

## Short Report

# Assessment of age-at-onset criterion for adult attention-deficit hyperactivity disorder

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## Summary

To investigate the accuracy of the age-at-onset criterion in those who meet other DSM-5 criteria for attention-deficit hyperactivity disorder, using a prospective population cohort we compared four different approaches to asking those aged 25 years ( $n = 138$ ) when their symptoms started. Receiver operating characteristic curves showed variation between the approaches ( $\chi^2_{(3)} = 8.99$ ,  $P = 0.03$ ); all four showed low discrimination against symptoms that had been assessed when they were children (area under the curve: 0.57–0.68). Asking adults to recall specific symptoms may

be preferable to recalling at what age symptoms started. However, limitations to retrospective recall add to debate on the validity of ADHD age-at-onset assessment.

## Keywords

ADHD; adult; age-at-onset; retrospective; ALSPAC.

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One of the criteria required for a diagnosis of attention-deficit hyperactivity disorder (ADHD) is symptom onset before age 12 years.<sup>1</sup> When individuals first present to clinicians as adults, this requires retrospective recall of symptoms and likely limits accuracy<sup>1,2</sup> owing to both false positives and false negatives.<sup>3</sup> Identifying the optimal method of assessing ADHD age-at-onset is an important question for adult psychiatrists. We compared the accuracy of four different ways of assessing age-at-onset in a prospective population cohort. We focus on those who met the other DSM-5 criteria for ADHD at age 25 years: at least five inattentive or five hyperactive/impulsive symptoms, plus impairment.

## Method

We analysed data from the Avon Longitudinal Study of Parents and Children (ALSPAC),<sup>4</sup> which includes repeated assessments since pregnancy (see supplementary material available at <https://doi.org/10.1192/bjp.2021.122>). Ethical approval was obtained from the ALSPAC Ethics and Law Committee and Local Research Ethics Committees (Research Ethics Committee approval references can be found at <http://www.bristol.ac.uk/alspac/researchers/research-ethics/>). Informed consent was obtained from participants following the recommendations of the ALSPAC Ethics and Law Committee at the time.

In total, 138 (42% male) individuals met DSM-5 symptom and impairment criteria at age 25 with complete data on age-at-onset and ADHD symptoms assessed in childhood (see below).

## Age 25 assessment

DSM-5 symptom and impairment criteria were assessed using self-reports of the Barkley Adult ADHD Rating Scale (BAARS-IV).<sup>5,6</sup> Parents also completed the BAARS-IV: these data were used for sensitivity analyses (see below).

The BAARS-IV uses two sets of questions for age-at-onset: (a) specify age – individuals were asked to recall as precisely as possible at what age (in years) ADHD symptoms began to occur; and (b) rate behaviour between 7 and 12 years – individuals were asked to rate the frequency of 18 DSM-5 ADHD symptoms on a 4-point scale.

We generated four retrospective definitions of ADHD age-at-onset before age 12 years:

- the specified age that ADHD symptoms began to occur was before 12 years old;
- at least one ADHD symptom was endorsed as having been clinically significant (occurring ‘often’ or ‘very often’<sup>6</sup>) between 7 and 12 years;
- several symptoms (at least three) were endorsed as having been clinically significant between 7 and 12 years (DSM-5 requires that ‘several’ inattentive or hyperactive/impulsive symptoms present prior to age 12 years<sup>7</sup>);
- at least six inattentive or six hyperactive/impulsive symptoms were endorsed as having been clinically significant between 7 and 12 years (DSM-5 symptom requirement for childhood ADHD<sup>7</sup>).

## ADHD symptoms assessed during childhood

Symptoms had been assessed when these adults were aged 7, 8, 9 and 12 years using the five-item ADHD subscale of the Strengths and Difficulties Questionnaire (SDQ)<sup>8</sup> rated by parents, as children’s self-reports are unreliable.<sup>9</sup> The SDQ is a screening questionnaire with symptoms in the past 6 months categorised as low (0–5), slightly raised (6–7) or high (8–10).<sup>8</sup> Individuals with slightly raised or high symptoms ( $\geq 6$ ) at any of these ages were defined as having ADHD symptoms when assessed in childhood: this was used to test the accuracy of adult retrospective reports of age-at-onset. This broad definition was used given the DSM-5 requirement that ‘several’ symptoms present prior to age 12 years.<sup>7</sup>

## Measures for sensitivity analyses

There were two measures used for sensitivity analysis: (a) ADHD assessed during childhood, defined based on full ADHD diagnosis at age 7 or 10 years of age, measured using the parent-rated Development and Well-Being Assessment<sup>9</sup> (see supplementary material); and (b) age 25 assessments of age-at-onset using the parent-rated BAARS-IV.

