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# Exploration of a Caregiver Report Screening Instrument for Infant Speech Patterns

by

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To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Brooke Swafford find it satisfactory and recommend that it be accepted.

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Exploration of a Caregiver Report Screening Instrument for Infant Speech Patterns

Thesis Abstract—Idaho State University (2021)

**Purpose:** The purpose of this project was to conduct an initial exploration of the *Speech Sound Development Screener*, an assessment tool for caregiver report of infant speech patterns.

**Method:** The *Speech Sound Development Screener* was created using commonly reported sounds/sound sequences from caregiver report of speech in 26 infants. A Qualtrics survey link was distributed to elicit responses from families who have infants between 7 to 18 months of age.

**Results:** Preliminary results from 18 survey responses demonstrated that the *Speech Sound Development Screener* appears to be sensitive to infant age and feasible with respect to perceived importance, content understanding, and time to complete.

**Conclusions:** Practical implications for study results support future evaluation of the *Speech Sound Development Screener*.

Keywords: “at risk”: infants who experienced any of the following conditions prior to 6 months of age: pre- and/or perinatal problems; ear, nose, and throat problems; swallowing/sucking problems; and/or a family history of speech and/or language problems.

## Chapter 1: Exploration of a Caregiver Report Screening Instrument for Infant Speech Patterns

In a recent study, Ramsdell-Hudock et al. (2018), demonstrated that caregiver report of infant vocalizations can provide a valuable means for describing early infant babbling. Typically, infants progress through a series of commonly accepted and well-documented stages of prelinguistic vocal development (Koopmans-van Beinum & van der Stelt, 1986; Oller, 1980; Stark, 1980), although, this time period is also marked by phonetic inconsistency and variability within and across infants (Fenson et al., 2000). Prelinguistic vocal milestones have been found to be indicative of later language development (Fasolo et al., 2008; Oller et al., 1999; Sotto et al., 2014; Watt et al., 2006). Given a strong focus on prelinguistic *language* development in diagnosis of infants in need of speech/language services[1], such as the *MacArthur–Bates Communicative Development Inventory* (CDI; Fenson et al., 2006), there is a need for a measurement tool where parents report the presence or absence of *speech sound* production milestones during this time frame. The CDI (Fenson et al., 2006) assesses a child's language development, meaning it focuses on the child's vocabulary and their ability to use language or understand language. The *Speech Sound Development Screener* (SSDS) has been designed with the intent to assess a child's speech sound development, meaning it will focus on the child's

[1] With respect to speech and language disorders in development, most children are not identified as needing therapy until 3 to 5 years of age, when certain speech and language skills should be mastered. While disorders are not typically identified until preschool/school age, there are tools that can facilitate early identification, such as the MacArthur-Bates Communicative Development Inventory (CDI; Fenson et al., 2006). The CDI can be used to identify children between the ages of 8 to 30 months who are at risk for later *language delays/disorders*. Tools for early identification of *speech sound disorders* are limited.

ability to produce the sounds that will eventually be used to articulate words. The SSDS is a screening instrument, which differs from an assessment because a screening instrument's purpose is to be a quick and efficient way to decide if further assessment is needed or not, while an assessment's purpose is to diagnose and get in-depth knowledge related to a person's abilities. Observing children's prelinguistic vocal development is likely to provide an important adjunct to existing assessments to support identification of children who need early intervention services.

**Prelinguistic Vocal Development**

Prelinguistic development has an ordered and predictable sequence of emerging sounds (Morgan & Wren, 2018). In General American English, the phonemes /m, n, p, b, t, d, w/ are typically mastered between 1;6 to 2 years of age; the phoneme /h/ is typically mastered by 2 to 2;6 years; the phonemes /f, s, j, ŋ, k, g/ are typically produced consistently between 2;6 to 3;6 years; the phonemes /v, z, l, ʃ, ʧ, ʤ/ typically emerge between 3;6 and 4;6 years; and the phonemes /r, ʒ, θ, ð/ are typically mastered after 4;6 years (Poole, 1934; Prather, Hedrick, &; Kern, 1975; Wellman, Case, Mengert, &; Bradbury, 1931). Speech development in the first 6 months of life however, includes cooing, vocal play (e.g., squealing, growling, yelling, whispering, blowing raspberries, etc.), and vegetative sounds; early establishment of breath support for speech production; and premature manipulation of the speech production mechanisms (e.g., respiratory, phonatory, resonatory, and articulatory mechanisms). During this time, recognizable consonant-vowel (CV) syllable structures that form the basis of adult productions are not expected or observed. After the first 6 months, the vocal patterns of infants continue maturing and canonical syllables emerge. Canonical babbling occurs when infants start to produce recognizable syllables with CV structure ("ma", "ba"; Morgan & Wren, 2018; Stoel Gammon & Otomo, 1986). Canonical babbling differs from the fuzzy (mushy, immature)

sounding consonant and vowel "like" productions in earlier development because it consists of fully-resonant vowels, clearly articulated consonants, and timely transitions between the two (Oller, 2000).

Beyond canonical syllable production emerging from 7 to 10 months of age, we also see the appearance of reduplicated babbling, or repetitions of well-formed CV syllables ("mamama" and "dadada"), followed quickly by production of variegated babbling that includes a variety of CV syllables ("maboda" and "idgeecoo"; Morgan & Wren, 2018). Variegated babbling is produced with intonation patterns mirroring adult conversation in the infant's ambient language, excluding meaningful words, and is often referred to as gibberish. When an infant who is typically developing reaches 12 months of age, they begin to produce their first words. An infant's first words may not be precisely articulated, but they can resemble the phonetic patterns of adult productions and are understood by caregivers and people who have regular interaction with the infant (Oller et al., 1999). By 18 months of age, children are consistently producing some words and regularly trying to imitate and produce new words, steadily adding to their vocabulary (Oller et at., 1999). Utterances produced by infants change with age and can differ depending on the situation in which they are produced. It is important to note in which situations infant utterances are produced most frequently in order to get the most representative sample of the infant's speech productions.

A study was conducted by Iyer et al. (2016) to examine the speech production of infants in three situations at different age ranges. The study included 16 infants that were recorded from 2 to 11 months in age. The participants passed newborn hearing screenings, were considered typically developing according to pediatrician report, and were from families of middle to high socioeconomic status. When recorded (for 30-minutes at a time), the infants wore a vest that housed a wireless microphone. The situations included No Talk, Talk, and Interview. During the

No Talk situation, the caregiver was in the room with the infant, but was preoccupied in a quiet activity (e.g., reading a magazine) while the infant played with age appropriate toys. During the Talk situation, the caregiver was instructed to interact and talk to the infant as they normally would. During the Interview situation, an experimenter would interview the caregiver about the developmental and vocal milestones of the infant as the infant independently played in the room with age appropriate toys (Iyer et al., 2016). The researchers discovered that infant utterances were produced more frequently when the caregiver was in the room and interacting with the infant, or doing a silent activity, than when the caregiver was in the room and being interviewed by the researcher. These results indicate that the optimal setting to get the most accurate inventory of infant speech productions are when a caregiver is interacting with infant or doing a silent activity. Results from observing infant's speech productions in the most optimal setting can then be compared to parent reported infant inventories to see if caregiver report is an accurate representation of the infant's actual speech productions.

**Caregiver Report of Infant Vocalizations**

If caregivers are able to report their infant's speech productions accurately, it would provide a quicker and more convenient way to assess an infant's speech production inventory. With the purpose of assessing if caregiver report is a reliable way to assess an infant's speech development, research was conducted by Ramsdell-Hudock and colleagues (2018) to determine if caregiver report of infant babbling would reflect established norms. Participants included 15 caregivers and infants who were typically developing (per caregiver report and informal observation of developmental milestones by laboratory staff) from 7 to 18 months of infant age. Caregivers were interviewed weekly for the duration of the longitudinal study, with the main question of interest being, "What sounds/words is your infant producing?" (Ramsdell-Hudock et al., 2018, p. 167). The interviews took approximately 5 minutes to conduct and responses were

phonetically transcribed. Results indicated that caregiver report replicated established norms and markedness theory, supporting the argument that caregiver report is a valuable tool for early identification and clinical application (see Ramsdell-Hudock et al., 2018 for detail). However, this means of data collection has yet to be efficiently implemented for clinical or diagnostic procedures. As of now, no screening instrument for emerging speech sounds in infants aged 7 to 18 months exists, but caregiver report has been well validated and is commonly obtained for older children starting around 2 years of age.

