

The Role of Brain Structure on Mental Health Concerns & Suicidality

Internalizing Behaviors

Internalizing behaviors are mental health conditions where individuals direct their distress internally, making it difficult for others to observe. Examples of internalizing behaviors include depression, anxiety, and physical conditions like headaches or stomach aches. Internalizing behaviors are relatively common in the United States. In 2021, 20.1% of Americans ages 14-17 (5.0 million people) and 8.3% of those ages 18 and older (21 million people) experienced a major depressive episode in the past year.¹

Suicidality

People who experience internalizing behaviors are at greater risk for suicidality (engaging in suicidal thoughts, plans, gestures, or attempts). In 2021, 4.8% of adults ages 18 or older (12.3 million) had serious thoughts of suicide in the past year. And among youth ages 12–17, approximately 3.3 million had serious thoughts of suicide, about 1.5 million made a suicide plan, and around 8,92,000 attempted suicide.

We don't know how the brain contributes to the development of internalizing behaviors or suicidality across the lifespan.

Why Twins?

Survey data from twins alongside their DNA information is uniquely able to answer questions about the extent to which certain types of brain structure measures influence internalizing behaviors and suicidality. This kind of knowledge can help to develop interventions that could prevent internalizing behaviors and suicidality.

What is ABCD?

Young twins who are part of the Mid-Atlantic Twin Registry as well as those in twin registries around the United States are participating in the Adolescent Brain and Cognitive Development (ABCD) study. This multi-year project combines data from twins and people who are not twins to study how childhood experiences (such as sports, social media, sleep patterns, and smoking) interact with each other and with a child's changing biology to affect brain development, behaviors, and other health outcomes. Almost 12,000 participants across the United States participate in the ABCD study.²

Study Framework

The researchers of this project used data from adults as well data from 456 twin pairs of older children aged 9-10 years old who participated in the ABCD study to answer two main questions:³

- 1. Is there a causal link between brain structure and suicidality in adults?**
- 2. Is there a causal link between brain structure and suicidality in children?**

The research team used the data from adults to test for relationships between genetic variants and measures of brain surface area, cortical thickness, and suicide attempt risk. These relationships (associations) were used in a special statistical analysis called *Mendelian Randomization* to assess if there was any evidence supporting a *causal relationship* between brain structure and risk of suicide attempt in adults.

Participants from the ABCD study answered questions about the extent to which they experienced internalizing behaviors (including depression) and if they have had any past or present suicidal thoughts or behaviors.⁴ ABCD study participants also shared their DNA through a saliva or blood sample,⁵ and allowed researchers to take pictures of their brains using a magnetic resonance imaging machine (MRI).⁴ Together, the genetic, psychological, behavioral, and brain imaging data from the ABCD study twin participants were used in a statistical analysis similar to the one used to analyze data derived from adults. The goal was to see if there was any evidence to support differences in brain structure *causing* increased risk of suicide attempt, or even the other way around (i.e. suicide attempt *causing* differences in brain structure) in the younger ABCD study twin participants.

If the same causal link between brain structure and suicide risk were found in both adults and children, then these brain markers may be useful for the early detection of those at risk of suicide later in life. Earlier detection of suicide risk opens the doors to preventative interventions that may save lives.

Results

Was there a causal link between brain structure and suicidality in adults?

Yes. We found evidence consistent with lower total cortical surface area causing increased risk of suicide attempt in adults, but not the other way around.

Was there a causal link between brain structure and suicidality in children?

No. We did not find evidence supporting a direct causal link between differences in brain structure and suicidality in children. However, there was evidence supporting a causal link between lower average cortical thickness and increased risk of depression and internalizing behaviors more broadly.

What's Next?

Our findings suggest that the causes of suicide attempts in adults may be different than the causes of suicide attempts in children, at least in terms of processes related to brain structure. Further, it is not hard to imagine that the reasons a younger person may attempt suicide might be very different from an older person. More work is needed to determine the nature of these differences to better characterize suicidality across age groups.

Resources

988 Suicide & Crisis Lifeline

<https://988lifeline.org>

A free, confidential, 24/7 crisis support service for anyone experiencing suicidal thoughts, emotional distress, or a mental health crisis. Accessible by calling or texting **988**.

BeWellVA

<https://bewellva.com>

A regional collaboration of seven Community Services Boards in Central Virginia, BeWellVA promotes suicide prevention, awareness, and access to mental health resources within local communities.

National Action Alliance for Suicide Prevention

<https://theactionalliance.org>

The nation's public-private partnership is working to advance the National Strategy for Suicide Prevention through collaboration, education, and policy advocacy.

The Jed Foundation (JED)

<https://jedfoundation.org>

A nonprofit organization focused on protecting the emotional well-being of teens and young adults and preventing suicide through education, school programs, and community support.

National Institute of Mental Health (NIMH) – Suicide Prevention

<https://www.nimh.nih.gov/health/topics/suicide-prevention>

A federal resource providing research-based information on suicide prevention, including data, treatment options, and guidance for individuals and professionals.

Suicide Awareness Voices of Education (SAVE)

<https://www.save.org>

A leading national nonprofit organization dedicated to preventing suicide through public awareness, education, and support for those affected by suicide loss.

National Alliance on Mental Illness (NAMI)

<https://www.nami.org/>

Free peer-support services with information, resource referrals, and support for people living with a mental health condition, their family members and caregivers, and mental health providers.

References

1. Substance Abuse and Mental Health Services Administration. (2022). Key substance use and mental health indicators in the United States: Results from the 2021 National Survey on Drug Use and Health (HHS Publication No. PEP22-07-01-005, NSDUH Series H-57). Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration.
<https://www.samhsa.gov/data/sites/default/files/reports/rpt39443/2021NSDUHFFRRev010323.pdf>
2. Saragosa-Harris NM, Chaku N, MacSweeney N, et al. A practical guide for researchers and reviewers using the ABCD Study and other large longitudinal datasets. *Dev Cogn Neurosci*. 2022;55:101115.
<https://doi.org/10.1016/j.dcn.2022.101115>
3. Zhou, Y., Castro-de-Araujo, L. F., Singh, M., & Neale, M. C. (2025). Causal Analyses of Associations Between Brain Structure and Suicide Attempt in Adulthood and Late Childhood. *JAACAP Open*.
<https://doi.org/10.1016/j.jaacop.2025.02.005>
4. Barch DM, Albaugh MD, Avenevoli S, et al. Demographic, physical and mental health assessments in the Adolescent Brain and Cognitive Development study: Rationale and description. *Dev Cogn Neurosci*. 2018;32:55–66. <https://doi.org/10.1016/j.dcn.2017.10.010>
5. Uban KA, Horton MK, Jacobus J, et al. Biospecimens and the ABCD study: Rationale, methods of collection, measurement and early data. *Dev Cogn Neurosci*. 2018;32:97–106. doi:
[10.1016/j.dcn.2018.03.005](https://doi.org/10.1016/j.dcn.2018.03.005)