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How Much Do Parents Think They Talk to Their Child?

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Abstract

This study investigated whether parent perceptions of their own and their child's levels of talkativeness were related to objective measures recorded via the LENA system. Parents of 258 children aged 7-60 months completed a questionnaire on which they rated how much they and their child talked. Six months previously they had recorded in their home language environment using the LENA system. Compared to recording measures, parents tended to overestimate how much they talk to their child, but were somewhat closer when estimating their child's talkativeness. Results were similar for a smaller sample with concurrent recordings, indicating that calibration of talk volubility is challenging without a reference standard. An important implication is that parents' motivation to participate in language-focused interventions may be reduced. That is, parents who overestimate how much they talk to their child may also underestimate what they could do to enhance their child's home language environment.

Key Words: parent, child, infant, language, perceptions, words, vocalizations, turns, LENA

How Much Do Parents Think They Talk to Their Child?

The Early Language Environment

Adult verbal engagement is critical to a child's language development, and even very young children are aware of and able to respond to parental stimulation (Chapman, 2000; Hart & Risley, 1995; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Rowe, 2008). Characteristics of adult language such as frequency of interaction are predictive of subsequent child language development. For example, the rate at which adults talk to children (Huttenlocher, et al., 1991), child vocalization (utterance) rates (Hart & Risley, 1995) and parental reaction to and solicitation of child vocalizations in conversational turns (Tamis-LeMonda, Bornstein, & Baumwell, 2001; Topping, Dekhinet, & Zeedyk, 2013) all correlate highly with child vocabulary size.

Rowe (2012) examined the quantity and quality of caregiver input longitudinally in a sample of 50 parent–child dyads, to determine which aspects of input contributed most to children's vocabulary skill. Measures of input from parent–child interactions at child ages 18, 30, and 42 months were examined in relation to children's vocabulary skill on a standardized measure 1 year later (i.e., 30, 42, and 54 months). Results overall showed that after controlling for socioeconomic status, input quantity, and children's previous vocabulary skill, two factors explained additional variance in later vocabulary ability: using a diverse and sophisticated vocabulary and using decontextualized language such as narrative (model coefficient of determination $R^2 = .79$). However, they also found that for the younger children (18 months), input quantity was the factor most predictive of later vocabulary skills

Walker, Greenwood, Hart, and Carta (1994) studied 32 children involved in Hart and Risley's (1995) influential study who were repeatedly assessed between 5 and 10 years of age (kindergarten through third grade). Differences in amount and type of child language input prior to school were predictive of subsequent verbal ability ($R^2 = .32$), receptive and spoken language

(R^2 = .64 and .56 respectively), and academic achievement assessed on standardized tests (R^2 = .41). The converse has also been observed - deprivation of language input in terms of quality or quantity delays the acquisition of language, lowers IQ, and reduces later school achievement (Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Landry, Smith, Swank, & Miller Loncar, 2000; Topping, Dekhinet, & Zeedyk, 2011).

Studies of the Early Language Environment Using LENA Technology

Automated estimates of language activity – adult word counts (AWCs), child vocalizations (CVs) and conversational turns (CTs: vocal interaction between adult and child) – have been incorporated in studies to demonstrate a link between adult and child language use. These measures can be generated by the LENA system (Xu, Yapanel & Gray, 2009), which automatically evaluates the language environment in which a child is immersed over the course of a full day. Audio is collected from a small recorder worn by the child and analyzed using speech recognition algorithms to parse adult and child vocalizing from other sounds in the environment (other children, noise, TV, and other electronic media, etc.).

A positive relationship has been observed between AWC and CV in pre-term infants, for example (Caskey, Stephens, Tucker, & Vohr, 2011; Johnson, Caskey, Rand, Tucker, & Vohr, 2014). Further, LENA measures have been utilized to characterize the language environments of children with disabilities as well, including: children who are deaf or hard-of-hearing (Wiggin, Gabbard, Thompson, Goberis, & Yoshinaga-Itano, 2012), children with autism spectrum disorders (Dykstra, Sabatos-DeVito, Irvin, Boyd, Hume, & Odom, 2013; Warlaumont, Oller, Dale, Richards, Gilkerson, & Xu, 2010; Warren, Gilkerson, Richards, Oller, Xu, Yapanel, & Gray, 2010), and children with language delays unrelated to autism (Oller et al., 2010).

In a more recent intervention study, Suskind et al. (2015) have shown that parents can

increase the quantity of child language input with focused coaching and LENA automated feedback. Participants were 23 low socioeconomic status parents and their children (aged 18 – 36 months). Twelve experimental and 11 control children were allocated randomly to condition and both received eight weekly home visits. For the experimental group these were hour-long and focused on parent-child interactions to promote language development (including video modeling by the visitor and of the parent). For the control group they were much shorter (10 minutes) and focused on nutrition. In the experimental group parent knowledge of language development increased significantly one week and four months after the intervention, but this did not happen in the control group. For the experimental group, AWCs (Cohen's d = 0.34), CTs (d = 0.66), and CVs (d = 0.43) from the LENA technology increased significantly pre-post during the intervention. At follow-up after the home visits had ceased, the scores were still somewhat elevated, but not to statistical significance.

Parent Perceptions

Despite the importance of the early language environment to the later development of the child, there is relatively little literature concerning the perceptions adults have of it. Given that children with lower language skills tend to elicit less parental speech, children in need of early language intervention may be even more likely to experience an impoverished language environment that could be improved with appropriate caregiver feedback (van Ijzendoorn et al., 2007; Warren & Brady, 2007; Wheeler, Hatton, Reichardt, & Bailey, 2007; Yoder, Warren, Kim, & Gazdag, 1994). However, the likelihood of intervention may depend in part on parental perspectives on the significance of their interaction with their children.