As follow-up to Ramsdell-Hudock et al. (2018) the group sought to determine if caregiver report of infant vocalizations prior to 18 months of age can 1) differentiate between infants who were typically developing versus those at risk[2] for speech/language delay/disorder and 2) predict later vocabulary ability (Ramsdell-Hudock, et al., in review). Participants included 25 caregivers and infants from 7 to 18 months of age, with 15 infants considered typically developing and 10 considered at risk. Caregiver report of infant vocal development was tracked from 7 to 12 months of infant age via the interview question, "What sounds/words is your infant producing?" (Ramsdell-Hudock, et al., in review, p. 13), and responses were phonetically transcribed. From transcriptions, the total number of utterances, consonants and vowels in utterances, and articulatory features for consonants (place – labial, coronal, dorsal, and laryngeal; manner – stop, fricative, affricate, nasal, liquid, glide, trill, click; voicing – voiced and voiceless) and vowels (high front, low front, central, low back, and high back) were tallied (Ramsdell-Hudock, et al., in review). Child vocabulary ability at 18 months of age was

[2] For this line of research, "at risk" is defined as infants who experienced any of the following conditions prior to 6 months of age: pre- and/or perinatal problems; ear, nose, and throat problems; swallowing/sucking problems; and/or a family history of speech and/or language problems (Brady et al., 2004; Farnsworth, 2019; Goldstein & Schwade, 2008; McDuffie & Yoder, 2010, Ramsdell-Hudock et al., 2018).

determined via the CDI *Words and Gestures* (CDI-WG; Fenson et al., 2006). Results revealed that caregiver report of vocalizations differed statistically significantly dependent upon infant developmental status after controlling for age [F (24, 82) = 5.647, p = 0.000, Wilks' Λ = 0.377, partial η 2 = 0.623], such that infants who were typically developing were reported to produce a larger number of sounds than infants who were at risk. Also, effect size results demonstrated that caregiver report was related to later expressive and receptive vocabulary size (0.25 = small effect, 0.40 = medium effect, 0.65 = large effect; Gaeta & Brydges, 2020), such that infants who were reported to have more variability in vocal productions from 7 to 12 months of age were children with larger receptive and expressive vocabularies at 18 months. Again, the findings justify incorporating caregiver report of early vocalizations into research methods and clinical diagnostic procedures for early identification. This line of research formed the foundations for creating the *Speech Sound Development Screener.*

**Creating the Speech Sound Development Screener**

The *Speech Sound Development Screener* (SSDS) is a parent report instrument that is intended to capture important information about early speech sound milestones. The intent behind development of the SSDS was to incorporate caregiver report into research methods and clinical diagnostic procedures for earlier identification of children considered at-risk for speech sound disorders/delays, use in clinical or home settings with or without professional administration, and more efficient methods of assessment for speech-language pathologist. A more efficient method of assessment for speech-language pathologists would be critical because it would enable them to screen more children in a shorter amount of time, which could help to identify more children at risk for later speech or language delays. An initial draft of the SSDS was created in an unpublished thesis by Thomas (2020; under the guidance of Ramsdell-

Hudock). After reviewing existing questionnaires used to obtain caregiver report (e.g., the CDI), the researchers generated a bank of questions that addressed anticipated differences between infants who are typically developing and those at risk (e.g., "Does your child produce sounds while playing by himself/herself?"). Specific speech sounds queried on the SSDS (e.g., /i/ as in "tea") were based on data from caregiver report in Ramsdell-Hudock et al. (2018) and Farnsworth (2019). Seven caregivers of infants aged 7 to 18 months and six experts in the field (e.g., speech-language pathologists, child development experts, etc.) were given a first draft of the screener and provided feedback about possible revisions or additions to the screener. The screener was then revised for clarification and inclusion of further speech sounds based on suggestions by experts and caregivers. The revised set of questions was then analyzed using the Flesch-Kincaid readability scale for reading level and ease of reading. The overall reading level for the SSDS was a 6.4 (i.e., a 6$^{th}$ grade reading level), which was deemed acceptable based on the reading levels of other assessments for caregiver report. For example, the average reading level of items on the *Preschool Pediatric Symptom Checklist* (PPSC) is grade 1.8, with items having reading levels greater than 6$^{th}$ grade revised (Sheldrick et al., 2012), and the reading level of the *Infant-Toddler Checklist* (ITC) is grade 4.9 (Wetherby et al., 2008). The current version of the SSDS can be reviewed in the Appendix of this thesis prospectus. Once the SSDS was revised and deemed readable, approval for the present project was obtained from the Human Subjects Committee at Idaho State University and the reported project was pursued.

## Chapter 2: Purpose

The long-term goal of this line of research is to establish a valid and reliable screening instrument for caregiver-report of infant speech patterns. As a continued step toward this goal, the SSDS was created using commonly reported sounds/sound sequences from archived longitudinal data of caregiver report of infant speech sounds from 26 families (Thomas, 2020). The screener was revised using feedback from six experts and seven caregivers. The overall objective of the present project was to administer the SSDS to a random sample of participants and explore responses for developmental patterns and feasibility. It was hypothesized that the SSDS would be sensitive to infant age and feasible with respect to perceived importance, content understanding, and time to complete. The rationale for the purposed research was to lend support to the utility of caregiver report for identifying trends in early vocal development and add to the growing body of research justifying caregiver report of early infant vocalizations as a fruitful tool to incorporate into our research methods and clinical diagnostic procedures for early identification.

We tested our central hypothesis by pursuing the following two Specific Aims. In Aim #1, we explored responses to SSDS questions across infant age. The working hypothesis for Aim #1 was that the screener results would be sensitive to infant age, such that caregivers would report older infants to be producing more sound types than younger infants. In Aim #2, we assessed the feasibility of the length of time to complete the SSDS, as well as the caregiver's perception of the importance of the SSDS content, and how well caregivers were able to understand the questions on the screener. The working hypothesis for Aim #2 was that it would take caregivers on average less than 20 minutes to complete the survey, they would be able to understand screener questions, and they would judge the screener topics/questions (e.g., speech sound development) to be of importance.

## Chapter 3: Methods

A Qualtrics survey link was used to elicit responses from families who had infants between 7 to 18 months of age. The link was distributed via social media (e.g., to parent groups on Facebook), email to faculty in the Kasiska Division of Health Sciences at Idaho State University, and mass email through the Idaho Infant Toddler Program. The survey included: informed consent, 132 simple questions from the SSDS, 32 questions to track demographic information, and 3 feasibility questions. A complete copy of the survey can be found in the appendix. Caregivers were asked to complete and submit responses to survey questions. No identifying information was collected; however, respondents were given the opportunity to provide contact information if they wanted to receive clinical results of completed materials. If respondents provided contact information and expressed concern about their infant's development, a list of community resources for further assessment (e.g., Bloom Therapy, the Idaho Infant Toddler Program, the Idaho State University Speech and Language Clinic, Speech Therapy Services, LLC, etc.) was provided. Families could participate in the research, even if they chose not to provide contact information. No incentives, beyond adding to the knowledge base related to vocal development, and referrals to clinical speech-language pathologists (if warranted and wanted), were provided to participants.

### Participants

Participants included caregivers of infants from 7- to 18- months of age at the time of enrollment. We recruited caregivers with no discretion; those from diverse backgrounds to the extent possible given demographic norms in the sampled population, those with infants who are typically developing, those with infants who are at risk for future speech/language delay/disorder, those with infants who are not developing typically (e.g., with Down's

syndrome, with cerebral palsy, etc.), and so forth. All families were given an opportunity to participate.

**Data Analysis**

Descriptive statistics (frequencies, percentages, mean, and range) were calculated to describe demographics and response rates. Survey responses across infant age are represented in tables for the following categories: infant demographics (Table 1), mother demographics (Table 2), father demographics (Table 3), reported speech sound production (Table 4), and SSDS feasibility (Table 5). Also, correlation analyses were conducted to examine the relationship between criterion and predictor variables. The criterion variables of interest were the sum of all reported sounds, the sum of all reported vowels (independent of consonant/syllable production), and the sum of all reported advanced forms (early word productions; independent of vowel/syllable production). The predictor variable of interest was infant age from 7 to 18 months.

## Chapter 4: Results

From the distributed survey link, 51 responses were returned and 18 (35.3% of the total response rate) were useable. Surveys were excluded either because permission was not given for results to be used for research purposes or responses were not provided for relevant survey questions. All analyzed data came from individuals who provided informed consent and permission to use their responses for research purposes.

