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# Spanish-English bilingual toddlers' vocabulary skills: The role of caregiver language input and warmth

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## Abstract

There is a well-documented link between bilingual language development and the relative amounts of exposure to each language. Less is known about the role of quality indicators of caregiver-child interactions in bilingual homes, including caregiver input diversity, warmth and sensitivity. This longitudinal study examines the relation between caregiver input (lexical diversity, amount), warmth and sensitivity and bilingual toddlers' subsequent vocabulary outcomes. We video-recorded caregiver-child interactions in Spanish-English Latino homes when toddlers ( $n = 47$ ) were 18 months of age ( $M = 18.32$  months;  $SD = 1.02$  months). At the 24-month follow-up, we measured children's vocabulary as total vocabulary (English, Spanish combined) as well as within language (Spanish, English). Results revealed that Spanish lexical diversity exposure at 18 months from caregivers was positively associated with children's Spanish and total vocabulary scores at 24 months, while English lexical diversity was positively associated with children's English scores; lexical diversity and amount were highly correlated. Additionally, caregivers' warmth was positively associated with children's Spanish, English and total vocabulary scores. Together, these factors accounted for substantial variance (30–40%) in vocabulary outcomes. Notably, caregiver input accounted for more variance in single language outcomes than did caregiver warmth, whereas caregiver warmth uniquely accounted for more variance in total vocabulary scores. Our findings extend prior research findings by suggesting that children's dual language development may depend on their exposure to a diverse set of words, not only amount of language exposure, as well as warm interactions with caregivers. A video abstract of this article can be viewed at [https://youtu.be/q1V\\_7fz5wog](https://youtu.be/q1V_7fz5wog)

## KEYWORDS

bilingual, caregiver language input, dual language, emotional supportiveness, English, Spanish

## Highlights

- Video-recorded observations of caregiver-child interactions revealed warmth and high sensitivity from Latino caregivers.
- Linguistically-detailed analyses of caregiver input revealed wide variation in the diversity of Spanish and English directed at 18-month-old bilingual toddlers.

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- Bilingual toddlers' vocabulary (single language, total) was positively associated with caregivers' diverse input and warmth, thus extending prior findings on bilinguals' amount of language exposure.
- Findings suggest that caregivers' lexical diversity explains more variance in bilingual toddlers' single language outcomes, whereas warmth explains more variance in total vocabulary scores.

## 1 | INTRODUCTION

Young Spanish-speaking Latinos, over 60% of whom speak English at home, are the principal drivers of U.S. demographic growth (Patten, 2016). Despite the accumulating research on the dual language development of this large and fast-growing group (Hammer et al., 2014), especially in the last decade (Genesee et al., 2021), there is still a limited understanding of the environmental factors underlying early bilingual development. It has long been known that bilingual children's development in a language varies as a function of the quantity of their input in that language (De Houwer, 2007; Hoff et al., 2012; Patterson, 2004; Pearson et al., 1997). Yet, little is known about how quality indicators in bilingual caregiver-child interactions influence bilingual learning, despite substantial research demonstrating that the quality of early language experiences – including the diversity of caregiver's input and emotional supportiveness – support the learning of one language (Anderson et al., 2021; Madigan et al., 2019). Caregivers' warmth and sensitivity may foster language development by creating stimulating and engaging learning environments (Tamis-LeMonda et al., 1998; Tamis-LeMonda, Kuchirko et al., 2014). In Latino families, caregivers' affection may be especially beneficial to children's bilingual skills given Latino cultural values that emphasize the importance of family interdependence and cohesion (Halgunseth et al., 2006; Li-Grining, 2012). Thus, to identify the features of caregiver-child interactions that are associated with bilingual development (Spanish, English combined), the current study examines Latino children's home language environments in-depth, with particular emphasis on caregivers' linguistic input in Spanish and English (amount, diversity), warmth, and sensitivity during caregiver-child interactions.

### 1.1 | The influence of language input on dual language skills

Interactionist theories posit that optimal language-learning environments provide children with frequent opportunities to engage with caregivers in interactions that provide language input and practice (Snow, 1994; Tomasello et al., 2005). Given the important role of culture in social-cultural theories, caregivers may model culturally-relevant language forms that children are expected to acquire (i.e., forms in both English and Spanish for bilingual Latinos).

For English monolinguals, there is a nuanced understanding that while the amount of caregiver language input is important for early language development (Huttenlocher et al., 1991; see Weisleder & Fernald, 2013 for functionally-Spanish-monolingual), the diversity of the input (or input quality) is an important predictor of language skills as children age (Jones & Rowland, 2017; Montag et al., 2018; Rowe, 2012). The influence of caregivers' lexical diversity (i.e., number of different word types; NDW) on English monolinguals' language learning is most pronounced around 24 months of age (Hirsh-Pasek et al., 2015; Jones & Rowland, 2017; Pan et al., 2005). The differential age-related influence of caregivers' lexical diversity may reflect the nature of the language learning tasks at different ages. In particular, the amount of input may be beneficial at the earliest stages of learning, when children know few words and are beginning to build a lexicon. By 24 months of age, when children have amassed a more extensive lexicon, they must hear a variety of words (i.e., diversity) to build their lexicons further.

Because age and language exposure are confounded in monolinguals, it is unknown whether the differential influence of caregiver input is a maturational phenomenon (i.e., age-related) or an artifact of children's length of exposure to a language. These questions about age-related input influences can be explored with bilingual children. Some scholars (Hoff et al., 2012) have argued that for bilingual children, who divide their time between two languages, exposure to a particular language may be less than it is for their age-matched monolingual peers (cf. De Houwer, 2009). Thus, the time scale for this age-related differential of caregiver input should differ between bilinguals and monolinguals. The differential age-related influence may reflect a threshold effect whereby diverse input plays a significant role after the accumulated language exposure reaches a particular point.

Conversely, the role of input may be analogous in monolingual and bilingual children in that diverse input is associated with bilingual language outcomes by 24 months of age. This remains an open question as past bilingual input studies have primarily assessed the amount of children's exposure to each language, using language questionnaires, diaries, and interviews (Carroll, 2017).<sup>1</sup> Too few input studies – excluding case studies – have involved labor-intensive approaches to describe bilingual input (NDW), beyond measures of amount, which require audio/video recordings (i.e., absolute input measures; Marchman et al., 2017; Orena et al., 2020).