Whitmarsh (2011) explored what first-time low-income mothers of children in the first two years of life knew and understood about three key contributors to infant development: child-

directed speech, book-sharing, and mother-child interaction. Fifty mothers completed questionnaires and 20 mothers were interviewed. They found these parents demonstrated a lack of knowledge of the importance of engaging in language interaction with their young infants. Mothers overall were unsure of the value of child-directed speech. Few mothers had a rationale for book-sharing. The interviewed mothers were generally not sharing books with their babies. Although most mothers agreed that repeating sounds supported language development, mothers were less sure about whether babies could copy speech sounds at two months.

A few studies have compared parent perceptions of young children's language development to more objective measures. Matthews-Somerville and Cress (2005) compared parent-perceived communication behaviors with formally assessed stages for 42 infants at risk for language disabilities. They found systematic differences between parent and formal observations of early skills. Parents' perceptions of increases in their child's communicative signals and functions tended to occur at different points relative to formally assessed transitions. For example, parents of children in transition to intentional communication and symbolic communication stages perceived higher levels of change prior to the transition as defined by the raters. In other cases parents might report greater changes coincident with or after the formal transition. The researchers concluded that stage transitions in communication involve gradual, qualitative changes which do not necessarily manifest across all domains or behaviors at once. Then, although parents often recognize the same behavioral and communicative changes as clinicians do, they understandably can differ in their interpretation. That is, neither perception is more correct; rather, parents may attend more to the initial development of a new skill or communicative behavior, whereas professionals evaluating a child may be more attuned to whether a criterion threshold has been reached.

Conversely, Squires, Bricker, and Potter (1997) examined parent responses to specific statements of child behavior on the Ages and Stages Questionnaire (ASQ) for children aged 4-60 months. The ASQ showed high reliability and validity when compared with examiner completed standardized measures of development, and the latter was even higher for children with disabilities. Squires et al. (1997) noted that most parents can accurately judge whether their children can or cannot perform observable behaviors, and results were similar when professionals and parents completed the same instruments with repeated observations. Squires, Potter, Bricker, and Lamorey (1998) found that for parents with low income the agreement between the completed ASQ and the standardized assessment ranged from 80-91%, and for middle income parents 85-93%, though conclusions were limited somewhat by a high attrition rate.

Finally, Roberts and Kaiser (2011) conducted a meta-analysis of 18 studies of parent-implemented language interventions for children with language disabilities and noted an average improvement in child overall language outcomes (7 studies) of effect size $g = .45$, $p = .06$, for expressive language (7 studies) $g = .61$, $p = .05$, and for expressive vocabulary (14 studies) $g = .48$, $p < .01$. Among their recommendations for successful intervention were that parents should be taught to increase the use of specific forms of language (depending on the disability) in enhanced socially communicative interactions on a daily basis across a full range of home and other activities. They commented however that few studies offered measures of treatment fidelity, or identified the exact components important to change, which remain a topic of future research. Although Roberts and Kaiser (2011) found that parental reports of change tended to agree with more objective external assessments, the challenges for parents seeking to effect increases in their language interactions with their children remained largely unexplored.

To summarize, some research suggests that parent and more objective assessments of a child's language development can diverge, although it is unclear whether one perspective is more accurate than the other in reporting different child behaviors in different environments. Further, parents' levels of education and cultural backgrounds can impact their perceptions of the quality of their child's language environment. Nevertheless, parents' judgments can be in agreement with those of language professionals, especially when more specific questions are provided.

The Present Study

This paper addresses the accuracy of parental estimates of how much they and their child talk and vocalize. Despite an increasing recognition of the importance of the early language environment to a child's later development, parents have had few if any objective reference points against which to evaluate how much they talk with their child. Consequently, if parental language engagement with their child is low but perceived to be high, parents may be less responsive to intervention efforts. That is, simply telling parents to talk and engage more with their child is unlikely to produce behavioral change in parents who believe they already are performing adequately and have no means of assessing the accuracy of their belief.

This study included families of typically developing children with a range of language skill levels from varied home language environments. We examined the relationship between parent perceptions of their own and their child's volubility and more objective LENA-based estimates of language use (parent talk, conversational turns, and child vocalizations) in the home. We also examined scores obtained from a parent-completed measure of child receptive and expressive language skills, the LENA Developmental Snapshot (Gilkerson & Richards, 2008a). Our general hypothesis was that, given the lack of a reference standard against which to compare themselves, parent self-ratings would be unlikely to match the more objectively-based talk estimates. We also

expected parent ratings of their child's talk to differ from the objective LENA measure, though not as much as their self-rating. Finally, we expected parents' assessments of their child's language skills on the LENA Developmental Snapshot to be similar to their judgement of child volubility. Our specific research questions were:

1) Will parental estimates of their own talk diverge from more objective and directly measured LENA-generated estimates of adult talk?
2) Will parental estimates of child talkativeness diverge from LENA-generated estimates of child vocalization frequency?
3) Will parental estimates of child talkativeness correlate with parental responses on the LENA Snapshot, a detailed parent-report measure of child language skills?

Method

This section describes the sample of participants and outlines three measures: the Parent Perception Questionnaire, the LENA Developmental Snapshot, and the objective, automated LENA language measures. It then describes the statistical analyses used.