### Demographics

Of the 18 participants used in the study, 7 of the infants were female and 11 of the infants were male. While it was requested that families with infants between 7 and 18 months complete the survey, we did have some families with both older and younger infants respond. Accordingly, there is one 4-month-old (Participant 7), one 5-month-old (Participant 3), and one 20-month-old (Participant 16) in the dataset. All 18 participants reported English being the primary language spoken in the home, with only one participant (Participant 5) reporting the child was occasionally exposed to another language. All but one family (Participant 1), reported the child lives with both mother and father all the time; with Participant 1 reported to live with mother all the time. Only three participants reported speech, language, or hearing problems in the child's immediate family. Participant 11 reported the child's father had received speech therapy for /r/, Participant 14 reported the child's sister has a tongue thrust, and Participant 15 reported the child himself had hearing problems. See Table 1 for infant demographic information.

Table 1
*Infant Demographics*

| Infant ID | Gender | Age | Lives With… | Spends Most Time With… | Speech/Language/Hearing Issues in Immediate Family… |
|---|---|---|---|---|---|
| 1 | Female | 8 months, 4 days | Mom | Mom/grandma | No |

| | | | | | |
|---|---|---|---|---|---|
| 2 | Female | 11 months, 23 days | Mom and dad | Mom/dad | No |
| 3 | Male | 5 months, 17 days | Mom and dad | Mom/dad | No |
| 4 | Male | 10 months, 29 days | Mom and dad | Mom | No |
| 5 | Male | 12 months, 20 days | Mom and dad | Mom | No |
| 6 | Female | 8 months, 15 days | Mom and dad | Mom/dad/ sibling | No |
| 7 | Male | 4 months, 20 days | Mom and dad | Mom | No |
| 8 | Male | 10 months, 24 days | Mom and dad | Mom | No |
| 9 | Male | 16 months, 19 days | Mom and dad | Mom | No |
| 10 | Male | 7 months, 1 day | Mom and dad | Mom/dad/ grandma | No |
| 11 | Female | 12 months, 26 days | Mom and dad | Mom | Father was in speech therapy for "r" sound |
| 12 | Male | 12 months, 23 days | Mom and dad | Mom/dad | No |
| 13 | Female | 17 months, 9 days | Mom and dad | Daycare | No |
| 14 | Male | 17 months, 20 days | Mom and dad | Whole family | Sister has tongue thrust |
| 15 | Male | 16 months, 13 days | Mom and dad | Dad | Infant has experienced middle ear infections |
| 16 | Female | 20 months, 15 days | Mom and dad | Mom/dad | No |
| 17 | Female | 18 months, 29 days | Mom and dad | Mom/dad | No |
| 18 | Male | 17 months, 15 days | Mom and dad | Daycare | No |

Demographic information for each infant's mother is shown in Table 2. In summary, mothers were between 22 and 42 at the time of their infant's birth, mostly White (with one *other* and two *Native Hawaiian or Pacific Islander*), mostly married (with one *single* and two *in a relationship*), and earning from under $10,000 to more than $150,000 annually.

Table 2
*Mother Demographics*

| Infant ID | Age at Child's Birth | Ethnicity | Marital Status | Number of Children | Occupation | Annual Income |
|---|---|---|---|---|---|---|
| 1 | 22 | White | Single | 1 | Customer representative | $20,000 - $29,999 |
| 2 | 42 | White | Married | 1 | N/A | $30,000 - $39,999 |
| 3 | 28 | White | Married | 1 | Speech-language pathologist | $70,000 - $79,999 |
| 4 | 24 | Native Hawaiian or | Married | 1 | Stay at home mom | Less than $10,000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Pacific Islander | | | | |
| 5 | 25 | White | Married | 1 | Customer service representative | $20,000 - $29,999 |
| 6 | 28 | White | Relationship | 2 | Human resource manager | $30,000 - $39,999 |
| 7 | 28 | White | Relationship | 1 | Daycare provider | $10,000 - $19,999 |
| 8 | 41 | White | Married | 2 | Speech-language pathologist | More than $150,000 |
| 9 | 37 | White | Married | 3 | Sales | $20,000 - $29,999 |
| 10 | 22 | Native Hawaiian or Pacific Islander | Married | 1 | Preschool teacher | $50,000 - $59,999 |
| 11 | 28 | White | Married | 1 | Speech-language pathologist | $50,000 - $59,999 |
| 12 | 34 | White | Married | 1 | Speech-language pathologist, not working | Less than $10,000 |
| 13 | 30 | White | Married | 1 | Researcher | $40,000 - $49,999 |
| 14 | 35 | White | Married | 4 | Physical therapist | $70,000 - $79,999 |
| 15 | 22 | White | Married | 1 | General manager | $60,000 - $69,999 |
| 16 | 30 | White | Married | 1 | Advanced emergency medical technician | $30,000 - $39,999 |
| 17 | 26 | Other | Married | 1 | Student | Less than $10,000 |
| 18 | 36 | White | Married | 2 | Dental hygienist/professor | $70,000 - $79,999 |

Demographic information for each infant's father is shown in Table 3. In summary, fathers were between 22 and 47 at the time of their infant's birth, all White, mostly married (with one *absent* and two *in a relationship*), and earning from $20,000-$29,999 to $100,000-$149,999 annually.

Table 3
*Father Demographics*

| Infant ID | Age at Child's Birth | Ethnicity | Marital Status | Number of Children | Occupation | Annual Income |
|---|---|---|---|---|---|---|
| 1 | | | | No response | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 42 | White | Married | 1 | Facilities manager | $100,000 - $149,999 |
| 3 | 36 | White | Married | 1 | Real estate agent | $80,000 - $89,999 |
| 4 | 22 | White | Married | 1 | Construction | $30,000 - $39,999 |
| 5 | 28 | White | Married | 1 | PhD student | $20,000 - $29,999 |
| 6 | 32 | White | Relationship | 2 | Winder | $30,000 - $39,999 |
| 7 | 27 | White | Relationship | 1 | Drywall | $40,000 - $49,999 |
| 8 | 47 | White | Married | 2 | Fire fighter | $90,000 - $99,999 |
| 9 | 35 | White | Married | 4 | Diesel mechanic | $60,000 - $69,999 |
| 10 | 25 | White | Married | 1 | Manufacturing | $50,000 - $59,999 |
| 11 | 33 | White | Married | 1 | Farmer | $30,000 - $39,999 |
| 12 | 36 | White | Married | 1 | Engineer | $90,000 - $99,999 |
| 13 | 43 | White | Married | 1 | Information technology | $70,000 - $79,999 |
| 14 | 35 | White | Married | 4 | Physical therapist | $70,000 - $79,999 |
| 15 | 24 | White | Married | 1 | Manager | $20,000 - $29,999 |
| 16 | 29 | White | Married | 1 | Nurse | $40,000 - $49,999 |
| 17 | 27 | White | Married | 1 | Elementary teacher | $30,000 - $39,999 |
| 18 | 34 | White | Married | 2 | Painter | $70,000 - $79,999 |

**Aim 1: Responses to SSDS Questions Across Infant Age**

Table 4 and Figures 1 through 3 present the descriptive statistics when examining sounds reported by caregivers on the SSDS. Positive, statistically significant correlations were observed between infant age and the sum of all reported sound types [$r(18) = 0.68$, $p = 0.002$], vowels regardless of consonant/syllable production [$r(18) = 0.61$, $p = 0.007$], and advanced forms (early word productions) regardless of vowel/syllable production [$r(18) = 0.63$, $p = 0.005$]. Examples of sound types are /pi/ as in "pea", /dɑ/ as in "dog", and /ʃu/ as in "shoe"; vowels are /ʊ/ as in

"book", /i/ as in "bee", and /ɛ/ as in "bet"; and advanced forms are /hɛp/ for "help", /mɑm/ for "mom", and /baɪ̯/ for "bye". Increasingly more sound types, vowels, and advanced forms were reported by caregivers as infant age increased.

Table 4
*Descriptive Statistics for Caregiver Reported Speech Sound Production*

| Infant ID | Sum* of All Reported Sounds | Sum* of Reported Vowels | Sum* of Reported Advanced Forms** |
|---|---|---|---|
| 1 | 147 | 16 | 14 |
| 2 | 184 | 21 | 11 |
| 3 | 123 | 20 | 7 |
| 4 | 171 | 26 | 16 |
| 5 | 186 | 26 | 7 |
| 6 | 175 | 24 | 7 |
| 7 | 151 | 23 | 10 |
| 8 | 204 | 25 | 11 |
| 9 | 131 | 14 | 7 |
| 10 | 188 | 24 | 13 |
| 11 | 170 | 22 | 13 |
| 12 | 151 | 23 | 7 |
| 13 | 236 | 29 | 18 |
| 14 | 274 | 31 | 20 |
| 15 | 276 | 36 | 21 |
| 16 | 226 | 33 | 20 |
| 17 | 305 | 35 | 19 |
| 18 | 204 | 32 | 17 |

*Summed values were on a scale of 0 to 3 with 0 = no response, 1 = no, 2 = maybe, and 3 = yes.
**Advanced forms are early word shapes such as /hɛp/ for "help".