## Analyses

Receiver operating characteristic (ROC) curve analyses using Stata’s `roccomp` function were used to examine the validity of the four retrospective assessments of ADHD age-at-onset in distinguishing

**Table 1** Discrimination of retrospective assessments of ADHD age-at-onset criterion in distinguishing those with and without ADHD symptoms when assessed in childhood, in young adults with ADHD symptoms and impairment at age 25 years

Retrospective assessment	ROC AUC (95% CI)	Accuracy	Sensitivity	Specificity	PPV	NPV
Specified age	0.60 (0.52–0.69)	60%	63%	58%	55%	66%
At least one symptom	0.57 (0.51–0.62)	53%	94%	20%	49%	79%
At least three (several) symptoms	0.62 (0.55–0.69)	59%	76%	53%	53%	76%
Six inattentive and/or six hyperactive/impulsive symptoms	0.68 (0.61–0.76)	69%	65%	72%	66%	71%

ADHD, attention-deficit hyperactivity disorder; ROC, receiver operating characteristic; AUC, area under the curve; PPV, positive predictive value; NPV, negative predictive value.

those with versus those without ADHD symptoms when assessed in childhood.

## Results

Of those who met DSM-5 criteria for adult ADHD symptoms and impairment at age 25 ( $n = 138$ ), when asked to specify the age at which symptoms started 51% ( $n = 71$ ) reported onset before age 12 years. When asked to rate behaviour between 7 and 12 years, 86% ( $n = 119$ ) retrospectively reported at least one ADHD symptom, 72% ( $n = 100$ ) reported at least three symptoms and 44% ( $N = 61$ ) retrospectively reported six inattentive and/or six hyperactive/impulsive symptoms.

Results for the four ADHD age-at-onset assessments are shown in Table 1. All approaches showed low discrimination in identifying ADHD symptoms assessed in childhood (AUC = 0.57–0.68), although there was evidence that this varied across the four approaches ( $\chi_{(3)} = 8.99$ ,  $P = 0.03$ ).

Reporting at least one symptom showed the highest sensitivity (the proportion of those with symptoms when assessed in childhood correctly identified by retrospective reports) and negative predictive validity (NPV: the proportion of those retrospectively reported not to have childhood-onset correctly identified) and the lowest specificity (the proportion of those without symptoms when assessed in childhood correctly identified by retrospective reports) and positive predictive validity (PPV: the proportion of those retrospectively identified who did have symptoms when assessed in childhood). Conversely, retrospectively endorsing at least six inattentive or six hyperactive/impulsive childhood symptoms showed the highest specificity and PPV, whereas specifying age showed the lowest sensitivity and NPV.

## Sensitivity analyses

Sensitivity analysis where ADHD assessed in childhood was defined based on full diagnostic criteria ( $n = 122$ ) showed a similar pattern of results although with somewhat higher discrimination (AUC = 0.60–0.81:  $\chi_{(3)} = 96.00$ ,  $P = 1 \times 10^{-20}$ ) (supplementary Table 1). Parent retrospective reports of age-at-onset at age 25 ( $n = 47$ ) showed fairly low discrimination (AUC = 0.63–0.70) with little evidence of variation across the four approaches ( $\chi_{(3)} = 1.19$ ,  $P = 0.76$ ) (supplementary Table 2).

## Discussion

We found variation in the discrimination of four approaches to retrospectively assess ADHD age-at-onset at age 25 years, although all showed limited validity. This is consistent with Brazilian birth-cohort findings.<sup>10</sup> Of the four approaches, the highest proportion of participants met age-at-onset criteria when this was defined based on asking participants to retrospectively rate their behaviour between ages 7 and 12 years, and requiring the endorsement of at least one of the 18 DSM ADHD symptoms: this definition (which does not fit with the DSM-5 requirement that ‘several’ symptoms

present prior to age 12 years) resulted in the highest proportion of true positives (highest sensitivity) but also the fewest true negatives. Conversely, the highest specificity (and lowest proportion of people identified) was found using the most stringent definition: the retrospective endorsement of at least six inattentive and/or six hyperactive/impulsive childhood symptoms.