The findings of one study examining slightly older Latino children's input (i.e., yearly from 24 months to 5 years) suggest that caregivers'



use of diverse language – albeit during book sharing – may support children's English and Spanish vocabulary development (Tamis-LeMonda et al., 2014). In particular, changes in caregivers' types, measured during caregiver-child book sharing sessions (~4–7 min in length), across the four time-points were associated with changes in children's English and Spanish vocabulary skills. Children's vocabulary was assessed separately by language as “types per minute” (English, Spanish) and with an expressive vocabulary measure in the child's preferred language (68.3% in English; 4.8% in Spanish and English). To better understand the role of caregivers' types on Latino children's early bilingual skills, across both languages (i.e., total vocabulary), not just within Spanish and English, the current study examines (a) caregivers' diverse language use in home settings when children were 18 months of age and (b) children's bilingual vocabulary skills at 24 months of age. Further, given that caregiver input occurs in the context of social interactions that vary in affection and support, and those variations may themselves be language promoting (Tamis-LeMonda et al., 1998; Tamis-LeMonda, Kuchirko et al., 2014), we also examined the contribution of caregivers' warmth and sensitivity during caregiver-child interactions.

## 1.2 | Caregivers' warmth and sensitivity on children's language skills

Attachment Theory (Ainsworth et al., 1978) posits that the emotional bond formed with caregivers is central in children's ability to learn from their linguistic experiences. When caregivers are warm and sensitive, they provide a secure base for children to explore and learn from their environmental experiences, including caregiver-child interactions. For example, when caregivers' responses to children's vocalizations provide didactic content (informative) and are scaffolded (modified in line with developmental capabilities), it may facilitate the mapping of words to their referents (Carpenter et al., 1998; Tamis-LeMonda et al., 2004). Supportive parenting is also prompt and contingent, as caregiver's responses generally follow children's attentional bids (e.g., vocalizations; Bornstein et al., 2008). Such supportive interactions with caregivers may foster children's Spanish and English vocabulary by promoting their attention and engagement during linguistic interactions.

Decades of research – albeit primarily with White and monolingual families – demonstrate that caregivers' warmth and sensitivity affect children's development across multiple domains, including language (e.g., Tamis-LeMonda, Song et al., 2014). A recent meta-analysis of such studies (Madigan et al., 2019) revealed stronger language skills among children whose caregivers displayed high levels of warmth and sensitivity. The reported effect sizes suggest that children are 2.8 times more likely to exhibit stronger language skills if their caregivers display high warmth and sensitivity than if they do not. Despite findings implicating caregivers' warmth and sensitivity as critical to language development, there are few studies investigating the caregiver behaviors that promote Latino children's bilingual language skills. Yet, these types of positive caregiving experiences may be particularly prevalent in Latino families, given culturally-based values emphasizing family

interdependence and cohesion (Halgunseth et al., 2006; Li-Grining, 2012).

A recent review highlighted two key findings of caregiving behaviors in Latino families (Cabrera & Hennigar, 2019). First, Latina caregivers typically display warmth during caregiver-child interactions (e.g., hugging, being loving). Yet, Fuller et al. (2010) found that Latina mothers' warmth was unassociated with children's general cognitive abilities (Cabrera & Hennigar, 2019). Given the relatively fewer studies involving Latino families, it remains unknown whether and how caregivers' warmth influences bilingual language skills. Given that learning two languages may be a more complex task than learning one, by virtue of having to learn two separate systems, it is expected that high levels of caregiver warmth will uniquely support bilingual language learning, as it does for monolingual language learning (Madigan et al., 2019).

Cabrera and Hennigar (2019) also highlighted inconsistent findings in terms of Latina caregivers' sensitivity. In the limited literature examining the role of Latina caregivers' sensitivity and warmth on single language outcomes, some findings show no statistically significant relations (Fuller et al., 2010) or positive associations in only one language (with English development, but not Spanish; Ramírez, 2021). Though Ramírez (2021) included a very small sample of Latina mothers ( $n = 8$ ), such findings highlight how caregivers' sensitivity and warmth may promote bilingual children's language development. Notably, Latina caregivers' sensitivity and warmth may vary as a function of their Spanish and English language use preferences, which may explain inconsistent findings. For example, Cabrera et al. (2006) found that Latina caregivers who reported higher English proficiency exhibited greater sensitivity than those who reported lower English proficiency. Similarly, Ispa et al. (2004) showed that Latina caregivers' warmth was positively correlated with their U.S. acculturation level based on a measure that predominantly included questions about caregivers' language use preferences. Such findings demonstrating linguistic differences in how language use preferences may relate to parenting behaviors highlight the need for a more holistic investigation of the quality indicators of caregiver-child interactions in Latino homes, including caregivers' warmth, sensitivity and language use.

## 1.3 | Variability in Bilingual children's language skills

The language-specific findings related to Latina caregiver behaviors highlight the importance of investigating the quality indicators of caregiver-child interactions and Latino children's bilingual skills, both within Spanish and English (i.e., single language) and across both languages (i.e., total vocabulary). The current recommended practice is to assess bilingual children in both languages (Peña et al., 2016). Doing so acknowledges that bilinguals' vocabulary knowledge is distributed across two languages and that their skills in each language can be balanced (e.g., similarly high) or unbalanced (i.e., higher performance in one language). This is because bilinguals' vocabulary knowledge is accumulated from their experiences with each language across contexts (e.g., home- and academic-related vocabulary). Bilingual children



do not typically learn the same vocabulary in both languages due to varying linguistic demands and contexts associated with each language (Peña et al., 2016). Thus, assessing bilingual children in one language taps only a subset of their total linguistic knowledge (Pearson et al., 1993). This explains why findings from studies relying on single language scores describe bilinguals' rate of vocabulary development in each of their languages as slower than for monolingual children (Hoff et al., 2012).

In contrast, when researchers assess bilingual children's vocabulary across both languages, their vocabulary knowledge, as a whole, is either equal to or exceeds that of monolingual children (Core et al., 2013; De Houwer, 2007; Hoff et al., 2012). For example, Pearson et al. (1993) compared 8–30-month-old bilingual children's total vocabulary (TV; the number of words known across two languages) to the vocabulary skills of a group of monolingual children in the same age range. They showed that bilingual and monolingual children scored comparably in terms of vocabulary when using TV scores. Recent research also shows comparable vocabulary scores for 22–30-month bilingual and monolingual toddlers, using TV scores (Core et al., 2013). Therefore, the current study adheres to recommended practices for the valid assessment of bilingual development, including measuring bilingual children's language skills in both languages and calculating single language (e.g., English and Spanish skills) and combined language scores (i.e., TV scores).