Participants

Participants were drawn from a sample of 329 Denver-area families with typically developing children who had recently completed a study in which they provided full day, in-home naturalistic recordings once a month for six months using the LENA recorder (Gilkerson & Richards, 2008b; Gilkerson et al., 2016). These families were selected to cover a range of socioeconomic strata that matched the national distribution in the 2004 US census and were balanced across child gender and age; the majority ranging from 2-36 months. Approximately six months after the original study, 303 of these families were contacted to participate in the current study (families who had moved, dropped out, or had followed protocols unreliably in the original

study were not contacted). Completed questionnaires and Snapshots were returned by 258 families (85%). Of these families, nine percent included children whose language development scores were substantially below average, although they were not diagnosed with any language delays (see below under Measures – LENA Developmental Snapshot). Table 1 provides more complete demographic information on these participants.

INSERT TABLE 1 ABOUT HERE

Children from responding families were balanced by gender (49% female) and ranged in age from 7-60 months (M = 28.6, SD = 11.8). Maternal education levels (M = 14.0, SD = 2.3) were somewhat skewed toward the higher end, but family income was distributed across a wide range. Ethnicity was primarily Caucasian (86%), with 8% Hispanic, 2% African American and 4% other. Mothers were respondents in 95% of families along with a few fathers (4%) and other caregivers (1%). In all but one family, the mother identified as the primary caregiver. In order to explore any effects of subsequent vs. simultaneous completion of measures, additional LENA recordings were included for 66 of these families who self-selected to volunteer to participate in an extension of the original study but were then researcher-selected to be balanced across child age and gender. They provided LENA data and questionnaires concurrently. Study approval was obtained from the Essex Institutional Review Board prior to initiation.

Measures

Parent Perception Questionnaire. Parents were provided a brief questionnaire (Appendix A) sent by mail. Questions were kept simple to enhance the response rate. The questionnaire was designed to elicit a typical level of parental awareness of their interaction with their child, without providing any further specific behavioral or observational criteria. Participants responded to the questions “How much do you talk to your child?” (referred to in

this paper as Adult Talk), and "How much does your child talk (or vocalize)?" (Child Talk), on a 5-point Likert Scale ranging from "Not much" to "Much more than average." Parents also indicated whether their child had at least a 50-word spoken vocabulary; two-thirds did.

LENA Developmental Snapshot. Parents also were sent and completed the LENA Developmental Snapshot, a parent report of expressive and receptive language skills for children ages 2 - 36 months (Gilkerson & Richards, 2008a). The 52 items cover child behaviors which the parents indicate their child does or is not yet doing (e.g., "Does your child vocalize while gesturing to let you know what he/she wants?"). The endorsed item Total Score yields a Development Age, Development Quotient (i.e., Development Age divided by Chronological Age), and an age-normalized Standard Score, all of which were utilized here. Gilkerson and Richards (2008a) reported a three-month test-retest reliability of 0.97 for the Snapshot and an average correlation of 0.93 with criterion measures, including the *Receptive Expressive Emergent Language Test, 3rd Edition* (Bzoch, League, & Brown, 2003), the *Preschool Language Scale, 4th Edition* (PLS-4; Zimmerman, Steiner, & Pond, 2002) , the *Cognitive Adaptive Test/Clinical Linguistic and Auditory Milestone Scale* (Accardo & Capute, 2005), and the *Child Development Inventory* (Ireton, 1992). Snapshot data were included for 182 families in the present study; children of other participants had aged beyond the appropriate range at the time of the talk questionnaire.

This sample included children from a broad range of language development. The average age-standardized Snapshot score was 103.05 (SD = 13.44), corresponding to performance at the 58th percentile. No children in this sample were reported to have diagnosed language disabilities, but 17 scored one or more standard deviations below average on the Snapshot, and of those eight were below 1.5 SDs. These small subsets were not analyzed separately given limited power.

Further, language assessment results from the previous study for this sample were consistent with those from the Snapshot. For example, PLS-4 assessments collected an average of 32.7 (SD = 10.7) weeks prior to the survey were available for 249/258 families. On average, PLS-4 Total Language standard scores were at the 70th percentile, but ranged from below the 1st to above the 99th percentile (M = 108.2, SD = 14.3, range 56 - 146).

LENA Language Measures. Objective language use data were collected using the LENA system (Ford, Baer, Xu, Yapanel, & Gray, 2008; Gilkerson & Richards, 2008b), designed to collect and quantify spoken language activity in the natural environment (e.g., in a child's home). The child wears specialized clothing that includes a front chest pocket to hold a small digital audio recorder which functions optimally within a 6-10 foot radius of the child and saves up to 16 hours of 16 kHz audio. Processing software algorithms parse out adult versus child vocalizing from among other acoustic features and using pre-trained statistical models yield: a) an estimate of the daily AWC, b) an estimate of the frequency of CV including prelinguistic babbling (i.e., when an infant appears to be experimenting with uttering articulate sounds, but does not yet produce any recognizable words) as well as words, and c) an estimate of the frequency of CT between adult and child. Non speech-related child vocal production (i.e., crying, breathing and other vegetative sounds) is automatically filtered out. A CT is defined as an uninterrupted speech-related vocal alternation between adult and child occurring within 5 seconds. LENA counts were standardized against a previously collected reference sample that included current participants to generate age-independent values.