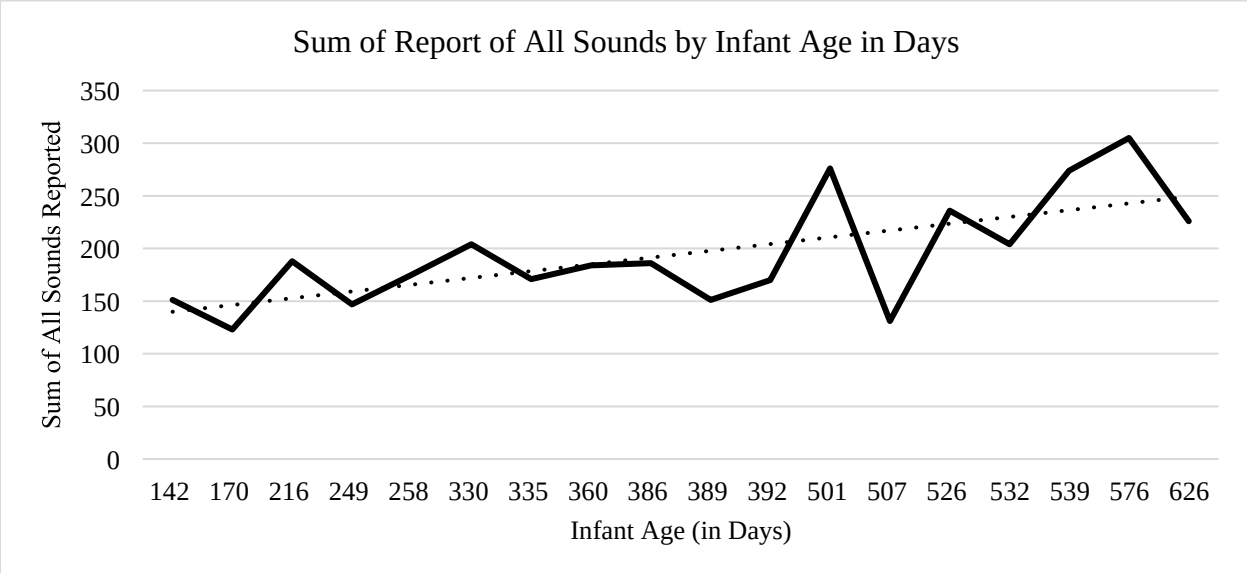


*Figure 1*. Line Graph with Dotted Trendline for Sum of Report of All Sounds by Infant Age in Days

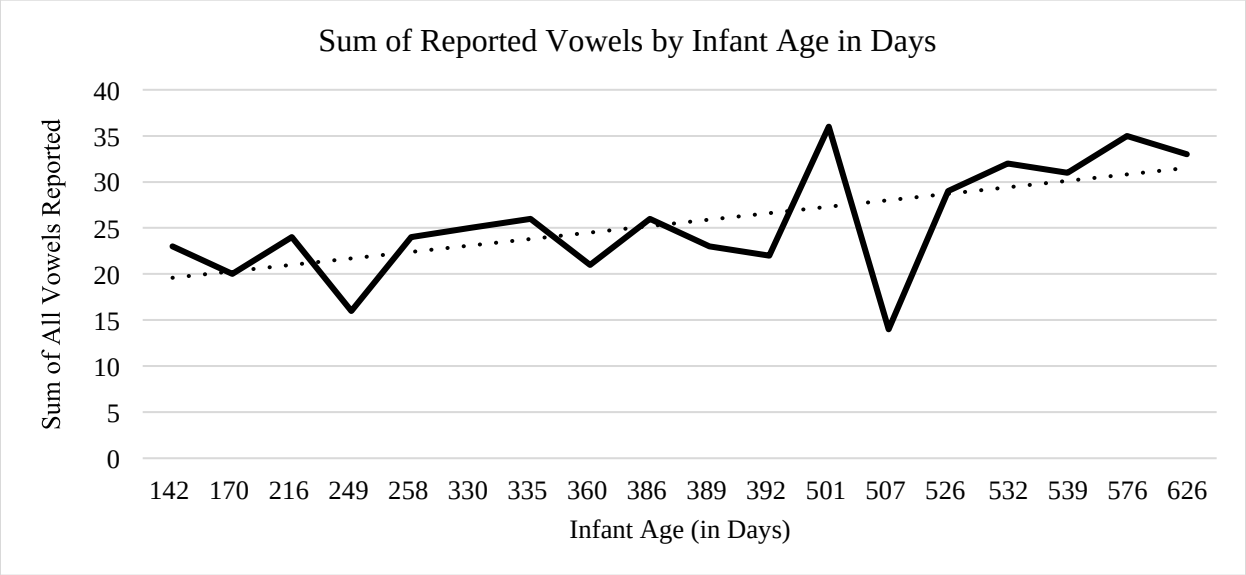


*Figure 2.* Line Graph with Dotted Trendline for Sum of Reported Vowels by Infant Age in Days

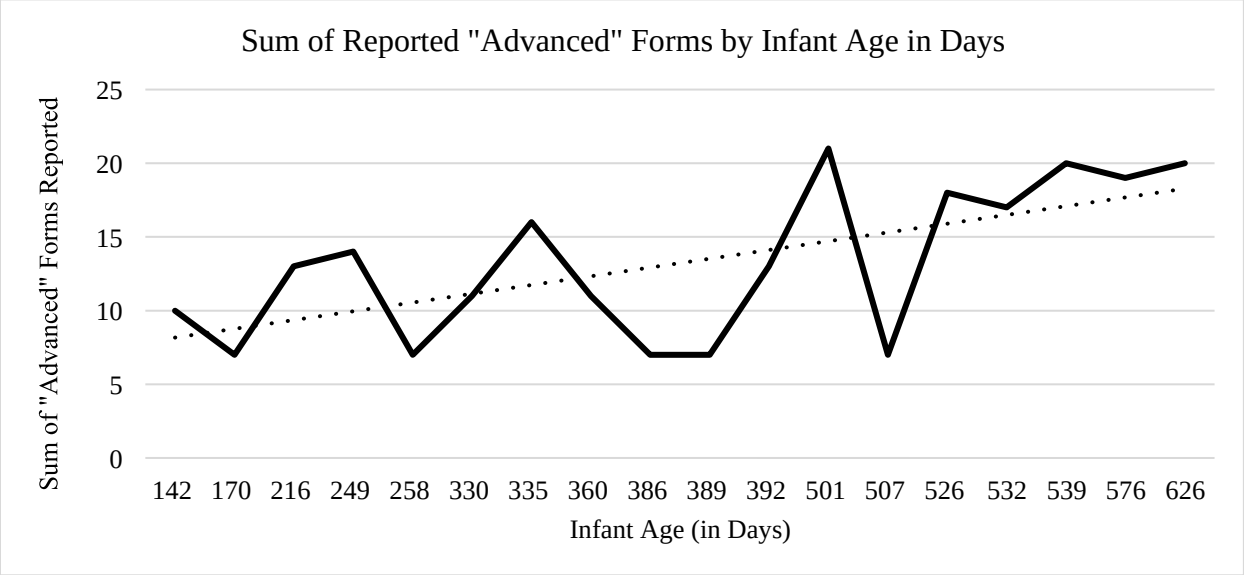


*Figure 3.* Line Graph with Dotted Trendline for Sum of Reported "Advanced" Forms by Infant Age in Days

We took the opportunity to explore the data further, grouping infants according to developmental stages given linguistic considerations, as previously done by Ramsdell-Hudock et al. (2018) and averaging caregiver report across sound types and infants per age group. Age groups were prelinguistic (less than or equal to 10 months), canonical (11 to 14 months), and early linguistic (greater than or equal to 15 months). At the extremes of this age grouping,

immature prelinguistic vocalizations (e.g., marginal syllables) are the primary vocal type produced during the prelinguistic stage and mostly canonical and early linguistic forms (e.g., well-formed syllables and first words) are the primary vocal types produced during the early linguistic stage. Vocal productions in the middle canonical stage contain both prelinguistic and early linguistic vocalizations, with more established canonical syllables than in the prelinguistic stage and fewer word forms than the early linguistic stage. In our dataset, we had seven infants each in the prelinguistic and early linguistic stages, and four infants in the canonical stage. Articulatory production characteristics of caregiver report per these age groups are displayed in Figures 4 through 7. Sound types were consonant place of articulation, explored in terms of labial, coronal, dorsal, and laryngeal sound types reported (Figure 4); consonant voicing, explored in terms of voiced and voiceless sound types reported (Figure 5); consonant manner of production, explored in terms of stop, fricative, affricate, nasal, liquid, glide, and click sound types reported (Figure 6); and vowel tongue position, explored in terms of high front, low front, central, low back, high back, and rising diphthong sound types reported (Figure 7). The most relevant finding showed that infants in the early linguistic age group (gray line in Figures 4 through 7) were reported to produce more of each vocalization type.