### 1.3.1 | The present study

In the present study, we examine Latino toddlers' English-Spanish bilingual development (using both single language and TV scores) and their caregivers' amount of and diverse input (English, Spanish) as well as warmth and sensitivity. Given the positive relation between caregivers' lexical diversity and monolingual children's language skills at 24 months of age (Rowe, 2012), we obtained caregiver reports of bilingual children's productive vocabulary skills at 24 months. Moreover, we measured caregiver input, warmth and sensitivity from video-recorded caregiver-child interactions in Spanish-English bilingual homes when the target child was 18 months of age. As noted, previous research with bilingual children has commonly described their language environments using measures of amount (Carroll, 2017). To add to this research, we generated samples of caregiver linguistic input from a 75-minute naturalistic observation. This ensured unbiased estimates of caregivers' use of English and Spanish. Naturalistic observations also allow for an estimate of the amount and diversity of children's exposure to English and Spanish; this was in addition to the quantity measures from a language survey. Also, we relied on the commonly used Three Bag Task (Brady-Smith et al., 1999) to measure caregivers' warmth and sensitivity, which stand out in the literature as potential predictors of children's developmental outcomes (Madigan et al., 2019). The following overall research question guided the present study: *What are the unique and combined contributions of Latino caregiver input (amount, diversity), warmth, and sensitivity on their 24-month-old bilingual toddlers' English and Spanish skills?*

## 2 | METHOD

### 2.1 | Participants

Forty-seven caregiver-child dyads participated in this longitudinal study. Child participants ( $F = 24$ ;  $M = 23$ ) were 18 months of age at the first recording session ( $M_{\text{age}} = 18.32$  months;  $SD_{\text{age}} = 1.02$  months) and 24 months of age ( $M_{\text{age}} = 24.85$  months;  $SD_{\text{age}} = 0.66$ ) by the end of this study. Thirty-four percent of children were first-born. According to parents' responses on a brief language and eligibility screener, participating children were exposed to English and Spanish by 18 months of age. Language and background questionnaire responses indicated that all children had been exposed to Spanish from birth. The majority of children were exposed to English from birth ( $n = 41$ ) or by the first year ( $n = 3$ ); three families did not indicate a specific age on the language questionnaire. All children were Latino (Latino only  $n = 39$ ; Latino and Caucasian/White  $n = 5$ ; Latino and Black/African-American  $n = 2$ , and Latino, Filipino and Black  $n = 1$ ).

Most primary caregivers ( $M_{\text{age}} = 33.11$  years;  $SD_{\text{age}} = 5.09$  years) were mothers ( $n_{\text{mothers}} = 45$ ;  $n_{\text{fathers}} = 2$ ). They had completed some college ( $n = 15$ ) or earned a college degree or higher ( $n = 24$ ); the remaining reported completing high school ( $n = 5$ ) or having attended high school ( $n = 3$ ). Participants lived in the greater Chicago area. All identified as Latino ( $n = 45$ ) and either first ( $n = 17$ ) or second generation ( $n = 28$ ), except for two mothers who identified as Caucasian/White and fourth or fifth generation. The majority of primary caregivers identified as being of Mexican descent (83%;  $n = 39$ ). Other self-reported ethnicities (17%) included Guatemalan ( $n = 3$ ), Ecuadorian ( $n = 1$ ), Columbian ( $n = 1$ ), Cuban-Peruvian ( $n = 1$ ) and US-American ( $n = 2$ ). As detailed below, a small sample of secondary caregivers ( $n_{\text{fathers}} = 4$ ;  $M_{\text{age}} = 36.00$ ;  $SD_{\text{age}} = 2.89$ ) also participated in portions of this study. All fathers identified as Latino of Mexican-descent and as first or second generation. They reported having an elementary school education ( $n = 1$ ), some college ( $n = 2$ ) or earning college degree or higher ( $n = 1$ ). Annual household income varied from less-than-\$15,000 to over-\$100,000 ("less-than-\$15,000"  $n = 3$ ; "\$15,000–\$49,999"  $n = 15$ ; "\$50,000–\$99,999"  $n = 15$ ; "100,000-or-more"  $n = 14$ ). Of note, this is the final sample from an original sample size of 50, after three participants were excluded because they were unavailable at the 24-month follow-up ( $n = 1$ ), the target child was not producing speech at the 24-month follow-up ( $n = 1$ ), or the caregiver did not agree to video-recording at the 18-month time-point ( $n = 1$ ).

### 2.2 | Materials

#### 2.2.1 | Demographics and language exposure questionnaires

Demographics and language background were assessed using researcher-developed questionnaires. A brief language screener, which was available in both English and Spanish, assessed participant eligibility (i.e., bilingual status) by asking caregivers to indicate whether



the child “was exposed to English and Spanish” (yes/no options). Caregivers also indicated their preferred language when communicating with researchers; this is the language that was used by researchers when interacting with caregivers. A separate and more detailed background and language questionnaire asked about the languages spoken at home with the child by different interlocutors (caregivers, other adults, siblings) on the following five-point scale: 5 = “Only Spanish,” 4 = “Mainly Spanish,” 3 = “English and Spanish Equally,” 2 = “Mainly English,” and 1 = “Only English” (Duursma et al., 2007). Responses to these four questions were averaged to derive a *Home Language Exposure* score for each child. The primary caregiver’s language use with the child was also assessed from this questionnaire (*Primary Caregivers’ Language Use*). Higher values indicate greater exposure to Spanish at home, lower values indicate more exposure to English at home, and intermediate values indicate relatively equal exposure to Spanish and English at home.

## 2.2.2 | Child vocabulary

Children’s word production was assessed using the MacArthur-Bates Communicative Inventories (MCDIs; Fenson et al., 1994; Jackson-Maldonado et al., 2001). These are reliable (e.g., publisher test-retest reliability  $r$ ’s = 0.80’s–0.90’s) and valid caregiver-report measures of language that can be used with children from 18 to 36 months of age. The “Words and Sentences” and “Palabras y Enunciados” forms are the English and Spanish versions, respectively. The Spanish form (Inventarios del Desarrollo de Habilidades Comunicativas MacArthur-Bates; IDHC) was adapted from the English form (MCDI) and includes words that are linguistically and culturally tied to Mexican Spanish. Each form includes a checklist of 680 words and instructs caregivers to indicate which words their child says. In line with recommended practices, we derived single language and total composite vocabulary 24-month raw scores: (1) English vocabulary score (total number of English words out of a possible 680), (2) Spanish vocabulary score (total number of Spanish words out of 680 possible), and (3) total vocabulary score (the sum of all items across both English and Spanish).

## 2.2.3 | Video-recording equipment

Caregiver-child interactions were video-recorded using handheld camcorders (Sony HDRCX405 HD).