LENA estimates have been shown to be both valid and reliable when compared with trained human transcribers (Xu, Yapanel, & Gray, 2009). For example, 82% of transcriber-identified adult speech and 76% of transcriber-identified child vocalizations were correctly

labeled as such by the automated LENA system. The segments not labeled as the respective speakers were predominantly labeled as overlapping speech, which could occur, for example, when one speaker interrupts another. Human coders might readily identify a dominant voice in such cases, but the LENA system is designed to exclude from consideration segments below a certain threshold of clarity. Importantly, confusing adult for child vocal activity was intentionally minimized, so only 2% of transcriber-identified adult vocalizations were attributed by LENA to the child, and 4% of LENA-identified child vocalizations were tagged adult speech by transcribers. AWC estimates on average were within 2% of transcriber word counts. Test-retest reliability of LENA estimates on recordings 4 weeks apart ranged from an average Pearson correlation of r = .44 for AWC to r = .69-.71 for CV and CT (Gilkerson et al., 2016).

Full-day (i.e., 12 contiguous hours in duration) recordings collected during the prior study (from 1-7 per family, M = 4.7, SD = 1.3) were included here and any shorter recordings excluded; prior recording data were unavailable for one family. For current sample participants, age-standardized measures indicated mean language use in the average range. Mean AWC was 101.82 (SD =16.24), corresponding to the 54th percentile. Mean CT was 99.84 (SD = 11.38), the 49th percentile. CV averaged 99.72 (SD = 10.59), also at the 49th percentile. Consistent with the broad range of Snapshot scores, CV values were well-represented across the reference distribution (see Table 1). Nine percent of the sample children had vocalization frequencies more than one standard deviation below the reference average, though these children did not necessarily also have similarly low Snapshot and PLS-4 scores.

Statistical Analyses

Analyses were conducted using a variety of statistical tests in SPSS v21/22. Correlation analyses are reported as Pearson's *r* or Spearman's rho (ρ) coefficients (for ordinal response

data). Chi-squared analysis was used to compare response distributions. LENA measures were compared between response groups via independent samples *t*-tests wherever appropriate and Mann-Whitney otherwise. Effect size measures were computed as Cohen's *d* (t-tests), ρ^2 (Spearman's rho correlations), and coefficient φ (χ^2 tests) as appropriate. Cohen's *d* indicates the difference between group means relative to their variability; the other two effect size measures derive from the percent of variance accounted for in a variable of interest by other variables.

Results

In this study we predicted that parents' perceptions of their own talkativeness would diverge significantly from LENA estimates of adult talk, and that their ratings of their child's language use would diverge from LENA-based estimates of child vocalization frequency. We further predicted that parental ratings of child talk would correlate with their responses regarding their child's general language abilities on the LENA Developmental Snapshot.

Parent Perception Ratings

Table 2 provides the distribution of responses indicating the level at which parents rated their own (Adult Talk) and their child's (Child Talk) talkativeness on a 1-5 Likert scale. For 258 parents, the Adult Talk mean, median, and modal response values were all 4 (i.e., "more than average"). Parental estimate of Child Talk mean, median, and modal values were all 4 as well. Only 3 families (1%) rated their own talk below average, compared to the 192 (74%) who indicated they talked more or much more than average. One-sample Chi-square analyses confirmed that responses were not uniformly distributed for either Adult Talk ($\chi^2 = 223.7$, $p<.001$) or Child Talk ($\chi^2 = 167.2$, $p<.001$). Two thirds of parents reported their child had a vocabulary of at least 50 words. Compared to the other third, these parents rated their child as significantly more talkative (mean rank = 150.4 vs. 87.0, Mann-Whitney $Z = 6.84$, $p<.001$).

These parents also rated themselves as significantly more talkative (mean rank = 142.2 vs. 103.7, Mann-Whitney $Z = 4.24$, $p<.001$).

INSERT TABLE 2 ABOUT HERE

Parent Perceptions and LENA Estimates

We compared parents' Adult and Child Talk ratings with LENA-based count and age-standardized estimates averaged from their recordings, as shown in Table 3. Overall, parent ratings of their own Adult Talk correlated only marginally with AWC ($\rho = .11$, $p = .08$). Correlations with CT count were somewhat stronger ($\rho = .19$, $p < .01$), though this effect was reduced when child age was controlled for using age-standardized LENA scores. In both cases, effect sizes were small. Parents' ratings of Child Talk correlated with LENA-based CV and CT counts (CV$\rho = .35$, CT$\rho = .33$, $p < .01$ for both), but again these effects were reduced when compared to age-standardized values (CV-SS$\rho = .08$, $p = .18$; CT-SS$\rho = .14$, $p = .02$).

INSERT TABLE 3 ABOUT HERE

Of the 74% of parents who rated their Adult Talk as more/much more than average, close to half (44%) were below the 50th percentile on AWC. And whereas 31% of parents rated themselves in the highest Adult Talk category, only two fifths of these were in the top AWC quintile. However, those parents who rated their own Adult Talk in the highest category in fact had AWCs significantly higher than those who rated themselves lower, as did families including college-educated mothers compared to those with less education, as seen in Table 4.

INSERT TABLE 4 ABOUT HERE

The relative differences between the subjective (Adult Talk) and objective (AWC) measures of parent talk are illustrated by assuming the five rating categories can be mapped approximately to quintiles of a normal distribution (1-19%, 20-39%, etc.). Figure 1 displays the

frequency distribution of families by their self-ratings and by their LENA-based AWC quintile. Agreement is indicated by "Match," with categories above the match indicating underestimates and those below the match overestimates. Using this formulation, only 61 parents (24%) accurately matched their self-rating to the LENA-based rating. Of the remaining parents, 20% provided an underestimate and 56% an overestimate of their own talk. But, parents in college-educated families were more accurate (N = 25/79, 32%), compared with those at lower education levels (N = 36/178, 20%), $\chi^2(1) = 3.94$, p =.047, φ Coefficient =.12 (Table 4).

