Stuttering and structural brain morphology: a population-based neuroimaging study in young children

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Conclusion
Children who stutter showed less gray matter volume and thinner cortex in relevant speech production regions than normally fluent speaking children. This suggests that gray matter structure develops differently in children who have a speech fluency disorder. Our findings support the idea that stuttering is a neurodevelopmental disorder that starts in childhood. The affected brain regions play an important role in auditory and speech production regions, which are needed to achieve fluent speech.

Background
Stuttering is a developmental speech production disorder that usually starts in childhood. Experimental neuroimaging studies in small groups of adults and children who stutter have shown structural and functional abnormalities in the brain in comparison to normally fluent speaking children.

Aim
The current study aimed to explore the association of stuttering and structural brain morphology in a relative large group of young children from a general population cohort.

Design and methods
This study was embedded in the Generation R Study. This is a population-based prospective cohort study in Rotterdam, the Netherlands. Information on speech fluency and high quality T1-weighted MRI-scans were available in 26 children who stutter and 489 fluent children at 6 to 9 years of age. Differences in cortical volume, cortical thickness and surface area were analyzed using
- a linear regression model in specific regions of interest based on prior literature
- exploratory whole brain surface-based analyses, using the FreeSurfer software programme

Linear regression adjust for age, gender, handedness, lingualism, education mother and total brain volume, p-value <0.05, False Discovery Rate correction.

Differences in cortical volume
Children who stutter had significantly less gray matter volume than controls in
- left frontal lobe
- left inferior frontal gyrus (Brodmann Area (BA) 45)
- left supplementary motor area (BA 6)

Differences in cortical thickness
Children who stutter had significantly thinner cortex than controls in
- left and right frontal lobe
- left inferior frontal gyrus (parsopercularis)
- right parietal lobe

The department of Otolaryngology and Head and Neck Surgery Erasmus MC financially supported this study.