48)	-0.91	36.84 (17.49)	33.93 (18.55)	-0.80	34.45 (16.62)	38.56 (21.15)	0.91
Inhibitory control (Time 1)	1.93 (1.81)	2.30 (2.14)	-0.95	2.11 (2.03)	2.07 (1.88)	-0.09	2.03 (1.95)	2.27 (2.01)	0.54
Inhibitory control (Time 2)	5.23 (2.35)	6.04 (1.99)	-1.87 [†]	5.11 (2.38)	6.21 (1.86)	2.59 [*]	5.33 (2.23)	6.26 (2.10)	1.86 [†]
Maternal sensitivity	7.96 (2.31)	7.58 (2.72)	0.76	7.46 (2.45)	8.22 (2.50)	1.53	7.58 (2.73)	8.41 (1.58)	1.89 [†]
Maternal intrusiveness	2.74 (1.04)	2.65 (1.09)	0.39	2.73 (1.07)	2.66 (1.06)	-0.34	2.77 (1.09)	2.52 (.98)	-1.10

Note. Except where noted, data are *M* (*SD*). HS = high school; FPL = federal poverty level.

[†] $p < .10$;

^{*} $p < .05$.

TABLE 4

Multivariable Regression of Change in Inhibitory Control From Age 2½ to Age 3½ on Household Characteristics, Maternal Behavior, and Child Vocabulary at Age 2½

Characteristic	<u>Inhibitory Control, Time 2</u>	
	<i>b (SE)</i>	<i>t</i>
Constant	0.74 (.37)	2.00*
Child inhibitory control (Time 1)	−0.02 (.12)	−0.20
Maternal education (1 = less than high school)	−1.12 (.46)	−2.42*
Average family income-to-needs ratio	1.18 (.88)	1.34
HOME scale	0.23 (.08)	2.85**
Number of older children in the home	0.43 (.19)	2.22*
Maternal language (0 = Spanish dominant)	−0.57 (.82)	−0.93
Maternal sensitivity composite (Time 1)	−0.20 (.11)	−1.75 [†]
Maternal intrusiveness (Time 1)	0.10 (.23)	0.65
Number of different words (Time 1)	0.03 (.01)	2.64*

Note. HOME = Home Observation for Measurement of the Environment.

[†]
 $p < .10$.

*
 $p < .05$.

**
 $p < .01$.