INSERT FIGURE 1 ABOUT HERE

Parent Perceptions and the Snapshot

We correlated parent ratings of Adult and Child Talk with Snapshot indices and objective LENA measures (Table 3). Adult Talk correlated with developmental age, developmental quotient and standardized score (ρ = .29, .31, .27 respectively), as did Child Talk (ρ = .44, .38, .35). Although Snapshot items reflect both receptive and expressive aspects of child language development beyond simple quantity of speech, we expected Snapshot scores to correlate with parents' ratings of Child Talk. As predicted, the more parents thought their child talked, the higher were their Snapshot scores. Somewhat unexpectedly, parent ratings of their own talk also were correlated with Snapshot scores, albeit to a lesser degree. Effect sizes (i.e., ρ^2) were relatively small (0.00 – 0.20).

Effect of Time Lapse between Measurements

It is conceivable that the time lag between the collection of child-related LENA estimates (CV and CT) and parents' Child Talk ratings could account to some extent for the correlations between the two weakening when controlling for age – perhaps the language environment had changed in the intervening period. We did not expect AWC in the current study to vary

significantly over the time gap, given that the original study (Gilkerson & Richards, 2008b; Gilkerson et al., 2016) from which age standardizations for LENA measures were derived reported no relationship with age or time for AWC. In fact, in the included sample average recording, AWC did not correlate with average child age either in the previously collected recordings, $r(255) = -.04$, $p = .57$, or in the contemporaneous recordings, $r(64) = -.03$, $p = .81$. However, in that prior study both CV and CT did increase with child age. So, to examine this effect for CV and CT, we compared Adult and Child Talk ratings with contemporaneously collected LENA estimates for the subset of families (N = 66) who had participated in an extension of the original study and were recording monthly with LENA at the time they completed the perception questionnaire. We averaged family LENA estimates for recordings conducted within six weeks of administration of the perception questionnaire.

There was little evidence that contemporaneous LENA estimates were different from those from previous recordings. Controlling for age, Pearson correlations were strong on all three LENA-based measures between the two recording periods, AWC ($r = .70$, $p<.001$), CT ($r = .62$, $p<.001$) and CV ($r = .54$, $p<.001$). Mean differences (MD) on age-standardized LENA values were small (though not necessarily nonsignificant): AWC MD = .002 ($SD = 14.54$), $t(65) = .001$, $p = .99$; CT MD =3.74 ($SD = 11.30$), $t(65) = 2.69$, $p = .009$; CV MD = 2.03 ($SD = 12.24$), $t(65) = 1.35$, $p = .18$. Nevertheless, as shown in Table 3 Adult and Child Talk ratings were not correlated with any concurrent LENA estimates.

However, examining this relationship separately for parents who indicated either their child did (N=29) or did not (N=37) have a 50-word vocabulary revealed varying trends for child vocalizations. Parents of children with larger vocabularies (>50 words) had ratings that correlated more positively with LENA CV at the trend level, $\rho(27) = .34$, $p = .07$. Conversely,

parents of children with smaller vocabularies (<50 words) had ratings that were not significantly related to LENA CV, $\rho(35) = -.15$, p = .38. That is, ratings of Child Talk for children speaking more words were somewhat more accurate.

Accuracy for this group (as previously defined) was somewhat similar to that reported for the full sample, though generally weaker. Only 17% of these parents (N=11) rated themselves in the highest talk category (compared to 23% in the full sample), and their average AWC was more variable and not significantly higher than that of the rest of the sample (see Table 4). College-educated mothers in this group demonstrated a trend toward greater accuracy (N = 7/18, 39% vs. N = 9/48, 19%), $\chi^2(1) = 2.89$, p =.089, φ Coefficient = .21, and they again demonstrated significantly higher average AWCs (Table 4).

Effect of Child Gender

The child sample was balanced across child gender with 126 females and 132 males. Age (in months) for girls (M = 28.2, *SD* = 11.0) and boys (M = 28.9, *SD* = 12.4) on average did not significantly differ, $t(256) = 0.50$, p = .62. There was little difference between parent ratings of Adult Talk addressed to boys or girls (see Table 2). But, parents (predominantly mothers) tended to rate girls somewhat higher on Child Talk frequency compared to boys (81% of females in categories 4 and 5 vs. 60% males), $\chi^2(1) = 13.71$, p = .001, and to a lesser extent on their vocabulary size (71% females with 50 words, 64% males), though this latter difference was nonsignificant, $\chi^2(1) = 1.43$, p = .23. No significant gender differences were found on LENA estimates of CV, either for concurrent or previously collected recordings.

Discussion

The present study compared parents' perceptions of their own and their child's

talkativeness with previously or concurrently collected objective LENA-based estimates of their full day language activity, and with a parental report measure of child language development (the Snapshot). We expected that parents' assessments of their child's language skills on the Snapshot would be congruent with their estimates of their child's frequency of talk. We did not however necessarily expect such congruency with LENA estimates, since as parents had no objective reference standards, estimation of their own volubility would be likely to be less accurate. We found that parental ratings of their child's talk tended to be high, and their self-ratings high as well. As expected, parents were moderately consistent in their assessments of their child's talkativeness and general language development, but less so compared to the more objective LENA-based estimates. Interestingly, a significant correlation between Child Talk rating and LENA CV was reduced to nonsignificance once child age was controlled for in the LENA measure. That is, parents who rated their child as more talkative did have a child who talked more than other participant children, but this effect was accounted for in large part by the child's age, because child vocalizing increases with age over this range.