## 2.3 | Procedures

After an initial phone screening to assess study eligibility, student researchers visited participant homes when the target child was 18 and 24 months old. The first visit involved the consent process. At each visit, researchers interviewed caregivers using the demographics and language background questionnaires in their preferred language (as indicated on the language screener). Following the interview, families

participated in two recording sessions: a naturalistic observation and a structured-play task. For the naturalistic observation, researchers video recorded caregiver-child dyads for 75-min. Caregivers were instructed to go about their day as they typically would. Thus, naturalistic observations involved a variety of indoor and outdoor activities (e.g., mealtime, toy play, etc.) and other people in the home (*Mode* = 2; *Mean* = 2.38; *SD* = 1.05), including the primary caregiver (primary caregiver only  $n$  = 10) and secondary caregivers, siblings, or “other” (e.g., relatives). Recordings took place in the morning (between 9:00 a.m. and 12:00 p.m.;  $n$  = 27) or afternoon (between 12:00 and 5:00 p.m.;  $n$  = 18) during the child’s awake time; two families were recorded in the evening (5:30 p.m. and 6:00 p.m.) because of scheduling conflicts. Notably, at study enrollment, most children did not attend daycare (83%). Also, in seven cases, the naturalistic observation lasted only 30–45-min ( $M_{\text{full sample}} = 65.43$ ;  $SD_{\text{full sample}} = 18.08$ ); see below for a description of how caregiver input data were prorated in these cases. These seven observations occurred at the start of the COVID-19 pandemic (July–August, 2020) and thus, video recordings took place outdoors to ensure social-distancing; all other observations were conducted prior to the COVID-19 pandemic (before March 2020).

Immediately following the naturalistic observation, caregivers and children participated in the 10-minute structured play task, the Three Bag Task (Brady-Smith et al., 1999). Caregivers and children were invited to sit on a blanket and received three cloth bags containing age-appropriate books and toys (Bag #1: *Goodnight Gorilla* and *Buenos Noches books*, *Gorila*; Bag #2: Barn house and animals, and Bag #3: Kitchen play set). Caregivers were instructed to use the items in each bag with their children, consecutively, with no time limit per bag. Researchers did not interact with participants during the recording and, when needed (e.g., to switch tasks), only used the primary caregivers’ preferred language. The MCDI and IDHC forms were left with the primary caregiver and picked up once completed, typically within two weeks. In line with recent recommendations (De Houwer, 2019), the caregiver who exposed the child to the language of the form (English or Spanish) was instructed to complete that form. Researchers also helped caregivers complete the forms, if needed. These data collected during the 18-month visit (video-recording sessions, language input and exposure) served as predictors of child language outcomes (MCDIs) at 24 months.

## 2.3.1 | Caregiver warmth and sensitivity coding

The 10-min Three Bag Task video was used to rate primary caregivers’ displays of warmth and sensitivity on 7-point scales (Brady-Smith et al., 1999). Ratings were based on the quantity and quality of the behaviors, from very low (1) to very high (7). Sensitivity refers to how caregivers observe and respond to the child’s vocalizations and actions (i.e., being “tuned in” and aware of the child’s needs and interests). Warmth, or positive regard, is evident in expressions of love, respect and/or admiration for the child, for example, through physical affection (hugging, kissing) and praise. Coders were Spanish-English bilinguals; coder intraclass correlations for the 18-month sensitivity and warmth scales



(either exact or within 1 point of the reliable coder's scores) were 1.00 (perfect agreement) and 0.675 (substantial agreement), respectively.

### 2.3.2 | Caregiver input transcription and coding

The 75-min naturalistic observation video was transcribed using CHAT conventions (Codes for Human Analysis of Transcriptions) of the Child Language Data Exchange System (CHILDES; MacWhinney, 2018). CHAT conventions represent a standardized format for producing computerized transcripts. This transcription process involved breaking speech into utterances, units of speech bounded by breaths/pauses or breaks in the flow of speech. Symbols were used to indicate speakers (mothers, fathers, siblings, other adults, target child) and languages (English vs. Spanish) spoken. Speech by all speakers was transcribed; words did not include morphological markings. Transcribers included highly-trained Spanish-English bilingual undergraduate students who passed a reliability test (between 85% and 90% agreement on words) after their 6-week transcription training.

The FREQ command of the CLAN program was used to generate the total number of words produced in English and in Spanish (i.e., tokens: amount of English; amount of Spanish). FREQ also generated a list of the different words in English and in Spanish. This list was manually coded for the number of different word types (English diversity; Spanish diversity), where higher values indicate more diverse speech (Gámez et al., 2019). Several decisions were made as to what constituted a word type. In line with Bedore et al. (2006), conjugated verb forms in Spanish were linked to their word roots ("sentado" was linked to "sentar" [sit]), as were noun plural forms ("amigos", "amigo" [friend]); these represented one type. Diminutive forms (e.g., "besito" [little kiss]) were marked as different from their non-diminutive word forms (e.g., "beso" [kiss]), as were gendered forms of words (masculine vs. feminine); these were marked as different words. Following the guidelines described by Huttenlocher et al. (1991), morphologically inflected variants of words in English (e.g., marking tense, number) were considered a single type, except in the case of irregular words ("ran" vs. "run" were considered different types). Further, onomatopoeic sounds (e.g., "cluck cluck" [pio pio]) and evaluative sounds (e.g., "wow" [hijole]) were counted as words. Only filler sounds (e.g., "um", "uh" in English; "eh", "ay" in Spanish) were excluded from word counts. Inter-rater reliability for 15% of the transcripts was 96% and 97% for English and Spanish language coding for word types.

Only utterances directed at the target child (i.e., input) were used to generate input scores. To do so, the transcripts were first manually coded for whether each utterance was directed to the target child or overheard. Utterances were considered directed if they were addressed to the target child, regardless of whether they were intended solely for the child or to a group including the child; all other utterances were categorized as overheard. In line with Padilla-Iglesias et al. (2021), the following cues were used to deem utterances as directed: Gaze direction (e.g., eye contact with child), grammatical marking (e.g., using "tu" or "-ito"), utterance content (e.g., child centered), and proximity to infant (e.g., sitting with the child).

Input scores were derived using the primary caregiver's directed speech to the target child, given that all but eight primary caregivers indicated on the language background questionnaire that they used English and Spanish with their child (responses of "Mostly English," "English and Spanish equally," and "Mostly Spanish"). In these eight cases, the primary caregiver reported using "Only Spanish" with the target child; none reported using "Only English." In addition, the primary caregiver reported that the target child received English (and Spanish) language exposure from a non-primary caregiver ( $n_{\text{fathers}} = 4$ ;  $n_{\text{older siblings}} = 4$ ; see Rojas et al., 2016 for a discussion of sibling interlocutor effects). In six of these eight cases, the non-primary caregiver was available during the naturalistic observation. Thus, to reliably estimate the English and Spanish exposure for these six children, their input scores were derived using both the non-primary and primary caregiver's directed speech. In the remaining two cases where the primary caregiver reported using "Only Spanish," but the non-primary caregiver was not video-recorded ( $n_{\text{older siblings}} = 2$ ), the primary caregivers did use some English during the recording. Of note, when a naturalistic video recording was not 75-min long, we prorated the caregiver input data based on the number of observation minutes missing, as is typical in input studies (Rowe et al., 2012). A total of four input scores were derived for all cases: (1) number of different words in Spanish (Spanish NDW), (2) number of different words in English (English NDW), (3) number of total words in Spanish (Spanish Tokens) and (4) number of total words in English (English Tokens).