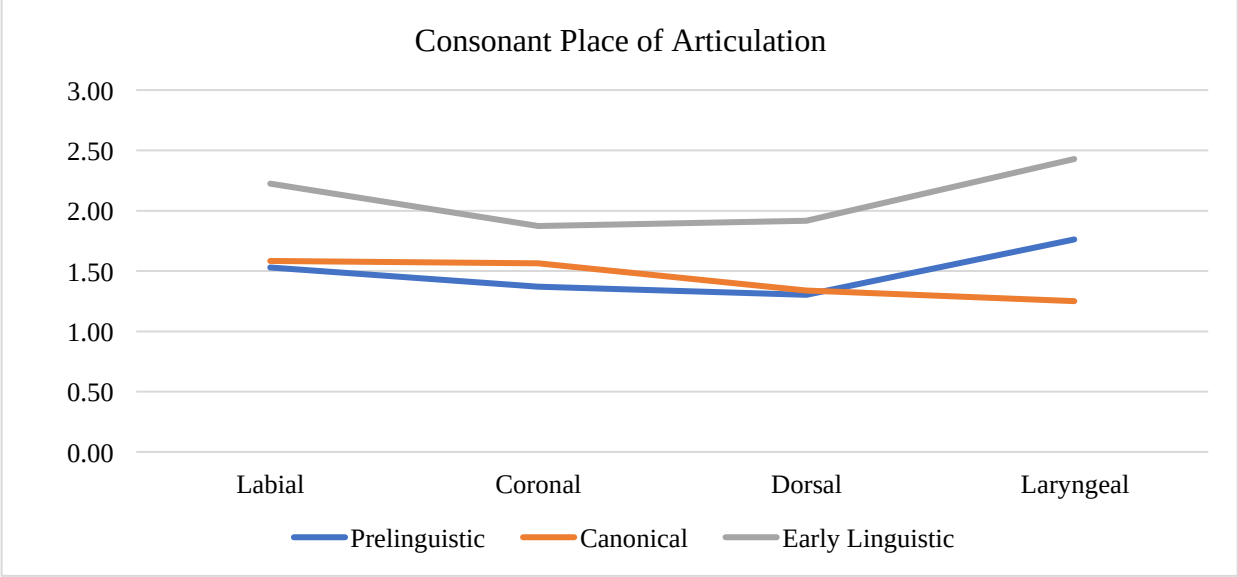


*Figure 4.* Consonant Place of Articulation per Caregiver Report on the *Speech Sound Development Screener*, Averaged Across Sound Types and Infants in each Age Group

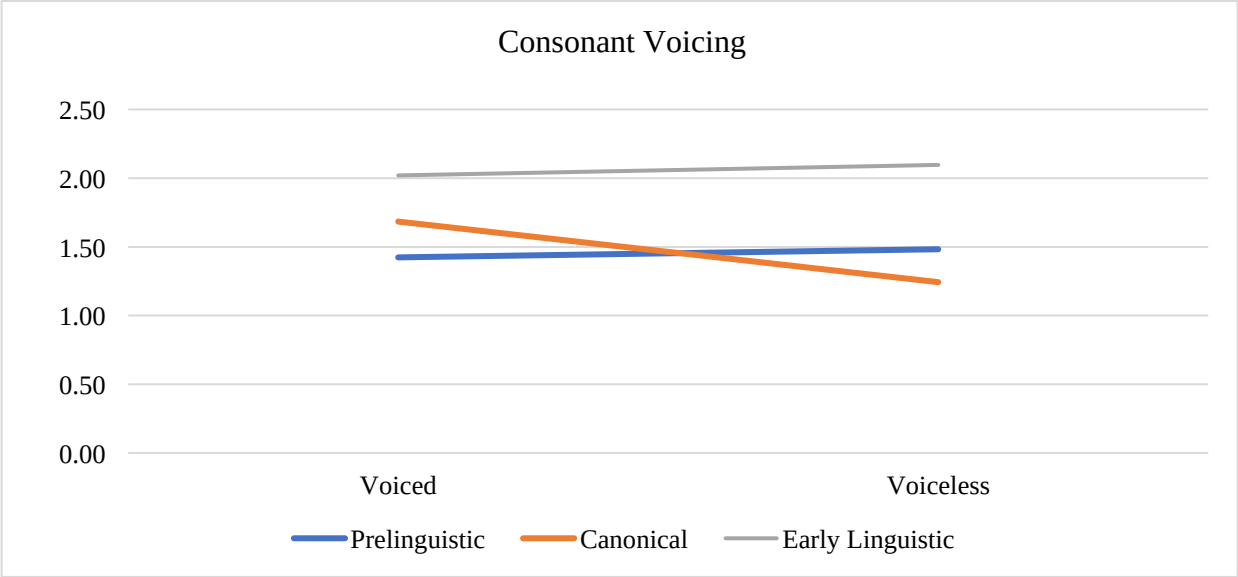


*Figure 5.* Consonant Voicing per Caregiver Report on the *Speech Sound Development Screener*, Averaged Across Sound Types and Infants in each Age Group

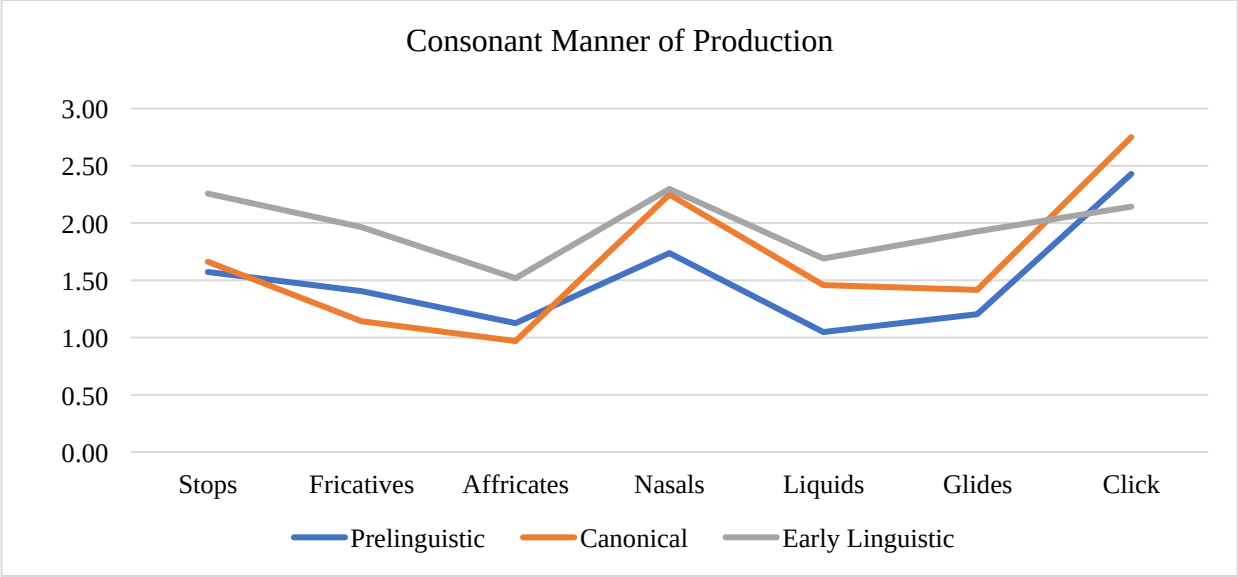


*Figure 6.* Consonant Manner of Production per Caregiver Report on the *Speech Sound Development Screener*, Averaged Across Sound Types and Infants in each Age Group

