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A systematic review of early predictors of language impairments in neurodevelopmental disorders

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Introduction

- **Early predictors of language outcomes have gained increased research attention** because identifying early markers of impairment could lead to improved early intervention on the one hand and relevant contributions to theories of language development on the other.

- Researchers are attempting to understand the various language profiles in people with neurodevelopmental disorders, **to comprehend how these features impact the children's development and to identify early predictors of language outcomes**.

- The increasing number of studies has been particularly evident for children with **autism spectrum disorders and language disorders.**

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Introduction

- Previous studies have shown that predictors of later language outcomes in the first years of life play a key role in a better understanding of the underpinnings of language acquisition and the developmental trajectories of typical and atypical groups.

- **Language skills are critical in predicting long-term outcomes** for children in areas such as adaptive functioning, psychosocial adjustment, and wellbeing (e.g., Gillespie-Lynch et al., 2012; Hofvander et al., 2009; Howlin, 2003; Howlin & Moss, 2012).

- Language skills are also critical to academic performance (Thurm, Lord, Lee, & Newschaffer, 2007).

Although language difficulties are common in several neurodevelopmental disorders, little is known about the prognosis of language outcomes for these disorders.

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Introduction

- Thus, we aim to **systematically review articles studying early predictors of language outcomes** in infants and toddlers across a range of neurodevelopmental disorders most extensively studied in the early years: of development:
  - **Autism spectrum disorder**
  - **Language disorder**
  - **Down syndrome**

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Autism Spectrum Disorder (ASD)

- **Autism Spectrum Disorder** (ASD) according to the Diagnostic Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) requires the presence of:

  A. Social communication difficulties

  B. Repetitive and restricted interests and behaviours

- Language difficulties are not a requisite for an ASD diagnosis, however, they are common comorbidities.

- There is enormous variability in the language profiles of children with ASD (Tager-Flusberg, Edelson, & Luyster, 2011). Some have intact structural language skills, some have comorbid language impairment, and some never acquire functional spoken language.

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Language Disorder (LD)

- **Language Disorder** (LD) according to the DSM-5 (American Psychiatric Association, 2013) requires the presence of:
  - **Difficulties using language in different manners** (speaking, writing, using sign language, or other) due to deficits in understanding or production that include:
    - Reduced vocabulary;
    - Limited sentence structure or limited ability to put words together to form basic, grammatically correct sentences;
    - Impairments in discourse.
  - **The individual's language capacity is significantly below what is expected at his or her age.**
  - The symptoms set in during the individual's early developmental period.
  - These difficulties are not resulting from a sensory impairment, motor dysfunction, or another medical condition, and cannot be attributed to intellectual disability or global developmental delay.

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Down syndrome (DS)

- **Down syndrome** (DS) results from a partial or complete duplication of chromosome 21, and it is the most common genetic cause of intellectual disability (Martin, Klusek, Estigarribia, & Roberts, 2009).

- Children with DS usually present delays in developmental milestones and may be at risk for language difficulties.

- For instance, children with DS have lower expressive vocabulary than typically developing children matched by nonverbal mental age (e.g., Næss, Lyster, Hulme, & Melby-Lervåg, 2011) and syntactic skills are another area of weakness (Chapman, Schwartz, & Kay-Raining Bird, 1991; Martin et al., 2009).

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Method - Inclusion criteria

- **Participants |** children up to 3 years of age were included in the study with a diagnosis of:
  - **Autism spectrum disorder** (ASD) | children with Asperger syndrome and children later diagnosed with ASD were also included.
  - **Language disorder (LD)** | Groups of children later diagnosed with LD were also included.
  - **Down syndrome**

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Method - Inclusion criteria

- **Studies**
  - **Publication date: 2010 - 2020**
  - A variety of study designs were included as long as initially defined **participants were followed up for a period of 3 months or more.**
  - Only **prospective cohorts** were included.
  - Only **experimental or observational studies** were included.

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Method - Inclusion criteria

- **Measures**
  - **Each included report must present at least one early language measure (before the first three years of age) and a later language outcome.**
  - The subsequent outcome should be a standardized measure in order to compare findings across studies.
  - Standardized parent report measures were permitted.

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Method - Exclusion criteria

- Single case research designs and qualitative designs were excluded, regardless of the number of participants.
- Review articles were excluded.
- Due to limited resources to translate studies written in other languages, reports unavailable in English were excluded.

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Method - Search Strategy

- The following **databases** were searched: Academic Search Complete, ERIC, MEDLINE with Full Text, PsycARTICLES, PsycINFO and Psychology, and Behavioral Sciences Collection.