## 3 | RESULTS

### 3.1 | Bilingual children's language skills and their reported language exposure

Table 1 shows children's single language vocabulary and total vocabulary raw scores. On average, children's performance on the Spanish IDHC and English MCDI at 24 months was unbalanced; they obtained higher Spanish IDHC ( $M_{\text{difference}} = 51.0$ ;  $SD = 165.41$ ) than English MCDI scores,  $t(46) = -2.113$ ,  $p = 0.04$ . There was also a positive correlation between Spanish and English vocabulary scores,  $r = 0.311$ ,  $n = 47$ ,  $p = 0.033$ , indicating that children who scored higher in Spanish also scored higher in English. Notably, missing vocabulary scores for four children were handled using multiple imputation (IBM Corp., 2010), as is recommended for handling missing data (Jeličić et al., 2009).

Table 1 also shows that children were exposed to, on average, "mostly Spanish" by their primary caregivers ( $\sim 4$  on the language exposure scale) and to "English and Spanish equally" when other interlocutors were taken into account ( $\sim 3$  on the same scale). Overall, reported language exposure scores ranged from 2 ("Mostly English") to 5 ("Only Spanish"); no one reported using "Only English." The primary caregiver's language use was also positively correlated with children's home language exposure ( $p < 0.01$ ). Further, children's home language exposure was negatively correlated with their English MCDI raw scores; the children with higher English vocabulary scores tended to

**TABLE 1** Children's productive vocabulary scores at 24 months and correlations with caregiver report of home language input

Variable name	Mean (SD) raw score	Primary caregiver home language use (Self-reported)	Home language exposure (Reported)
Vocabulary outcome			
English MCDI	126.12 (131.29)	-0.237	-0.341*
Spanish IDHC	177.12 (149.53)	0.468**	0.311*
Total vocabulary	303.24 (227.60)	-	-
Home language exposure (Survey)			
Home language exposure	3.41 (0.73)	0.661**	-
Primary caregiver's home language use	3.87 (0.85)	-	-

Note: IDHC = Inventarios del Desarrollo de Habilidades Comunicativas MacArthur-Bates; MCDI = MacArthur Communicative Developmental Inventories (680 possible score); Total Vocabulary = English MCDI raw scores plus Spanish IDHC raw scores.

\* $p < 0.05$ .

\*\* $p < 0.01$ .

\*\*\* $p < 0.001$ .

**TABLE 2** Descriptive statistics for caregivers' input and emotional supportiveness

Variable name	Mean	SD	Min	Max
Input measures				
Spanish NDW	284.36	132.10	19.00	542.50
Spanish tokens	1535.76	1110.88	46.00	4615.00
English NDW	88.08	95.77	2.50	393.00
English tokens	309.18	503.70	2.50	2643.00
Emotional supportiveness				
Positive regard (warmth)	3.74	0.92	2.00	5.00
Sensitivity	5.53	0.62	4.00	6.00

Note: NDW = number of different, uninflected words; Tokens = total number of words.

be exposed to more English (i.e., closer to 1 "Only English") by various interlocutors ( $p < 0.05$ ). The correlation between primary caregiver's home language use and English MCDI raw scores was not statistically significant ( $p > 0.05$ ). Also, children with higher Spanish IDHC vocabulary scores tended to be exposed to more Spanish (i.e., closer to 5) by primary caregivers ( $p < 0.05$ ) and other interlocutors ( $p < 0.05$ ).

### 3.2 | Caregivers' input, warmth and sensitivity

Caregivers' directed speech to their child (from the naturalistic observation) was unbalanced in terms of Spanish and English (Table 2). That is, caregivers used, on average, 284 different words in Spanish, while they used 88 words in English. Thus, children's Spanish input was over three times more diverse than their English input. They were also provided with close to five times more Spanish words (i.e., tokens) than English words. In fact, paired-sample *t*-tests revealed that caregivers used significantly more Spanish, compared to English, both in terms of NDW,  $t(46) = -6.894$ ,  $SE = 28.47$ ,  $p < 0.001$ , and Tokens,  $t(46) = -6.246$ ,  $SE = 196.37$ ,  $p < 0.001$ .

The range in input scores, for both English and Spanish, was also wide (Table 2). Within the 75-min naturalistic observation, some children heard about three different words in English and 19 different words (or close to 20 words) in Spanish, whereas others heard about 393 and 543 different words in English and in Spanish (or close to 400 and 550), respectively (note prorated scores due to observation time differences). Descriptively, the range for input scores in Spanish was wider than in English (Spanish NDW range = 523.5; English NDW range = 390.5). Further, as seen in Table 3, whereas caregiver input scores (NDW; Tokens) were highly and positively correlated within language ( $p$ 's  $< 0.001$ ), they were inversely related across languages ( $p$ 's  $< 0.05$ ). That is, caregivers who tended to use more English, used less Spanish and vice versa. These measures of input correlated with caregiver's self-reported input to their children, with indices of observed English input being negatively associated with self-reported input scores on the language questionnaire, and indices of observed Spanish being positively associated with self-reported input scores on the language questionnaire ( $p$ 's  $< 0.05$ ). Of note, posthoc one-way ANOVAs were conducted to assess whether caregiver input scores would differ statistically between morning or afternoon recordings,



**TABLE 3** Correlations between caregiver input measures (observed and self-reported) by language

	Spanish tokens	English NDW	English tokens	Caregiver self-reported home language use
Spanish NDW	.889***	-.454**	-.396**	.497**
Spanish tokens	-	-.342*	-.290*	.485**
English NDW	-	-	.937**	-.434**
English tokens	-	-	-	-.416**

Note: NDW = # of different words; Tokens = Total number of words; Caregiver Self-reported input on a scale of 1 (Only English) to 5 (Only Spanish).

\* $p < 0.05$ .

\*\* $p < 0.01$ .

\*\*\* $p < 0.001$ .

or if two people or more-than-two people were home during the recording. None of these comparisons were statistically significant ( $p$ 's  $> 0.0125$ , with a Bonferroni correction). Of further note, given that caregiver English input scores (NDW; Tokens) were right skewed (e.g.,  $Skewness_{Tokens} = 3.167$ ;  $SE = 0.347$ ), these data were transformed using a log transformation and thus, transformed scores were used for inferential analyses.