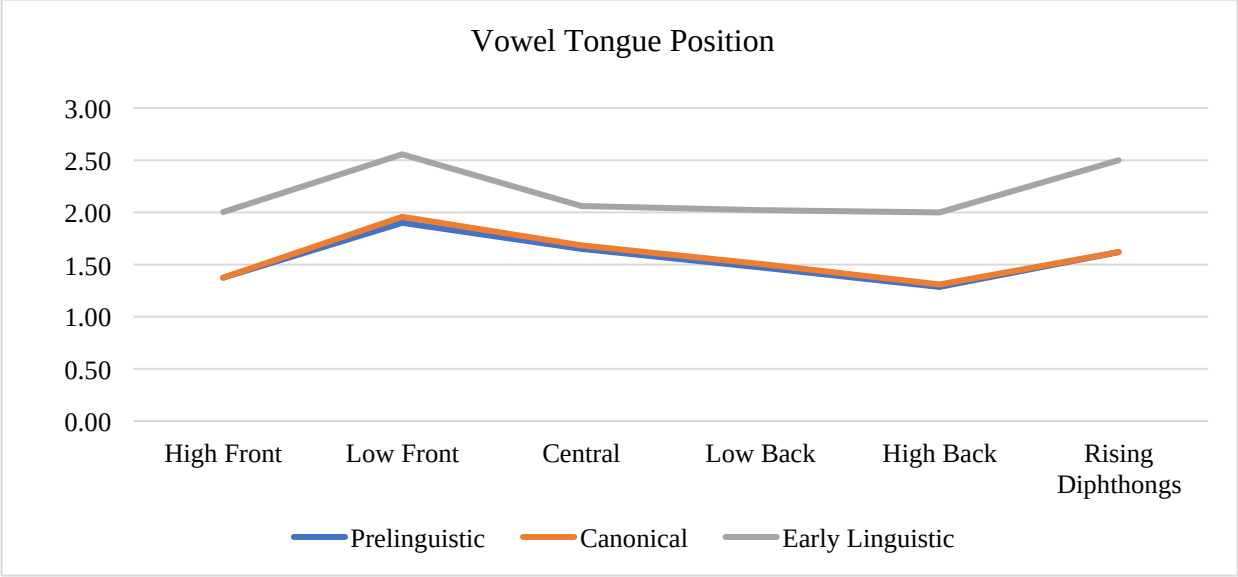


*Figure 7.* Vowel Tongue Position per Caregiver Report on the *Speech Sound Development Screener*, Averaged Across Sound Types and Infants in each Age Group

**Aim 2: Feasibility**

The caregivers were asked three questions to assess feasibility aspects of the screener. They were asked, "approximately how long did it take for you to complete this survey", "indicate your level of agreement with the statement: I was able to understand the questions

asked in this survey", and "indicate your level of agreement with the statement: I think the material covered in this survey is important". Caregiver responses to these questions are shown in Table 5. Most caregivers indicated that it took *between 11 to 20 minutes* to complete the survey (10 participants), with three additional participants taking *less than 10 minutes,* four taking *21 to 30 minutes*, and one taking *more than 31 minutes*. Most caregivers *strongly agreed* that they were able to understand the questions asked (12 participants), with five additional participants only *somewhat agreeing*, and one *somewhat disagreeing*. Finally, most caregivers *strongly agreed* that the material covered in the screener is important (11 participants), with three additional participants only *somewhat agreeing*, and three *neither agreeing nor disagreeing*.

Table 5
*Feasibility*

| Infant ID | Time to Complete Survey | I was able to understand the questions asked. | I think the material covered is important. |
|---|---|---|---|
| 1 | 11 to 20 minutes | Strongly agree | Strongly agree |
| 2 | 21 to 30 minutes | Strongly agree | Strongly agree |
| 3 | Less than 10 minutes | Strongly agree | Strongly agree |
| 4 | 11 to 20 minutes | Somewhat agree | Neither agree nor disagree |
| 5 | 21 to 30 minutes | Somewhat agree | Strongly agree |
| 6 | 11 to 20 minutes | Somewhat agree | Somewhat agree |
| 7 | 11 to 20 minutes | Strongly agree | Strongly agree |
| 8 | 11 to 20 minutes | Strongly agree | Strongly agree |
| 9 | More than 31 minutes | Somewhat disagree | Neither agree nor disagree |
| 10 | Less than 10 minutes | Strongly agree | Neither agree nor disagree |
| 11 | 11 to 20 minutes | Strongly agree | Strongly agree |
| 12 | 11 to 20 minutes | Somewhat agree | Strongly agree |
| 13 | 21 to 30 minutes | Strongly agree | Somewhat agree |
| 14 | 11 to 20 minutes | Strongly agree | Strongly agree |
| 15 | Less than 10 minutes | Strongly agree | Strongly agree |
| 16 | 11 to 20 minutes | Strongly agree | Somewhat agree |
| 17 | 11 to 20 minutes | Strongly agree | Strongly agree |
| 18 | 21 to 30 minutes | Somewhat agree | Somewhat agree |

## Chapter 5: Discussion

The purpose of this study was to conduct an initial exploration of the SSDS by administering the screener to a random sample of participants and exploring responses for developmental patterns and feasibility. The long-term goal of this research is to establish a valid and reliable screening instrument for caregiver-report of infant speech patterns. Given the longterm goal, the original purpose of this study was to assess the screener's validity and reliability for identifying children as at risk or typically developing by comparing screener results to results on the *Communication and Symbolic Behavior Scales—Developmental Profile* (CSBS-DP; Fenson et al., 2006). Despite multiple attempts to reach Brook's Publishing for permission to reprint and distribute a subscale of the CSBS-DP, we were not able to obtain the appropriate permissions in a timely manner (and still have not heard from the publishers at this time). Accordingly, the overall objective and aims for the study were revised; we administer the SSDS to a random sample of participants and explored responses for developmental patterns and feasibility. It was hypothesized that the SSDS would be sensitive to infant age and feasible with respect to perceived importance, content understanding, and time to complete. Participants were from 4 to 20 months of age.

### Aim 1. Responses to SSDS Questions across Infant Age

The purpose of Aim 1 was to explore responses to SSDS questions across infant age. It was hypothesized that the screener results would be sensitive to infant age, such that caregivers would report older infants to be producing more sound types than younger infants. The results revealed that the SSDS is sensitive to infant age based on strong, positive correlations between caregiver reported sounds on the SSDS and infant age. Given typical speech sound development, we would expect caregiver report of sound productions to increase with infant age, as it did.

Specifically, caregiver report of overall sound types produced by infants ranged from a sum of 151 sound types reported for the 4-month-old participant, to 226 sounds types reported for the 20-month-old infant participant, with a consistent, statistically significant trend observed from fewer sounds types reported for younger infants to more sound types reported for older infants. This suggests that the screener results are and would be sensitive to developmental status with increasing age and supports continued exploration of the screener's ability to differentiate between children who are at risk or typically developing. While it is not possible to say exactly how many sound types we should observe reported for each infant age, it is projected that we would be able to determine such a value with a larger sample size given the results from the present study. With said value, we would be able to identify whether or not an infant is producing the expected number of sound types for a given age, and recommend a full speech language evaluation for infants falling below the expected value.

**Aim 2. Feasibility**

The purpose of Aim 2 was assess the feasibility of the length of time to complete the SSDS, as well as the caregiver's perception of the importance of the SSDS content, and how well caregivers were able to understand the questions on the screener. It was hypothesized that it would take caregivers on average less than 20 minutes to complete the survey, they would be able to understand screener questions, and they would judge the screener topics/questions (e.g., speech sound development) to be of importance. The majority of the caregiver's reported it took between 11 and 20 minutes to complete the screener, supporting the hypothesis that it would take on average less than 20 minutes to complete. The majority of caregivers also reported they strongly agreed that they were able to understand the questions asked and that they perceived the material covered in the screener to be of importance. These results indicate the

SSDS is feasible with respect to perceived importance and content understanding. This supports continued exploration of the SSDS for validity and reliability.

**Study Limitations and Future Directions**

There are some potential limitations to consider. The sample size was small, and participant selection was not randomized as it was volunteer based from social media and mass email outlets. In future study of the SSDS, we will need to find a way to access more participants and get a larger response rate. Perhaps we could contact daycares or pediatric health clinics to access more participants. It is also not known if the children who were reported on were typically developing or at risk given that no normed/validated existing tool of developmental abilities was administered with the SSDS. To control for this limitation in future study of the SSDS, we could use a validated assessment tool (such as the CSBS-DP) that will identity each child as typically developing or at risk. Further, it would be useful to compare caregiver report on the SSDS to expert report of infant productions. In the future, we could have caregivers complete the SSDS and gather recordings of the infants for researchers/clinical SLPs to analyze. Upon analysis of the recordings, the researchers/clinicians could complete their own SSDS and the results of the two reports (caregiver and researcher/clinician) could be compared to identify whether or not there is overlap/consistency across reports. And finally, caregiver report of infant vocalizations in the research lab has been shown to be related to later vocabulary development (Farnsworth, 2019). This is useful information because it allows researchers and clinicians with a basis for predicting future language skill based on infant vocal production. It would similarly be useful to determine whether or not caregiver report on the SSDS is related to later speech and/or language abilities. Longitudinal study looking at caregiver report on the SSDS and later speech and language abilities in children is therefore a potential goal of future research with this tool.