Similarly, parents' self-assessments were only weakly related to direct measures of talk in the home. Supplemental analyses of LENA recordings collected concurrently with parent questionnaires indicated that time elapsed between recordings and these assessments had little impact on LENA estimates, but the relationships between these and parent ratings were reduced. Examining subsets of families revealed that parents were not completely inaccurate in their ratings, however. Parents who rated themselves at the high end of the Adult Talk scale did in fact have significantly higher AWCs than other families. College-educated mothers not only had higher AWC estimates than those of mothers with less education but also were more accurate in their self-ratings. The predominantly female parent respondents rated the female children as

more talkative than their similarly aged male counterparts, though this difference was not borne out by the LENA recording data.

Correlations between parent questionnaire perceptions and the Snapshot were statistically significant but generally small in size. Thus our expectation that parents' assessments of their child's language skills on the Snapshot would be congruent with their estimates of their child's frequency of talk was very modestly supported. We did not however necessarily expect such congruency with LENA estimates, and this was indeed the case. In summary, compared to a LENA-based characterization of the home language environment, parents in general were not that accurate when estimating how much they talked to their child, but they were somewhat more so when rating how much their child talked. The lack of widely available reference standards for talk in the home presents a challenge for parents seeking to assess and improve their child's language environment.

Implications with Previous Research

Despite the rich literature on the important role of adult talk and adult-child engagement on child vocalizations, vocabulary and syntax development, the effect of parental estimation of their own level of verbal interaction with their child has been relatively little studied. Rowe (2012) found that a sophisticated adult vocabulary and use of decontextualized (i.e., abstract rather than concrete) language were predictive of child language skills over and above amount of parent talk, though for younger children, amount of talk was the strongest predictor. Specifically, the proportion of adult words that incorporated more abstract language was an important predictor of later child skills such as language comprehension and early literacy. However, adult words of any sort are more likely to impact the child if the child pays some attention to them and (preferably) responds. So, providing objective feedback on conversational turns becomes

important as their effect on subsequent verbal ability, receptive and spoken language, and academic achievement assessed on standardized tests is substantial.

Whitmarsh (2011) found disadvantaged first-time mothers knew little about the importance of their input to the child's language development. Other studies have highlighted differences between cultures in underlying assumptions. However, the studies of Squires and colleagues (1997, 1998) showed that when parents were asked to respond to specific behavioral statements their accuracy was quite acceptable. The present study aligns with this result. When asked rather simple and general questions, parents have no benchmark and tend to overestimate. When provided with direct feedback on performance, parental estimations may become more accurate. An important goal then is to move parents on from a simpler and more general framework to one which gives them a sharper focus and emphasizes the importance of the task.

Implications for Practice, Policy, and Future Research

The practical implications of these results are considerable. Parental responsiveness is a key factor across a broad range of child development indices (Warren & Brady, 2007). If the aim of an intervention is to maximally enhance the child's language environment from an early age, parents who consider themselves already able in this respect may be unlikely to be motivated to participate in an intervention. If they could be engaged using objective measures, discovering that the reality may differ considerably from their self-assessment could be empowering. There are implications not only for practitioners designing interventions, but also for researchers doing the same with a view toward evaluating the relative effects of interventions, and indeed for policymakers.

Data-based feedback from objective measures may be helpful to include as part of an intervention, providing an opportunity to establish and track clear markers of familial change.

The manner in which results from LENA recordings might be provided to parents is an issue to consider. Families are likely to respond better to showing them how much more opportunity they have to engage with their child than to only telling them they don't talk as much as they think they do. Employing tactics to persuade parents of the need to change may be combined with building on their self-perceived strengths.

Although not an objective measure, the parent-report LENA Developmental Snapshot offers parents a useful tool for gauging their child's language development. The full version of LENA can also provide more regular feedback, but the Snapshot could be used at a lesser frequency to encourage parents attempting to improve their language interaction with their infants in a similar way. However, the Snapshot does offer more wide-ranging information, and can help inform parents who might have concerns.

Another issue to consider is the influence of cross-cultural beliefs. For example, Simmons and Johnston (2007) had Indian mothers and Euro-Canadian mothers of preschool age children complete a survey concerning talking to children. Despite similar levels of education, the two samples exhibited clear differences. For example, parents holding a more adult-centered perspective on child-rearing were more likely to be directive when interacting with a child and more likely to correct grammatical errors, compared to parents with more child-centered views who were more responsive to what they thought the child wanted or needed. As well, book reading was naturalistically more infrequent in families coming from cultures with stronger oral traditions. Such cultural practices could readily impact parents' perceptions of their own and their children's appropriate levels of talk but remain a topic for further research.

Limitations

The present study had several limitations. The first was the likely generalizability of these

results to other families. These parents of mostly typically developing children were recruited based on their prior participation in a study of the home language environment and represented a broad range of socioeconomic status. Although a small percentage of children did score in the clinical range on language measures, the current sample did not target families of children with diagnosed language disabilities. We nevertheless observed that the language environments of a proportion of children in the study had lower than average levels of talk and conversational turns, but the implications for the parents of children with even greater need of language intervention remain untested. We do believe that children of any ability status could benefit from enhancements to their home language environment, and we surmise (given the evidence that children with language delays may elicit less speech from their caregivers) that they would benefit even more from interventions including objectively-based feedback to caregivers.

