NEWS

Estimate of autism's sex ratio reaches new low

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The ratio of boys to girls who qualify for an autism diagnosis drops to about 3-to-1 in a massive new analysis of published research[1].

The findings highlight the need to look out for **girls with autism who may be misdiagnosed**, identified late or overlooked entirely.

"It gives us the firmest empirical basis to date to support the idea that autism is probably underdiagnosed in girls," says **Francesca Happé**, professor of cognitive neuroscience at King's College London, who was not involved in the work. "That's big news, really."

Most sources put the sex ratio in autism at 4-to-1. The new analysis is based on data from 54 **prevalence** studies worldwide, with a total of nearly 14 million participants, including 53,712 children with autism. Overall, these studies show that there are 4.2 boys for every girl with autism.

But a lower ratio, 3.25 boys for every girl, emerges from studies in which researchers evaluate participants for autism, rather than interviewing parents or reviewing medical or school records.

The findings have implications for basic research, says study leader **William Mandy**, senior lecturer in clinical psychology at University College London. "A lot of theorizing about autism is predicated on it being a condition to which males are much more vulnerable than females," Mandy says. "So I think it's a pretty important fact to try and get straight." The results appeared 4 April in the *Journal of the American Academy of Child and Adolescent Psychiatry*.

Seek and ye shall find:

Mandy and his colleagues combed through studies from five continents, conducted between 1992 and 2011. All of the autism diagnoses were based on criteria in the fourth edition of the "Diagnostic and Statistical Manual of Mental Disorders" (DSM), which is used primarily in the United States, or the 10th edition of the "International Statistical Classification of Diseases and Related Health Problems." (No large prevalence studies so far have used criteria from the latest edition of the DSM.)

The analysis uses more rigorous methodology than previous efforts to define the sex ratio in autism. For example, it weights studies according to their sample size and examines how different study characteristics — such as how diagnoses were attained — affect the ratio.

Of the studies, 34 used 'passive case ascertainment,' in which researchers identify children with autism by reviewing medical or school records, or telephoning parents to ask if their child has ever received the diagnosis. The remaining 20 used 'active case ascertainment,' meaning that researchers evaluated the children.

Passive studies found a sex ratio of about 4.6-to-1 on average, whereas the ratio in active studies fell to 3.25-to-1. "That's the key contrast in this study," Mandy says.

The active studies provide a more accurate sex ratio, experts say.

"These results suggest that when you are more active in looking for autism, in screening, that you will find more females," says **Marisela Huerta**, associate professor of psychology at Weill Cornell Medical College in New York, who was not involved in the work.

Girls with autism may be missed because doctors and others think of autism as primarily affecting boys. Girls may also be better than boys at **masking their autism features**.

Biased benchmarks:

The analysis also showed a more even distribution of boys and girls — a 3.1-to-1 ratio — in studies that include a high proportion of children who also have intellectual disability, although less than half of the studies included information about participants' intelligence. It may be that girls' ability to mask their autism features depends on their intelligence, or that they tend to be more severely affected than boys with the condition.

Some researchers say the overall ratio may be even lower than 3-to-1. Even when researchers look for girls with autism, they may still miss some girls with the condition because autism tests are **geared toward features found in boys.** "Because most research and clinical experience has been with males, our diagnostic criteria are almost certainly male-biased," Happé says.

Some evidence suggests there is a female form of autism. Girls with autism tend to have **subtler restricted interests** and fewer **repetitive behaviors** than boys. But changing the diagnostic criteria to detect more girls with autism-like features is not a straightforward task. "It's a very complex question," Mandy says. "If you change the criteria, are you changing the thing itself?"

Insight to resolve this conundrum may soon be within reach. Mandy is investigating how masking, or 'camouflaging,' of autism features affects diagnosis in girls. Studies also show that the ratio of males to females who score poorly on tests of social ability and other autism traits is around 2-to-1. Happé is studying why some of these girls do not meet diagnostic criteria for autism, and asking how girls differ from boys who have similar scores.

REFERENCES:

1. Loomes R. *et al. J. Am. Acad. Child Adolesc. Psychiatry* Epub before print (2017) **Abstract**