

Differences in brain structure and memory suggest adolescents may not 'grow out of' ADHD

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Children with ADHD find it more difficult to focus and to complete their schoolwork. Credit: public domain image

Young adults diagnosed with attention deficit/hyperactivity disorder (ADHD) in adolescence show differences in brain structure and perform

poorly in memory tests compared to their peers, according to new research from the University of Cambridge, UK, and the University of Oulu, Finland.

The findings, published today in the journal *European Child Adolescent Psychiatry*, suggest that aspects of ADHD may persist into adulthood, even when current [diagnostic criteria](#) fail to identify the disorder.

ADHD is a disorder characterised by short attention span, [restlessness](#) and [impulsivity](#), and is usually diagnosed in childhood or adolescence. Estimates suggest that more than three in every 100 boys and just under one in every 100 girls has ADHD. Less is known about the extent to which the disorder persists into adulthood, with [estimates](#) suggesting that between 10-50% of children still have ADHD in adulthood. Diagnosis in adulthood is currently reliant on meeting symptom checklists (such as the American Psychiatric Association's Diagnostic and Statistical Manual).

Some have speculated that as the brain develops in adulthood, children may grow out of ADHD, but until now there has been little rigorous evidence to support this. So far, most of the research that has followed up children and adolescents with ADHD into adulthood has focused on interview-based assessments, leaving questions of brain structure and function unanswered.

Now, researchers at Cambridge and Oulu have followed up 49 adolescents diagnosed with ADHD at age 16, to examine their brain structure and memory function in young adulthood, aged between 20-24 years old, compared to a control group of 34 young adults. The research was based within the Northern Finland Birth Cohort 1986, which has followed up thousands of children born in 1986 from gestation and birth into [adulthood](#). The results showed that the group diagnosed in adolescence still had problems in terms of reduced brain volume and

poorer memory function, irrespective of whether or not they still met diagnostic checklist criteria for ADHD.

By analysing the structural magnetic resonance imaging (MRI) brain scans and comparing them to the controls, the researchers found that the adolescents with ADHD had reduced grey matter in a region deep within the brain known as the caudate nucleus, a key brain region that integrates information across different parts of the brain, and supports important cognitive functions, including memory.

To investigate whether or not these grey matter deficits were of any importance, the researchers conducted a functional MRI experiment (fMRI), which measured brain activity whilst 21 of the individuals previously diagnosed with ADHD and 23 of the controls undertook a test of working memory inside the scanner.

One third of the adolescents with ADHD failed the memory test compared to less than one in twenty of the control group (an accuracy of less than 75% was classed as a fail). Even amongst the adolescent ADHD sample who passed the memory test, the scores were on average 6 percentage points less than controls. The poor memory scores seemed to relate to a lack of responsiveness in the activity of the caudate nucleus: in the controls, when the memory questions became more difficult, the caudate nucleus became more active, and this appeared to help the control group perform well; in the adolescent ADHD group, the caudate nucleus kept the same level of activity throughout the test.

There were no differences in brain structure or memory test scores between those [young adults](#) previously diagnosed with ADHD who still met the diagnostic criteria and those who no longer met them.

Dr Graham Murray from the Department of Psychiatry, University of Cambridge, who led the study, says: "In the controls, when the test got

harder, the caudate nucleus went up a gear in its activity, and this is likely to have helped solve the memory problems. But in the group with adolescent ADHD, this region of the brain is smaller and doesn't seem to be able to respond to increasing memory demands, with the result that memory performance suffers.

"We know that good [memory function](#) supports a variety of other mental processes, and memory problems can certainly hold people back in terms of success in education and the workplace. The next step in our research will be to examine whether these differences in brain structure and [memory](#) function are linked to difficulties in everyday life, and, crucially, see if they respond to treatment."

The fact that the study was set in Finland, where medication is rarely used to treat ADHD, meant that only one of the 49 ADHD adolescents had been treated with medication. This meant the researchers could confidently rule out medication as a confounding factor.

To date, 'recovery' in ADHD has focused on whether people do or do not continue to meet symptom checklist criteria for diagnosis. However, this research indicates that objective measures of [brain structure](#) and function may continue to be abnormal even if diagnostic criteria are no longer met. The results therefore emphasize the importance of taking a wider perspective on ADHD outcomes than simply whether or not a particular patient meets diagnostic criteria at any given point in time.

More information: "Brain structural deficits and working memory fMRI dysfunction in young adults who were diagnosed with ADHD in adolescence." *European Child Adolescent Psychiatry*; 27 Aug 2015
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