Additional limitations (such as the brief nature of the parent questionnaire scale employed, its scalar properties, and the absence of longer-term follow up) place caveats on the interpretability of these results. The parent perception measure included questions that were broad, and the response categories may have been too limited. In particular, parents were asked to rate themselves on a Likert scale on behavior for which they had no standard point of reference. That is, we did not know for any given family what their interpretation of an "average" amount of talk actually was. We might speculate that parents rated themselves against their own families of origin or observations of friends or other family members. Future questionnaires could provide parents with more objective criteria by which to judge the rating anchor points and perhaps offer a finer degree of rating granularity.

Ultimately, our interest was in parents' self-perception. We can observe that the majority of parents rated themselves as above average. In fact, only about 1% of respondents rated their

quantity of talk as below average, and barely one quarter saw themselves as average. It certainly could be that parents interpreted "average" in a negative way and so rated themselves higher. But whatever their internal representations, parents responded in a highly skewed manner, and we would argue this pattern supports our broader point that brief parental estimates are inaccurate. Nevertheless, future inquiries along these lines could benefit from soliciting more information from parents regarding the bases of their ratings and investigating whether their views change over time.

Conclusions

We hypothesized that parents' self-assessments of their talkativeness with their children would diverge from more objectively measured LENA estimates, and indeed the two estimates were at best only weakly correlated. We predicted that parents' ratings of their child's talk would vary from LENA estimates and similarly found the relationship was weak at best, especially when controlled for child age. We did expect parents to demonstrate a degree of internal consistency regarding their child's talkativeness in relation to overall language development, and the positive correlations observed between those metrics support that view.

From these data, parents do not appear to have a reliable basis of comparison to judge how much they talk to their child. Perceptions of their child's vocalizing are somewhat better aligned with more objective estimates. Whether these results may be generalized to families of children with diagnosed language disabilities remains a question for future study. These results have clear implications for interventions aimed at improving a child's home language environment: parents of children in relatively impoverished language environments may be less aware of the need to initiate behavioral changes. Providing parents with an objective standard of reference could facilitate their interest and participation in such interventions.

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Table 1

Sample Demographics for Parent and Child Participants

	Child Gender			
	Female	Male	Total	Percent
Age (months)				
6 – 12	12	16	28	11%
13 – 18	20	21	41	16%
19 – 24	20	19	39	15%
25 – 30	18	17	35	14%
31 – 36	26	19	45	17%
37 – 42	19	18	37	14%
43 – 48	9	17	26	10%
> 48	2	5	7	3%
Child Voc Quintile				
< 20%	16	15	31	12%
20-39%	38	33	71	28%
40-59%	33	32	65	25%
60-79%	30	34	64	25%
>= 80%	8	18	26	10%
Mother Education				
Some High School	15	14	29	11%
H.S. or Equivalent	37	42	79	31%
Some College	35	36	71	27%
BA+	39	40	79	31%
Family Income				
Below $20K	28	21	49	19%
$20K – $40K	36	39	75	29%
$41K – $60K	31	21	52	20%
$61K – $100K	17	35	52	20%
> $100K	14	16	30	12%
Total	126	132	258	100%

Table 2

Parent Perception Questionnaire Responses

	Response Category						
	1 Not Much	2 Less Than Average	3 About Average	4 More Than Average	5 Much More Than Average	Median	Mean (SD)
Adult Talk							
Female Child	0	1	25	73	27	4	4.00 (.67)
Male Child	1	1	38	58	34	4	3.93 (.80)
Total	1	2	63	131	61	4	3.97 (.74)
Percent	0%	1%	24%	51%	24%		
Child Talk							
Female Child	0	1	23	67	35	4	4.08 (.70)
Male Child	3	6	44	46	33	4	3.76 (.96)
Total	3	7	67	113	68	4	3.91 (.86)
Percent	1%	3%	26%	44%	26%		
50-Word Vocabulary	**Not Yet**	**Yes**	**Total**				
Female Child	37	89	126				
Male Child	48	84	132				
Total	85	173	258				
Percent	33%	67%	100%				

Table 3

Spearman Correlations: Parent Ratings with Recording Measures and LENA Snapshot

		Adult Talk Rating			Child Talk Rating		
LENA Measure	N	Sp-ρ	p	ρ^2	Sp-ρ	p	ρ^2
Previous Recs							
AWC	257	.11	.08	.01	.04	.50	.00
AWC SS	257	.11	.07	.01	.04	.48	.00
CT	257	.19*	.003	.03	.33*	<.001	.11
CT SS	257	.11	.07	.01	.14*	.02	.02
CV	257	.09	.15	.01	.35*	<.001	.12
CV SS	257	-.03	.65	.00	.08	.18	.01
Concurrent Recs							
AWC	66	.05	.70	.00	.07	.58	.00
AWC SS	66	.04	.76	.00	.07	.60	.00
CT	66	.11	.40	.01	.21	.09	.04
CT SS	66	.10	.45	.01	.12	.34	.01
CV	66	.01	.96	.00	.14	.26	.02
CV SS	66	.03	.80	.00	.07	.60	.00
Snapshot							
Dev Age	182	.29*	<.001	.08	.44*	<.001	.20
Dev Quotient	182	.31*	<.001	.10	.38*	<.001	.15
Standard Score	182	.27*	<.001	.07	.35*	<.001	.12

Note. Sp-ρ = Spearman's rho correlation; Recs = Recordings; AWC = Adult Word Count; CT = Conversational Turn count; CV = Child Vocalization count; SS = age-normalized Standard Score; Dev = Developmental; *p < .05.

