

# Brain and Language Associations in Autism Spectrum Disorder: A Scoping Review

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## Background and Rationale

- Autism spectrum disorder (ASD) affects **1 in 66** Canadian children [1]
- Nearly **one quarter** of children with ASD have **language impairments** related to **form and content** [2]
- Language ability** in children with ASD linked to **social skills and adaptive behaviour later in life** [3]
- Examining **brain and behaviour associations** in ASD may bring us closer to identifying **neural mechanisms** that contribute to the **differing language profiles** seen in some children with ASD
- This is the **first paper** to systematically examine the **neural correlates of language** in ASD

## Methods

In this **scoping review** [4], we searched **five databases** (MEDLINE, EMBASE, PsycINFO, CINAHL, Cochrane) for **peer-reviewed scientific articles** that looked at **neurological data** and **language ability in ASD**

- The studies had to meet **five inclusionary criteria**:
- Published **in English** in 2000 or later
  - Used an **MRI** method to take images of the brain (incl. DTI and fMRI)
  - Used a **standardized language measure** (e.g., CELF, OWLS)
  - Had an **ASD group** and a **typically developing group**
  - Both groups had participants **n≥10**

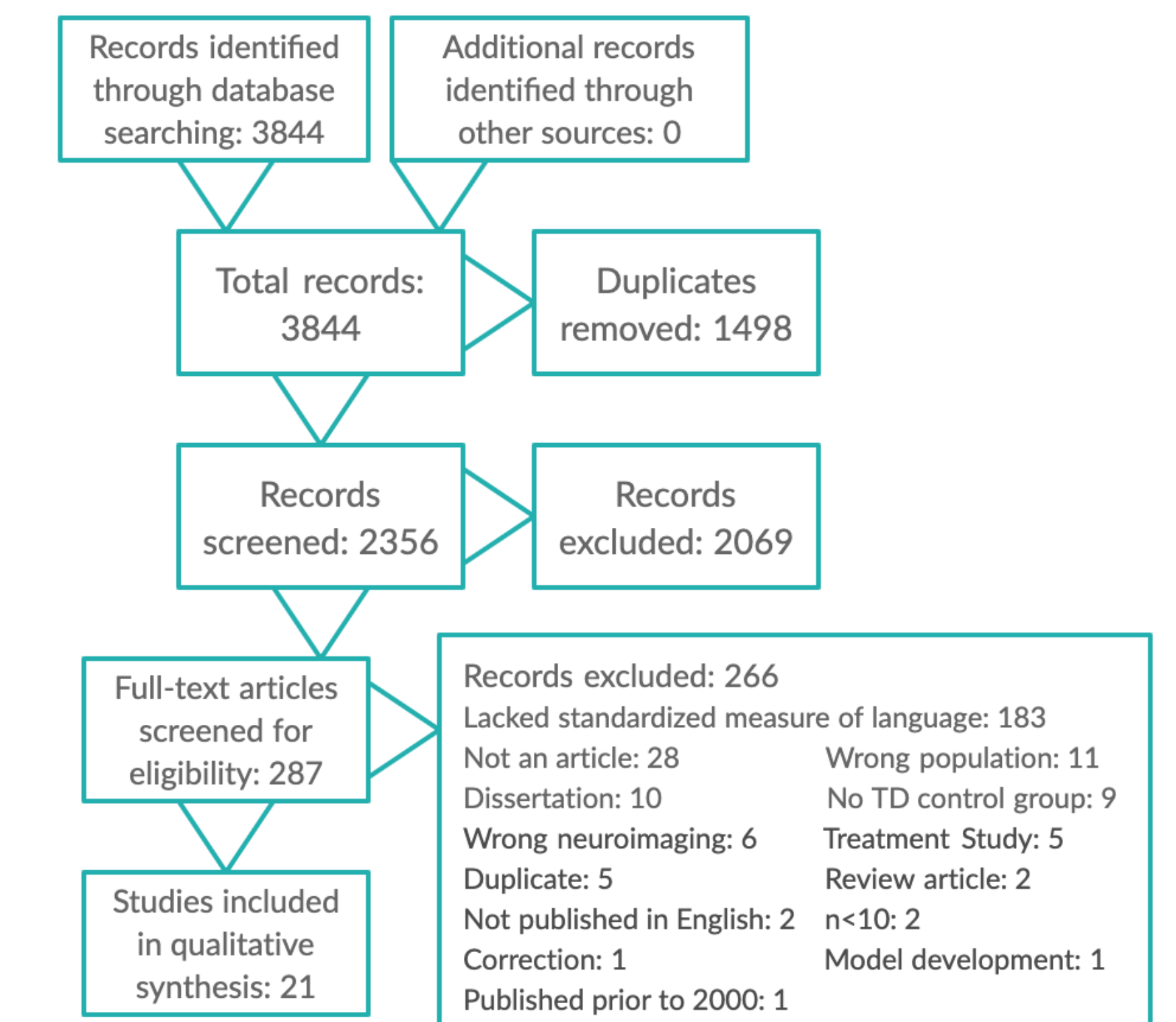


Fig. 1: PRISMA flow diagram [5] describing the selection process of the papers included

# In autism spectrum disorder, language ability is positively correlated with activation of the left superior temporal gyrus, and volume of the right inferior frontal gyrus



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## Results

- 21 studies included:**
- 14 reported finding a link between **neuro-imaging data** and **language performance**
  - 17 were conducted **in the US**
  - 20 examined **school-age children/adolescents**
  - Neuroimaging methods used were diffusion tensor imaging, magnetic resonance imaging, and resting state functional magnetic resonance imaging
  - Language evaluations used were CELF (Fig. 2), OWLS, and MSEL
  - Brain regions examined include temporal, frontal, and parietal lobes; and the superior longitudinal and arcuate fasciculi



