Medical Xpress

Teenage mental health—how growing brains could explain emerging disorders

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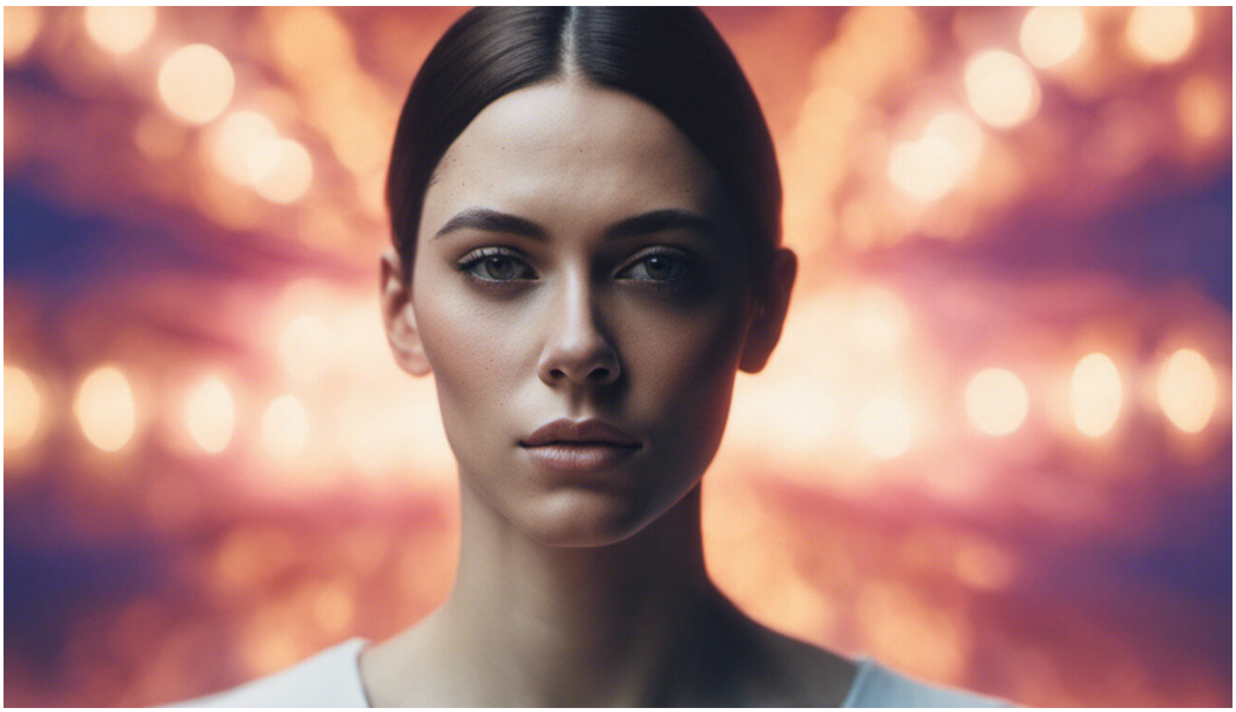

Credit: AI-generated image (disclaimer)

Adolescence is the time when most mental health problems arise. Diagnoses of psychiatric illnesses increase across the board, with teenagers suffering not only from mood disorders such as depression, but also from the most pervasive psychiatric illnesses, such as schizophrenia or obsessive-compulsive disorder (OCD).

The impact of such illnesses is substantial. Suicide is one of the top five most common causes of death in adolescents.

If mental health researchers have long been aware of this sharp rise in psychiatric illnesses, we still struggle to understand and explain why teenagers are so vulnerable to them. One reason for this may be a lack of information on quite how the brain changes in adolescence. To this end, my colleagues and I recently undertook research following a group of teenagers over several years. We were able to assess not only how their brain develops during adolescence, but also how this was related to their evolving mental health.

Brain changes

As recently as a few decades ago, it was still thought that the brain only grew during childhood and did not change much after that. However, newer brain imaging studies show that the brain does in fact mature past childhood and that these changes continue well into the twenties and thirties.

During adolescence, the grey matter of the brain (where the nerve cells sit) is slowly shrinking, while white matter (the wiring between nerve cells) is still growing. These changes in the brain indicate that the neural networks are further refining their functions and connections, getting rid of what is irrelevant and reinforcing what is important.

Scientists believe that a driving factor of this change is the growth of myelin. Myelin is a fatty substance that insulates the connections between cells and leads to better transmission of information.

These changes are more accentuated in some areas of the brain than others, namely the ones hosting the higher-order cognitive functions. The prefrontal cortex, in particular, shows the most protracted development, lasting well into a person's twenties. This is the part of the brain that hosts the most sophisticated of our abilities – from making complex decisions to planning and suppressing unwanted urges.

In other words, in adolescence, many of these sophisticated brain functions are still in development. This may explain why teenagers sometimes struggle to use complex reasoning skills or why they act on impulse and take unnecessary risks.

The long-lasting brain development in the prefrontal cortex may also be behind the surge in mental health problems among teenagers. In our research, we found that myelin in the prefrontal cortex grows more slowly in adolescents who are struggling more with their mental health. Those who were particularly impulsive showed a reduced myelin-related growth in the prefrontal brain areas that have often been associated with impulse control.

Moreover, we found that this reduced myelin growth was actually directly related to the worsening of mental health symptoms over time. We not only looked at how impulsive individual adolescents were on average, but also at how they changed specifically over the course of our study.

Our results show that those adolescents who had the least myelin growth in this impulse-related prefrontal area were the ones whose impulsivity worsened the most during adolescence. This suggests that there is a close and dynamic association between the change in mental health and brain maturation.

Cognitive deficits

Interestingly, the deficits in brain development seem to differ between different mental health domains. Adolescents with high OCD-related symptoms, for example, also showed reduced myelin growth, but in different areas of the prefrontal cortex – mainly the areas responsible for cognitive functions that are known to be impaired in OCD. This suggests that such cognitive deficits may arise from impaired brain development.

A challenge that remains is understanding how well these effects translate to the general population, and whether these findings could be used to predict (and maybe even prevent) the emergence of mental health issues.

To address these questions, my colleagues and I have developed an app called Brain Explorer that incorporates the latest insight from neuroscience research. It allows us to answer questions we cannot address using traditional lab experiments.

The app features a series of games that probe specific brain functions, such as how we make decisions or how well we can reflect on ourselves. To do so, it targets those brain areas that are most likely affected by the reduction in myelin-related brain growth. The app further asks questions about behaviour and feelings, so that we can trace how these functions change during development.

With this citizen science project, we hope to go beyond the boundaries of lab experiments and broaden our understanding of how the population at large thinks and behaves. It is a novel means of crowd-sourcing data collection. Our hope is that it will allow us to reach groups of people too often underrepresented in research studies, but at elevated risks for mental health problems, in particular teenagers from marginalised communities.

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