The approach of asking participants to specify the age at which endorsed symptoms started resulted in the fewest true positives, i.e. this missed the most people who had ADHD symptoms when assessed in childhood. This provides tentative evidence that asking people to recall specific symptoms during a specific age period is preferable to recalling the age at which symptoms started. However, none of the four approaches showed high accuracy, which is consistent with previous work highlighting the limitations of retrospective recall.<sup>3</sup> Sensitivity analyses defining ADHD assessed in childhood based on full DSM-5 diagnostic criteria (and requiring the retrospective endorsement of six inattentive and/or six hyperactive/impulsive childhood symptoms) showed moderate discrimination. This suggests that recall of more severe and impairing symptoms may be better than recall of just a few specific symptoms. In practice there is likely benefit in asking about specific ADHD symptoms in childhood and acquiring additional information from other sources, such as school reports.

Although the age-at-onset criterion for ADHD is important from a developmental perspective,<sup>1</sup> our results, alongside increasing evidence of ‘late-onset’ ADHD,<sup>2</sup> raise queries about its validity. Further research is needed to address the limitations of the current work, including limited sample size and non-random attrition. Defining age-at-onset is important for informing adult psychiatrists and diagnostic criteria.

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## Supplementary material

Supplementary material is available online at <https://doi.org/10.1192/bjp.2021.122>.

## Data availability

The ALSPAC data management plan ([www.bristol.ac.uk/alspac/researchers/data-access/documents/alspac-data-management-plan.pdf](http://www.bristol.ac.uk/alspac/researchers/data-access/documents/alspac-data-management-plan.pdf)) describes in detail the policy regarding data sharing, which is through a system of managed open access.

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## Author contributions

L.R. and A.T. conceived and designed the study. L.R. analysed the data and wrote the first draft. All authors contributed to the interpretation of data for the work and provided critical revisions. All authors read and approved the submitted manuscript.

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## Declaration of interest

None.

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## Psychiatry in the arts

### The Napoleon delusion: 200 years later

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The year 2021 marked 200 years from the death of Napoleon Bonaparte (1769–1821), the Emperor of the French, one of the most celebrated and controversial political figures in history. Napoleon’s epic life – his rise to power and his fall from glory – has continued to have an overwhelming effect on minds during the past two centuries. The ‘Napoleon delusion’ – the delusional belief of being Napoleon Bonaparte himself – is a classic stereotype in psychiatry, which seems to have been assimilated in modern pop culture as well. In artworks, films, comic books and strips, the unusual but characteristic bicorn hat and hand-in-jacket pose are a strong visual that immediately suggests the madness of its wearer. As known, this disorder is part of grandiose delusions (or delusions of grandeur), a subtype of delusion that occurs in people with a wide range of psychiatric diseases, including schizophrenia and bipolar disorder.

As described by Laure Murat in her book *L’Homme qui se prenait pour Napoléon* (2011), the first cases occurred in 1840, as a consequence of the return of Napoleon’s remains to France. The writer Alphonse Esquiros (1812–1876) recorded the admission of 14 cases to Paris’s Bicêtre Asylum in that year. The legend of Napoleon, a self-made man of bourgeois heritage who had succeeded in ascending to the throne of France on his own will and courage, thrilled many key representatives of the new Romantic generation. Playing a central role in the writings of Romantic authors even long after his death – for instance *The Count of Monte Cristo* (1844) by Alexandre Dumas (1802–1870) or *War and Peace* (1865) by Leo Tolstoy (1828–1910) – was certainly key to his legacy being passed down intact through these centuries, as much as the birth of cinema and modern mass media. The origin of the Napoleon delusion in these was likely the play *The Misleading Lady* by Charles W. Goddard (1879–1951) and Paul Dickey (1882–1933), originally intended for theatrical performance in 1913 and then novelised 2 years later. It was made into a silent film in 1920; the Napoleon delusion character inspired the 1922 film *Mixed Nuts*, starring Stan Laurel (1890–1965). Stan plays a salesman peddling a book about Napoleon; after he is hit on the head by a brick, he believes he actually is Napoleon, recruiting neighbourhood children as soldiers to recreate a famous battle. Stan is committed to an insane asylum, where he continues to behave like the French emperor. Parodied in the Bugs Bunny cartoon *Napoleon Bunny-Part* (1956), the cliché can be still found in the 21st-century adult animated science fiction sitcom. People affected by this disorder became the main characters of comic strips and jokes among children, so that Napoleon became the prototype of the insane in the asylum.

### Supplementary material

To view supplementary material for this article, please visit <https://doi.org/10.1192/bjp.2021.166>.

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