



Risk and Protective Factors for Late Talking: An Epidemiologic Investigation

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Objective To identify risk and protective factors for late talking in toddlers between 24 and 30 months of age in a large community-based cohort.

Study design A prospective, longitudinal pregnancy cohort of 1023 mother-infant pairs in metropolitan Calgary, Canada, were followed across 5 time points: before 25 weeks gestation, between 34–36 weeks gestation, and at 4, 12, and 24 months postpartum. Toddlers who scored ≤ 10 th percentile on The MacArthur-Bates Communicative Development Inventories: Words and Sentences between 24 and 30 months of age were identified as late talkers. Thirty-four candidate characteristics theoretically and/or empirically linked to language development and/or language impairment were collected using survey methodology.

Results The prevalence of late talking was 12.6%. Risk factors for late talking in the multivariable model included: male sex ($P = .017$) and a family history of late talking and/or diagnosed speech or language delay ($P = .002$). Toddlers were significantly less likely to be late talkers if they engaged in informal play opportunities ($P = .013$), were read to or shown picture books daily ($P < .001$), or cared for primarily in child care centers ($P = .001$).

Conclusions Both biological and environmental factors were associated with the development of late talking. Biological factors placed toddlers at risk for late talking, and facets of the environment played a protective role. Enveloping infants and toddlers in language-rich milieus that promote opportunities for playing, reading, and sharing books daily may decrease risk for delayed early vocabulary. (*J Pediatr* 2016;172:168–74).

Impaired language learning is linked with poor outcomes in academic achievement,¹ reading, and comprehending text,² social and behavioral development,^{3–6} self-esteem,^{7,8} and being bullied or victimized.⁹ Accordingly, the American Academy of Pediatrics counsels parents to seek guidance if their toddlers show a delay in saying or understanding words so that early management can be contemplated if deemed necessary.¹⁰ The term late talker is often used to describe toddlers between 18 and 35 months of age who, in the absence of clear underlying neurologic, sensory, or cognitive deficits, fall at the bottom of the population distribution for number of words in their early vocabularies.^{11,12} Often considered an expressive language phenomenon, late talking may occur with or without a concomitant delay in receptive language.^{11,12}

The few prospective studies that have tracked the evolution of delayed word production after the toddler period have reported wide variation in later language abilities across a number of dimensions (eg, vocabulary, grammar, inflectional morphology), spanning typical to impaired.^{13–16} Factors contributing to these differences in reported trajectories include the inherent heterogeneity of language development and lack of consistent inclusion criteria, measures, and thresholds for identifying late talking. Prospective, longitudinal, population-based studies, applying consistent instruments and selection criteria, are required to characterize more fully typical and atypical variation across pivotal language dimensions as a function of age.¹²

Current theories of language impairment posit a multifactorial causal mechanism, inclusive of an array of inherited and acquired factors.^{17,18} A limiting factor to a better understanding of how these factors might work together to shape language delay, however, is the small sample sizes of the majority of late talker cohorts, which restricts the number of factors considered simultaneously. Five large, population-based studies, to date, have investigated the relations between a number of genetic/biological and environmental associations with late talking status.^{19–23} Two involve longitudinal cohorts in Australia,^{19,20} 1 involves a longitudinal cohort in Denmark,²¹ 1 reports a longitudinal cohort of twins in England and Wales,²² and the fifth is a cross-sectional investigation of young children with language delay in the US.²³ Together, these studies have yielded robust evidence for 2 biological associations for late talking: male sex and a family history of late talking or speech and language difficulties. Environmental factors that are hypothesized to be associated with late talking,

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CDI McArthur-Bates Communicative Development Inventories
PP Predicted probability

however, have either not yet been tested or consistently contributed significantly to multivariable models. Those that have shown an associative relationship with late talking in at least 1 large cohort include a bilingual language learning environment, low maternal education, low family expressiveness, and presence of siblings.¹⁹⁻²³ These 4 variables represent a small fraction of possible environmental factors hypothesized to be associated with the development of early vocabulary delay, leaving the majority largely unspecified.²² Yet, the identification of factors that are conducive to modification holds promise in the mitigation of a suboptimal language learning trajectory.