Table 2 also shows caregivers' scores for positive regard (warmth) and sensitivity during the 10-minute Three Bag Task. Caregivers scored, on average, approximately a 4 ( $SD = 0.92$ ) on the scale of positive regard, indicating "moderate positive regard." Recall that positive regard, like sensitivity, is rated as both the quality and quantity of such behaviors. Thus, as a group, parents displayed warm behaviors that were not considered "intense" or occurring very frequently. That said, there was a range of behaviors from "low positive regard" to "high positive regard" (range = 3.00). On the sensitivity scale (Table 2), caregivers scored, on average, about a 5.5 ( $SD = 0.62$ ), meaning that as a group, caregivers displayed between "moderately high sensitivity" to "high sensitivity." The full range in scores (range = 2.00) was positivity skewed toward "moderate sensitivity" and "high sensitivity." Thus, for much of the interaction, caregivers were highly sensitive, with little variation. Moreover, caregivers scored about two points higher ( $M_{difference} = 1.75$ ;  $SD = 0.95$ ) on sensitivity than they scored on the positive regard scale,  $t(46) = 12.842$ ,  $p < 0.001$ . Also, positive regard and sensitivity were significantly and positively correlated with each other (one-tailed),  $r_s = 0.332$ ,  $p = 0.011$ . These scores did not correlate with any caregiver input scores ( $p$ 's  $> 0.10$ ), which were derived from a separate interaction.

### 3.3 | Unique and combined contributions of caregiver input, warmth and sensitivity on bilingual children's productive vocabularies at 24 months

Multiple regression analyses were conducted to examine the contributions of caregivers' input, warmth and sensitivity from the 18-month visit on bilingual children's vocabulary skills at 24 months of age. Separate models were built for each child outcome variable: English MCDI, Spanish IDHC and total vocabulary raw scores. Of note, given that caregivers' NDW and tokens were very highly correlated ( $r$ 's  $\sim .90$ 's,

$p$ 's  $< 0.001$ ), caregivers' NDW was used to represent caregiver input, instead of tokens, in all models. Also, the control variable, child age, was included in each model to account for the expected relation between age and vocabulary outcomes. Child's gender and household income were consistently insignificant in multiple regression models and thus, were not included as control variables in any final models. Further, caregiver sensitivity was not statistically significant in any models ( $p$ 's  $> 0.05$ ), perhaps due to the low variability in sensitivity scores for this sample (i.e., skewed toward high sensitivity).

To examine the combined contributions of caregiver input (i.e., NDW) and warmth (i.e., Positive Regard), we present the results of full models (for each outcome) that included these caregiver variables (Table 4, Part C). The results showed that caregivers' positive regard was significantly and positively associated with children's English MCDI scores ( $p < 0.01$ ) as was caregiver's English NDW ( $p < 0.01$ ). These results indicate that when controlling for child age, caregiver input and warmth accounted for almost 40% ( $R^2 = 0.375$ ) of the variance in English MCDI outcomes. This is in addition to child age positively predicting English MCDI scores ( $p < 0.05$ ), suggesting that older children obtained higher scores in English. Also, children's Spanish IDHC scores and total vocabulary scores were positively associated with caregivers' positive regard ( $p$ 's  $< 0.01$ ) and Spanish NDW ( $p$ 's  $< 0.05$ ); Child age was not a significant predictor of these child outcomes ( $p$ 's  $> 0.05$ ). Caregiver input and warmth, together, accounted for 34% of Spanish IDHC ( $R^2 = 0.341$ ) and 30% of total vocabulary ( $R^2 = 0.302$ ) outcomes, when controlling for child age. Together, these results suggest that a greater diversity of caregiver English promotes children's English productive vocabularies, whereas a greater diversity of caregiver Spanish promotes Spanish productive and total vocabularies (English and Spanish combined). In addition, the findings suggest that children's exposure to warm interactions promotes their total vocabularies and single language English and Spanish vocabularies.

To examine the unique contributions of each predictor, we present the results of simple models, which included either caregivers' positive regard (Table 4, Part A) or caregivers' NDW (Table 4, Part B) to predict child outcome scores. When positive regard was added as the main predictor, along with child age, the models accounted for close to 24% ( $R^2 = 0.238$ ), 14% ( $R^2 = 0.144$ ) and 21% ( $R^2 = 0.214$ ) of the variance in English MCDI, Spanish IDHC, and total vocabulary scores, respectively. When Spanish NDW and English NDW (caregiver input) were added

**TABLE 4** Multiple regression models predicting child productive vocabulary raw scores at 24 months of age

Parameter estimates	English MCDI	Spanish IDHC	Total vocabulary
	B (SE)	B (SE)	B (SE)
<b>Part A</b>			
Intercept	-1793.570 (653.870)**	415.103 (789.399)	-1378.467 (1151.373)
Child age	70.908 (26.490)*	-18.879 (31.981)	52.029 (46.646)
Positive regard (Warmth)	42.205 (18.911)*	61.702 (22.831)*	103.907 (33.300)**
<b>R<sup>2</sup></b>	<b>0.238</b>	<b>0.144</b>	<b>0.214</b>
Effect size <i>f</i> <sup>2</sup>	0.312	0.168	0.272
<b>Part B</b>			
Intercept	-2040.439 (634.472)**	388.727 (767.422)	-1651.712 (1212.762)
Child age	77.581 (25.373)**	-13.656 (30.689)	63.925 (48.498)
Spanish NDW	0.158 (0.143)	0.510 (0.173)**	0.669 (0.273)*
English NDW	114.463 (36.890)**	-10.293 (44.621)	104.169 (70.514)
<b>R<sup>2</sup></b>	<b>0.309</b>	<b>0.220</b>	<b>0.160</b>
Effect size <i>f</i> <sup>2</sup>	0.447	0.282	0.190
<b>Part C</b>			
Intercept	-2010.756 (610.401)**	434.125 (714.320)	-1576.630 (1119.004)
Child age	71.693 (24.562)**	-22.662 (28.743)	49.031 (45.027)
Spanish NDW	0.123 (0.138)	0.457 (0.162)**	0.580 (0.254)*
English NDW	106.432 (35.684)**	-22.576 (41.759)	83.855 (65.416)
Positive regard (Warmth)	37.425 (17.676)*	57.240 (20.686)**	94.665 (32.405)**
<b>R<sup>2</sup></b>	<b>0.375</b>	<b>0.341</b>	<b>0.302</b>
Effect size <i>f</i> <sup>2</sup>	0.60	0.517	0.433
<b>Change in R<sup>2</sup></b>			
+Caregiver input $\Delta R^2$ = Part C - Part A	<b>0.137*</b>	<b>0.197**</b>	<b>0.088</b>
+Positive regard (Warmth) $\Delta R^2$ = Part C - Part B	<b>0.066*</b>	<b>0.121**</b>	<b>0.142**</b>

Note: Inventarios del Desarrollo de Habilidades Comunicativas MacArthur-Bates; MCDI = MacArthur Communicative Developmental Inventories; NDW = number of different, uninflected words; Child Age = Child age in months; Change in  $R^2$  is the difference between the  $R^2$ 's in Parts C and either Part A (+Caregiver Input) or Part B (+Positive Regard).

