

Boys and girls show different depressive symptoms tied to early brain development

Researchers analysed 917 brain scans from 549 children

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Boys and girls in Singapore may develop depressive symptoms differently, with patterns of brain development in early childhood linked to signs of depression in adolescence, according to a new study.

The finding suggests that researchers may need to examine mental vulnerabilities earlier in childhood, rather than focusing only on adolescent years when depressive symptoms are more commonly observed. This could help enable more timely support for children.

The study found that different parts of the brain were associated with different types of depressive symptoms in boys and girls later in



life.

In girls, changes in brain regions involved in emotional processing were linked to symptoms such as low mood and poor self-esteem. In

boys, changes in other brain areas were associated with symptoms including tiredness and a sense of ineffectiveness.

Findings from the Sex-specific

Neurodevelopmental Pathways to Depressive Symptoms study come amid growing concerns about youth mental health in Singapore.

A separate research paper in May

found that mental disorders were the leading cause of disability and death among 10- to 14-year-olds in Singapore, and the impact of mental distress on population health here is the highest in ASEAN.

In 2023, NUS' Youth Epidemiology and Resilience study found that about one in three youth aged 10 to 18 years old in Singapore reported internalising mental health symptoms such as depression, anxiety and loneliness.

The latest study tracked how different parts of the brain developed and interacted over time. It found that girls showed a faster rate of change than boys in brain development between the ages of 4½ and six years.

Researchers also examined how these childhood brain development patterns were related to depressive symptoms reported at age 13.

They found that girls were 2½ times more likely than boys to report depressive symptoms at 13.

The study, led by the A*STAR Institute for Human Development and Potential (IHDP), was published in the scientific journal *Molecular Psychiatry* in April. It involved researchers from the KK Women's and Children's Hospital (KKH), National University Health System, Yong Loo Lin School of Medicine at the National University of Singapore, and McGill University.

The team used data from the Growing Up in Singapore Towards Healthy Outcomes birth cohort. It is a longitudinal study tracking over 1,200 Singaporean mothers and their children from pregnancy through childhood. Researchers analysed 917 brain scans from 549 children taken when they were aged 4½, 6 and 7½ years.

In a statement on June 3, A*STAR, KKH and NUS said the findings do not mean depression can be predicted from a single brain scan, nor that all boys and girls follow the same developmental trajectory.

Instead, the study points to the need for more research on how risk may develop differently across sexes, they said.

A*STAR IHDP senior scientist Chan Shi Yu, who is the study's lead author, said: "What excites us about these findings is that they point us to a much earlier window than we typically look.

"If we can better understand how the brain develops across childhood, and how that differs between boys and girls, we may be able to support children's mental health in a more timely and meaningful way," she said.

The team also found that incorporating sex-specific brain development patterns into models improved the accuracy of predicting depressive symptoms at age 13.

A*STAR IHDP principal scientist Tan Ai Peng said the findings underscore the importance of moving beyond a one-size-fits-all approach to mental health research and prevention.

"Because developmental pathways can differ between the sexes, these findings highlight why a one-size-fits-all approach may overlook important early signals in boys and girls," she said.

Future research could further study how these sex-specific developmental patterns shape later health outcomes and improve earlier identification, prevention, and clinical strategies, she added.

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