This study used a prospective, North American community-based cohort of 1023 mothers and toddlers to examine the potential association of 34 theoretically and/or empirically identified factors to late talking at 24-30 months of age. We tested the hypothesis that, in addition to biological risk for late talking, previously untested environmental factors can be associated with decreased risk for the development of early vocabulary delay.

Methods

The present study is based on data from the All Our Babies community-based prospective longitudinal pregnancy cohort in Calgary, Alberta, Canada, (metropolitan population; 1.3 million). Canada has a publically funded universal health care system, and 99% of women receive some prenatal care. Women were recruited from physician offices, laboratory services, provincial healthcare websites, and community posters between May 2008 and December 2010 (details reported elsewhere).²⁴ Women were eligible to participate if they met the following criteria: less than 24 weeks, 6 days gestation at the time of recruitment, 18 years or older, receiving prenatal care in Calgary, and able to complete the surveys in English. The participation rate for the All Our Babies study at the 24-month follow-up was 75.5%. Comparisons between the All Our Babies cohort and national, provincial, and local statistics showed that the women in the All Our Babies cohort are representative of the sociodemographic profile of the pregnant and parenting population in urban Canada, including, for instance, average age at delivery, foreign-born proportion, visible minority status, and household income.²⁵ This study was approved by the Conjoint Health Research Ethics Board at the University of Calgary, and all participants provided written informed consent.

Participants completed questionnaires at the following time points: before 25 weeks gestation, between 34-36 weeks gestation, and at 4, 12, and 24 months postpartum. The questionnaires were composed of both standardized scales and investigator-derived questions on a variety of topics, including maternal mental health, sociodemographics, work-life balance, parenting, and child development. When their children were 12 months of age, mothers completed child development assessments that included the McArthur-Bates Communicative

Development Inventories (CDI): Words and Gestures as well as the Ages and Stages Questionnaire-3.^{26,27} When their children were 24-30 months old, mothers completed the CDI: Words and Sentences as well as the Ages and Stages Questionnaire-3.

Thirty-four candidate factors associated with late talking in toddlers were identified from studies that theoretically and/or empirically linked these factors to language development and/or language impairment (Table I). Candidate factors included child sex, family history (late talking/diagnosed speech or language delay), other children in the home, number of adults in the home, number of children younger than 5 years, maternal age at birth of child, maternal education, nominal exposure to another language (operationalized as ≤ 12 hours per week), ethnicity, time in Canada, preterm birth status, family income, maternal paid employment, neighborhood safety, maternal depression, stress and anxiety (state and trait), maternal smoking, alcohol use, drug use, physical health, emotional health, social support (partner, friends, family), mother and partner concordance in their views of their child, child frequency of ear infections, use of formal community resources, engagement in informal play opportunities, television viewing, computer habits, reading and sharing picture books, and child care type. Toddlers with an identified medical condition or syndrome associated with language or cognitive impairment and those whose families reported a bilingual language learning environment were excluded from the sample. We excluded simultaneous bilinguals because an accurate measure of their productive language involves combining vocabulary in both languages. Our participants completed the CDI: Words and Sentences in English only. To capture bilingual language learning environments, we applied the threshold of "exposure to a language other than English more than 12 hours per week" to our sample to align with the norming sample of the outcome measure, the CDI: Words and Sentences (Figure; available at www.jpeds.com).

We compared the final sample of eligible participants with the full sample on the 27 variables that were collected either at baseline or at 12 months of age. There were 27 *P* values generated, so caution must be taken in the interpretation of the *P* values because the probability of spuriously significant *P* values is high. There were 6 variables on which the 2 groups differed at $P < .01$ and an additional 3 variables that had *P* values less than .05 but greater than .01. Women who had missing data at 24 months (including the CDI: Words and Sentences) were more likely to be those who had lived in Canada less than 5 years or were not Caucasian. They were also less likely to live in a home with 2, and only 2 adults, and were less likely to have a college education. They were more likely to report their physical health as fair or poor and high trait anxiety scores (all *P* values $< .01$). Women who had missing data at 24 months (including the CDI: Words and Sentences) may be more likely to have low income, feel less safe in their neighborhoods, and use street drugs ($.05 < P < .01$).

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