## Clinical Implications and Conclusions

The potential of the present findings, paired with continued exploration of the SSDS could provide a clinical tool that can facilitate earlier identification of children considered at-risk for speech sound disorders/delays, enable use in clinical or home settings with or without professional administration, and support more efficient methods of assessment for speech language pathologist. Future directions for this line of study could consist of assessing the validity of the SSDS for differentiating between children who are at-risk or typically developing.

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## Appendix

### Exploration of a Caregiver Report Instrument for Infant Speech Patterns

INFORMED CONSENT

You are being asked to participate in a research study exploring speech development. Your participation in this research is voluntary. If you decide to participate, you are free to withdraw at any time. We are asking that you complete the following survey (related to your child's development) at some point in the next week. Completion of the survey should take no more than 30 minutes of your time. We will use your responses to explore patterns in speech sound development. There are no risks to participating in this study. We do not know if you will get any benefits by participating. The benefits to you are mostly the same as the benefits to us. You will be helping us learn about development, and this is a contribution to science. Please note, if you do not want to take part in this study, you do not have to. Anytime that you want to stop participating, that is fine. If you choose to provide your contact information so that we can share screener results, your (your child's) name will not be known and your responses to the study forms will be completely private. No identifiable information will be documented on survey materials. Survey responses will only be viewed by the researchers conducting the study and laboratory staff, all of whom are trained in human subjects and responsible conduct of research. Results will be maintained indefinitely in the research archives of the project, under the supervision of Heather L. Ramsdell or her successor(s). If you have any questions about the research study, please contact Heather L. Ramsdell, PhD, CCC-SLP at Idaho State University in the Department of Communication Sciences & Disorders, phone 208-282-3077, email ramsdell@isu.edu. Also, if you have any questions about your rights as a research participant, you may contact the Human Subjects Committee at Idaho State University, phone 208-282-2179.

I agree to complete the following survey. I understand the purpose and nature of this study and I am participating voluntarily. I understand that I can withdraw from the study at any time, without any penalty or consequences.

- o Yes
- o No

I grant permission for the data generated from this survey to be used in the researcher's publications and presentations on this topic.

- o Yes
- o No

CONTACT FOR FEEDBACK

If you would like to be contacted by one of the researchers after we review your completed survey, please provide your contact information here. Providing contact information is optional and you can participate in the study without providing contact information.

Name

_____

Email

_____

Phone number (including area code)

_____

## SPEECH SOUND DEVELOPMENT SCREENER

Please indicate your level of agreement with the statement: I am concerned about my child's speech and/or language development. ○ Strongly agree ○ Somewhat agree ○ Neither agree nor disagree ○ Somewhat disagree
○ Strongly disagree

How often does your child make sounds (throughout the day, in the time that your child is awake, and in the time that you get to spend with your child)?
○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child cry?
○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child laugh as expected (in an appropriate context)? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child growl/grunt? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child squeal? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child produce raspberries (sounds like lip trills or balloons deflating)? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child yell? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child whisper? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child produce sounds while playing by himself/herself? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child produce sounds while playing with others (such as parents, siblings, friends, etc.)?

○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child call to you for attention?

○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child imitate speech sounds that you make? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child take turns making speech sounds with you or others, as if participating in a conversation?

○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child produce sounds in repetition (such as "ma ma" or "ba ba")? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child produce advanced babbling (such as "ma be do yah")? ○ Always (81% to 100% of the time) ○ Most of the time (61% to

80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child produce jargon, or sound like they are speaking, but in a different language? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

Does your child use single words (e.g., "ball" or "dog")?

○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

If your child uses single words, approximately how many single words do they produce?

_____

Does your child use two or more words in combination with each other (e.g., "more drink" or "mommy up")?

○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child recognize his/her name?

○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child respond to sounds when a source is not visible (perhaps by turning his/her head toward the sound)? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child understand simple commands (such as "no" or "sit")? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

How often does your child use baby sign language? ○ Always (81% to 100% of the time) ○ Most of the time (61% to 80% of the time) ○ About half the time (41% to 60% of the time) ○ Sometimes (21% to 40% to of the time) ○ Not often (1% to 20% of the time) ○ Never (0% of the time)

The following is a list of speech sounds babies produce in babbling and first words. Indicate whether or not your child produces each sound (yes, maybe, or no). First the sounds have been transcribed using a phonetic alphabet, followed by a description underlined in quotation marks. Pay attention to the underlined part of the description only when thinking of the sounds your child makes. Do not worry if your child only produces a few of the speech sounds listed because development of speech sounds is variable across children.

***Responses were “Yes”, “Maybe”, or “No”

Does your child produce /i/ as in “t**ea**”?

Does your child produce /ɪ/ as in “t**i**p”?

Does your child produce /ɛ/ as in “t**e**n”?

Does your child produce /æ/ as in “t**a**p”?

Does your child produce /ʌ/ as in “t**u**b”?

Does your child produce /ɝ/ as in “t**ur**n”?

Does your child produce /ɑ/ as in “t**o**p”?

Does your child produce /ʊ/ as in “t**oo**k”?

Does your child produce /u/ as in “t**oo**l”?

Does your child produce /eɪ/ as in “t**a**pe”?

Does your child produce /oʊ̯ / as in “t**oe**”?

Does your child produce /aɪ̯/ as in “t**ie**”?

Does your child produce /pi/ as in “**pea**s”?

Does your child produce /pɪ/ as in “**pi**n”?

Does your child produce /pæ/ as in “**pa**ss”?

Does your child produce /pʌ/ as in “**pu**tt”?

Does your child produce /pɑ/ as in “**po**p”?

Does your child produce /pu/ as in “**poo**l”?

Does your child produce /bi/ as in “**be**”?

Does your child produce /bɪ/ as in “**bi**d”?

Does your child produce /bæ/ as in “**ba**t”?

Does your child produce /bʌ/ as in “**bu**d”?

Does your child produce /bɑ/ as in “**ba**ll”?

Does your child produce /bu/ as in “**boo**”?

Does your child produce /ti/ as in “**tea**”?

Does your child produce /tʌ/ as in “**tu**b”?

Does your child produce /tɑ/ as in “**to**p”?

Does your child produce /tu/ as in “**two**”?

Does your child produce /di/ as in “**dee**p”?

Does your child produce /dɪ/ as in “**di**p”?

Does your child produce /dæ/ as in “**da**d”?

Does your child produce /dʌ/ as in "**do**ne"?

Does your child produce /dɑ/ as in "**do**g"?

Does your child produce /du/ as in "**do**"?

Does your child produce /ki/ as in "**key**"?

Does your child produce /kʌ/ as in "**cu**t"?

Does your child produce /kɑ/ as in "**co**p"?

Does your child produce /ku/ as in "**coo**l"?

Does your child produce /gi/ as in "**gee**k"?

Does your child produce /gʌ/ as in "**gu**m"?

Does your child produce /gɑ/ as in "**go**t"?

Does your child produce /gu/ as in "**goo**p"?
Does your child produce /hi/ as in "**he**"?

Does your child produce /hɪ/ as in "**hi**t"?

Does your child produce /hæ/ as in "**ha**t"?

Does your child produce /hʌ/ as in "**hu**t"?

Does your child produce /hɑ/ as in "**ho**t"?

Does your child produce /hu/ as in "**who**"?

Does your child produce /fi/ as in "**fee**t"?

Does your child produce /fʌ/ as in "**fu**n"?

Does your child produce /fɑ/ as in "**fo**g"?

Does your child produce /fu/ as in "**foo**d"?

Does your child produce /vi/ as in "**vea**l"?

Does your child produce /vɑ/ as in "**vo**lley"?

Does your child produce /vu/ as in "**voo**doo"?

Does your child produce /θi/ as in "**the**me"?

Does your child produce /θɑ/ as in "**thaw**"?

Does your child produce /ði/ as in "**the**se"?

Does your child produce /si/ as in "**see**"?

Does your child produce /sɑ/ as in "**saw**"?

Does your child produce /su/ as in "**sou**p"?

Does your child produce /zi/ as in "**ze**bra"?

Does your child produce /zu/ as in "**zoo**"?

Does your child produce /ʧi/ as in "**chee**k"?