- The search string included the following **keywords**:

  - language AND longitudinal OR prospective AND autism spectrum disorder* OR ASD OR autism OR Asperger syndrome OR Asperger * OR autistic disorder*

  - language AND longitudinal OR prospective AND down syndrome OR T21 OR trisomy 21

  - language AND longitudinal OR prospective AND specific language impairment* OR SLI OR developmental language disorder* OR DLD

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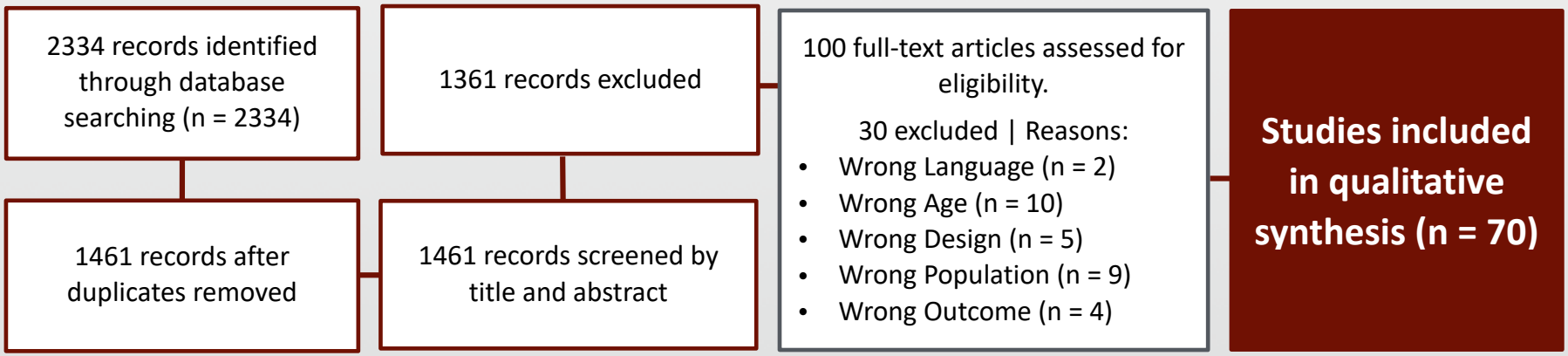
Method - PRISMA Flow Diagram

- Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.



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Results | Autism spectrum disorder (ASD)

- **Not all children with ASD have structural and adaptive language difficulties, but the majority do.**
- Language skills can vary from fluent to minimal language comprehension.
- Most of the studies reported receptive and expressive language skills of children with ASD bellow age-expected levels that improve over time.
- The same patterns were found for expressive and receptive vocabulary, adaptive language, and acquisition of verbal language.

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Results | Autism spectrum disorder (ASD)

- **The majority of children with ASD continued to make positive language gains after the 3 years of age. Language gains occurred across multiples domains.**

- Some infants with ASD typically lose language skills (e.g., productive language and vocalizations) during the second year of life.

- However, substantial heterogeneity was found between studies.

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Results | Autism spectrum disorder (ASD)

- **Main early language predictors of language outcomes:**
  - Perception of speech sounds;
  - Maternal linguistic input (e.g., vocabulary, use of parental "child-directed speech")
  - Preference for child-directed speech
  - Preference for speech stimuli;
  - Use of communicative behaviors (e.g., gaze, facial expressions, gestures);
  - Early vocal communication;
  - Child communicative intent;
  - Consonant inventory;
  - Receptive and expressive language composites;
  - Brain responses to language.

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Results | Language disorder (LD)

- The literature on LD is less consistent;
- However, there is evidence for a variety of developmental trajectories for children with LD:
  - A stable pattern of slower growth;
  - A temporary spurt and catch up, though this may be followed by a plateau; and
  - A lower intercept but similar slope to typically developing children.

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Results | Language disorder (LD)

- Children are typically considered late talkers when they produce fewer than 50 words and/or no word combinations at 24 months. However, in the majority of the cases, the apparent early language difficulties will resolve itself. Others will have continuing deficits that may lead to a later diagnosis of language disorder (LD).

- Late talkers use more gestures than those later diagnosed with a language disorder.

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Results | Language disorder (LD)

- **Main early language predictors of language impairments:**
  - Perception speech sounds;
  - Late-onset of talking
  - Early vocabulary delay;
  - Slow vocabulary growth;
  - Delayed onset of word combinations;
  - Early language delay;
  - Difficulties with rapid auditory processing;

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Results | Down syndrome (DS)

- There is a paucity of research regarding this topic on Down syndrome;
- Overall, the rate of increase in language skills in individuals with DS across time appears to be slower than for those who are developing typically;
- Once they begin to produce words, their progress when compared with typically developing peers is very slow.

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Results | Down syndrome (DS)

- **Main early language predictors of language impairments:**
  - Gestures production
  - Speech segmentation
  - Reduced vocalizations
  - Delay in the onset of first words
  - Reduced vocabulary (however, it appears to be a relative strength concerning language for individuals with Down syndrome)
  - Lower rates of growth in single and multiple word combination
  - Phonological difficulties
  - Early receptive language skills (e.g., syntax, vocabulary)

- However, it remains unclear whether persistent and more profound deficits in language reflect the impact of auditory perception.

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Conclusion

- Despite these results, conclusions should be interpreted considering some limitations:
  - Heterogeneity of participants (e.g., participants diagnosed with these neurodevelopment disorders and other comorbidities);
  - In some cases, the lack of control groups.
- It is also crucial to explore other factors that may influence language outcomes (Tager-Flusberg, 2016).
- **Nevertheless, results highlight the importance of early language development for later prognosis.**

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Conclusion

- This review provides synthesized information for researchers, families, and clinicians on language development over time and on language outcomes for individuals with specific neurodevelopmental disorders.
- This is highly relevant for policymakers and service providers to support these individuals across the lifespan.
- However, much needs to be done to refine the accuracy of predictions of language outcomes.
- A better understanding of developmental factors that underlie, facilitate, and predict language acquisition in neurodevelopmental disorders would shed light on the nature of these disorders and will allow the refinement of targeted early interventions.

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Thank you!

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