\* $p < 0.05$ .

\*\* $p < 0.01$ .

\*\*\* $p < 0.001$ .

as the main predictors, along with child age, the models accounted for close to 31% ( $R^2 = 0.309$ ), 22% ( $R^2 = 0.220$ ), and 16% ( $R^2 = 0.160$ ) of the variance in English MCDI, Spanish IDHC and total vocabulary scores, respectively. A comparison of  $R^2$  values between simple models suggests that caregiver input uniquely accounts for more variance in single language outcomes (e.g., larger  $R^2$ 's for English and Spanish), than does caregiver warmth (e.g., smaller  $R^2$ 's for English and Spanish), whereas caregiver warmth uniquely accounts for more variance in total vocabulary scores (e.g., larger  $R^2$ ), than does caregiver input (e.g., smaller  $R^2$ ).

To further compare the contributions of each caregiver predictor to child outcomes, we computed the change in  $R^2$  values (Table 4,  $\Delta$

$R^2$ 's) by subtracting the simple models'  $R^2$  values (Parts A and B) from the full model's  $R^2$  values (Part C). These calculations (see "Change in  $R^2$ , +Caregiver Input") revealed that the addition of caregiver input, after positive regard and child age were already accounted for, further explained close to 14% ( $\Delta R^2 = 0.137$ ) and 20% ( $\Delta R^2 = 0.197$ ) of the variance in single language scores; hierarchical regression analyses revealed that these were statistically significant changes in  $R^2$  values ( $p$ 's  $< 0.05$ ). The addition of caregiver input, when positive regard and child age were accounted for, further explained close to 9% ( $\Delta R^2 = 0.088$ ) in total vocabulary scores, but this change in  $R^2$  was not statistically significant ( $p > 0.05$ ). Moreover, the addition of positive regard, when caregiver input and child age were already accounted

for (see “Change in  $R^2$ , +Positive Regard”), further explained close to 7% ( $\Delta R^2 = 0.066$ ), 12% ( $\Delta R^2 = 0.121$ ) and 14% ( $\Delta R^2 = 0.142$ ) of the variance in English MCDI, Spanish IDHC and total vocabulary scores, respectively; all  $R^2$  changes were statistically significant ( $p$ 's < 0.05). Thus, the changes in  $R^2$  values for single language outcomes were greater with the addition of caregiver input (e.g., larger  $\Delta R^2$ 's), than with the addition of caregiver warmth (e.g., smaller  $\Delta R^2$ 's). In contrast, the change in the  $R^2$  value for the total vocabulary outcome was greater with the addition of caregiver warmth (e.g., larger  $\Delta R^2$ ), than with the addition of caregiver input (e.g., smaller  $\Delta R^2$ ). Also, the difference between the  $\Delta R^2$ 's by outcome (e.g., English  $\Delta R^2$  0.137–0.066) shows that caregiver input accounts for ~7–8% more variance in single language outcomes than does caregiver warmth, whereas caregiver warmth accounts for ~5% more variance in total vocabulary, than does caregiver input.

#### 4 | DISCUSSION

Bilingual skill varies across children, depending on their language status as Spanish-dominant, English-dominant, or balanced (Rojas & Iglesias, 2013). Much of the research seeking to explain individual differences in bilingual skill has focused on the influence of the amounts of exposure to each language (Carroll, 2017). We conducted an in-depth analysis of Latino home language environments to identify environmental factors associated with bilingual children's English, Spanish and bilingual skill development. We focused specifically on quality indicators of bilingual children's environments, namely the diversity of caregiver input as well as their warmth and sensitivity, given that the quality of early monolingual language experiences predicts the learning of one language (Anderson et al., 2021; Madigan et al., 2019).

To assess the unique contribution of bilingual input to the learning of two languages, we obtained naturally-occurring recordings of caregiver-child interactions in bilingual homes. Extending previous research that has relied predominantly on assessing bilingual input using survey methods (Carroll, 2017; Paradis, 2017), our methodology allowed us to measure caregivers' amount of English and Spanish use (Marchman et al., 2017) and assess the diversity of speech directed to children. We found that the amount and diversity of caregivers' English and Spanish varied considerably across homes. Within a 75-min observation, some children heard close to 550 different words in Spanish, whereas others heard close to 20 different words. There was also a wide range of diversity in English exposure, with some children hearing about 3 different words in English and others hearing close to 400 words. These ranges highlight that caregivers tended to use more Spanish than English and a more diverse set of words in Spanish than English (e.g., three times more diverse). Additionally, caregiver input scores were inversely correlated across languages, suggesting that caregivers who used more Spanish used less English.

A main contribution of the current study is that we examined whether the variability in caregivers' diversity of English and Spanish was related to the variability in children's productive vocabularies by 24 months of age, thus extending prior bilingual input studies mostly

focused on the relative amounts of bilingual children's language exposure (e.g., Hoff et al., 2012; Pearson et al., 1997). Bilingual children's productive vocabularies did, in fact, vary as a function of caregivers' English and Spanish lexical diversity. In particular, Spanish diversity positively predicted children's Spanish and bilingual (i.e., total) productive vocabularies, whereas English diversity positively predicted children's English productive vocabularies. These results suggest that by 24-months, bilingual children may leverage the diversity of their bilingual input to learn word labels in each of their languages. Thus, if it is indeed the case that bilinguals receive less exposure to each of their languages than monolinguals due to divided exposure to two languages (Hoff et al., 2012), then these findings of a positive influence of diverse input by 24 months suggests a strength for bilinguals. That is, bilinguals appear to be doing “*more with less.*”

Despite parallels with findings from monolingual language input studies (Anderson et al., 2021), our findings are novel and unique given the bilingually-exposed sample of children and caregivers included in this study. According to the *wholistic* view of bilingualism (Grosjean, 1989), exposure to two languages produces a unique and specific learner, distinct from the monolingual learner. In other words, bilinguals should not be regarded as two monolinguals in one. Thus, the role of lexical diversity on bilingual outcomes should not be interpreted as akin to the role of monolingual input on English-only outcomes. Instead, these findings suggest that lexical diversity is predictive of vocabulary outcomes in children learning two language systems (Spanish, English and bilingual vocabulary), specifically within environments where they receive exposure to not only one, but two languages, with varying degrees of exposure to each language by caregivers.

Our study findings with bilinguals also advance the understanding of developmental processes in language learning more broadly. The same scholars that argue for bilingual children's divided input also argue that the time scale for reaching language milestones must be different between bilingual and monolingual learners (Hoff et al., 2012). By extension then, diverse input should be observed to play a significant role for bilinguals only after they have accumulated enough language exposure to reach a certain point (i.e., a threshold effect), which would be at a later age than in monolinguals. Yet, our findings with bilinguals are consistent with findings from studies with monolinguals in suggesting that exposure to diverse input is a robust predictor of children's vocabulary by 24 months of age (Hirsh-Pasek et al., 2015; Huttenlocher et al., 1991; Pan et al., 2005; Rowe, 2012). Thus, these findings suggest that the positive influence of diverse input on language learning may reflect a maturational phenomenon driven by age, not necessarily length of language exposure.