Table 4

Mean LENA AWC by Parent Rating of Adult Talk and Maternal Attained Education

	N	AWC-M	AWC-SD	t	p	Cohen's d
Previous Recs						
Adult Talk = 5	60	14,259	5,140	2.00	.046	.30
Adult Talk < 5	197	12,918	4,341			
College Degree	79	15,036	4,562	4.37	<.001	.59
< College Degree	178	12,430	4,345			
Concurrent Recs						
Adult Talk = 5	11	14,307	7,491	0.68	.500	.23
Adult Talk < 5	55	13,091	4,917			
College Degree	18	15,734	4,982	2.33	.023	.65
< College Degree	48	12,379	5,282			

Note. Recs = Recordings.

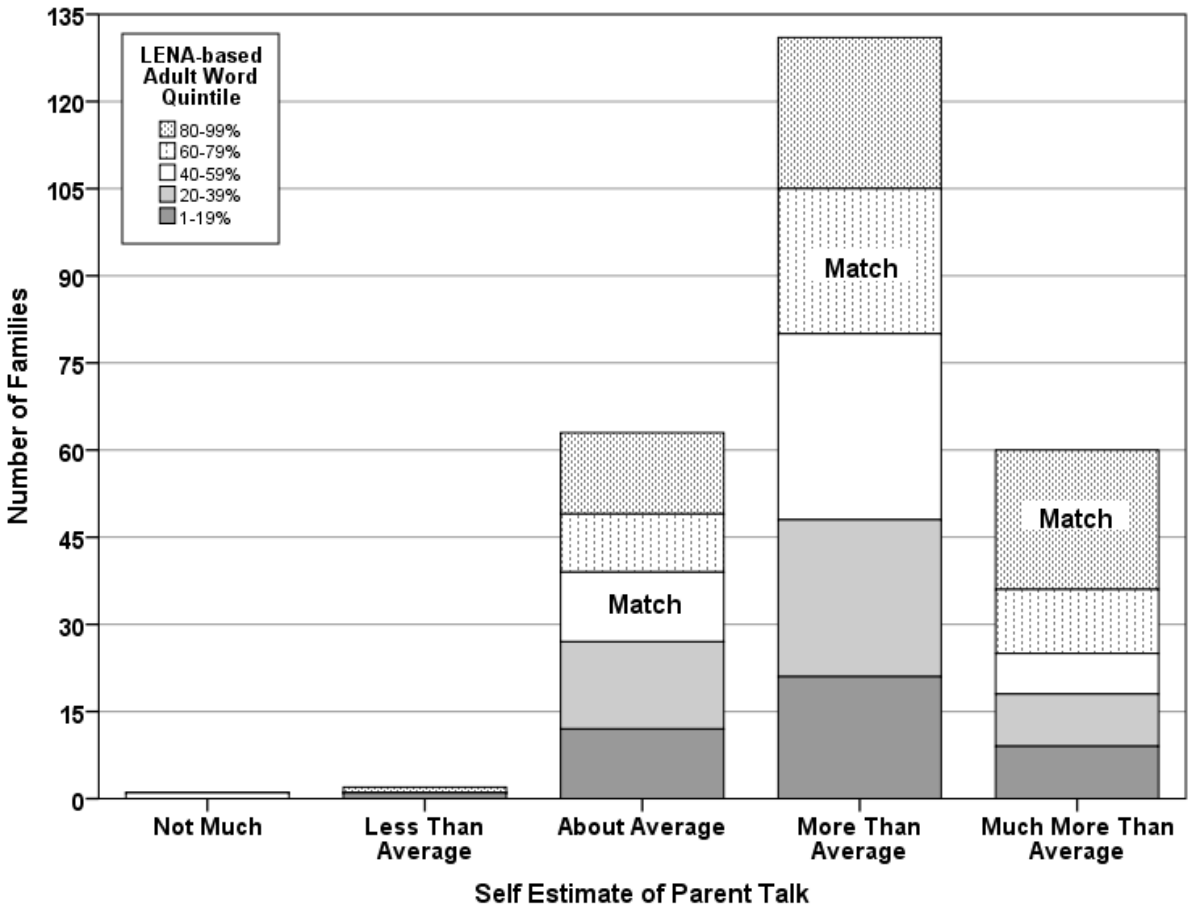

Figure 1. Distribution of parental perception of Adult Talk by LENA-AWC Quintile

Appendix A

PARENT QUESTIONNAIRE

Do not write your name on this form

Please return this completed questionnaire in the enclosed self-addressed envelope within three days.

Date: _____

1) What is your child's date of birth (mm/dd/yy)? _____

2) Are you the child's primary caregiver? YES☐ NO☐

3) Are you the child's: MOTHER ☐ FATHER☐ OTHER☐

4) How much do you talk to your child? (circle one)

1	2	3	4	5
not much	less than average	about average	more than average	much more than average

5) How much does your child talk (or vocalize*)? (circle one)

1	2	3	4	5
not much	less than average	about average	more than average	much more than average

*Vocalizations are babble-like sounds children make before they begin to talk

6) Does your child have at least a 50 word spoken vocabulary? (check one)

Yes ☐ Not Yet ☐

Many thanks from the LENA™ Research Team!