Figure 2: The 4th edition of the Clinical Evaluation of Language Fundamentals (CELF) test

- Major Findings**
- In ASD, language abilities were often found to be associated with **left temporal cortices**
  - Higher language** scores in ASD were related to **greater activation** of the **left superior temporal gyrus**
  - Studies examining **language networks** consistently found **significant hypoactivation** of **left temporal cortices** in ASD
  - Inconsistent brain-language associations** were found in **white matter tracts**, particularly the **superior longitudinal** and **arcuate fasciculus**

## Discussions and Conclusion

- Take-Home Message**
- Although **some inconsistencies** were present, there were clear trends: **superior language performance** was **linked** with **left STG activation** (Fig 3, left) and **right IFG volume** (Fig. 3, right) **in ASD**

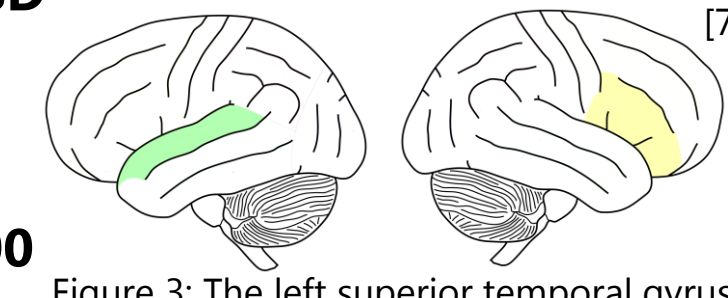


Figure 3: The left superior temporal gyrus (left) and right inferior frontal gyrus (right)

- Limitations**
- Number of papers analyzed limited by **selection criteria**: only papers **published 2000 and after in English, using standardized, norm-referenced language measures**
  - Studies often focused on **limited brain regions**
  - Heterogeneity** present among **age groups within** and **between studies**
  - Studies often **pooled groups**, rather than analyzing **ASD and TD separately**
  - Focus on **statistical significance**: ASD groups often had **within-average scores** on standardized language assessments even though standard score means were **statistically lower** than TD controls

- Recommendations**
- Future studies should **divide language groups** based on **clinical significance**, rather than **statistical significance**
  - Whole-brain analysis** should be used to avoid missing **key connections**

- Relevance to Holland Bloorview**
- Language impairment** is a **common challenge** for those with **ASD**
  - Understanding the **neural correlates of language in ASD** will help elucidate the **exact causes of language impairment** and inform **development of effective treatment methods**
  - This will be useful for **speech-language pathologists** and **ASD specialists**

**References**

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