Our findings also show that by 24 months of age, bilingual children's Spanish vocabulary performance was higher than their English vocabulary performance, which is in line with their reported home language exposure. This finding of unbalanced vocabulary performance contrasts with findings from the longitudinal studies conducted by Hoff and colleagues (Hoff et al., 2012, 2018), which show stronger English over Spanish skills among Cuban-Americans, thus highlighting the heterogeneity in Latino populations. Also, while children's reported mean home language exposure suggested that they were exposed to English



and Spanish relatively equally, the responses on the language questionnaire were skewed more toward Spanish than English. Notably, a key strength of the survey used to measure home language exposure is that it assessed children's language exposure from various interlocutors. This comprehensive examination of children's amount of language exposure revealed wide variability in terms of caregivers' reported Spanish and English use across homes, with families reporting using exclusively Spanish, both English and Spanish, or mostly English at home (López et al., 2020).

To assess the unique contributions of caregivers' warmth and sensitivity during caregiver-child interactions to bilingual language learning, we relied on a video-recorded semi-structured task and coding scale (Three Bag Task; Brady-Smith et al., 1999). On this scale, Latino caregivers displayed high levels of sensitivity and moderate levels of warm behaviors (e.g., hugging, kissing, praising) toward their children. Caregivers' displays of sensitivity were not associated with children's productive vocabularies, perhaps due to the limited variability in caregivers' sensitive behaviors. This finding of high sensitivity scores in a sample who self-reported being bilingual in Spanish and English is in line with previous findings showing that Latina moms who reported greater English skills generally displayed greater sensitivity than mothers with lower self-reported English skills (Cabrera et al., 2006). When studies of parenting behaviors include Latina mothers with limited English skills who may be less acculturated to U.S./English-dominant parenting styles, some findings tend to show low sensitivity scores (Isapa et al., 2004).

In contrast, caregivers' warm behaviors were not very intense and they were positively associated with children's vocabulary skills in Spanish and English. More importantly, caregivers' warmth influenced bilingual children's vocabularies, above and beyond caregivers' linguistic input. Results showed that caregiver input, together with caregiver warmth, explained a substantial amount of variance in bilingual children's vocabulary scores (~30–40% variance in outcome scores). Yet, when the contribution of each predictor was examined separately (while controlling for children's age), results showed that caregiver warmth uniquely accounted for more of the variance in TV scores, than did caregiver input. In contrast, caregiver input accounted for more variance in single language outcomes than did caregiver warmth. Taken together, our findings suggest that caregiver warmth may support Latino children's bilingual development, as a whole, by simultaneously supporting their Spanish and English vocabulary skills or TV, whereas the possible benefit of caregiver input to children's vocabulary skills is more language-specific. Thus, caregiver warmth may be an important socio-emotional aspect of Latino children's home language environments that holistically enhances their bilingual development.

The combined contributions of caregiver input and warmth are consistent with the idea that language development is a social process guided by linguistic input and relational qualities. In the early stages of language development (bilingual, monolingual), children receive linguistic input primarily from social interactions with caregivers, and caregivers' emotional support during those interactions appears to play an important role in Latino children's bilingual development. Research with monolingual children suggests that positive or

affectionate caregiving behaviors promote children's cognitive skills, including language skills (Bornstein, 2002; NICHD ECCRN, 2002), and our study findings suggest that this may be the case for Spanish-English bilingual skills as well. Such caregiving practices may promote socio-emotional abilities and beliefs that facilitate children's bilingual development. Support for this idea stems from research suggesting that caregiver warmth fosters children's engagement with caregivers and self-regulatory skills, facilitating their ability to pay attention, ignore distractions, and persist during challenging tasks (Conway et al., 2014; Isapa et al., 2017; Spinrad et al., 2012). Positive caregiving also fosters children's autonomy and trust in caregivers, creating a fun and secure context for children to learn, ask questions, and explore (Cummings & Cummings, 2002; Downer & Pianta, 2006). Thus, the results of the present study suggest that caregiver linguistic input and warmth are equally important factors to consider in young children's bilingual Spanish-English vocabulary development perhaps because they contribute jointly to their vocabulary skills within each language and across both languages.

#### 4.1 | Limitations and future directions

There are some limitations to this study that suggest directions for future research. For example, given the labor-intensive nature of transcription, this study focused on diverse input from primary caregivers, but not other sources. That type of study would require a different methodology, perhaps involving day-long recordings of the various interlocutors present in the home, including secondary caregivers (see Orena et al., 2020), which was beyond the scope of the present study. Also, though our sample was socio-economically diverse, we were unable to systematically examine the role of SES in our final regression models due to sample size (though preliminary results showed no significant effects of income). Further, because we were resolute in examining within-culture variation instead of making between-culture comparisons, the study findings may have limited generalizability for Latino families from backgrounds other than Mexican, or other bilingual families whose native language is not Spanish in the U.S. Relatedly, our findings suggesting moderate levels of caregivers' warmth and very high levels of sensitivity – two behaviors that are typically correlated as they were in this study – may highlight differences in how caregivers show affection across cultures. That is, these findings may indicate that current models of emotional supportiveness, based primarily on non-Latino populations, may not be tapping into culturally-salient aspects of the caregiver-child interactions in Latino homes like how they conceptualize “warmth” (see concept of *respeto* in Tamis-LeMonda et al., 2019). Future research is thus needed with larger samples, different age groups and Latinos from various backgrounds to tease apart language input, emotional supportiveness, and SES effects (see Prime et al., 2020).

A final limitation of the study is its correlational nature, which does not allow for causal claims. Thus, future studies are needed that employ experimental designs, for example by experimentally manipulating children's language exposure to test input effects on bilingual learning

(e.g., Daskalaki et al., 2020; Gámez & Vasilyeva, 2015). Despite the challenges in conducting this in-depth, linguistically-detailed analysis of bilingual children's home language environments, the study findings represent an important step toward a better understanding of how caregiver-child interactions, including caregiver input and warmth, support bilingual learning.

## Note

<sup>1</sup> It is worth noting that some bilingual input studies have measured caregiver self-reported language fluency or native language status (Hoff et al., 2018; Paradis, 2017; Place & Hoff, 2011), but we argue that these factors, while related, are not estimating exposure to a diversity of language forms.

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## CONFLICT OF INTEREST

The authors report no conflicts of interest.

## DATA AVAILABILITY STATEMENT

Research data are not shared as video recordings contain identifying information.

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