Does your child produce /ʧʌ/ as in "**chu**g"?
Does your child produce /ʧɑ/ as in "**cha**lk"?

Does your child produce /ʧu/ as in "**chew**"?

Does your child produce /ʤi/ as in "**jee**p"?

Does your child produce /ʤʌ/ as in "**ju**g"?

Does your child produce /ʤɑ/ as in "**jo**b"?

Does your child produce /ʤu/ as in "**jui**ce"?

Does your child produce /mi/ as in "**me**"?

Does your child produce /mɪ/ as in "**mi**t"?

Does your child produce /mæ/ as in "**ma**t"?

Does your child produce /mʌ/ as in "**mu**d"?

Does your child produce /mɑ/ as in "**mo**m"?

Does your child produce /mu/ as in "**moo**"?

Does your child produce /ni/ as in "**knee**"?

Does your child produce /nɪ/ as in "**kni**t"?

Does your child produce /næ/ as in "**na**p"?

Does your child produce /nʌ/ as in "**nu**t"?

Does your child produce /nɑ/ as in "**no**t"?

Does your child produce /nu/ as in "**new**"?

Does your child produce /ji/ as in "**yea**r"?

Does your child produce /jɪ/ as in "**yi**ppy"?

Does your child produce /jæ/ as in "**yeah**"?

Does your child produce /jʌ/ as in "**yu**m"?

Does your child produce /jɑ/ as in "**yaw**n"?
Does your child produce /ju/ as in "**you**"?

Does your child produce /wi/ as in "**wee**k"?

Does your child produce /wɪ/ as in "**wi**nd"?

Does your child produce /wæ/ as in "**wa**gon"?

Does your child produce /wʌ/ as in "**wha**t"?

Does your child produce /wɑ/ as in "**wa**nt"?

Does your child produce /wu/ as in "**woo** hoo"?

Does your child produce /ri/ as in "**rea**ch"?

Does your child produce /rɑ/ as in "**ro**ck"?

Does your child produce /ru/ as in "**roo**m"?

Does your child produce /li/ as in "**lea**p"?

Does your child produce /lɑ/ as in "**lo**ck"?

Does your child produce /lu/ as in "**loo**p"?

Does your child produce /ʌm/ as in "**um**"?

Does your child produce /mɑm/ as in "**mom**"?

Does your child produce /haɪ̯/ as in "**hi**"?

Does your child produce /ʌʔoʊ̯ / as in "**uh oh**"?

Does your child produce /hʌp/ as in "**hup**" like "cup"?

Does your child produce /Θ/ a "kissy" noise?

Does your child produce /bɑɪ̯/ as in "**bye**"?

Does your child produce /heɪ̯/ as in "**hey**"?

Does your child produce /!/ a tongue "click"?

## FAMILY AND INFANT BACKGROUND

### GENERAL INFORMATION

Person completing this survey (and relationship to child):

_____

Child's gender:

- ○ Male ○ Female
- ○ Non-binary / third gender ○ Prefer not to say

Child's date of birth (mm/dd/yyyy):

_____

Today's date (mm/dd/yyyy):

_____

Primary language spoken in the home:

_____

Other language(s) spoken in the home:

_____

Does your child live with both parents? ○ Child lives with both mother and father all the time ○ Child lives with mother only ○ Child lives with father only ○ Parents have split custody of child ○ Child lives with someone other than parents

With whom does your child spend most of his/her time?

_____

Are there any speech, language, or hearing problems in child's immediate family? If yes, please list relation to child and problem.

_____

## MOTHER

Age at infant's birth:

_____

Ethnicity:

○ White ○ Black or African American ○ American Indian or Alaska Native ○ Asian ○ Native Hawaiian or Pacific Islander ○ Other

Marital status: ○ Married ○ Widowed ○ Divorced ○ Separated ○ Single ○ In a relationship

Number (and current age) of children:

_____

Occupation:

_____

Annual income: ○ Less than $10,000 ○
$10,000 - $19,999 ○
$20,000 - $29,999 ○
$30,000 - $39,999 ○
$40,000 - $49,999 ○
$50,000 - $59,999 ○
$60,000 - $69,999 ○
$70,000 - $79,999 ○
$80,000 - $89,999 ○
$90,000 - $99,999 ○
$100,000 - $149,999
○ More than $150,000

## FATHER

Age at infant's birth:

_____

Ethnicity:
○ White ○ Black or African American ○ American Indian or Alaska Native ○ Asian
○ Native Hawaiian or Pacific Islander ○ Other

Marital status: ○ Married ○
Widowed ○
Divorced ○
Separated ○
Single
○ In a relationship

Number (and current age) of children:

_____

Occupation:

_____

Annual income: ○ Less than $10,000 ○
$10,000 - $19,999 ○
$20,000 - $29,999 ○
$30,000 - $39,999 ○
$40,000 - $49,999 ○
$50,000 - $59,999 ○
$60,000 - $69,999 ○
$70,000 - $79,999 ○
$80,000 - $89,999 ○
$90,000 - $99,999 ○
$100,000 - $149,999
○ More than $150,000

## INFANT

Birthplace:
○ In Idaho ○ In a state other than Idaho
○ Out of the United States

Length of pregnancy:
_____ Length of labor:
_____

Type of delivery: ○ Head first ○ Feet first (breech)
○ Caesarian

Birth weight:
_____

Were there any unusual conditions that may have affected pregnancy or delivery? If yes, please describe.
_____

Has your child experienced allergies? If yes, at what approximate age?
_____

Has your child experienced asthma? If yes, at what approximate age?
_____

Has your child experienced chicken pox? If yes, at what approximate age?

_____

Has your child experienced colds? If yes, at what approximate age?

_____

Has your child experienced ear infections? If yes, at what approximate age?

_____

Has your child experienced gastroenteritis? If yes, at what approximate age?

_____

Has your child experienced hand-foot-mouth? If yes, at what approximate age?

_____

Has your child experienced high fever? If yes, at what approximate age?

_____

Has your child experienced influenza? If yes, at what approximate age?

_____

Has your child experienced COVID-19? If yes, at what approximate age?

_____

Has your child experienced measles? If yes, at what approximate age?

_____

Has your child experienced meningitis? If yes, at what approximate age?

_____

Has your child experienced mumps? If yes, at what approximate age?

_____

Has your child experienced roseola? If yes, at what approximate age?

_____

Has your child experienced pneumonia? If yes, at what approximate age?

_____

Has your child experienced pertussis (whooping cough)? If yes, at what approximate age?

_____

Has your child experienced respiratory syncytial virus (RSV)? If yes, at what approximate age?

_____

Has your child experienced seizures? If yes, at what approximate age?

_____

Has your child experienced strep throat? If yes, at what approximate age?

_____

Has your child experienced tonsillitis? If yes, at what approximate age?

_____

Has your child experienced any other medical conditions that you feel should be included? If yes, please list and provide approximate age(s)?

_____

Has your child had any surgeries? If yes, what type and when (e.g., tonsillectomy, tube placement, etc.)?

_____

Describe any major accidents or hospitalizations.

_____

Is your child taking medication? If yes, please indicate what medication(s).

_____

Provide the approximate age at which your child began to crawl (if your child has begun to crawl).

_____

Provide the approximate age at which your child began to sit (if your child has begun to sit).

_____

Provide the approximate age at which your child began to stand (if your child has begun to stand).

_____

Provide the approximate age at which your child began to walk (if your child has begun to walk). _____

Provide the approximate age at which your child began to feed himself/herself (if your child has begun to feed himself/herself).

_____

Provide the approximate age at which your child began to dress himself/herself (if your child has begun to dress himself/herself).

_____

Provide the approximate age at which your child began to use the toilet (if your child has begun to use the toilet).

_____

Does your child have difficulty walking, running, or participating in other activities that require small or large muscle coordination? If yes, please describe.

_____

Does your child receive special services (e.g., occupational therapy, physical therapy, speechlanguage therapy, etc.)? If yes, please describe.

_____

How does your child interact with others (e.g., shy, aggressive, uncooperative, etc.)?

_____

## FEASIBILITY

Approximately how long did it take for you to complete this survey? ○ Less than 10 minutes ○ 11 to 20 minutes ○ 21 to 30 minutes
○ More than 31 minutes

Please indicate your level of agreement with the statement: I was able to understand the questions asked in this survey.
○ Strongly agree ○ Somewhat agree ○ Neither agree nor disagree ○ Somewhat disagree
○ Strongly disagree

Please indicate your level of agreement with the statement: I think the material covered in this survey is important. ○ Strongly agree ○ Somewhat agree ○ Neither agree nor disagree ○ Somewhat disagree
○ Strongly disagree